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Clean, Just and Competitive Transition

Economic study on the dynamic effects of mergers

Volume 2 – Detailed literature review

Prepared by oxera

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Economic study on the dynamic effects of mergers

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[1] European Commission (2025), 'Study on dynamic merger effects', accessed 21 July 2026.

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1 Introduction, methodology, and scope of the literature synopsis

1.1 This second Volume provides additional detail on the academic literature summarised in Volume 1. In this introductory chapter we set out the methodology and scope of the papers reviewed.

1.1 Methodology for paper selection

1.2 To select the set of papers for the literature review, we first established an initial long list of potentially relevant papers, based on existing literature surveys, online search, and expert views from Study team members, advisers, and peer reviewers. As part of this process, we ensured that a sufficient number of papers from fields other than industrial organisation (IO) were included in this initial long list. We then sorted all papers by core theme, produced an initial internal review, and produced an initial short list of potentially relevant papers. These papers were then sorted into the relevant chapters and sections that are now used in Volume 1, Part B and Volume 2 and reviewed. Particular attention was given to the literature review sections of existing papers, to identify any further missing papers. We also endeavoured to include any further relevant or updated papers that emerged during the course of the Study.

1.3 The final set of papers included in the synopsis of the Study (i.e. Volume 1, Part B and Volume 2) consists of 475 publications and working papers.

1.2 Scope of the papers reviewed

1.4 The literature synopsis is interdisciplinary, both in terms of academic fields and in terms of theoretical and empirical methodologies. We have defined papers as *theoretical* if they are mostly based on mathematical models of competition between firms, based on assumptions on how demand and costs behave, and in some cases numerical simulations of market outcomes (using a range of possible input parameters). By contrast, the *empirical* literature seeks to understand the impact of competition on dynamic outcomes (e.g. innovation and investment) by looking for example at how past outcomes have varied with changes in market circumstances (e.g. past mergers), or by considering simulated mergers based on estimated or calibrated parameters.

1.5 While special care has been taken that recent relevant publications and working papers are included (e.g. from the last five to ten years), we have also included earlier relevant work.

1.6 Finally, for the empirical papers reviewed, our list of papers includes a wide range of different sectors. Although the most relevant sector-specific empirical papers have studied pharmaceuticals, mobile telecommunications, and digital markets, we have nevertheless identified several papers studying a wider range of other sectors. A discussion of these is included in Volume 1, Chapter 7.

1.7 One way to get a sense of the scope of our review is to look at the academic journals cited. In total, we cite 349 academic articles published in a total of 81 different peer-reviewed academic journals. Table 1.1 ranks all journals with at least six articles included in our review, ranked by number of articles (and not by impact factor of each journal).

1.8 Out of all published academic articles reviewed, 69% come from journals that include at least six articles reviewed in Volume 2 of the Study, with the remaining

31% from a long tail of less cited journals. This shows that the final review includes a wide range of academic journals.[1]

1.9 The academic journals with the highest number of included articles include all top IO journals (such as *International Journal of Industrial Organization*, *RAND Journal of Economics,* and *Journal of Industrial Economics*). However, also top general economics journals (such as *American Economic Review, Journal of Political Economy*, and *Quarterly Journal of Economics*), finance journals (such as *Journal of Financial Economics* and *Journal of Finance*), and business and management journals (such as *Research Policy*, *Management Science*, and *Strategic Management Journal*) are included.[2]

Table 1.1 Top academic journals by article count in Volume 2

Academic journal	Main field	Articles
Int. Journal of Industrial Organization	Industrial organisation	32
Journal of Finance	Finance	21
RAND Journal of Economics	Industrial organisation	21
American Economic Review	General economics	20
Journal of Financial Economics	Finance	16
Journal of Industrial Economics	Industrial organisation	16
Journal of Political Economy	General economics	14
Management Science	Business	12
Review of Economic Studies	General economics	11
Strategic Management Journal	Business	11
Quarterly Journal of Economics	General economics	10
Review of Financial Studies	Finance	10
Economics Letters	General economics	9
Research Policy	Business	9
Antitrust Law Journal	Competition law	6
Information Economics and Policy	Industrial organisation	6
Journal of Economics & Management Strategy	Industrial organisation	6
Review of Economics and Statistics	General economics	6
Review of Industrial Organization	Industrial organisation	6

Note: This table lists all academic journals with at least six citations in Volume 2 of the Study, ranked by the number of papers cited in Volume 2. Main field refers here to what we consider to be the journal's main area of focus. This classification is not strict, as many of these journals also publish contributions from other fields.
Source: Oxera.

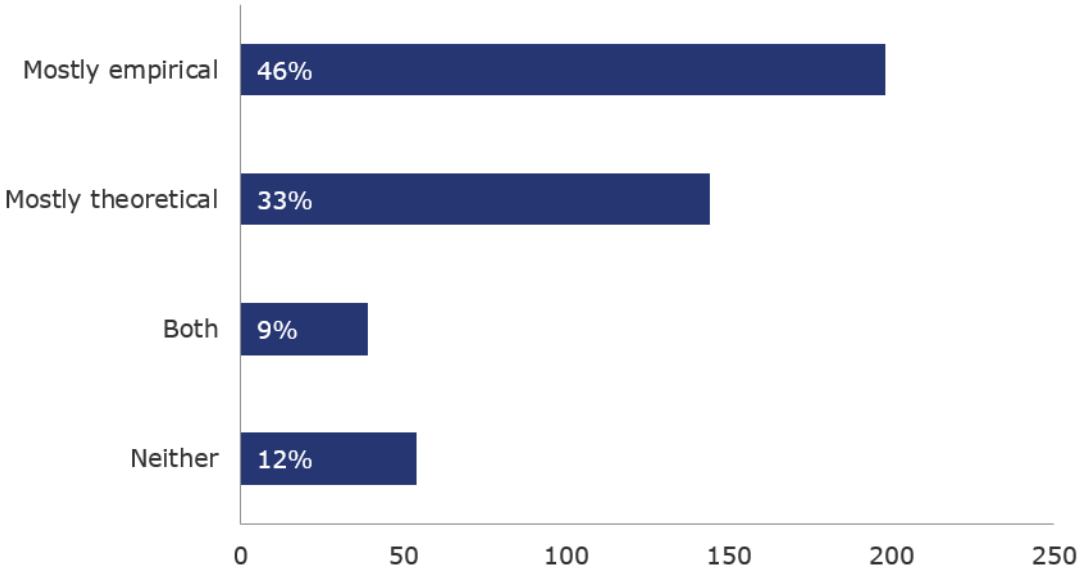
1.10 In addition to looking at academic journal citations, we can consider the scope of our literature review with reference to the balance of type of publications and methodology. As discussed in Volume 1, Chapter 3, the final set of papers included in the synopsis consists of 475 publications and working papers: 375 (79%)

[1] Note that the breadth of academic journals cited merely informs on the scope of the literature review, not necessarily on the quality of the specific papers reviewed, which is instead undertaken on a paper-by-paper basis in the relevant Chapters.
[2] This general classification of journals by field is not strict, as many journals also publish contributions from other fields.

published, peer-reviewed academic papers; 61 (13%) academic working papers;[3] and the remaining 39 (8%) policy reports, books, book chapters, and other non-academic publications. Around 41% of these are from 2020 or later.

1.11 To provide further summary statistics on the scope of the papers included, we have classified all 436 published academic papers and academic working papers by their methodology. Figure 1.1 provides statistics looking at the proportion of papers classified as: (i) mostly theoretical; (ii) mostly empirical; (iii) both; or (iv) neither. The majority of reviewed papers (around 46%) are mostly empirical, with around 33% of papers being mostly theoretical.

Figure 1.1 Distribution of the literature by methodology



Note: These figures show the share of published and unpublished academic papers by methodology. Papers that are neither empirical nor theoretical are generally conceptual papers, e.g. competition policy papers without formal modelling or empirical analysis.
Source: Oxera.

1.12 Some of the publications reviewed come with relevant disclosures. Annex A2 provides an overview of relevant disclosures of the papers reviewed. These disclosures include whether the article or study was (i) commissioned or funded by an interested party (including private or public organisations) and/or (ii) authored by someone directly affiliated with an interested party at the time of publication. We identify 70 papers with relevant disclosures, of which 35 are affiliated with private organisations and 35 with public organisations.

[3] Although we do not make a distinction here between different types of academic working papers, we note that some working paper series included—e.g. NBER and CEPR—are generally regarded to be of higher quality than average.

2 Competition and innovation

2.1 This Chapter provides a detailed paper-by-paper review of the literature summarised in Volume 1, Chapter 4.

2.1 Innovation incentives as a function of market structure

2.2 This section examines papers that develop some of the main mechanisms determining a firm's innovation incentives across different product market structures, notably the comparison of the polar cases of monopoly and perfect competition, and in some cases the comparison between monopoly and duopoly. A common feature of these papers is that they consider the case where a single innovation opportunity (or patent) is available, for acquisition by one or multiple firms. The papers then consider which market structure delivers the greatest incentive to acquire that innovation.

2.3 The literature begins with **Arrow's (1962)** seminal result that competitive firms have stronger incentives than monopolists to adopt cost-reducing **process innovations**, establishing the so-called **replacement effect**. This effect captures the fact that an incumbent firm with market power faces lower innovation incentives than a firm in a competitive market, because introducing a successful innovation *cannibalises* its existing (preinvention) profits. We then discuss how this mechanism translates to **product innovation**, where firms introduce new products that may coexist with existing offerings rather than simply reducing production costs. We then compare the incentives to innovate of a **monopolist threatened by entry** with those of a new entrant, which can give rise to pre-emption effects that are not present in Arrow's original model. The analysis of the literature shows that Arrow's replacement effect is present across several models, but there are also countervailing effects on innovation incentives.

2.1.1 Monopoly vs competition: process-innovation (*Arrow*)

2.4 **Arrow (1962)** considers the question of whether a monopolist or a firm in a competitive market has a stronger incentive to invest in a cost-reducing innovation. Arrow assumes that a given firm under either market structure has access to an existing production technology, and the innovation is made possible by a new technology that lowers production costs and is protected by a patent. The monopolist is assumed to control the technology for both the old and new product, and prices the corresponding products at monopoly level. The competitive firm is assumed to be part of a competitive fringe offering the old product, which is therefore priced at cost. Arrow then compares the incentive to innovate of the monopolist, and of one of the competitive firms (which would obtain a monopoly on the new technology, if it successfully innovates). In this model, there is therefore only one innovator, and no competition between rival innovators.

2.5 Arrow demonstrates that a competitive firm has a greater incentive to innovate than a monopolist (i.e. it places higher value on the patent). This result is straightforward to establish in the case of a *drastic* innovation—i.e. innovation that lowers costs so significantly that it eliminates the old technology, implying that monopoly pricing of the new technology is not constrained by the cost of the old technology. In this case, both the monopolist and competitive firm would earn the same profit post-innovation. But the monopolist's net gain from innovation is only the difference between new and old monopoly profits, while the competitive firm's net gain is the full new monopoly profit. The monopolist thus internalises the opportunity cost of cannibalising its own existing profits, and therefore faces weaker net innovation incentives. This result is the essence of the Arrow *replacement effect* (Tirole, 1988).

2.6 Arrow also shows that his result holds for the less immediate (but possibly more common) case of non-drastic innovation. A non-drastic innovation means that a competitive firm that introduces the new technology is constrained in its pricing by the old technology, and therefore earns lower overall profits than the monopolist when using the new technology. Despite this, Arrow shows that the *incremental* profit for introducing the new technology remains higher for the competitive firm, since monopoly pricing restricts output compared to competitive markets, implying that cost reductions deliver a smaller total profit gain. In particular, Arrow shows that the incremental gain from innovating for a monopolist is always lower than the value of the cost reduction on the postinvention monopoly output, which is in turn less than the competitive output. Since the incentive under competition equals the cost reduction on the competitive output, this shows that the incentive for competitive firms exceeds that of a monopolist. In essence, in Arrow's model the value of a process innovation comes solely from reducing the firm's cost, and this cost reduction applies to a smaller output under monopoly than under competition.

2.7 Arrow's model shows that 'preinvention monopoly power acts as strong disincentive to further innovation' (Arrow, 1962, p. 622), and that a monopolist 'tends to rest on his laurels' (Tirole, 1988, p. 392). Borrowing an expression that will be introduced later in the economic literature, Arrow's model shows that a firm in a competitive market faces stronger incentives to innovate than a firm with market power in order to *escape competition*, and capture higher profits by innovating.

2.8 Note that in Arrow's model, in the case of non-drastic innovation, the monopolist is able to charge a higher price for the postinvention output, and hence *appropriate* higher returns than a competitive firm. This market power effect in the product market is, however, not strong enough to compensate for the disincentive from preinvention profits. In this setting, as Arrow puts it (p. 622):

> '[t]he only ground for arguing that monopoly may create superior incentives to invent is that appropriability may be greater under monopoly than under competition. Whatever differences may exist in this direction must, of course, still be offset against the monopolist's disincentive created by his preinvention monopoly profits'

2.9 We will return to the concept of *appropriability*, in the context of later literature.

2.1.2 Monopoly, duopoly, and competition: product-innovation

2.10 Arrow's result is shown in a simple model of process innovation with homogeneous goods. Later papers have tested the result in the context of product innovation and differentiated products, obtaining different results.

2.11 **Greenstein and Ramey (1998)** extend Arrow's framework to a setting with *vertical product differentiation*, studying what happens when companies decide whether to introduce a new, improved product while still selling an older version. The paper analyses product innovations that create vertically differentiated products, that is new versions that provide higher utility to every consumer at the same price, but where some consumers prefer the old product if priced lower. The authors compare a number of scenarios: when the old product market is *competitive* (i.e. supplied at cost by a competitive fringe), when it is controlled by a *monopoly* that faces no threat of new competitors, when there is a monopoly on the old product but another firm can innovate on the new product (*duopol*y), and when a monopolist on the old technology competes for the innovation with another firm (*threatened monopolist*—we return to this fourth scenario in Subsection 2.1.3).

2.12 Contrary to Arrow, Greenstein and Ramey find that a monopoly has the *same* incentive to introduce the new product as competitive firms do for the case of non-

drastic innovation (whereby the new product is better but does not completely replace the old one, so some customers still prefer the older, cheaper option).

2.13 This happens because two opposing forces cancel each other out.

- *The replacement effect (Arrow)*: the monopoly loses some profits from its old product when it launches the new one—customers who would have purchased the old product at the old price now switch to the new product. This is the analogue to Arrow's replacement effect in the product-innovation context, where introducing the new product cannibalises existing profits from the old product.
- *Product inertia effect:* under a competitive old-product market, the suppliers of the old product act as a constraint on a new-product monopolist by reducing the new product's price and the rents extractable from it. Under a protected monopoly the monopolist internalises that constraint because it earns profits from both products and can optimally adjust the output mix accordingly.

2.14 The authors show that, for non-drastic innovations and vertical product differentiation, the replacement effect and the product inertia effect exactly offset. Therefore, the incentives to innovate by a monopolist are the same as those of a player facing a competitive market on the preinvention product. Given this result, from a total welfare perspective it then follows that a competitive structure delivers higher total welfare than a monopoly, as it leads to lower prices (i.e. greater allocative efficiency) and the same level of innovation. For the case of drastic innovation, a competitive structure delivers higher return than a monopolist, in line with Arrow (1962).

2.15 Greenstein and Ramey also show that a *duopoly* structure (where the new product and the old product are owned by separate firms) delivers *greater incentive* than a monopolist facing a competitive fringe for non-drastic innovation, because in this case the innovator faces a weaker competitive constraint from the old product compared to the competitive fringe (and is therefore able to extract higher rents).

2.16 Finally, Greenstein and Ramey also consider the case of a monopoly facing a credible entry threat, modelled as a scenario where the inventor of the new product can sell the licence to any firm (e.g. in an auction). We discuss this extension in Subsection 2.1.3, in the context of the Gilbert and Newbery (1982) paper.

2.17 Finally, **Chen and Schwartz (2013)** compare product innovation incentives in the case of horizontal product differentiation (i.e. innovation results in the introduction of a new product that appeals to different customer segments without necessarily being superior to the existing product). The paper adopts a *Hotelling* model of product differentiation to model this setting, assuming that an existing product is located at the end of the *Hotelling line*, and that the new product would be located at the other end (if innovation is successful).

2.18 The authors compare across three scenarios:

- *monopoly* (whereby the same firm controls the existing product and can add the new product);
- *duopoly* (whereby a firm controls the existing product, and a different firm can add the new product);
- *competition* (whereby the old product is supplied by a competitive fringe of rivals (like in Arrow) and any firm can add the new product).

2.19 The paper shows that the introduction of a new product gives rise to two effects, as follows.

- A familiar diversion (or Arrow replacement) effect, whereby the introduction of the new product diverts sales from the existing product. This effect is only internalised under the monopoly scenario, reducing the net incentives to introduce the new product by a monopolist, as in Arrow's original model.
- A (price) *coordination* effect, which reflects the fact that a monopolist can coordinate the prices of the old and of the new product, to maximise overall profits.

2.20 Chen and Schwartz show that the coordination effect can dominate the diversion effect in a Hotelling model, if the new product has higher quality than the old product. This implies that incentives to introduce the new product are stronger under *monopoly* than *duopoly* if the new product has higher quality than the old one, and are always higher under *monopoly* than under *competition* (reversing the findings of Arrow).

2.21 Compared with Greenstein and Ramey's model of vertical product differentiation, the monopoly and duopoly result can therefore be reversed under the assumption of horizontal product differentiation in a Hotelling model. Chen and Schwartz discuss the reasons for this result (in Section 4 of the article), and emphasise the following principle: when comparing the incentive of a monopolist to add a second product relative to the incentive of a more rivalrous firm facing more competition, a key factor determining whether the monopolist has a higher incentive is the extent to which the monopolist can, following a price increase of its old product, divert sales to the new product as opposed to leaking sales to outside goods (p. 525).

2.22 In terms of consumer welfare, in their baseline model Chen and Schwartz show that the introduction of a new product under monopoly harms consumers (compared to the no-innovation benchmark). This is because consumers who switch from the existing product to the new product receive the same welfare (on aggregate), but consumers who continue purchasing the existing product are harmed (due to the higher price induced by the joint ownership of the existing and new product). Therefore, the greater innovation induced by the monopolist in their baseline model is harmful for consumers, as it allows it to price discriminate more effectively.[4] In the working paper version, mentioned in the published version, the authors discuss an extension of the baseline model where consumer welfare may be higher under monopoly if there is an additional market segment where the new product can be sold at a different price from the main market segment (i.e. there is a market expansion effect from innovation). Together with the results of Greenstein and Ramey (1998), this suggests that the ranking of incentives to invest in product innovations across market structures can be sensitive to modelling assumptions, including whether products are vertically or horizontally differentiated.

2.23 In terms of total welfare, Chen and Schwartz establish that it is possible that welfare is higher under monopoly than under duopoly. This is the case for example in the case of a significant innovation in the new product, implying that the market share of the old product is close to zero. In this case consumer welfare is almost the same pre- and post-innovation, and the monopolist appropriates all of the gains of innovation via higher prices. With sufficiently high fixed costs of introducing the new product, only the monopolist innovates (as its gains from innovation are higher than a duopolist), and total welfare is higher given that its net post-innovation profits are higher.

[4] In this model the monopoly case with innovation is worse for consumers than the monopoly case without innovation, which is, in turn, worse than the duopoly case with innovation.

2.1.3 Monopoly threatened by entry

2.24 In Subsections 2.1.1 and 2.1.2, we considered the incentives to innovate of a secure monopolist, relative to a firm in a competitive environment. We now extend the analysis to an incumbent that is threatened by an entrant, and is competing with an entrant to obtain a new technology. We consider a simple setting where the race for the patent to the new technology is deterministic, implying that the licence to a given technology is effectively awarded to the firm making the highest offer.

2.25 **Gilbert and Newbery (1982)** model this set-up, in a setting where a potential entrant may innovate and enter the market to compete with the incumbent.[5] If the incumbent innovates first, entry is prevented. The patent race itself is modelled as a deterministic race in which the firm spending the most on research and development (R&D) gets the patent. In this set-up, the incumbent has an incentive to outbid the potential entrant, and preserve its monopoly position. A *pre-emption effect* is at work, which incentivises the monopolist to invest and ensure it gets the patent. The intuition here is that the monopolist has more to lose from going from a monopoly to a duopoly than the challenger has to gain from becoming a duopolist, since competition erodes industry profits. Tirole (1988) defines this as an *efficiency effect*. As we will see in the discussion of acquisition of potential competitors in Chapter 4 of this Volume, the efficiency effect may also be present in the context of acquisitions of potential competitors, and explain why incumbent firms face stronger incentives to take over an innovative rival than outside investors, to avoid an erosion of their existing profits.

2.26 As noted by Gilbert and Newbery, it may be that the incumbent obtains the patent but then it does not use it (i.e. innovation by the incumbent may result in a 'sleeping patent'). This can be the case if the new technology is not sufficiently differentiated or superior to the existing technology to offset the cost of development and commercialisation. This effect is similar to the more recent discussion of 'killer acquisitions' (discussed later in Chapter 4).

2.27 Overall, Gilbert and Newbery find that a threatened incumbent has stronger incentives to innovate than an entrant. It also has stronger incentives than a secure incumbent not facing the threat of entry, implying that rivalry at the innovation stage enhances innovation incentives.[6]

2.28 **Greenstein and Ramey (1998)** also consider an extension of their model with a monopolist competing for innovation with an entrant. The paper shows that a threatened monopoly has a stronger incentive to innovate than either the protected monopoly or competitive firms. The threat of entry makes the monopoly more willing to cannibalise its own old product profits to block potential entrants from establishing a foothold with the new product, giving it a stronger innovation incentive than in the other three scenarios (competition, monopoly, and duopoly). This result is in line with the pre-emptive patenting logic formalised by Gilbert and Newbery (1982).

2.2 Patent races

2.29 To discuss the direct effect of changes in innovation competition on innovation, largely in isolation from changes in product market competition, we discuss the

[5] This is modelled as an incumbent firm facing unit cost $\bar{c}$ and the entrant an infinite unit cost, and the innovation reduces the unit cost to $\underline{c}$.

[6] Vickers (1985) extends the analysis by looking at the case with multiple incumbents. In this case, entry deterrence via pre-emptive patenting is less likely as the incentives to acquire the patent of any individual incumbent are smaller.

literature on 'patent races', where firms compete to secure exclusive rights to an innovation. We first discuss the basic stochastic innovation involving symmetric or asymmetric firms, and then consider extensions involving the choice of riskiness and correlation of innovation races, and involving the effect of asymmetry in market position (laggards versus leaders).

2.30 Overall, this literature shows that the effect of increased rivalry (measured as an increased number of competitors or closeness of competition) on the individual incentives of firms to incur R&D expenditure in pursuing novel patents is *a priori* ambiguous—as firms may increase or decrease their R&D efforts in the face of increased rivalry, depending on factors like cost structure (fixed versus variable) and nature of the innovation (drastic versus non-drastic). However, overall industry-wide innovation tends to increase with innovation rivalry.

2.2.2 Symmetric stochastic innovation

2.31 Section 2.1 considered three papers where one firm had monopoly power on a new innovation. However, a firm does not usually have such monopoly power, and firms may instead be in competition to win a patent race. Additionally, innovation is not generally deterministic, as modelled by Gilbert and Newbery (1982). Models of patent races address both of these limitations.

2.32 One of the first theoretical papers to consider the effect of increased rivalry on a firm's rate of innovative activity, as modelled in a patent race, is **Kamien and Schwartz (1976)**. Kamien and Schwartz take a model in which a firm needs to decide how fast to develop a new innovation while facing the potential of rival entry seeking a similar innovation. The firm faces a trade-off: developing the innovation over a shorter period reduces the risk of a rival achieving and patenting the innovation earlier, while a shorter development period comes with a higher total development cost. Increased rivalry is modelled as an exogenous increase in the risk of rival entry at any one period. Kamien and Schwartz conclude that a firm's rate of innovative activity is highest at intermediate levels of rivalry, with the following intuition: while increased rivalry initially incentivises the firm to invest more to pre-empt rival entry, too much rivalry increases the chance of the extra development expenditure without subsequent profit, causing firms to 'hedge' against entry by reducing their total expenditure.

2.33 As discussed by **Loury (1979)**, there are several limitations to the approach by Kamien and Schwartz: they do not model strategic interaction, instead modelling investment as unilateral optimisation given a fixed risk of rival entry; their model does not address the impact on aggregate levels of innovation of an increase in rivalry; and the question of the net social benefit from increased investment in innovation remains unanswered. Several papers have since tried to deal with these limitations.

2.34 In line with Kamien and Schwartz, Loury (1979) and **Lee and Wilde (1980)** assume that individual firms face a stochastic relationship between their investment in R&D and the time at which a usable innovation is produced. This creates uncertainty on the timing of the innovation. Additionally, they assume a 'winner-take-all' setting: firms compete for the constant, known, perpetual flow of rewards that will become available only to the first firm that introduces the innovation. In contrast to Kamien and Schwartz, Loury and Lee and Wilde model the innovation race as taking place between multiple firms, creating strategic interdependency. This creates an additional market uncertainty that is absent in Kamien and Schwartz. Higher rivalry is proxied by an increase in the number of identical competing firms.

2.35 The results of Loury and Lee and Wilde show that the effect of rivalry on a firm's level of R&D expenditure depends on the cost structure of this expenditure. While Loury models the R&D expenditure as a fixed cost, Lee and Wilde allow for an additional per-period cost component that occurs as long as no firm has innovated yet. Loury finds that more competition reduces *individual* firms' incentives to invest in R&D in equilibrium, as the marginal probability of winning the race decreases. In this model, R&D efforts are **strategic substitutes**. Lee and Wilde show, however, that R&D efforts are **strategic complements** when variable development costs are high, relative to the upfront fixed cost. Despite this difference, both Loury and Lee and Wilde conclude that *overall industry innovation*—measured by the average speed at which an innovation is expected to enter the market—*increases in the number of firms* (that is, innovation rivalry stimulates innovation). In Loury's model, this is the case despite the fact that increasing the number of competitors in an industry means that each competitor invests less in R&D.

2.2.3 Asymmetric stochastic innovation

2.36 Expanding on Gilbert and Newbery's deterministic model of innovation by an incumbent innovator facing a challenger, **Reinganum (1983)** provides a stochastic R&D model in line with Loury (1979) and Lee and Wilde (1980). In her model, the probability of making a discovery and obtaining a patent at a point of time is a function of the firm's R&D expenditure. Increased competition is measured by the number of potential challengers and the process is again 'memoryless' in that success only depends on current expenditure. As explained by **Tirole (1988, Chapter 10)**, this set-up leads to a trade-off between the replacement effect (as in Arrow) and the pre-emption effect (as in Gilbert and Newbery). When considering the net effect on a monopolist's incentive to innovate, Reinganum shows that this depends on the nature of innovation.

- In case of drastic innovation, there is no reduction of monopoly rents in case of innovation by an entrant (as the innovator becomes a new monopolist), and therefore only the replacement effect is at work, leading to greater innovation incentives by the entrant and a tendency towards entry in the output market.
- In case of non-drastic innovation, entry would dissipate industry profits, and the monopolist therefore has a pre-emption motive to innovate. This can outweigh the replacement effect, and lead to greater innovation efforts by the incumbent. With non-drastic innovation, there is a tendency for the monopoly to persist.

2.37 In line with Loury and Lee and Wilde, Reinganum concludes that adding more rivals has an unambiguously positive effect on the overall rate of innovation (that is, innovation rivalry increases the average speed at which a successful innovation is found).

2.38 In terms of welfare, as discussed by **Tirole (1988, pp 399–400)**, there are two effects at play: an *appropriability effect*, whereby the private surplus from innovating is below the social optimum, because of the distortions from monopoly pricing (unless firms can perfectly price discriminate); and a *business-stealing* effect, whereby firms that introduce a new product do not internalise the loss of profits suffered by rivals in the product market or in the patent race. The appropriability effect leads to too little innovation compared to the first best, while business-stealing causes excessive innovation. Knowledge spillovers can further reduce the private incentives to innovation, as they lead to positive externalities on other firms (i.e. innovation has a public good characteristic).

2.39 **Yi (1995)** revisits Reinganum's (1983) stochastic patent-race model and argues that the conclusion on the persistence of monopoly depends critically on how competition for innovation is modelled. Reinganum assumes that the incumbent and the entrant compete directly in a stochastic R&D race. Yi instead considers a setting

in which an independent laboratory first auctions exclusive rights to a stochastic R&D technology, after which the winner undertakes R&D. Combining Gilbert and Newbery's (1982) auction framework with Reinganum's stochastic innovation process, Yi shows that the incumbent monopolist outbids the entrant for both drastic and non-drastic innovations and therefore acquires the technology with probability one. The intuition is that the incumbent internalises the effect of innovation on existing monopoly profits and industry profits, whereas the entrant does not. Yi concludes that monopoly persistence under uncertain innovation depends not only on uncertainty itself but also on whether firms can bid for exclusive access to the underlying R&D technology.

2.3 R&D competition, product market competition, and innovation

2.40 In this Section, we consider additional articles from the academic literature which have looked at the effect on innovation from changes in either 'upstream' innovation competition or in 'downstream' product market competition. These models combine insights from the patent race literature, with those from the innovation and market structure literature (both reviewed in Sections 2.1 and 2.2), and typically allow for richer settings of oligopoly competition.

2.41 We start by reviewing some of the key papers from the literature on endogenous growth, as they have been influential in the debates on competition policy; we then look at subsequent papers that have focused on the impact of product market competition; we then consider papers which examine the impact of innovation competition, in combination with changes in product market competition; and finally we consider a paper on the impact of competition policy, outside the context of a merger.

2.3.1 Models from literature on macroeconomics and growth

2.42 This strand of the literature originates in models of endogenous growth (e.g. **Romer (1990)** and **Aghion and Howitt (1992)**). This is a literature that seeks to provide micro-foundations for the rate of innovation and growth in an economy.

2.43 In the context of the discussion on the relationship between competition and innovation, a seminal paper is the one by Aghion and Howitt (1992) (these authors were awarded the Nobel Prize for Economics in 2025 largely for this and related work).[7] In this paper the authors present a model of R&D competition where successful innovation allows the innovator to obtain temporary monopoly rents in an input market. Due to Arrow's replacement effect the market leader does not innovate, and only technology laggards (i.e. potential entrants) do. When outside firms innovate, they displace the incumbent, and render its technology obsolete. The model assumes intertemporal spillovers, implying that any innovation builds on the success of previous innovation (a so-called 'standing on the shoulders of giants' effect).

2.44 The Aghion and Howitt papers show that growth and innovation result in a process of Schumpeterian creative destruction whereby new firms introduce new products, replacing the products of incumbent firms, and eliminating their rents. In this model, competition at the innovation stage, and the resulting 'business-stealing' effects, promotes growth.[8] By contrast, product market competition (proxied as the

[7] For a description of this paper, see also Royal Swedish Academy of Sciences (2025). Our discussion partially builds on this.
[8] As the authors put it: 'Growth results exclusively from competition among research firms that generate innovation' (p. 349).

elasticity of demand for the monopoly supplier of the input goods) decreases innovation incentives, by reducing post-innovation profits (this can be seen as a Schumpeterian product market effect). The impact of R&D competition therefore goes in a different direction than the impact of product market competition (see further below).

2.45 In terms of overall welfare, innovation may be below the social optimum due to the presence of inter-temporal spillovers (i.e. a positive externality not internalised by firms) and the allocative inefficiency from monopoly pricing (which also results in limited appropriability of the social returns from innovation). By contrast, the presence of business-stealing effects (i.e. a negative externality not internalised by firms) increases innovation, acting as a countervailing force.

2.46 In extensions of their model, **Aghion and Howitt (1998)** present additional analysis of the impact of competition in R&D, which indicates that competition in R&D can be beneficial for innovation and growth, unless market power at the R&D stage internalises knowledge spillovers to a sufficient extent.[9] This result is shown formally by assuming that the R&D sector is monopolised, and thus relaxing the free entry assumption in Aghion and Howitt (1992).[10] In this case, research is undertaken only by the incumbent, and incentives to innovate are reduced by the *Arrow replacement effect*. The authors show that whether a competitive R&D sector will create more growth depends on whether *business-stealing effects exceed the intertemporal spillover effects*. The authors also comment that if intertemporal spillovers arise across sectors (and no sector is large enough to internalise intertemporal spillovers), then only the Arrow effect remains, and competition is unambiguously favourable to growth.[11]

2.47 Subsequent papers on this literature have provided a richer characterisation of the strategic interaction between rival innovators, and of the impact of changes in *product market competition*. Building on previous work on patent races between leaders and followers (e.g. Harris and Vickers, 1987; Budd, Harris, and Vickers, 1993), **Aghion, Harris, Howitt, and Vickers (2001)** set out a duopoly model where both firms can innovate in each industry (and not just the technology follower), and R&D competition takes place gradually, in incremental *steps* (i.e. each firm needs to climb its own productivity ladder, and cannot directly overtake the leading firm).[12] Product market competition is proxied by a parameter capturing the degree of substitutability between products in each duopoly market.

2.48 The model's set-up results in a rich interaction between product market competition and innovation. In particular, innovation incentives now do not just depend on post-innovation profits (as in Aghion and Howitt (1992)), but on the difference between pre- and post-innovation profits. This setting generates an *escape competition* effect, whereby an increase in product market competition stimulates R&D by increasing the incremental profit from innovation in situations of 'neck-and-neck'

[9] As the authors put it: 'Schumpeter's notion of creative destruction projects a view of the competitive struggle somewhat at odds with the standard textbook version, one in which the main instrument of competition is innovation rather than price. Clearly, 'more competition' in this Schumpeterian sense means not a higher price elasticity of demand faced by a producer, but an increased freedom of entry into the competitive innovation sector by potentially rent-stealing rivals. It is relatively straightforward to show that more competition in this sense will lead to higher growth.' (p. 206).
[10] See Section 7.2 of Aghion and Howitt (1998).
[11] The authors present an additional extension where the innovation function in a competitive R&D sector is increasing and concave, and firms need to pay an entry fee to be active in research. They show that a lower entry fee leads to more innovation, which 'vindicates the Schumpeterian claim that more competition in research is growth-enhancing' (p. 208).
[12] See also Aghion, Harris, and Vickers (1997), and discussion in Aghion (2026).

(or levelled) competition with a rival. This happens when product market competition reduces pre-innovation rents by more than post-innovation rents. The step-by-step nature of competition means that firms cannot leapfrog the existing leader in an industry, but must first catch up with it. This implies that a fraction of the market will be in a neck-and-neck state, where the escape competition effect is at work.

2.49 The model by Aghion, Harris, Howitt, and Vickers does not allow for an analytical solution for equilibrium R&D levels, and is therefore illustrated via simulations. The authors show that the standard Schumpeterian effect where more intense competition in the product market reduces innovation is almost always outweighed by the increased incentives of firms to innovate to escape competition. In more detail, the results show that a little product market competition is always growth enhancing; and that for most parameter values this effect of product market competition on growth continues to hold as the degree of product market competition reaches its maximal value. When both product market competition and imitation can be varied together, the maximal growth rate is achieved by allowing the maximal degree of competition. More generally the paper shows that product market competition is most likely to reduce innovation when it is already very intense initially. With respect to imitation, high levels of imitation are bad for growth, but imitation can boost growth at lower levels by promoting more frequent neck-and-neck rivalry.

2.50 Building on and extending the step-by-step innovation models of Aghion, Harris, and Vickers (1997) and Aghion et al. (2001), **Acemoglu and Akcigit (2012)** explore to what extent and in what form intellectual property rights (IPRs) of innovators should be protected. They suggest an optimal policy to involve state-dependent IPRs: firms that are further ahead technologically should receive stronger protection, while those only slightly ahead should be granted weaker protection. The key theoretical insight is a 'trickle-down' incentive effect, whereby stronger protection for frontier leaders also raises R&D incentives for firms below them, implying that fully uniform patent protection is not optimal.

2.51 **Aghion, Bloom, Blundell, Griffith, and Howitt (2005)** apply a modified version of the theoretical model of Aghion et al. (2001), and test its empirical implications on UK data.[13] We review the theoretical model here, and discuss the empirical findings in Section 2.4 below. The theoretical model simplifies the step-by-step model of Aghion et al. (2001), by restricting the maximum gap between leaders and followers to one step. This means that if one firm that is already one step ahead innovates, the lagging firm automatically learns to copy the leader's previous technology and thereby remains only one step behind. At any point in time, there are two kinds of states: a levelled or neck-and-neck state (where firms are at the same technology level) and an unlevelled state, with a technology leader and a follower. Only followers innovate in the unlevelled state, due to the one-step assumption.

2.52 In this model, the degree of product market competition is proxied by the degree to which two firms in the neck-and-neck state are able to collude, and share industry profits. Absent collusion, the firms are in Bertrand competition with homogeneous goods and hence their profits are zero.

2.53 The authors employ this set-up to illustrate two effects of more intense product market competition (proxied by variations in the partial collusion parameter).

[13] For a general review, see also Griffith and Van Reenen (2021).

- *The escape competition effect*, whereby more product market competition stimulates innovation. This effect is at work in neck-and-neck (or levelled) states, where firms directly compete with each other. In this state, product market competition stimulates innovation by reducing preinvention profits (while not affecting postinvention profits).
- *The Schumpeterian effect*, whereby more product market competition reduces innovation when firms are in the unlevelled state. In this state, product market competition reduces post-innovation rents of laggards, and therefore decreases innovation incentives.

2.54 Product market competition therefore has an *ambiguous effect* on innovation (unlike the Aghion and Howitt (1992) model, where only the Schumpeterian product market effect was at work; and Aghion et al. (2001), where the prevailing force was the escape competition effect).

2.55 Aghion et al. (2005) then show that the overall effect of product market competition on innovation has an *inverted U-shape*, i.e. starting from low levels of competition greater competition stimulates innovation, while at high levels of product market competition, greater competition reduces innovation. This relationship is due to *compositional effects* in the model. When there is limited product market competition, neck-and-neck firms face weak incentives to innovate, and hence innovation will be highest in the unlevelled state (allowing laggards to catch up with market leaders). This means that markets will be quick to leave the unlevelled state, and will spend most of the time in the levelled state, where the escape competition effect dominates, and hence greater product market competition fosters innovation. By contrast, when competition is high, laggards face limited incentives to innovate, and markets will be slow to leave unlevelled states. As a result, markets will be mostly in unlevelled states where the Schumpeterian effect dominates, and hence more product market competition reduces innovation. The inverted-U theory has been influential in subsequent policy discussions (see Volume 1, Chapter 4, and the discussion in several policy papers reviewed in Volume 1, Chapter 10).

2.56 **Hashmi (2013)** reexamines the inverted-U relationship between competition and innovation developed by Aghion et al. (2005) by proposing a modified version of their framework that takes into account the size of the technology gap. In his version, the technology gap is not restricted to one step, so industries can move beyond the neck-and-neck/leader-laggard dichotomy used by Aghion et al. (2005). In Hashmi's model, firms can be separated by the size of technology gaps, and the laggard's probability of successful innovation includes a technology-gap-dependent 'help' or spillover term: the further behind the laggard is, the easier catching up becomes. The key implication is that the effect of product market competition on innovation depends on how far apart firms are technologically. When firms are very close, competition tends to stimulate innovation through the escape-competition effect. At intermediate gaps, the relationship can take an inverted U-shape, because competition initially strengthens innovation incentives but eventually reduces the rents from innovating. When gaps are large, the relationship becomes negative, because stronger competition mainly lowers the return to catching up. Hashmi shows that this relaxation of the one-step restriction of the original model allows the same framework to explain both the inverted-U found by Aghion et al. (2005) for UK firms and the negative relationship he finds for publicly traded US firms (discussed in Subsection 2.4.1). He interprets this difference as reflecting the fact that UK industries are more neck-and-neck on average, whereas US industries exhibit larger technology gaps.

2.57 **Askenazy, Cahn, and Irac (2013)** extend the inverted-U framework of Aghion et al. (2005) to account for heterogeneity in firm size and the relative cost of innovation. The paper develops a modified step-by-step innovation model in which the cost of R&D increases with the size of innovation, and where the effect of

competition on innovation is weaker when innovation is relatively costly or firms are smaller.[14] The model predicts that in neck-and-neck industries competition has a weaker positive 'escape competition' effect on innovation when innovation costs are high relative to firm size, while in unlevelled industries the negative Schumpeterian effect of competition on laggard innovation incentives also becomes less pronounced.[15]

2.3.2 Further models of product market competition

2.58 A number of subsequent papers have studied in more detail the impact of variations in product market competition. They largely confirm the finding that the relationship between product market competition and innovation is complex and can go in either direction. On the one hand, greater product market competition before innovation (ex ante) can spur innovation by creating incentives for firms to 'escape competition' through technological improvements—this effect is present because more intense rivalry lowers profits from existing products, and hence raises the relative value of innovation. On the other hand, intense product market competition after innovation (ex post) dissipates the rents that reward successful innovation, potentially discouraging investment. The papers in this Section examine how these countervailing forces play out as a function of the intensity of rivalry in the product market (measured by product substitutability), and the distribution of technological capabilities across firms (frontier versus laggard; and efficient versus inefficient).

2.59 **Boone (2000)** studies how product market competition affects innovation by considering a model where companies first decide whether to enter a market with a new good, and how much to invest in improving their production methods, then compete by setting quantities or prices. Competitive pressure is modelled by a parameter that captures the exposure of firms to each other's conduct (e.g. product substitutability).

2.60 The paper shows that when competition intensifies, companies respond differently depending on their market position, and depending on whether one considers product or process innovation. In terms of *product innovation*, the paper notes the following:

- For firms with an advantage over rivals ('eager' or 'complacent' firms), higher competition leads to stronger incentives to invest in product innovations. A rise in competitive pressure raises the incentives to undertake product innovations as it enables them to better exploit their cost advantage. This can be interpreted as a selection effect of competition, where more efficient firms prosper at the expense of less efficient ones;
- For firms who are lagging behind their rivals ('faint' or 'struggling' firms), more competition reduces the reward from innovating, and hence reduces incentives. This is the Schumpeterian effect of product market competition identified in Aghion and Howitt (1992).

2.61 In terms of *process innovation*, 'eager' and 'struggling' firms (i.e. firms who do not have a strong advantage or disadvantage compared to rivals) invest more in process innovation as competition increases, while the effect works in the other direction for large asymmetries ('complacent' and 'faint' firms). Boone defines this as an *adaptation* effect of competition. The findings of this paper therefore confirm that

[14] Empirically, the authors combine a large unbalanced panel of approximately 15,000 French firms from the Banque de France FIBEN database over 1990–2004 with French Ministry of Research R&D survey data on patents and R&D expenditure.
[15] The authors also provide an empirical assessment, which we discuss in Section 2.4.

greater product market competition has an ambiguous effect on innovation incentives, depending on the relative position of each firm, and the nature of the innovative process.

2.62 In subsequent work, **Boone (2001)** examines the impact of variations in product market competition on innovation incentives in a context where firms have asymmetric costs, and compete to acquire a patent for a superior technology. In this setting, the relationship between competition and innovation is non-monotonic, as it depends on the type of the firm obtaining the patent, and whether the identity of the winner changes with product market competition. In particular, Boone (2001) shows the following:

- At low intensity of product market competition, firms with lower efficiency (*followers*) buy the innovation to leapfrog their rivals, and that a greater level of product market competition from this level *reduces* their innovation incentives. This effect arises because at low levels of competition, strategic effects between rival bidders are limited, and the inefficient firm gains more by innovation. However, these gains are limited in a more competitive market (i.e. competition limits the gains from catching-up, as in Schumpeterian models of innovation).
- At higher intensity of competition, the winner of the patent is instead the more efficient firm (the leader), and in this case an increase in competition *increases* innovation incentives. Here, the leader increases its dominance by buying the new technology, because strategic effects are stronger and the leader does not want to become a follower. This is a strategic pre-emption effect, similar to the one found by Gilbert and Newbery (1982).

2.63 As a result, increasing competition can either encourage or discourage innovation depending on the starting positions of the companies and how competitive the market already is. The different incentives of asymmetric firms, and the change in the identity of the innovator at different levels of competition, inevitably leads to a non-monotonic relationship between competition, innovation, and the speed of technological progress.

2.64 **Schmutzler (2013)** provides a general framework to understand the impact of changes in product market competition on investment (for a given market structure at the R&D stage). He considers a sequential duopoly model where two competing companies first decide how much to invest in lowering their marginal production costs (i.e. process innovation), and then compete against each other in selling their products, under either price or quantity competition. As in previous literature, product market competition is proxied by a parameter capturing the degree of substitutability between competitors. He shows that in symmetric states (i.e. both firms have the same initial level of efficiency), greater product market competition generally has an ambiguous effect on investment incentives, depending on the functional form of demand. In the case of asymmetric firms (which resembles the unlevelled states in the previous growth literature), investments are decreasing in competition for laggards (this can be seen as a Schumpeterian effect), and are increasing for leaders for sufficiently high competition. Positive spillovers support a negative effect of competition on investment. Like other papers in the literature, this paper confirms that the relationship between product market competition and innovation is complex, and sensitive to the specific setting (e.g. degree of asymmetry; assumptions on demand behaviour; presence of spillovers).

2.3.3 Further models of innovation and product market competition

2.65 Other papers in the literature have further considered the impact of variation in the intensity of innovation competition, while also modelling any associated change in product market competition.

2.66 **Vives (2008)** instead studies models with symmetric firms and compares different competitive scenarios, including competition in prices and in quantities, and models with free entry and restricted entry (i.e. endogenous and exogenous market structure). Firms compete in cost-reducing R&D (i.e. process innovation), in a non-tournament environment (unlike a patent race setting), and also compete in the product market. Competitive pressure is modelled by a variety of indicators (an increase in product substitutability, an increase in the number of competitors, a larger market size, and a decrease in entry costs).

2.67 In the models with exogenous market structure, Vives (2008) shows the following.

- Increasing the number of rival firms (i.e. more rivalry at both the innovation and product market stage) tends to reduce cost-reducing expenditure per firm. This follows the fact that the reduction in residual demand for each firm (a direct size effect) dominates the elasticity effect from facing more competitors (an indirect effect). However, it is still possible, and indeed likely, that increasing the number of firms increases R&D intensity (i.e. cost reduction expenditure over sales).
- Increasing the degree of product differentiation tends to increase cost reduction expenditures per firm in leading demand models (e.g. linear models with Shapley-Shubik specification, constant elasticity, and constant expenditure demand systems).

2.68 In the models with free entry and endogenous market structure Vives (2008) establishes the following.

- Increasing the market size increases per-firm output and cost reduction expenditure. However, the number of firms and varieties may increase or diminish.
- Decreasing the entry cost increases the number of firms (varieties) introduced but decreases output and cost reduction expenditure per firm. Industry cost reduction expenditure and overall research intensity increases robustly with lower entry costs (as in the models with restricted entry, when the number of players increases).
- Increasing the degree of product substitutability can increase per-firm cost-reducing expenditure as it may lead to higher price pressure with less entry.

2.69 Vives also finds that an alternative model of competitive pressure modelled as a symmetric degree of partial coordination between firms (i.e. a 'partial' horizontal merger) reduces cost reducing expenditure per firm, both under restricted and free entry.

2.70 Overall the paper suggests that different measures of competition have different impacts on investment in process innovation. When using measures which directly capture the intensity of competition at the R&D stage (i.e. number of firms or entry costs), greater competition reduces innovation efforts at firm level, but tends to increase overall industry expenditure on R&D.

2.71 **Gilbert, Riis, and Riis (2018)** extend the stepwise-innovation model developed by Aghion et al. (2005) beyond a duopoly setting. They find that lessons from the duopoly model do not carry over to markets with a larger number of firms. In a more general oligopoly setting, innovation incentives depend both on the number of rivals and on the nature of industry demand. The model shows that under a modified Bertrand competition assumption (like the one employed by Aghion et al. (2005)), increasing the number of competitors leads to higher innovation. However, in the model of product differentiation considered by Aghion et al. (2001), innovation exhibits an inverted-U relationship with the number of competitors (for a given level of product differentiation). This shows that the predictions of the step-

by-step models of competition and innovation are affected by the parameter assumptions related to competitive intensity and demand.

2.72 **Marshall and Parra (2019)** combine elements of the patent race literature and product market competition literature. They consider a dynamic model where vertically integrated large firms sell products and undertake R&D, together with specialised research labs that only compete to develop innovations and sell them (via auctions) to the large firms. Innovation competition is modelled like a patent race, where successful innovation allows a firm to become a market leader, and enjoy a positive profit gap relative to followers. The degree of competition is proxied by the number of rival large firms who are followers at any given time.

2.73 In this model, competition affects innovation via two channels, as follows.

- *An innovation competition channel*, whereby increasing the number of innovators accelerates arrival of new innovation (as in the patent race literature).
- *A product market competition channel*, which depends on how the number of competitors affects product market payoffs, and hence the profit gap between leaders and followers. This second channel has an indirect effect on innovation incentives, and it has an ambiguous impact (depending on the model of competition that is assumed).

2.74 The model implies that if the profit gap is increasing in the number of firms, then greater competition will unambiguously boost innovation. Consumer welfare is also higher in this case, as a result of higher innovation and lower prices in the product market. However, if the profit gap decreases in the number of firms, then competition may reduce innovation. Depending on the model assumptions, there are scenarios where this effect is large enough to reduce consumer welfare (and offset the lower product market prices brought about by competition). The authors present numerical simulations indicating that it is possible to obtain an inverted-U relationship between the number of firms and both innovation and consumer surplus.

2.75 **Jeanjean (2021)** examines how technical progress[16] affects the relationship between the number of firms, investment, and welfare, in an oligopoly model of differentiated products in which firms simultaneously choose price and investment. The main result is that greater technical progress shifts the peak of the inverted-U relationship between competition and investment to the left, so the number of firms at which investment is maximised becomes smaller. Jeanjean also finds that, in a given parameter range, technical progress lowers the level of competition that maximises consumer surplus and welfare.

2.3.4 Competition and innovation in technology licensing markets

2.76 The models on R&D competition, product market competition, and innovation discussed so far largely abstract from the possibility of a market for technology, where innovators license their technology—either to one competitor or potentially market-wide.

2.77 **Spulber (2013)** presents a two-stage model with upstream inventors and downstream producers. In this setting, inventors work on risky research projects, and then they sell or license their inventions to companies that then compete by

[16] Technical progress refers to the ease of innovation, that is the higher the degree of technical progress is, the lower the cost of innovation for a given cost reduction, so innovation is easier. In this model, investment is proportional to the firm's own output, such that lower concentration and hence lower output per firm weakens firm-level incentives for cost reductions.

offering differentiated products to consumers. The analysis models innovation incentives under different market conditions and levels of patent protection. The key findings of the paper are:

- when there is a well-functioning market for inventions, greater product market competition (modelled as a higher number of producers, or lower barriers to entry) increases innovation incentives, by leading to higher industry output (which enhances the returns to applying the best invention, in line with Arrow (1962));
- similarly, competition in the market for inventions also increases innovation incentives, compared to a multi-project monopoly inventor, through lower royalties and greater output and variety in the product market (a business creation effect);
- however, lower appropriability in the form of weak intellectual property (IP) protection decreases innovation incentives, and leads to free-riding effects (implying that greater competition reduces the incentive to innovate in this environment).

2.78 On the basis of these results, Spulber concludes that competition policy and IP policies are *complementary* tools to promote innovation: policies that favour competition stimulate innovation when IP rights are effective, and policies to strengthen IP generate benefits from competition.

2.79 **De Bettignies, Liu, Robinson, and Gainullin (2023)** examine how technology licensing shapes the relationship between product market competition and innovation.[17] They consider a technology market in which an innovator licenses an invention to firms that then commercialise it in the product market. The paper develops a theoretical model in which the innovator offers a quality-improving innovation either through targeted licensing to one firm or through market-wide licensing to all firms.[18] In the model, the return to innovation depends on firms' willingness to pay for the licence. The key finding is a U-shaped relationship between competition and innovation: innovation initially falls and then rises as competition intensifies. This pattern reflects two opposing forces: a rent reduction effect, whereby stronger competition lowers product prices and reduces the value of licensing, and a business-stealing effect, whereby stronger competition raises demand elasticity and increases the gains from superior quality. The balance between these effects depends on the licensing strategy. Under targeted licensing, the business-stealing effect dominates because the licensee can charge higher prices and gains more from capturing market share. Under market-wide licensing, the rent reduction effect dominates because all firms license the innovation, prices remain lower, and the value of innovation falls.

2.3.5 Competition policy and innovation

2.80 Finally, we consider a paper that unlike the others in this Section, looks explicitly at the impact of competition policy, for the case of exclusionary conduct. This is instructive, as it shows that studying the impact of (exogenous) changes in product market competition is not the same as looking at changes in conduct that can result from different applications of competition policy.

[17] We review the theoretical model here, and the empirical analysis of the paper in Section 2.4 below.
[18] Under targeted licensing, innovation's effect on the licensee's willingness to pay operates through improved quality advantage, market share, and profits; under market-wide licensing, it operates through both the quality disadvantage faced by unlicensed firms and the reduced market share and profits they would experience without the license.

2.81 **Segal and Whinston (2007)** consider the impact of exclusionary conduct and competition policy on innovation rates. Their model builds on the patent race and endogenous growth literature, as it considers a dynamic model where innovation is a continuous process where new innovators displace current incumbents, and hold an incumbency position until they are themselves replaced. Competition (or antitrust) policy is measured as a tool that protects new entrants at the expense of incumbents, by limiting the scope for exclusionary conduct (e.g. exclusive or long-term contracts). Greater competitive pressure in this model implies a more protective competition policy. This has in turn two opposite effects on innovation: an increase in the profits of new entrants (which boosts their incentives to innovate), but also a reduction of the profitability of becoming an incumbent. Since successful entrants become the next incumbents, both effects are at work to determine the incentive to innovate. Segal and Whinston show that a more protective antitrust policy can boost innovation by *frontloading* the profits of an innovative new entrant. They also present examples where more restrictive competition policy (proxied as a lower incidence of long-term contracts) boosts innovation by increasing the profits of being an entrant while not reducing the profits of a continuing incumbent for a given rate of innovation (so that no trade-off arises).

2.82 An interesting feature of the Segal and Whinston paper is that it models how a change in competition policy affects innovation, rather than looking at exogenous changes in structural proxies for the degree of competition (e.g. elasticity of demand, or elasticity of substitution across products). They therefore consider changes in competition directly caused by a change in policy. This is not a minor difference in modelling approaches, as it has implications for the policy implications of their results. It is instructive to quote from the paper on this aspect (footnote 4):

> 'The growth literature often considers how changes in various parameters will affect the rate of innovation, sometimes even calling such parameters measures of the degree of 'antitrust policy' (e.g. Aghion et al. (2001) refer to the elasticity of substitution as such a measure). Here we are much more explicit about what antitrust policies toward specific practices do. This is not a minor difference, as our results differ substantially from those that might be inferred from the parameter changes considered in the growth literature. As an example, one would get exactly the wrong conclusion if one interpreted results showing that more inelastic demand functions lead to more innovation (e.g. Aghion and Howitt 1992) to mean that allowing an incumbent to enhance its market power through long-term contracts leads to more innovation.'

2.83 As we will discuss more extensively later, a similar point applies to the modelling of mergers and of merger control.[19]

2.4 Empirical evidence

2.84 This Section reviews within- and cross-industry empirical studies that test the relationship between competition or firm size on the one hand, and innovation or productivity on the other hand. To identify causal effects, these papers use various reduced-form econometric modelling techniques (e.g. panel data regressions to control for various fixed effects, instrumental variable (IV) approaches to account for endogeneity, and difference-in-differences (DiD) designs), as well as structural

[19] For a discussion directly related to mergers see Shapiro (2012) and the discussion in Whinston (2012). We will return to these papers in Section 8.1.

econometric modelling that calibrates theoretical models of competition based on observed data and conducts counterfactual simulations.

2.85 The remainder of this Section discusses in turn the papers that look at (i) competition and innovation, (ii) competition and productivity, and (iii) firm size and innovation.

2.4.1 Competition and innovation

2.86 Several key empirical papers have looked at the relationship between competition and various measures of innovation input or output.

2.87 Some of these papers consider the underlying mechanisms that would drive the effect of competition on innovation, including in particular the *escape-competition effect* (where more competition reduces pre-innovation profits and hence pushes firms to innovate in order to gain a temporary technology lead over their rivals) versus an opposing *Schumpeterian effect* (where more competition reduces post-innovation profits, lowering lagging firms' incentives to innovate). Additionally, some of these papers consider *pre-emption effects* (where incumbent firms innovate early to prevent rivals from entering or overtaking them) at the same time as *cannibalisation effects* (where incumbent firms hesitate to innovate because new products would reduce profits from their existing products). The papers considered in this Subsection rely on reduced-form econometric modelling across industries, structural modelling within a specific industry, or DiD approaches applied to past antitrust interventions.

Reduced-form econometric modelling

2.88 In an early study looking at most of the *Fortune* 500 largest US firms, **Scherer (1965)** finds that market concentration (as well as profitability, liquidity, and diversification) has only a modest or statistically weak relationship with variations in firms' patenting behaviour, with over 30% of this variation explained by firms' scientific and technological base instead. This paper is discussed in more detail in para. 2.135. In a subsequent paper, **Scherer (1967)** uses a more granular dataset of 56 US manufacturing industries from 1960 to examine more closely the relationship between competition and innovation.[20] He finds a statistically significant inverted-U relationship between market concentration and innovation, with a negative cross-sectional association between market concentration and innovation in more concentrated industries (i.e. less competitive) and a positive association in less concentrated industries (i.e. more competitive industries). The empirical threshold that Scherer finds above which further concentration would be bad for innovation is low: as he concludes, '[w]hen the four-firm concentration ratio exceeds 50 or 55 per cent, additional market power is probably not conducive to more vigorous technological efforts and may be downright stultifying' (p. 530).

2.89 Below, we focus only on the more recent studies (from the 1990s onwards).[21]

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[20] Competition is measured by industry-specific four-firm concentration ratio, and industry-level innovation activity, as measured by the number of scientists and engineers per 1,000 employees and total R&D expenditure per employee. He then estimates a series of cross-sectional OLS regressions relating his measures of innovation to market concentration and its square, while controlling for proxies for technological opportunity, product characteristics (complexity, durability), and industry scope and size (total sales, number of firms, degree of vertical integration).

[21] For further references to older papers from the 1980s and prior, see Cohen and Levin (1989), as well as Gilbert (2006). Cohen and Levin (1989) provide an early survey of reduced-form empirical studies on innovation and market structure that highlights some key methodological weaknesses of these early papers. In particular, these early papers do not account for endogeneity of market

2.90 Moving from a purely cross-sectional industry-level analysis to firm-level panel data, **Blundell, Griffith, and Van Reenen (1999)** find a positive effect of market shares on innovation (i.e. larger firms in an industry innovate more), but also that market competition in the industry is related to higher innovative activity.[22] They further investigate also the mechanism behind the positive relation between firm market share and innovation, concluding on a pre-emption effect. More specifically, they show that the impact of innovation on stock market valuation is larger for firms with higher market shares, which they conclude is consistent with models where high market share firms have incentives to pre-emptively innovate, as they have more to lose in the counterfactual.

2.91 Blundell, Griffith, and Van Reenen estimate a linear specification for the relationship between competition and innovation, both at the firm and industry level. Allowing instead for a non-linear relationship, as also concluded by Scherer (1967), **Aghion, Bloom, Blundell, Griffith, and Howitt (2005)** consider an unbalanced panel dataset of listed UK firms across 2-digit SIC industries from 1973–'94 and use a flexible non-linear model with industry- and year-fixed effects.[23] Competition is measured as industry-average profitability and innovation as the number of citation weighted patents.[24] Overall, the authors conclude on a causal relation from competition to innovation (using an IV approach)[25], and find that innovation is highest at intermediate levels of competition. This is explained as a tension between (i) the escape-competition effect that creates a positive effect of competition on innovation, particularly when firms operate at the same technological level (i.e. are neck-and-neck) and (ii) the Schumpeterian effect where increased competition reduces the post-innovation rents of laggard firms and thus their incentive to catch up. Figure 2.1 below replicates the figure that plots the data and the fitted exponential quadratic curve. Aghion et al. provide further empirical results to show that in more neck-and-neck industries (identified as industries with a below-median average distance of firms from the technological frontier), innovation is both higher for any level of competition and more sensitive to competition. As with the previous papers however, Aghion et al. do not investigate the effect of competition on consumer surplus.

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concentration (e.g. more innovative firms becoming larger and hence decreasing concentration, rather than the reverse) and may still suffer from omitted variable bias related to unobserved factors not controlled for (e.g. managerial quality or regulatory environment). Additionally, they do not look at variations within an industry. Finally, they do not provide an interpretation of why market power would enable firms to innovate more (i.e. what the underlying mechanism would be).

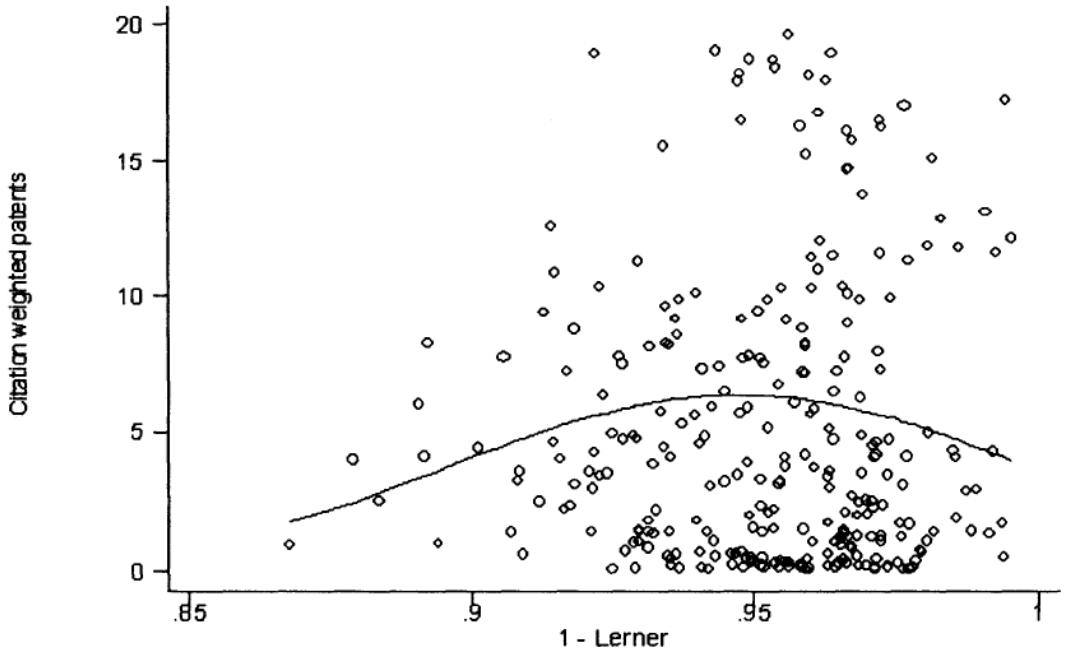
[22] They use an (unbalanced) annual firm-level panel of 340 listed UK manufacturing firms from 1972–'82. Competition is measured using firm-level market shares (firm's sales divided by the total sales at the 3-digit SIC level), industry-level five-firm concentration ratios, and industry-level import penetration rates (share of imports relative to home demand). Innovation is measured based on (i) counts of innovations from the Science Policy Research Unit (SPRU) at the University of Sussex, which record 'technologically significant and commercially important' innovations based on systematic screening of technical journals, trade publications, and expert sources; and (ii) count of patents registered at the US Patent Office (as a robustness check). Using various methods (dynamic log-link Poisson models and long pre-sample innovation histories used to proxy firm fixed effects), the authors control for firm-specific characteristics that do not change over time and reduce the risk that the results are driven by reverse causality between innovation and market power.

[23] For a discussion on the theoretical step-by-step innovation model presented by Aghion, Bloom, Blundell, Griffith, and Howitt (2005), see Subsection 2.3.1.

[24] Taken from the NBER patent and citation data base.

[25] The model allows for non-linearity by including the competition variable as both a linear and a quadratic term. To address endogeneity, the authors use three sets of policy instruments as instrumental variables. The instruments used are the Thatcher era privatisations, the EU Single Market Programme, and the Monopoly and Merger Commission investigations that resulted in structural or behavioural remedies being imposed on the industry.

Figure 2.1 Inverted-U in competition and innovation (Aghion et al., 2005)



Note: The figure plots a measure of competition on the x-axis (with 1 indicating perfect competition) against citation-weighted patents on the y-axis. Each point represents an industry-year. The scatter shows all data points that lie in between the 10th and 90th deciles in the citation-weighted distribution. The exponential quadratic curve that is overlaid is reported in column 2 of table 1 in Aghion et al. (2005).
Source: Aghion et al. (2005), p. 706.

2.92 **Aghion, Blundell, Griffith, Howitt, and Prantl (2009)** examine how firm entry is associated with incumbent innovation and productivity, and whether that association varies with distance to the technology frontier.[26] The theoretical framework focuses on two effects of firm entry: an escape-entry effect and a discouragement effect. A higher threat of entry induces incumbents in sectors close to the technology frontier to innovate more in order to escape this pressure, but it reduces innovation incentives in sectors further behind the frontier, where incumbents have little chance of surviving entry. As a result, increasing the threat of entry has a more positive effect on incumbent productivity growth in sectors nearer the frontier than in sectors that are further behind.

2.93 In line with the theoretical predictions, the empirical results[27] suggest that the relationship between greenfield foreign entry and incumbent performance is heterogeneous across industries: incumbent productivity (captured by labour productivity and total factor productivity (TFP)) growth and patenting are more

[26] The authors consider greenfield foreign firm entry i.e. entry of multinational firms that set up a new production facility in the UK and operate internationally.
[27] For the empirical analysis, the authors use data consisting of a UK panel of 5,161 domestic incumbent establishments for 1987–'93 in the productivity analysis and 1,073 observations on 174 incumbent firms in the patenting analysis.

positive in sectors close to the technology frontier, while the relationship is much weaker, and can turn negative, in sectors further behind the frontier.[28,29]

2.94 Other empirical papers have re-examined the findings by Aghion et al. (2005). For example, **Correa (2012)** uses the same dataset as in Aghion et al. (2005) (311 UK-listed firms with USPTO patents, 1973–'94) and argues that their result is driven by a structural break around the 1982 establishment of the United States Court of Appeals for the Federal Circuit, which decreased the difficulty of granting a patent and increased the number of patent applications and grants. Using Poisson regressions and Chow tests, the paper shows that the competition–innovation relationship is unstable over time: before 1982 (1973–'82), competition has a positive and significant effect on innovation, while after 1982 (1983–'94), the relationship becomes statistically insignificant. The break is attributed to a shift towards a more pro-patent environment, which expanded patenting across industries and changed incentives.

2.95 Replicating the empirical analysis executed by Aghion et al. (2005) by using a set of 7,789 publicly listed manufacturing firms in the US from 1976 to 2001, Hashmi (2013) reexamines the competition-innovation relationship taking into account the size of the technology gap.[30] In contrast to Aghion et al. (2005), who find an inverted-U relationship between competition and innovation for the UK, Hashmi finds a weak negative relationship for the US. As described in Subsection 2.3.1, this empirical finding is in line with his theoretical model, which takes into account technological gaps within industries and predicts that in industries with larger technological gaps, such as the US, stronger product market competition lowers the returns from catching-up and thus competition is negatively associated with innovation.

2.96 **Askenazy, Cahn, and Irac (2013)** analyse how the relationship between competition and innovation depends on firm size and the relative cost of innovation. In addition to the theoretical model discussed in para. 2.57, the authors also test the model predictions using a panel of French firms.[31] The main finding is that the

[28] To account for endogeneity of firm entry, the authors implement an IV approach and exploit variation in UK entry costs that arises from EU and UK policy reforms that affected entry differentially across industries and time. Specifically, two sets of policy interventions were used: (i) European reforms under the Single Market Program, captured by indicators for industries in which the reforms were ex ante expected to reduce medium or high entry barriers, and (ii) UK product-market reforms, namely privatisation decisions, proxied by stock market sales in directly affected industries, and merger and monopoly cases in which Competition Authority investigations culminated in policy interventions.

[29] Technological frontier distance is measured using a three-year moving average of US industry labour productivity relative to labour productivity in the respective incumbent UK industry, averaging over the current and the two preceding years. US industries are used as the benchmark because they most often represent the world technological frontier.

[30] The theoretical contribution of Hashmi (2013) is discussed in para. 2.56. The sample used for the empirical analysis contains 7,789 firms, compared to a sample of 311 UK firms between 1973 and 1994 used in Aghion et al. (2005). To account for endogeneity of competition, Hashmi uses a measure of foreign competition as an instrument, namely a source-weighted average of industry exchange rates, where the weights are the relevant country's share in exports to the US industry in the base year. As in Aghion et al. (2005), product market competition is captured by industry-average profitability, and innovation is measured as number of citation-weighted patents.

[31] The authors combine a large unbalanced panel of approximately 15,000 French firms from the Banque de France FIBEN database over 1990–2004 with French Ministry of Research R&D survey data on patents and R&D expenditure. They estimate fixed-effects and Heckman selection models using firm-level Lerner indices and Boone indices, while interacting competition variables with firm size and sector-level innovation costs. The Boone index measures competition as the elasticity of firms' profits with respect to their costs, where the idea is that in more competitive markets, less efficient (higher-cost) firms suffer a larger reduction in profits.

inverted-U relationship between competition and innovation becomes progressively flatter as the relative cost of innovation rises or firm size declines, and disappears altogether for many small firms. As the authors themselves recognise, they do not control for possible endogeneity in the size of innovation or firm size.

2.97 Looking at financial services, **Bos, Kolari, and van Lamoen (2013)** consider whether the inverted-U pattern predicted by the Aghion et al. (2005) model holds. The authors capture innovation in the banking sector as a reduction in a firm's technology gap, defined as a firm's distance to the global frontier (i.e. the best available technology). The analysis uses panel data stemming from call reports of US commercial banks over 1984–2004.[32] Results suggest an inverted-U relationship between competition and innovation in the US banking industry. Additional findings indicate rising price–cost margins over time, declining average innovation, and evidence that consolidation and interstate banking deregulation are associated with lower innovation outcomes.

2.98 Considering productivity measures (TFP and labour productivity) next to patent-based indicators as alternative measures of technological progress,[33] **Correa and Ornaghi (2014)** investigate the relationship between competition and innovation at the industry level.[34] To address endogeneity of competition, the paper instruments industry competition with measures of foreign competitive pressure, namely tariff rates, EU productivity indices, and Chinese import penetration.[35] The empirical findings reveal a positive monotonic relationship between competition and innovation, with patent counts (simple or weighted by citations) increasing with greater competition, and TFP and labour productivity growing as industries move from market power towards greater competitiveness.

2.99 Looking at the relationship between intensity of competition and investment in telecoms, **Houngbonon and Jeanjean (2016)** use an unbalanced quarterly panel of 110 wireless operators between 2005 and 2012. They measure intensity of competition as gross profit margins (i.e. EBITDA over revenue) and investment in mobile services in terms of capital expenditure (CAPEX) and CAPEX per subscriber.[36]

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[32] Competition is measured as a bank's price cost margin using the Lerner-Index. To address endogeneity of competition, the authors estimate a dynamic panel data model in which lags of competition are used as an IV in a first-differences specification.

[33] The authors note that, although patents are useful indicators of innovative output, they have important limitations as measures of technological progress: many firms rely on trade secrecy rather than patenting, so patents capture only a fraction of productivity-enhancing innovations, and they do not reflect efficiency gains arising from the adoption of more efficient technologies or better managerial practices. For this reason, the authors use TFP and labour productivity as alternative measures of technological progress, intended to capture technological change associated with new ideas, new technologies, and improved managerial practices.

[34] The study employs reduced-form estimation of competition and innovation, estimating a count-data model in which the number of patents is assumed to be a nonlinear function of competition, and uses piecewise linear regressions with multiple breaks to explore nonlinearities in the competition-innovation relationship. Competition is measured by an index of the average profits in the industry, and the analysis uses firm balance-sheet and financial data matched with firm-level patent data, together with information on output, inputs, and productivity for manufacturing industries, spanning the period 1974–2001 for patents (223 four-digit SIC-4 industries) and 1987–2008 for productivity (85 four-digit NAICS-4 industries).

[35] The underlying idea of those instrumental variables is that lower tariffs and faster productivity growth abroad increase competitive pressure in US industries and thereby shift domestic profitability, while being plausibly orthogonal to contemporaneous industry-level innovative outcomes except through their effect on competition. Thus, they provide exogenous variation in the degree of competition faced by US producers.

[36] Using lagged competition intensity as an instrument is based on the assumption that it affects current investment only through past competition, and not through any other channel. However, this assumption does not hold if lagged competition is correlated with unobserved shocks that also affect

They find that the relationship between competition and investment is inverted U-shaped, with the estimated level of gross profit associated with the highest level of investment lying between 37 and 40 percent of revenue.

2.100 **Beneito, Rochina-Barrachina, and Sanchis (2017)** extend the study by Aghion et al. (2005) by investigating the competition–innovation relationship when selective exit (i.e. the possibility of inefficient firms facing the threat of exit when competition intensifies) is taken into account, and analyse whether this also changes the link between competition and the within-industry technological gap. In unlevelled sectors this threat-of-exit effect means laggards may innovate in order to survive, offsetting the negative Schumpeterian effect, so that, depending on the strength of this mechanism, the model can generate either an inverted-U or a positive competition–innovation relationship.[37] Their main finding is a positive relationship between competition and patenting, and a negative relationship between competition and the technology gap.

2.101 Applying a reduced-form panel approach to US firms over 1980–2015, **Gutiérrez and Philippon (2017)** use Tobin's Q[38] as a benchmark for investment opportunities.[39] They document persistent underinvestment relative to Tobin's Q beginning around 2000, associated with rising concentration (measured in terms of Herfindahl-Hirschman Index (HHI) within the 3-digit NAICS industry group), increasing markups, greater intangible investment, and rising institutional ownership. They further show that this underinvestment is especially pronounced in industries with greater common ownership: using both traditional and common-ownership-adjusted Herfindahl indices, they find that industries with higher common ownership invest significantly less, even after controlling for current market conditions and intangibles. There are three forces at work to explain these results, as described by the authors: weaker competition makes firms less eager to invest; changes in corporate governance and ownership encourage firms to pay shareholders instead of investing in new capital; and the growing importance of intangible assets such as software and R&D has changed how and what firms invest, shifting spending away from traditional physical capital. Although the paper focuses

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current investment—for example persistent demand shocks or technological changes which influence both past competition intensity and current investment decisions. Because the study also incorporates competition intensity as a quadratic term, the study uses operator's year of market entry as a second instrument. This is argued to be a valid instrument because entry timing is regulator-driven and influences investment mainly via its effect on competitive conditions. However, this instrument may also be weak if regulatory decisions are correlated with factors simultaneously influencing firms' investment behaviour—for example because regulators may time their decisions depending on expected market growth, or anticipated investment developments in the sector. They estimate a dynamic quadratic investment model using IV-generalized method of moments (GMM) to address endogeneity concerns, where competition intensity is instrumented with its lagged values and operators' year of market entry.

[37] Using a panel of 80 Spanish manufacturing industries over 1990–2006, the authors estimate three equations: the first equation links innovation (measured as number of patents) with a quadratic competition term (measured as one minus the Lerner index, and product market substitutability in an alternative specification). The second equation relates competition with the rate of firms' exit from the industry due to bankruptcy. To account for endogeneity of competition in these two equations, the authors use reductions in import tariffs as an IV in a control function approach. The third equation then relates the within-industry technological gap to the predicted values of innovation and exit from the first two equations, which allows the authors to distinguish between the effects of competition on the technological gap operating through innovation and through exit.

[38] Tobin's Q is the ratio of the market value of a firm to the replacement cost of its physical assets and is a common indicator of the attractiveness of new investment, where firms invest when the market valuation of capital exceeds its replacement cost.

[39] They estimate panel regressions with an estimator that corrects for classical measurement error in Tobin's Q.

on total investment in general rather than innovation specifically, the findings indicate that greater market power is associated with reduced investment.

2.102 Using a laboratory experiment to analyse the causal effect of competition on step-by-step innovation, **Aghion, Bechtold, Cassar, and Herz (2018)** design a controlled environment in which matched pairs of subjects make costly innovation investments that stochastically move them up a technology ladder. This design allows for identification of the escape-competition effect, the Schumpeterian effect, and the composition effect (i.e. the tendency for stronger competition to reduce the share of neck-and-neck firms) predicted by step-by-step innovation models. They find that higher competition significantly increases R&D investment by neck-and-neck firms (in line with the escape-competition effect) and reduces investment by laggard firms (in line with the Schumpeterian effect). They also find that the reduction in investment by laggard firms is smaller under longer horizons, which indicates a positive *anticipated* escape-competition effect (where laggards anticipate that they can benefit from escaping the competition if they become leaders). These effects unambiguously increase aggregate innovation, while shifting industry composition away from neck-and-neck sectors. At the competition levels considered in this experiment, they do not identify an inverted-U relationship.

2.103 Using a structural model, **Rao (2020)** studies whether pharmaceutical firms adjust Phase 3 R&D decisions in response to competitors' states (i.e. competitors' positions along the product development process, including research, filing, launch, and exit), and how those strategic responses affect the value of a faster FDA approval process and longer market exclusivity.[40] The results show that firms are less likely to continue investment when a competitor has launched and more likely to continue investment when a competitor exits or receives an FDA rejection, while entry into Phase 3 is lower when competitors are actively researching, have filed, or have launched. The structural estimates and counterfactuals indicate that ignoring strategic responses overstates the expected value of entering Phase 3. In addition, a faster FDA process raises the value of entering, but when competitors are close to launch the negative competitive effects dominate. The paper also finds that a one-year increase in market exclusivity raises entry incentives and profits, though the effect is smaller than that of faster approval.

2.104 **De Bettignies, Liu, Robinson, and Gainullin (2023)** use a panel of publicly listed US firm-level data from 1985–2010, to investigate the relationship between product market competition and innovation in technology markets.[41] Their empirical analysis confirms the U-shape relationship predicted by their theoretical model (discussed in Subsection 2.3.4). In addition, they find that higher competition in licensee product markets is associated with a greater propensity towards targeted licensing rather than market-wide licensing, and that competition is positively related to innovation under targeted licensing but negatively related under market-wide licensing.

2.105 Finally, **Garfinkel and Hammoudeh (2025)** investigate whether the mixed evidence on the competition–innovation relation reflects measurement problems: the first is aggregation of innovative activity, where innovation is typically measured at the firm or higher level, pooling projects across multiple product markets and

[40] It combines reduced-form regressions with a dynamic oligopoly model allowing for unobserved market heterogeneity, using market-year-level Phase 3 entry, continuation, filing, launch, and exit decisions for 294 disease indications over 1995–2008.

[41] The final sample contains 2,896 firms in total. To address endogeneity of product market competition to the upstream innovation landscape, the authors use reductions in import tariff rates in licensee product markets as an IV for product market competition. The underlying idea is that tariff reductions increase availability of imported products and decrease foreign firms' market entry costs, thereby increasing homogeneity between products and heightening competitive pressure.

thereby hiding potential heterogeneous responses within firms.[42] The second is imperfect measurement of distance to the technological frontier, where existing proxies often rely on productivity-based measures and do not capture project-specific proximity to the frontier. To address both measurement problems, the authors focus on the pharmaceutical industry, in which data is available on the project/product level and in which innovation is regulated and documented, allowing them to observe innovation and competition at the level of specific therapeutic markets and identify targeted rival responses to competitive shocks.[43] Results show support for the inverted-U hypothesis by Aghion et al. (2005): Phase-II projects from rival firms that are 'shocked' by the approval of a breakthrough innovation for a competitor's drug in the same therapeutic area exhibit higher continuation rates when the affected market was initially less competitive, and lower continuation rates when it was more competitive. Among shocked phase-II projects, projects in less competitive markets are about 50% more likely to progress to phase-III (since laggards have an incentive to catch up in less competitive markets), and projects in more competitive markets are about 23% less likely to continue (since innovation gets discouraged as post-innovation rents decrease). Both figures are measured relative to control projects in markets with similar levels of ex ante competition that did not experience a shock in BTD. In addition, projects which are further away from the technological frontier are estimated to have lower continuation rates, with an estimated drop by 35% in more competitive markets.

Foreign import competition and innovation

2.106 A further set of empirical papers exploits trade liberalisation and import shocks, in particular the rise of Chinese import competition following the 2001 World Trade Organization (WTO) accession of China, as a source of exogenous variation in competitive pressure, and examines how such changes affect firms' innovation, productivity, survival, and the reallocation of activity across firms.[44]

2.107 For example, considering the impact of increased foreign competition on innovation and productivity, **Bloom, Draca, and Van Reenen (2016)** explore whether increased Chinese import competition is associated with faster technical change in Europe.[45] The authors analyse both within-firm effects of increased Chinese import

[42] To highlight the impact of the aggregation problem, Garfinkel and Hammoudeh (2025) conduct a complementary analysis of US manufacturing firms from 1991 to 2011, examining how competition influences their innovation activities, measured by R&D expenditures and citation-weighted patents. To instrument for competition, they use Chinese imports into non-focal but comparable countries. To address the aggregation measurement issue, the authors use a measure capturing the breadth of product markets in which a firm operates. Their analysis shows that the relationship between competition and innovation is sensitive to potential aggregation problems, with firms operating in narrower product scopes exhibiting a clearer relationship than those with broader scopes.

[43] Specifically, the study uses a pharmaceutical project-quarter panel of 12,038 phase-II projects developed by 2,319 firms in 992 therapeutic markets from 2010–'21. To identify the effect of competition on innovation, the empirical design exploits Breakthrough Therapy Designations (BTDs), which are FDA-granted designations to early-stage drugs that show substantial improvement over existing treatments and thereby represent shocks that 'unlevel' competition within a therapeutic market. These shocks are used to examine how rival projects adjust their innovation behaviour, conditional on ex ante competition and their distance to the technological frontier. Distance to the technological frontier is captured based on whether a rival project uses at least one of the same underlying technologies as the BTD-designated drug, with such projects interpreted as being closer to the frontier.

[44] In addition to studies using international trade as a source of exogenous variation to competition, a larger body of literature directly examines the relationship between international trade and productivity. See, for example, Alcalá and Ciccone (2004) or Melitz and Ottaviano (2008).

[45] They use firm- and plant-level data for twelve European countries (Austria, Denmark, Finland, France, Germany, Ireland, Italy, Norway, Spain, Sweden, Switzerland, and the UK) over 1996–2007.

competition on technical change (measured as patenting, IT intensity, and TFP) as well as between-firm effects (i.e. a reallocation of economic activity between firms through increased import competition).[46] The paper's core result is that firms more exposed to Chinese imports show higher patenting, greater IT intensity, and higher productivity within surviving firms. In addition, increased import competition is associated with between-firm reallocation towards more technologically advanced firms because lower-tech firms with lower levels of patents or TFP exit relatively faster and experience larger employment declines in response to Chinese competition. Specifically, a ten-percentage-point increase in Chinese imports is associated with a 0.57 percentage point reduction in survival probability, which corresponds to a 25% increase in exit rates relative to the mean. A back-of-the-envelope quantification reveals that in aggregate Chinese import competition accounts for about 15% of European technology upgrading over 2000–'07, with within-firm and between-firm effects roughly equal in magnitude and the aggregate contribution approximately doubling once offshoring and endogeneity are incorporated.

2.108 Similarly, **Autor, Dorn, Hanson, Pisano, and Shu (2020)** ask how rising Chinese import competition is related to innovation by US firms, focusing on whether greater product-market competition is associated with more or less patenting in the US manufacturing industry.[47] The paper finds that greater import exposure is associated with stronger competitive pressure (reflected in lower US and global sales, lower book and stock values, reduced purchases of labour and capital inputs, and proportionally lower R&D expenditure). Autor et al. then show that, once confounding sectoral patenting trends are accounted for, this higher competitive pressure is associated with lower patent production by US firms. The induced fall in patents is described as roughly proportional to the contraction in sales, employment, capital, and R&D expenditure. The same negative relationship between import competition and innovation appears at the technology-class level for corporate patents, but not for patenting by noncorporate entities such as governments and universities, and it is more pronounced among firms that are initially less profitable and less capital intensive. The result of a negative relationship between import competition and innovation by Autor et al. contrasts with the results of Bloom, Draca, and van Reenen (2016). Autor et al. explain these differences by drawing on the argument advanced by Aghion et al. (2005): the relationship between competition and innovation depends on the size of the technological gap between leading and lagging firms, which tends to be larger in the US than in the European countries studied by Bloom, Draca, and van Reenen (2016).

Sample sizes vary across regressions due to missing data constraints, with approximately 30,000 firms in the patent (baseline) regression, and over 290,000 firms in the TFP (baseline) regression.

[46] To address the endogeneity of import competition the authors exploit the accession of China to the WTO in 2001, which removed product-specific quotas on textiles and apparel, using cross-industry variation in pre-2001 quota exposure to identify exogenous differences in subsequent import growth. The quota instrument is meant to isolate the part of import growth that came from a policy-driven relaxation of trade barriers rather than from underlying technology shocks: after WTO entry, quotas were phased out, so industries that had been more heavily quota-constrained before 2001 should mechanically experience larger subsequent increases in Chinese imports once those restrictions disappeared.

[47] The authors combine records of US patents granted between 1975 and 2013 with firm-level information for publicly listed companies, constructing a sample of more than 170,000 corporate patents with US-based primary inventors from 6,081 firms. They estimate firm-level and technology-class first-difference models over 1991–2007 and instrument US industry import growth with contemporaneous import growth from China in other high-income countries. They also use alternative measures of trade exposure based on changes in trade policy as alternative instrumental variables.

2.109 While Autor et al. (2020) study how increased Chinese import competition affects US firms, **Liu, Lu, Lu, and Luong (2021)** examine the reverse setting by analysing how greater exposure to import competition affects innovation by Chinese firms. The authors exploit China's WTO accession in November 2001 as a quasi-natural experiment. China's WTO commitment entailed substantial and heterogeneous tariff reductions across industries, with sectors facing higher initial tariffs in 2001 experiencing larger post-accession cuts, which generated different exposure to import competition.[48] In line with findings by Autor et al. (2020), their results show that import competition reduces firm innovation overall, as patent filings decline more in industries experiencing greater liberalisation. Heterogeneity analysis indicates that the negative effect is statistically and economically significant for initially high-productivity firms but insignificant for low-productivity firms. Across patent types, import competition has a positive but insignificant effect on less-stringent patents (i.e. design patents with relatively low requirements of inventiveness and without substantive examination and functional/technical thresholds), and negative, statistically significant effects on more-stringent patents, with a stronger effect for the most-stringent patents (i.e. utility model and invention patents, which require a high level of inventiveness and are subject to substantial examination).

2.110 Finally, using a rivalry measure based on product similarity, **Xia, Cassiman, and Wehrheim (2025)** investigate whether increased product market rivalry from Chinese import competition is associated with innovation among incumbent US firms, and whether their firm-level measure reveals heterogeneity that industry-level measures may miss.[49] Their empirical results suggest that greater import competition from China stimulates US firm innovation when firm-level heterogeneity in import competition is taken into account. According to the baseline estimates, an increase in import competition from China from the 25th percentile to the 75th percentile raises US firm innovation by approximately 10 percentage points. In addition, the study finds that firms more directly exposed to Chinese import rivalry respond not only by increasing patenting, but by producing higher-quality and more product (rather than process) oriented innovation, expanding into new technological and business areas, and differentiating their product portfolios in ways that help them mitigate competitive pressure over time.

Structural econometric modelling

2.111 Rather than adopting a reduced-form approach across different industries, several papers have instead resorted to structural econometric modelling and counterfactual simulations within the context of a specific industry.

2.112 Looking at the personal computer microprocessor industry, **Goettler and Gordon (2011)** provide a structural equilibrium model of dynamic oligopoly competition with durable goods and endogenous innovation to examine the effect of competition

[48] The authors manually match tariff data, patent filing data, and firm-level operation data to construct a panel of 440,877 Chinese firms over 1998–2005. They implement a DiD design comparing changes in innovation (measured as number of patents) between industries with large versus small tariff reductions before and after accession.

[49] Focusing on the electronic and electrical appliance industry, the authors build a firm-specific rivalry measure from text-based cosine similarity between US firms' product descriptions and those of Chinese firms which enter into the US market following China's accession to the WTO. The authors then estimate a DiD model over a five-year window before and after entry events between 2001 and 2003, in which they compare US firm innovation outcomes before and after the entry of Chinese competitors, whereas the identifying variation comes from within-firm changes over time in the intensity of competitive exposure captured by the continuous similarity score. The main estimation sample contains 668 firms.

between Intel and AMD on innovation.[50] Based on their structural model and counterfactual simulations, they find that the overall industry rate of innovation—measured as the increase over time in the best available CPU in the market—is 4.2 percent higher when Intel is a monopolist, relative to when it is in competition with AMD. The authors explain this result with reference to the (even) higher monopoly margins Intel would earn from migrating customers to upgraded products—i.e. reduced competition increases the difference between pre- and post-innovation margins, as with the Schumpeterian effect outlined by Aghion et al. (2005). With sufficient growth in the market, this effect dominates the pro-innovation effect from competition between Intel and AMD for being at the technological frontier. However, they also conclude that consumers would be worse off by about $12 billion per year (4.2 percent) due to much higher prices (ca. 50 percent increase).

2.113 Where Goettler and Gordon model innovation as stochastic jumps in product quality within a stable duopoly of durable goods, **Igami (2017)** models innovation as discrete decisions and timing of adopting a new technology generation within a multi-firm industry characterised by creative destruction (i.e. incumbent firms being replaced by more innovative entrants). Looking at the global Hard Disk Drive (HDD) industry between 1981–'98, Igami investigates explicitly the different mechanisms that may incentivise or deter an incumbent to move from an old generation technology (5.25-inch) to a new generation (3.5-inch), considering the balance between cannibalisation on the one hand (which reduces the incentive for incumbent firms to move to a new substitute technology) and pre-emption on the other hand (which instead increases the incentive to innovate, to deter rival entry), allowing for relative cost (dis)advantages in innovation to also affect this balance.[51] The paper finds that while pre-emption incentives are strong and incumbents have an innovation cost advantage, incumbents still have a large innovation delay, which is driven by the cost of cannibalising their existing products.

2.114 In the context of a larger oligopoly with continuous quality competition, **Hashmi and van Biesebroeck (2016)** estimate a structural dynamic game using 1982–2006 data from the global automobile industry, to examine how firms' innovation decisions (measured by patent applications) depend on market structure—specifically their own product quality, the quality distribution of rivals, and changes in competitive conditions such as entry and changes in concentration.[52] The paper finds that firms with intermediate quality invest most in R&D (i.e. there is an inverted-U relation between own quality and R&D) and that, holding own quality constant, firms reduce innovation when average rival quality is higher or more concentrated. On the effect from changes in competitive conditions, they find that

[50] They use quarterly data from 1993–2004 on Intel and AMD CPUs, including prices, performance (benchmark-based quality measures), market shares, unit production costs, R&D expenditures, and consumer CPU ownership distributions from surveys. Innovation is measured as stochastic jumps in product quality generated by R&D investment (observed empirically through improvements in CPU performance benchmarks).

[51] He uses a uniquely constructed panel dataset of the world's HDD manufacturers (1,378 firm-year observations) combined with aggregate annual data on price, shipment quantities, product generations, and quality for HDDs. He then estimates a structural dynamic oligopoly model by combining a logit demand system, an assumption on Cournot competition to recover marginal costs, and a finite-horizon dynamic discrete-choice game that explicitly models entry, exit, and innovation decisions, estimated using maximum likelihood.

[52] Quality is defined as the product's attractiveness to the average consumer. This is a firm level index that combines observed features (size, power/weight, fuel efficiency, etc.) and unobserved attributes (reliability, design, reputation) and is inferred from the firm's market share after adjusting for price under a logit discrete-choice demand model.

entry always reduces incumbent innovation, but thanks to entrant innovation, aggregate innovation typically goes up.

2.115 These industry-specific structural studies yield different conclusions about how competition affects innovation, highlighting the importance of market context and innovation type. **Goettler and Gordon (2011)** find a negative effect from competition on innovation (measured as investment in stochastic increases in product quality), by reducing the gap between pre- and post-innovation rents, while at the same time reducing overall consumer surplus by increasing prices (despite the increased innovation). Igami (2017) structurally identifies three forces—cannibalisation, pre-emption, and cost differences—and quantifies their net impact. He finds strong pre-emptive incentives, which push incumbents to adopt the new technology earlier when rivals are present, but cannibalisation of their existing products dominates, making incumbents reluctant innovators overall. Finally, Hashmi and van Biesebroeck (2016) provide a third perspective from the automobile industry: exogenous entry and stronger rival-quality pressure reduce individual incumbents' innovation (consistent with the Schumpeterian effect identified by Goettler and Gordon), but aggregate industry innovation typically rises because entrants themselves innovate.

Breakups

2.116 Finally, some papers examine the effect of competition on innovation by considering the effect of competition-enhancing remedies following antitrust intervention. We review four papers that employ quasi-experimental DiD designs using patent data and examine the following cases: the 1952 IG Farben breakup, the 1956 and 1984 Bell consent decrees, the 1911 Standard Oil breakup, and the 1975 Xerox consent decree.

2.117 Studying the 1952 Allied-mandated breakup of the German chemical and pharmaceutical conglomerate IG Farben, **Poege (2022)** analyses the impact of this structural change on innovation using data from the pharmaceutical and chemical sectors in Germany. Using a DiD approach, he compares patenting trends before and after the breakup across technologies. The analysis shows that the breakup affected innovation output in the German chemical industry and finds that innovation in technologies exposed to the IG Farben breakup increased strongly and persistently relative to other chemical technologies. Specifically, the breakup led to a statistically significant increase in innovation (proxied by patent activity) of about 70% for a typical technology, or roughly 35 additional patents per patent class per year. Poege also proposes a mechanism for this effect: the breakup created multiple strong R&D competitors, which not only increased the successors' own innovation but also generated technology spillovers that stimulated innovation across the broader domestic industry. Successors also increased their patenting activity and became more specialised relative to the pre-breakup period. Testing alternative explanations, he shows that these effects are not driven by intensified product-market competition, inventor mobility across firms, duplication of research, or a higher propensity to patent.

2.118 **Watzinger, Fackler, Nagler, and Schnitzer (2020)** use US patent data and build a DiD model around the 1956 Bell consent decree, in which the vertically integrated telecom monopoly was forced to license 7,820 existing patents royalty-free to competitors and barred Bell from entering non-telecom industries. They show that the royalty-free compulsory licensing raised follow-on innovation (~12–15%) compared to comparable non-Bell controlled patents, but only outside Bell's vertically-integrated telecommunications market. By contrast, no uplift occurred within telecoms because, according to Watzinger et al., limited competition from customer-market foreclosure persisted. The results imply that increased competitive pressure, in this case created by royalty-free access to Bell's patents, has the

potential to increase follow-on innovation, but in this case also required rival access to customers and markets. Where vertical foreclosure impedes competition, as in telecommunications, removing patent barriers alone may not raise innovation.

2.119 **Watzinger and Schnitzer (2022)** examine the 1984 Bell System divestiture, alongside the 1911 Standard Oil breakup. Drawing on European Patent Office PATSTAT data and a difference-in-differences approach, they report that the 1984 Bell breakup—which split network services from equipment manufacturing to prevent customer-market foreclosure—led to about 19% more patents in the telecom technologies and roughly 9% greater innovation diversity, while the 1911 Standard Oil breakup increased oil-related patenting by about 15%.

2.120 **Mamrak (2026)** examines how antitrust enforcement affects innovation when patents are the main barrier to entry, studying the 1975 Xerox consent decree, which required compulsory licensing of Xerox's copier-related patents in the US and abroad.[53] The paper reports a disproportionate increase in patenting in technologies more closely related to copiers after the decree, concentrated in applications that directly or indirectly built on Xerox's technology through patent citations, with no significant change for technologically more distant patents.[54] The increase is attributed primarily to Japanese applicants rather than US applicants, especially for Japanese firms with the highest technological proximity to Xerox. The paper further reports that the post-decree patenting of Japanese competitors became more novel and diverse, expanded into new technology fields, and was more closely associated with smaller desktop copiers, whereas small firms and startups did not exhibit the same increase.

2.4.2 Competition and productivity

2.121 Rather than looking at the more specific relationship between competition and innovation, several key empirical papers have looked into the more general relationship between competition and productivity. In addition to establishing potential causal effects from increased competition on increased productivity, these papers also consider whether this is driven by a *treatment effect*, in which competition pushes firms to increase their productivity, or by a *selection effect*, in which low-productivity firms exit and demand shifts from low to high-productive firms. Additionally, some papers delve deeper into why there might be a treatment effect, linking this to e.g. specialisation or improved management practices. In the papers reviewed, productivity is most often measured at the firm or plant level, by estimating a firm's TFP, which is defined as the unexplained component of output after accounting for capital, labour, and other inputs. In some cases, alternative measures are used—such as the estimated minimum input required for a fixed level of output or a sector's hourly labour productivity (i.e. sector output divided by total number of hours worked).

[53] Xerox was the de facto monopolist in the US market for plain-paper copiers in the 1960s and early 1970s, with a market share close to 95% at the start of the FTC case in 1972. It had commercialised a novel copier technology, protected it through more than 2,000 patents. In 1975, under a consent decree, it was required to license all of its domestic and foreign copier-related patents to third parties.
[54] The author uses panel data on the number of patent applications in the US from 1970–'85 based on 2217 six-digit technology classes (with 15.3 patents per subclass on average) that belong to 141 four-digit classes. He then implements a DiD design across technology classes which compares the annual number of US patent applications filed by non-Xerox applicants across six-digit technology classes that were differentially exposed to the antitrust case, with exposure being measured based on the share of patents within a six-digit class that were subject to compulsory licensing. These comparisons are made within the same four-digit classes, while controlling for various fixed effects.

2.122 Looking at a potential treatment effect from competition on firm-level productivity, **Nickell (1996)** estimates the relationship between competition and the level and growth of firm productivity.[55] Overall, he finds that firms with higher market shares have lower levels of productivity (e.g. a 10 percentage point increase in market share of a firm is associated with approximately 2–3 percent lower level of productivity), and that firms in more competitive environments experience higher productivity growth and a lower amount of rents compared to otherwise comparable firms.

2.123 Nickell looks specifically at a potential treatment effect and imposes a specific parametric form on the production function, and does not correct for potential simultaneity in firms choosing inputs after having observed their own productivity levels. **Olley and Pakes (1996)**, by contrast, find that aggregate productivity rose sharply after deregulation, and that this was driven primarily by a reallocation of capital towards more productive plants (i.e. selection effect) rather than improvements within surviving plants.[56]

2.124 Similarly using US Census data (1982, 1987, 1992) but looking specifically at the US ready-mixed concrete industry, **Syverson (2004)** measures greater product-market competition by the degree of geographical demand density—which is appropriate in the case of ready-mixed concrete because competition is fundamentally spatial and driven primarily by transport cost. After estimating plant-level TFP,[57] he estimates how market density affects TFP. The key finding is that more competitive (i.e. denser) markets exhibit statistically significantly higher minimum, median, and average productivity and lower productivity dispersion. Syverson concludes that this relationship is linear for dispersion of TFP and minimum productivity, and mildly concave for median and average productivity—i.e. the positive effect of competition on productivity fades somewhat for higher levels of competition, but does not reverse.

2.125 In his empirical model, Syverson explicitly focuses on the selection effect only, and abstracts from the treatment effect by assuming that plants have a fixed productivity level and showing that competition forces least productive plants out of the market. Building on Syverson and using the same dataset on the US ready-mixed concrete industry in 1982–'92, **Backus (2020)** instead aims to identify whether the positive correlation between competition and productivity is driven by a treatment effect or selection effect. He finds that the positive relationship between competition and higher productivity in the US ready-mixed concrete industry occurs

[55] He uses an annual panel dataset of around 147 UK manufacturing firms between 1972–'86. Competition is measured using firm-level market shares, number of reported competitors, and profit. The annual total productivity of a firm (measured by its TFP) is estimated by calibrating a Cobb-Douglas production function relating firms' output (measured as value of sales and value-added) to its use of labour and capital, allowing for the effect of labour and capital to vary by firm but not over time and controlling for industry-specific time trends (at the 2-digit SIC level). Changes in the level of productivity are estimated by including firm-year fixed effects, and changes in productivity growth are estimated by including a firm-specific parameter multiplied by the year. Importantly, due to the value-based approach implemented to estimate TFP, price variation becomes part of the dependent variable, which may be affected by market power effects.

[56] They develop a semiparametric production-function estimator in which TFP is treated nonparametrically and which corrects for simultaneity and selection by explicitly modelling firms' exit decisions through estimated survival probabilities. They look specifically at the US telecommunications equipment industry, using US Census data from 1963 (133 plants, 104 firms), 1972 (302 plants, 240 firms), 1982 (473 plants, 375 firms), and 1987 (584 plants, 481 firms).

[57] This is done by calibrating a standard (volume-based) Cobb-Douglas production function without using the Olley-Pakes semiparametric production function estimator.

at all quantiles of productivity.[58] This suggests a within-firm treatment effect rather than a selection effect, as otherwise the observed effect would be limited to lower quantiles of productivity. He points to specialisation and improved managerial input as potential channels, rather than better capacity utilisation or economies of scale. Similar to Syverson, Backus does not find that the effect of competition on productivity becomes negative at any part of the distribution.

2.126 In line with Backus, **Fabrizio, Rose, and Wolfram (2007)** find support for a treatment effect using instead annual plant-level panel data on large fossil-fuelled generating plants owned by US electric utilities between 1981–'99.[59] They find that investor-owned plants in restructured states (i.e. more competitive states) achieve the same output at 3–5 percent lower labour and nonfuel operating costs relative to similar investor-owned plants in non-restructured states, and at 6–12 percent lower labour and nonfuel operating costs relative to public plants.

2.127 Further support for a treatment effect is provided by **Holmes and Schmitz (2010)**. They provide an extensive survey of the literature, concluding that firms that survive following increases in competition were typically found to have large productivity gains (i.e. within-firm treatment effect), and that these gains often accounted for the majority of overall industry gains (i.e. limited across-firm selection effect).

2.128 **Van Reenen (2011)** surveys a broad theoretical and empirical literature to argue that improved management practices are a key driving factor for why competition increases productivity. He does not conclude on either a selection or treatment effect, arguing that the mechanism of improved management practices works both in terms of selecting out poorly managed firms and in terms of inducing incumbent firms to upgrade their management practices. He further conceptualises management as a form of transferable technology, whose adoption is accelerated by competitive pressure.

2.129 Building on this literature, **Sadun, Schuh, Hartley, Van Reenen, and Bloom (2025)** present plant-level evidence based on a structured management survey, linking management quality to firm dynamics and productivity.[60] They formalise management as comprising both Van Reenen's definition of firm-level transferable ability, as well as specific plant-level practices. They show that better-managed firms are significantly more dynamic: they more frequently open new plants, acquire existing establishments, close underperforming facilities, and dispose of plants. They demonstrate that when a well-managed firm acquires a plant, the acquired establishment's productivity subsequently improves—providing direct evidence that management is indeed a transferable capability. It also provides further support for the mechanism through which acquisitions can increase competition—by improving management quality.

2.130 Overall, the papers surveyed so far indicate a positive effect of competition on productivity at the levels of competition considered—with no indication of a reversal

[58] He combines an Olley-Pakes semiparametric production function estimator and a quantile regression (with geographic features as instruments for the degree of competition).
[59] Rather than estimating productivity based on TFP, they measure productivity changes indirectly through cost and input efficiency by estimating how much input (labour, non-fuel inputs, and fuel) is needed to produce a given level of electricity output, with plant fixed effects and an IV approach to address simultaneity and selection (using the log of total state electricity sales as instrument).
[60] To measure this link, the authors score plant- and firm-level management using structured surveys (US Census Management and Organizational Practice Survey (MOPS) and World Management Survey), linking scores from those surveys to Census and firm accounting records to track plant entry, exit, acquisitions, and disposals, and then estimate how variation in acquirer or parent management predicts changes in plant outcomes.

in the relationship at high levels of competition. An exception to this is **Ciriani and Jeanjean (2020)**, who instead present evidence of an inverted-U relationship. Measuring productivity as the annual growth rate of hourly labour productivity (i.e. sector output divided by total number of hours worked), they examine how sector-level markups relate to productivity growth across 30 French sectors, looking at the period 1978–2015. Grouping sectors by their level of technological progress,[61] they find evidence of a statistically significant non-monotonic association, with the 'optimal' level of markup being higher for industries with higher levels of technological progress and overall annual labour productivity growth approximately 0.4 percentage points lower than what it would have been at these optimal levels.

2.4.3 Firm size and innovation

2.131 Subsections 2.4.1 and 2.4.2 looked at the (causal) relationship between competition on the one hand and innovation or productivity on the other hand. Rather than considering competition, several key empirical contributions have looked at whether firm size has an impact on firms' innovation input or productivity.

2.132 The studies employ diverse methodologies—from cross-sectional analyses of patent counts and innovation surveys to firm-level data and structural estimation—and cover different countries, time periods, and industries. Early research studies question whether innovation (observed both as an input through e.g. R&D expenditure and R&D employment, as well as an output through e.g. patent counts) scales proportionally with firm size, and identify the relative importance of firm-level characteristics versus industry-specific technological opportunities in explaining patenting and R&D patterns, typically through cross-sectional regression analyses that decompose the variance in innovation outcomes into firm-level and industry-level components. Subsequent work refines these aggregate findings by distinguishing between product and process innovation, recognising that size effects may differ across innovation types due to cost-spreading and profit-capture mechanisms, and by shifting focus from scale to scope (i.e. the breadth of firms' research activities and associated economies of scope and spillovers), particularly in knowledge-intensive sectors such as pharmaceuticals where spillovers and organisational capabilities matter.

2.133 With the exception of one paper discussed below, all papers reviewed are from before 2010, with most papers from the 1980s and prior. One reason why there are few more recent papers looking at the relationship between firm size and innovation may be because of the inherent challenges in identifying exogenous variations in firm size that allow for causal inference—and identification has become more important than before.

2.134 Below, we discuss only a selection of the older papers from the 1980s and prior.[62]

2.135 **Scherer (1965)** provides one of the early papers on scale and innovation intensity, using a sample of 448 of the *Fortune 500* largest US industrial companies in 1955, with detailed R&D data for 352 of the firms. He uses 1959 US invention patent counts as the primary output measure and 1955 R&D employment as the main input measure, and relates both to firm-size measures.[63] Scherer's findings indicate that larger firms generate more patents (i.e. innovation output), but not in direct

[61] They measure sectoral technological progress as the difference between output growth and input growth (named Solow residual) and assume constant proportions of input (that is, Hicks neutral).
[62] For further references to these older papers, see Gilbert (2006).
[63] Scherer acknowledges the limitations of patent counts as an output measure, noting firm and industry differences in propensity to patent and wide variation in patent quality (see Section I of the paper).

proportion to their size: patent output increases more rapidly than company size for firms up to approximately $500 million in sales, but beyond this figure any additional sales yield progressively fewer patents.[64] Scherer emphasises that the differences among industries in their ability to generate exploitable and patentable advances account for over 30% of the variation in corporate patenting,[65] which is nearly as much as firm size itself (42%), while market concentration, profitability, and diversification result in only modest effects. He explains these results given diminishing returns as research operations expand and strategic differences between industry leaders and smaller specialised innovators.

2.136 To address key measurement issues in relating firm size to innovation—specifically using either R&D expenditures or patent counts alone, as Scherer previously did—**Bound, Cummins, Griliches, Hall, and Jaffe (1984)** provide one of the first comprehensive analyses systematically matching firm-level R&D inputs to patent outputs.[66] They use a 1976 cross-section of US manufacturing firms with matched Patent Office records covering 1965–'79.[67] By estimating both the relationship between (i) size (measured by firm sales) and R&D expenditure and (ii) R&D expenditure and innovation output (measured by patent count), the paper is able to decompose Scherer's aggregate pattern between size and innovation. The authors find that R&D intensity (innovation output per input) scales approximately proportionally with sales, but with significant nonlinearity: small and very large firms are more R&D-intensive than medium-sized firms, and more capital intensive firms invest more in R&D. Regarding the relationship between innovation input and output, Bound et al. find that patenting rises roughly proportionally in R&D expenditure once annual R&D exceeds about $2 million, but is characterised by diminishing returns for the very largest R&D programmes. This is in line with Scherer's findings, though localised to the extreme upper tail of R&D spending, rather than all large firms.

2.137 Challenging Scherer's emphasis on firm size as a determinant of innovation, **Cohen, Levin, and Mowery (1987)** show that industry context, rather than firm size, primarily explains innovation input as measured by R&D intensity, once appropriate econometric controls are applied.[68] Their findings directly contradict Scherer's

[64] $500 million in 1965 equates to ca. $5,000 million in 2024 terms, accounting for inflation. However, one cannot readily make inferences from these quantitative results from 1960 to today, given that a lot of other determining factors will have changed. Scherer applies linear and nonlinear reduced-form estimations (including quadratic, cubic, and log transformations, plus size subgroup regressions), to test for diminishing returns in the size-innovation relationship.

[65] Scherer provides concrete examples showing that some industries, such as electrical equipment and general chemicals, possess a scientific and technological base that continuously generates exploitable and patentable possibilities, while industries such as paper, food, and conventional textiles offer fewer such opportunities.

[66] The authors then construct a firm-level dataset including sales, R&D expenditures (innovation input), and patent counts (innovation output). They use log-linear and nonlinear regressions, and introduce instrumental variables to reduce omitted variable bias caused by endogeneity (i.e. more innovation leading to larger firm size), as well as estimate count-data models (Poisson, negative binomial, nonlinear least squares) to account for the integer, zero-inflated, and heteroskedastic nature of patent counts.

[67] The sample contains approximately 2,595 firms in total.

[68] Using Federal Trade Commission data on 2,494 business units across 244 manufacturing categories from 345 companies, they apply OLS regression on firms that conduct R&D. The paper also uses censored regression techniques known as Tobit models. This helps the authors estimate relationships when the dependent variable is constrained at a limit, typically zero, which in this case accounts for the fact that many firms report zero R&D expenditure while those that do invest report positive amounts. Tobit models therefore correct for the bias that would arise from excluding zero observations or treating them as missing data in standard OLS regressions. In addition, the authors implement generalised least squares with a multiplicative correction to adjust for heteroscedasticity,

conclusions by showing that firm and business-unit size together explain almost none of the variation in R&D intensity, while industry-specific fixed effects alone account for nearly half of the overall variance. They distinguish between company-level factors, such as access to internal finance or diversification, and business-unit-level factors, such as the ability to spread fixed R&D costs over larger output. Importantly, they stress that a handful of outlier observations drive much of the weak positive firm-size effect in less careful specifications.

2.138 Shifting focus to the size distribution of innovating firms and actual innovation output, **Pavitt, Robson, and Townsend (1987)** use the Science Policy Research Unit (SPRU) expert-nomination survey of significant innovations successfully commercialised in the UK between 1945 and 1983 and find a U-shaped pattern between firm size and innovation intensity.[69] The SPRU survey involved writing to experts in each sector of industry and commerce, asking them to identify significant technical innovations successfully commercialised in the UK since 1945 and to name the firm responsible. After identifying innovating firms from the SPRU survey, they find that medium size firms (between 1,000 and 9,999 employees) exhibit persistently below-average innovation intensity, recording innovation-to-employment ratios consistently below one, whereas both small and very large firms exceed one. Using sector-level regressions they attribute these patterns to mechanisms that favour different firm types. While large, diversified firms benefit from strong appropriability and R&D-intensive technological opportunities, small, specialised suppliers thrive where entry barriers are low and user-firm collaboration is strong.

2.139 **Acs and Audretsch (1988)** extend Pavitt, Robson, and Townsend's U-shaped analysis.[70] Analysing US Small Business Administration Data on 8,074 innovations across 247 US manufacturing industries from 1982, they find that total innovation output rises with R&D spending, skilled labour, and the share of employment in large firms, and falls with concentration and unionisation. They also show that the determinants of innovation differ between small and large firms by estimating separate regressions for large-firm and small-firm innovation counts, and formally testing whether individual coefficients and the coefficient set jointly are equal across firm-size categories.

2.140 Instead of focusing on whether firm size affects overall innovation levels, **Cohen and Klepper (1996a)** look at the composition of innovative activity. They distinguish between research aimed at improving production methods (process R&D) and research aimed at developing new products (product R&D).[71] Analysing

line-of-business fixed effects to control for time-invariant unobserved characteristics specific to each industry segment, and probit models to estimate binary outcomes such as whether a firm conducts R&D.

[69] The estimation sample contained 4,378 significant and successfully commercialised innovations in total.

[70] This is done by empirically testing whether small and large firms react differently to the same industry conditions. To do so, they estimate log-linear cross-sectional relationships between 1982 innovation counts and industry characteristics measured five years earlier. Innovation counts are then broken down by firm size and related to industry-level variables such as total and per-company R&D spending, market concentration, average unionisation rate, advertising intensity, the share of skilled workers, the share of employment in large firms, and overall industry size. The paper also tests whether industry characteristics affect large and small firms differently and checks robustness by comparing results with alternative measures based on patents and R&D data.

[71] They regress the share of process research on size, using Tobit regression models to handle the fact that the process research share is bounded between zero and one. To further correct for heteroscedasticity, they also weight each observation by its patent count and report results both pooled across all industries (including industry dummies to control for industry-specific effects) and separately for individual industries.

587 Federal Trade Commission business-unit records across 36 manufacturing industries between 1974–'76, their results show that the fraction of R&D devoted to process innovation increases with business-unit size, though at a diminishing rate. The tendency for larger business-unit sales to raise the share of R&D devoted to process innovation remains strongest in industries where R&D spending is more evenly split between product and process and in industries where new products are more saleable or can generate rapid growth. Quantitatively, a $100 million increase in business-unit sales raises the process-share by approximately 0.29 percentage points from a median of 11% or average of 28% and at the median firm size ($130 million in sales), while the effect is much larger in balanced or high-growth industries (about 1.4–2.7 percentage points per $100 million) compared with roughly 0.32 percentage points in industries already focused heavily on product innovation. They attribute these findings to a cost-spreading and profit-capture mechanism: process innovations benefit a firm mainly through its own production volume, so larger existing output provides relatively greater incentive to invest in process improvements versus new product development.

2.141 **Cohen and Klepper (1996b)** extend this analysis to show that the relationship between size and research originates at the business-unit level rather than the corporate level.[72] Analysing Federal Trade Commission business-operation data (averaged 1974–'77) covering 75 industries and about 1,200 business units conducting research, they find a strong positive relationship between R&D expenditure and firm size that originates at the business-unit level, whereas overall corporate size adds little explanatory power. They show a more-than-proportional increase in R&D expenditure in research-intensive sectors, and a rising share of process research with unit size, especially where licensing opportunities or growth prospects are high. They explain this given cost-spreading effects, where firms capture research benefits mainly through their own production volume and apply innovations across their existing output, which benefits larger business units that are able to profitably undertake more marginal research projects despite lower average research productivity.

2.142 **Fritsch and Meschede (2001)** provide support for the Cohen and Klepper product and process framework in the context of Europe, using survey data on German manufacturing companies in the early 1990s.[73] Similar to Cohen and Klepper, they find that total R&D expenditure rises less than proportionally with company size, and product research dominates among small firms.

2.143 Overall, the results so far suggest that while innovation output may decrease less than proportionate to firm size, at least some of this can be explained by a concurrent shift in the composition from more product-oriented innovation in case of smaller firms to more process-oriented innovation in case of larger firms. This already suggests that firm size may not be a primitive determinant itself for overall

[72] The authors compare the effects of business-unit versus overall corporate sales. They test whether R&D expenditure grows proportionally with size across research-intensive and high-licensing industries, distinguishing between product versus process research.

[73] They use a postal survey of over 1,800 German manufacturing companies between 1993–'95 drawn from three regions and including many small, single-location firms. They then estimate how product and process R&D expenditures scale with firm size using log-linear relationships controlling for industry dummies, multi-plant status, cooperation with research institutions, product life cycle, and innovation objectives. To account for endogeneity between product and process research decisions which might influence one another and examine differences in size elasticities across the two R&D types, they complement OLS and Tobit estimates with an IV approach (instruments are not specified in the article).

innovation, but rather a proxy for other underlying determinants—in this case the focus on product versus process innovation.

2.144 Another potential determinant for overall innovation that may correlate with firm size is the degree of economies of scope and presence of potential spillovers. Shedding more light on this using detailed within-firm data, **Henderson and Cockburn (1996)** examine detailed program-level data from ten major research-oriented pharmaceutical firms.[74] The results suggest that larger firms' research efforts are more productive largely because of economies of scope and significant interfirm and intrafirm knowledge spillovers, while pure scale effects at the program level are limited. The mechanisms described by Henderson and Cockburn as driving these results include the public-goods character of knowledge (where knowledge can be used by multiple agents without being depleted and it is difficult to exclude others from using it), internal cross-fertilisation of ideas, and the need to sustain diverse portfolios.

2.145 Building on their 1996 finding that economies of scope and spillovers boost discovery productivity, **Cockburn and Henderson (2001)** look specifically at the development phase within pharmaceutical companies. They show that, although development success initially appears linked to a firm's scope, that effect disappears when introducing firm-specific organisational capabilities (captured by firm fixed effects).[75] Unlike their previous work (which used program-level patent counts), this paper extends the dataset and inquiry to the clinical development stage, adding detailed measures of project expenditures, duration, and firm-level measures of scale and scope. To capture a firm's scale and scope (i.e. the diversity of development activity across different therapeutic areas) they measure explanatory variables at the start of each project, including the firm's total development spending across all projects, the number of different therapeutic areas in which the firm spends more than $1 million, the firm's accumulated stock of past drug approvals in the relevant therapeutic class, and project-level controls such as the length of the project and the rate of spending. They report robustness checks that add therapeutic-class dummy variables and firm fixed effects to test whether the estimated scope and scale effects reflect genuine advantages or merely capture unobserved differences across therapeutic areas or persistent firm-specific characteristics. They find that scope is positively and significantly associated with project success while scale alone is not. However, the scope effect disappears once including enduring company-specific characteristics such as development strategy, pace, and timing of spending, incentives, and decision-making processes that influence project success. They interpret these patterns as consistent with benefits from breadth of experience or knowledge spillovers and with important roles for accumulated expertise and lasting differences in company organisation and management practices that drive development productivity.

[74] Their dataset covers roughly 1961–'88 (4,930 program-year observations), and they relate research inputs of current expenditures, accumulated knowledge capital, firm size and scope, and spillovers, to measurable knowledge outputs measured as counts of patents filed in at least two of the three major jurisdictions (Europe, the US, and Japan). They estimate this using program-level data, controlling for firm and therapeutic-class effects, including stocks of past patents and measures of internal spillovers (such as news in own patents in related programs), external spillovers (such as news in competitors' patents in the same and related programs), scope (measured as the number of programs with annual research spending above $500,000), and firm size (measured as total firm research spending).

[75] They estimate a logit regression model using project-level data on 708 clinical development projects from the internal records of 10 major pharmaceutical firms (1960–'90), where the outcome variable indicates whether a project ultimately reached a New Drug Application filing.

2.146 Studying when and why firm size matters, **Lee and Sung (2005)** show that the relationship between firm size and innovation particularly depends on firms' technological capabilities.[76] Analysing a World Bank dataset of R&D-performing firms across nine manufacturing industries in six countries across the globe,[77] the authors find that the typical relationship between firm size and research intensity is U-shaped overall, but that this pattern disappears—and can become more-than-proportional—for firms with high technological competence or large accumulated technological knowledge. They attribute these results to variations in firms' learning capabilities: high-competence firms are able to exploit economies of scale and scope that enhance competence in research and more effectively utilise external technology. In contrast, low-competence firms experience diminishing research productivity as their size increases, since they lack the absorptive and learning capabilities to capture scale and scope gains from larger R&D activity and thus suffer stronger 'fishing-out' (where they exhaust the easiest, highest-value technological opportunities) and bureaucratic inefficiencies as size rises.

2.147 Complementing Lee and Sung's focus on technological capabilities, **Shefer and Frenkel (2005)** highlight the importance of industry context and organisational form by examining a random sample of 209 industrial firms in Israel's northern district within the electronics, plastics, and metal product sectors.[78] They find that research intensity is substantially higher in high-tech firms and in firms belonging to corporate groups. Interestingly, they also show that smaller and younger high-tech plants show higher research intensity than larger established firms.

2.148 Providing a synthesis of the empirical literature on the relationship between firm size and innovation thus far, **Cohen (2010)** also concludes that innovation input (commonly measured as R&D expenditure) typically rises strongly and usually proportionately with firm (or, more precisely, business-unit) size, but that innovative output rises less than proportionately—implying declining R&D productivity in larger firms. Cohen also concludes that large firms specialise relatively more in incremental and process innovation, while smaller firms and entrants contribute disproportionately to major innovations.

2.149 **Choi, Braguinsky, Ding, Jo, and Kim (2023)** extend the literature by considering the role of 'mega firms', defined as the top 50 publicly listed firms by annual sales in S&P Compustat, in shaping innovation dynamics. They highlight the *positive* contribution of mega firms to both groundbreaking research and the spread of knowledge.[79] They measure the impact and diffusion of novel patents by counting follow-on patents that reuse the same new combination within five years, documenting that 42% of such patents generate no follow-on patents in the first five years while a smaller subset become 'hits', spawning numerous follow-on

[76] They develop a formal framework integrating demand pull and technology push factors and estimate statistical relationships between firm research intensity (measured as the ratio of firm R&D expenditure to sales, in percent) and firm size (measured as the logarithm of firm sales), technological capability (measured by a firm's self-rated technological capability relative to the world technological leader on a five-point Likert scale), and several control variables.

[77] The sample contains about 1,400 firms in total.

[78] They apply analysis of variance and t-tests to examine whether R&D intensity differs systematically across firm-size categories, industries (high-tech versus traditional manufacturing), locations (metropolitan versus peripheral regions), and ownership types (independent firms versus corporate group members), measuring R&D intensity both as the percentage of employees engaged in R&D and as R&D spending as a percentage of revenue. To assess the independent contribution of each factor while controlling for other firm characteristics, they estimate linear and log-linear models.

[79] Using USPTO patent data covering 1976–2023 linked to Compustat firms via name and URL matching, they track novel patents from 1980 onwards. They define novel patents as those introducing a new combination of technological components that had not previously been used together.

patents and shaping new technological directions. They present a U-shaped pattern in mega firms' share of novel patents over time.[80] This share fell from 1980 to 2001 then rebounded sharply, reaching a historical high by the mid-2010s. Choi et al. explain this due to mega firms' growing share of total patenting and an increasing propensity within mega firms to produce novel patents, with the patent-share effect dominating post-2000. Using local projections to trace dynamic responses of patenting to cash-holdings shocks, the authors find that firms with higher cash holdings increase novel patenting, with a 1% increase in cash leading to approximately 5% more novel patents after two years, and that the mega versus non-mega cash gap similarly exhibits a U-shaped pattern rebounding after the late 1990s. Although the paper focuses on 'mega firms' due to their significant impact on the overall economy, these firms are often structured and equipped very differently compared to smaller, private companies, and, due to the methodology adopted by the authors, the identity, industry, and absolute and relative size of 'mega firms' varies considerably over time. These considerations limit the interpretability and generalisability of the results beyond publicly listed US firms.

[80] They employ firm-year panel regressions using Poisson pseudo-maximum likelihood for patent counts and OLS for rates and probabilities, alongside DiD style interactions comparing mega firms with non-mega firms before and after 2001.

3 Horizontal mergers: established competitors (theory)

3.1 This Chapter provides a detailed paper-by-paper review of the literature reviewed in Volume 1, Chapter 5.

3.1 Investment in existing markets

3.2 A number of papers consider the effects of mergers between incumbent firms in existing markets. In this setting, firms invest to either reduce their costs, or improve the quality of their products. Firms also compete in price in these models, so the papers capture competition in both price and investment.

3.3 This strand of the literature was pioneered by **Motta and Tarantino (2021)**, motivated by a series of mergers in the mobile telephony industry across a number of national European markets.[81] The paper considers a baseline setting where firms produce differentiated products and simultaneously compete on prices and investments (this implies that investments are assumed to not be observable by other firms, when they set prices). Investments are modelled as deterministic and they result in lower costs (*process innovation*) in the baseline setting. The model shows that, absent efficiency gains, the merging parties (insiders) raise prices and reduce investments. The result on investments is due to the fact that higher prices lead to less output, and hence a lower marginal return on cost-reducing investment. The impact on non-merging parties (outsiders) is more complex, as their demand tends to increase due to the higher prices of the insiders, and hence they will increase their investment. This in turn will result in lower costs, and may ultimately lead them to lower prices. In principle this leads to an ambiguous impact on consumer welfare. The authors show that for widely used demand models which satisfy the 'Independence of Irrelevant Alternatives' (IIA) property (e.g. for the Logit and Constant Elasticity of Substitution), the merger reduces both total investment and consumer welfare. The authors show that this result holds in other demand models under parametric assumptions (e.g. in a linear model of product differentiation (Shubik-Levitan); and in the Salop model of product differentiation).[82] The paper shows that a merger leads to a loss of consumer surplus in the linear Shubik-Levitan model for any given number of symmetric firms pre-merger, and that consumer harm decreases in the number of firms (i.e. at lower levels of market concentration).

3.4 Motta and Tarantino consider two main extensions: a sequential model where firms first compete in cost-reducing investment, and then in price; and a model of quality-enhancing investment (as opposed to process innovation). For the sequential case, the authors illustrate effects with numerical simulations for the Shubik-Levitan and Salop models of competition, confirming the results of the baseline sequential model (i.e. higher prices and lower investments for the insiders; higher investments for the outsiders; lower total investment and lower consumer welfare).[83] For the case of simultaneous quality-enhancing investments (i.e. product innovation), the paper shows that the baseline results on process innovation extend to two types of demand: quality-adjusted models (where consumer utility depends on quality-adjusted prices); and models with 'hedonic' prices (where demand depends on an adjusted measure of price, controlling for product quality).

[81] The working paper of this paper, with its main results, was already in circulation in 2016.
[82] The parametric assumptions include the linear variable cost and quadratic fixed cost assumptions.
[83] The authors also note that total surplus may rise under the Salop model, when competition is softened.

3.5 **Federico, Langus, and Valletti (2018)** analyse the effects of horizontal mergers on firms' incentives to invest in quality-enhancing innovation and on consumer surplus, in a symmetric and sequential oligopoly setting pre-merger.[84] Firms sell differentiated products, and can increase the quality of their products by engaging in costly R&D efforts. R&D outcomes are assumed to be stochastic. R&D efforts increase the probability of successful innovation, but do not change the improvement in product quality. The paper identifies two channels through which a merger affects the merging firms' innovation incentives—a *price coordination* channel and an *innovation externality* channel.

- The *price coordination* channel captures the fact that a merger internalises the negative pricing externality that merging firms impose on each other absent consolidation. This increases both their pre-innovation and post-innovation profits, thereby influencing the gains from innovation. While the sign of this effect is a priori ambiguous (as the merger affects both pre- and post-innovation profits), it is positive across the specific demand functions simulated in the paper.
- The *innovation externality* channel reflects the fact that a merger internalises the negative innovation externality that each merging firm inflicts on the other.[85] This effect is unambiguously negative.

3.6 The authors first present separate analytical treatments of the two channels before examining their interplay through numerical simulations for a 4-to-3 merger (looking at both the direct impact of the merger on the innovation incentives of the merging firms, and at the equilibrium effects). They establish that the effect stemming from internalisation of the innovation externality dominates in a number of standard demand models, yielding a reduction in the merging firms' innovation incentives[86], an increase in the innovation incentives of non-merging parties, and a reduction in total innovation[87] (in line with Motta and Tarantino, 2021). Consumer welfare is therefore lower post-merger, as a result of higher prices (for existing and improved products) and lower overall innovation.

3.7 Federico, Langus, and Valletti also show that the results on innovation extend to other symmetric industry structures (the authors model all mergers between an 8-to-7 merger and a 3-to-2 merger, for the linear demand systems).

3.8 In extensions, the authors consider two types of R&D efficiencies that may result from the merger: (i) synergies that improve innovation effectiveness and (ii) reductions in R&D costs. Using the same simulation-based approach as in the baseline analysis, the authors demonstrate that in both cases, the adverse impact of the merger on innovation can be reversed if R&D efficiencies are sufficiently substantial, to offset both the reduction in innovation incentives and the increase in price for existing and improved products.

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[84] This paper was motivated by mergers in the agrochemical sector reviewed by the European Commission (notably Dow/DuPont, in 2017).
[85] This is the same effect identified by Farrell and Shapiro (2010) in the context of horizontal merger, as an extension of their framework on the effects of mergers when firms compete in prices. This effect was also recognised in the 2010 US Horizontal Merger Guidelines (see Volume 1, Chapter 11).
[86] This is the case both in states where firms innovate to 'escape competition', and in states where they 'catch up' with competitors (contrary to the predictions of the theoretical model of Aghion et al. (2005)). Moraga-González and Motchenkova (2026) show that this is not always the case, depending on the underlying demand model.
[87] This is measured in terms of stochastic dominance of the pre-merger distribution of innovation outcomes compared to the post-merger distribution.

3.9 **Bourreau, Jullien, and Lefouili (2026)** build on and generalise previous work, and examine the effects of a horizontal merger to monopoly in a setting where (incremental) innovation can reduce costs and/or enhance quality, with demand functions taking a general form. As in the baseline setting of Motta and Tarantino (2021), price and innovation competition take place simultaneously. The overall impact of a merger on innovation comprises the sum of a *market power* effect and an *externality* effect.

- The *market power* effect encompasses two effects driven by the merger's impact on output. First, the output reduction due to higher prices adversely affects merging firms' innovation incentives, when innovation increases margins. This margin expansion effect is negative. Second, an output change may influence the return to investment per unit of output, either positively or negatively.
- The *externality effect* likewise decomposes into two components, which relate to the innovation and price externalities internalised by the merger. First, the merged entity internalises the negative impact of each merging firm's innovation on the other merging firm's demand. This *innovation diversion* effect dampens innovation incentives, as in the previous literature. Second, the merger influences the merging firms' margins and thereby affects their innovation incentives when innovation augments their sales. This *demand expansion* effect is positive. A key insight of the paper is that the overall externality effect is negative if and only if the standard price diversion ratio lies below the innovation diversion ratio (which is the counterpart of the price diversion ratio for innovation).

3.10 Bourreau, Jullien, and Lefouili show that for cost-reducing innovation the externality effect is zero and the market power effect is negative. Consequently, a merger diminishes innovation in this scenario (in line with Motta and Tarantino, 2021). Conversely, when innovation enhances demand, the externality effect differs from zero, and the merger's impact on innovation can be either positive or negative. This in turn implies that the merger's effect on consumer surplus is ambiguous in general. Nevertheless, simulations based on two classes of demand functions under which a merger can stimulate innovation (the multinomial logit model, and an 'augmented' Singh-Vives model where innovation has both a vertical and a horizontal dimension) suggest that it is unlikely that a merger benefits consumers absent synergies (in R&D and production) and spillovers. The authors suggest as a possible explanation that a positive effect of a merger on innovation is likely to be driven by a strong *demand expansion* effect, which requires a large price diversion ratio and, therefore, implies a large adverse effect of the merger on prices.

3.11 The authors also incorporate R&D synergies and spillovers and demonstrate that their decomposition admits a straightforward extension under these conditions. They find that the comparison between the innovation and price diversion ratios retains its informativeness, provided the diversion measures are appropriately adjusted. In the case of R&D synergies, the externality effect needs to be adjusted for the presence of R&D synergies (which affect the magnitude of the relevant price diversion ratio). This makes it more likely that a merger will increase innovation incentives. In the case of spillovers, innovation incentives are now affected by a spillover effect. It is possible to adjust the innovation diversion ratio to account for spillovers, and show that the spillover-adjusted innovation diversion ratio is always below the unadjusted innovation diversion ratio, making it more likely that a merger will increase innovation incentives.

3.12 **Moraga-González and Motchenkova (2026)** study a symmetric and sequential duopoly model where R&D investments may influence both the probability of innovation success and the payoff conditional on success (nesting the findings of previous models). The authors first examine the class of models where R&D investments affect only the probability of innovation success (as in Federico,

Langus, and Valletti, 2018), and then apply their analysis to cases where investment efforts determine the value of innovation (e.g. the extent of a cost reduction or of a quality improvement—as in Motta and Tarantino (2021) and Bourreau, Jullien, and Lefouili (2026)). Overall, the authors find that the effect of a merger to monopoly on innovation incentives can be either positive or negative depending on the shapes of the demand function and the R&D cost function (confirming the results of Bourreau, Jullien, and Lefouili (2026)).

3.13 In particular, Moraga-González and Motchenkova (2026) examine how the overall impact of a merger on innovation depends on how pre-merger profits from innovation for each firm compare to post-merger profits, both in the state where the other firm succeeds in its innovation effort, and when it fails. Post-merger incentives differ from the pre-merger equivalent because mergers increase prices, but also internalise innovation externalities. In some settings, the impact of a merger on prices dominates the innovation externality effect, leading to stronger post-merger incentives to invest than pre-merger ones.

3.14 If the pre-merger incentive to innovate is larger than the post-merger incentive both in the state where the other firm innovates and when it fails, then the merger reduces innovation. The converse is true if the post-merger incentive is larger in both states. It may also be that post-merger innovation incentives are larger in the state where the other firm succeeds, but smaller when it fails (or vice versa). In this case, the net innovation incentive depends on the relative frequency of each case (and hence on the nature of R&D costs).

3.15 The authors provide a micro-foundation for each of the possible cases. They show that in some demand models, a merger to monopoly may increase innovation incentives, as also found by Bourreau, Jullien, and Lefouili (2026) and D'Annunzio, Jullien, Lefouili, and Madio (2026a). This is the case: for the Hotelling model[88]; for the Sutton model with no horizontal product differentiation, under some parameter ranges on the size of innovation and the steepness of the R&D cost function; for the logit demand system, with sufficiently low price elasticity, and depending on the level of R&D costs; and for the Mussa-Rosen model, for sufficiently low R&D costs. By contrast, a merger reduces innovation for the Singh-Vives model, and for alternative specifications of the Sutton, Mussa-Rosen, and logit models.

3.16 As for consumer surplus, the authors show that in most model specifications (absent synergies), mergers lead to lower consumer surplus also in cases where innovation increases post-merger. The intuition is that, in these environments, the price effects of the merger are typically strong enough to offset the gains from higher innovation effort. The paper also presents a multi-product extension, where each firm sells an additional non-overlapping product, and innovation applies to both overlapping and non-overlapping products. In this case, the consumer benefits from higher innovation are larger (as they also apply to the non-overlapping products), and hence a merger may benefit consumers.

3.17 The authors then extend their approach to cases where the size of the innovation (e.g. the increase in product quality) depends on innovation efforts (as in Motta and Tarantino (2021) and Bourreau, Jullien, and Lefouili (2026)), and the model is sequential. They provide a general decomposition of the effects of a merger, and show that a merger may increase or reduce investment also under this setting.

3.18 Finally, Moraga-González and Motchenkova (2026) extend the model in several directions. They first examine the impact of R&D synergies, considering both R&D output synergies that arise when innovations developed by one division of the

[88] This is similar to the result of Chen and Schwartz (2013).

merged entity can be exploited by the other division, and R&D input synergies, modelled as R&D spillovers across the divisions of the merged entity enabling the 'effective' R&D effort of a division to increase with the effort of the other division. They find that R&D output synergies often—but not invariably—augment the merged entity's R&D efforts, whereas R&D input synergies consistently enhance such efforts. Sufficient R&D synergies can overturn the negative impact of a merger on consumer surplus.[89]

3.19 **López (2025)** develops a framework to study and quantify merger effects in markets where investment expands capacity and reduces congestion.[90] In this 'capacity sharing model', there is a negative congestion externality across users from the same firm. Greater capacity reduces the congestion cost experienced by users, and hence increases their utility.

3.20 This alternative modelling approach may be particularly relevant in industries such as communication networks, transportation, electricity, and telecommunications. A key difference between a standard model of quality-enhancing investment and a capacity model is that, in the former, an increase in investment leads to higher prices, whereas in the latter firms reduce prices following investment. This occurs because, in a capacity model, lowering prices allows firms to capture a larger share of demand. Moreover, the intensity of investment changes significantly in the two models as in a quality model firms can meet demand without facing capacity constraints, whereas in a capacity model this is not the case as additional demand comes with additional congestion costs.

3.21 López (2025) uses the model to simulate the impact of horizontal mergers (in terms of prices, investment, and consumer surplus) and to compare results with those from a model of quality-enhancing investment (as in the corresponding extension of Motta and Tarantino (2021), with Singh-Vives demand). Overall, results are similar across the two models, with mergers leading to higher prices, lower investment by insiders, and lower consumer welfare (absent synergies). The quality-enhancement model, however, predicts higher price increases compared to the capacity-sharing model (for both the merging firms and non-merging firms), especially when products are highly substitutable. Similarly, the reduction in investment by merging firms is more pronounced in the quality model than in the capacity model. Overall, the author reports that there are no remarkable differences in the reduction in consumer surplus, with the negative impact on consumer surplus being slightly less pronounced in the capacity model except when products are highly substitutable and investment intensity is low. The simulations reported in the paper also indicate that the impact of product differentiation on merger effects is non-monotonic (but typically the harm from a merger is larger if products are closer substitutes), and higher concentration leads to stronger effects (as shown by the comparison of a 4-to-3 merger relative to a 3-to-2 merger).

3.22 The paper models three types of merger efficiencies: operational efficiencies (i.e. lower production costs), investment cost efficiencies (i.e. lower costs of investing in additional capacity), and network allocation efficiencies (i.e. an increase in capacity obtained per unit of investment, due to better allocation of network resources, including spectrum). The merger simulations reported in the paper model the case

[89] R&D output synergies do not result in greater consumer surplus in some of the models considered (i.e. the Sutton and Mussa-Rosen models of vertical product differentiation), as in these cases the merged entity only offers the high-quality post-innovation product, and the outcome is equivalent if one assumes R&D output synergies. The authors also find that R&D output synergies always result in lower consumer surplus from a merger under Hotelling competition.

[90] This setting is motivated by mergers in the telecommunications industry, where investment in infrastructure increases capacity and may reduce congestion.

of investment cost efficiencies, generally showing that they overturn the harm to consumers if they are sufficiently strong to offset both the adverse impact on prices and on investment. The predictions on consumer welfare are generally similar between the capacity sharing and quality enhancement models, with the exception of scenarios with high investment intensity (where consumer surplus is always higher in quality enhancement models, while this is the case in the capacity sharing model only for sufficiently low levels of product differentiation).[91] The simulations reported in the paper also suggest that merger outsiders are harmed whenever a merger benefits consumers due to efficiencies.

3.2 Additional settings

3.23 The recent literature has looked at the impact of horizontal mergers between incumbents in a number of additional environments, including settings where firms invest to enter a new market or offer a new product; competition between asymmetric firms; settings with sequential innovation and intertemporal or informational spillovers; models of R&D diversity; models where mergers enable voluntary technology transfers, or allow firms to internalise involuntary spillovers; and dynamic models with endogenous mergers. We review each setting in turn in this Section.

3.2.1 Investments to enter new markets

3.24 This strand of the literature considers a setting where firms are not active in a given market, and need to innovate to be present in the market.

3.25 An example of this setting is the paper by **Federico, Langus, and Valletti (2017)**. The authors examine how mergers affect stochastic product innovation in a setting where multiple identical firms compete to develop a new product (with no product differentiation across firms). The model assumes that when three or more products succeed, competitive pressures eliminate all profits entirely. Consequently, an investor can anticipate positive returns only under monopoly conditions or when facing a single rival innovator. In the event of a merger between two firms, the research units continue operating as distinct entities under centralised coordination by the merged firm. Assuming the merged entity maintains equal investment levels across both units, the authors show that aggregate R&D expenditure declines relative to the pre-merger baseline as long as pre-merger duopoly profits are positive. The underlying mechanism operates through internalisation of negative externalities: whereas independent firms ignore competitive externalities, the merged entity recognises that simultaneous success by both units would cannibalise sales across its portfolio. This internalisation dampens investment incentives compared to the scenario with autonomous competing laboratories. This leads to consumer harm as a result of the reduction of innovation incentives and the higher prices caused by the merger when both merging parties succeed. For the limit case of Bertrand competition (i.e. duopoly profits are zero), a merger has no impact on innovation, in line with the previous findings of **Sah and Stiglitz (1987)**, but it has a significant impact on expected prices.

3.26 **Denicolò and Polo (2018)** extend the setting of Federico, Langus, and Valletti (2017), allowing for a more general treatment of innovation incentives post-merger,

[91] When efficiencies are taken into account (and modelled as a 25% reduction in investment costs), some of the predictions of the two models diverge more sharply. In the quality model, the presence of efficiencies leads to higher post-merger prices and higher investment relative to the case without efficiencies. By contrast, in the capacity model, investment also increases (albeit to a smaller extent), while the post-merger price increase is lower when efficiencies are present.

but assuming no product market competition effects, and considering only the duopoly case. The authors show that depending on the shape of the R&D cost function, the merged entity may choose to close one of its two R&D facilities and consolidate all R&D efforts into the remaining firm. The logic stems from recognising that under competition, simultaneous innovation by both labs generates duplicative R&D and significant sales cannibalisation (given the assumption of homogeneous products). Whether such reallocation occurs depends on the R&D technology's returns to scale characteristics. Specifically, when R&D exhibits limited decreasing returns at the individual firm level, the merged entity may *reallocate* R&D across its research units.[92] The authors show that when the merged entity optimally chooses an asymmetric allocation (concentrating R&D effort in one firm), this reduces duplication and increases the probability of innovation. Since consumer welfare in this framework depends only on the innovation probability (in light of the assumption of no price effects), consumer surplus moves in the same direction as the probability of innovation.

3.27 **Bourreau and Jullien (2018)** consider the impact of a merger in a duopoly model where firms compete in market coverage for a new technology (e.g. this could apply to roll-out of broadband or mobile telephony), and in price. The model assumes that each firm needs to set the same price for the market area that it covers (i.e. there is no geographical price discrimination), and that firms offer differentiated products. The authors show that absent the merger (and with simultaneous setting of investment in coverage and prices), an asymmetric equilibrium arises, with one firm offering larger coverage than its competitor, and setting higher prices (to exploit its market power on consumers in the single-product area). A merger to monopoly has three effects: it increases prices (to the monopoly level), it increases total coverage (i.e. coverage of the area where it offers only one product), and it reduces the coverage of the multi-product area (i.e. the area where it offers both products). The reason for the higher total coverage is that higher prices increase the incentives to reach more consumers. However, the merger also internalises business-stealing effects, and hence leads to less coverage in the multi-product area. The impact of the merger on total and consumer welfare is therefore ambiguous, as there is a trade-off between total coverage, prices, and product variety. The authors present an example of their results showing that total welfare with the merger may increase (with sufficiently low coverage costs and high product substitutability) and that consumer welfare may also increase for a limited range of parameters.

3.28 **Gilbert (2019)** extends the framework of Federico, Langus, and Valletti (2017) by considering a setting that allows for replacement effects and knowledge spillovers. The paper establishes that absent spillovers, mergers often—but not always—reduce industry R&D effort and the probability of discovery. This is illustrated with a linear Cournot model. Under baseline parameters, a merger reduces both the probability of discovery and relative consumer surplus. This is shown for all mergers with a number of rivals pre-merger equal to seven or below. Consumer harm in this setting comes from both the reduction in the probability of innovation and the loss of future price competition (conditional on discovery), with the loss of future price competition accounting for a large share of the overall loss of consumer surplus (e.g. more than half in the case of a 4-to-3 merger). The model is then extended to account for replacement effects and spillovers. With sufficiently large existing profits at risk from innovation, a merger does not necessarily reduce innovation incentives (i.e. the probability of innovation can display an inverted U-shape on the number of pre-merger rivals). Nevertheless, mergers still harm consumers due to traditional price effects. Accounting for spillovers implies that mergers may increase

[92] The relevance of asymmetric outcomes on R&D effort is also discussed in the literature on R&D joint ventures (Leahy and Neary, 2005). We discuss this strand of the literature in Section 3.3.

the probability of innovation (even in the case of a merger-to-monopoly), and potentially benefit consumers especially when accounting for out-of-market effects (assuming that spillovers benefit other markets).

3.29 **D'Annunzio, Jullien, Lefouili, and Madio (2026a)** analyse horizontal merger effects on incentives to launch new products requiring R&D investments, in a framework where products are differentiated (unlike Federico, Langus, and Valletti (2017) and Denicolò and Polo (2018)).

3.30 The paper first considers a duopoly with costly R&D and stochastic innovation. In this setting, a merger allows the merging parties to internalise the negative externalities that each firm's innovation efforts impose on its rival. All else equal, this reduces the merged entity's incentives to innovate. However, a merger also leads to higher prices, which increases the expected return from successful innovation and therefore raises the merging firms' innovation efforts.[93] Because of these two opposing forces, the effect of a merger to monopoly on innovation is a priori ambiguous. They show that a merger raises innovation if and only if the merged firm's incremental profit from a second successful innovation exceeds the profit that an independent firm would earn when both firms operate separately and both are successful in innovation.

3.31 The authors apply this result to a Salop duopoly model with quadratic transportation costs, finding that a merger between duopolists raises innovation if products are not too differentiated (i.e. transportation costs are not too large), implying that the ability of the merged entity to coordinate prices across two new products is relatively strong, and outweighs the negative effect stemming from direct internalisation of innovation externalities. The reverse holds when products are sufficiently differentiated. In terms of consumer surplus, the paper shows that for some R&D cost functions, the merger leads to an increase in consumer surplus. In the Salop model studied by the authors, simulations show that this result occurs in a small region of the parameter space.

3.32 The paper also extends the Salop model to a setting with three symmetric firms, and where two of them (the insiders) merge.[94] The authors show that after the merger, depending on parameter values, the equilibrium investment efforts of the insiders and outsiders may both increase, or may go in opposite directions (e.g. higher insider innovation, and lower outsider innovation; or vice versa). A 3-to-2 merger reduces consumer surplus in all simulations studied in the paper (independently of the effects on insider and outsider innovation), in contrast with the duopoly case. When a merger to monopoly harms consumers, the loss in consumer surplus may be larger in a 3-to-2 merger than in a merger to monopoly under some conditions (e.g. if products are sufficiently differentiated).

3.33 Finally, the paper studies the impact of R&D and production efficiencies.[95] Both types of efficiencies increase in the insiders' innovation efforts and decrease in the outsider's innovation effort.

3.34 **Valletti (2025)** discusses some of the papers in this literature (notably Denicolò and Polo (2018), and Mukherjee (2022)—reviewed below), and provides some formal extensions of their results. He considers an extension of Denicolò and Polo

[93] The mechanism parallels that in Chen and Schwartz (2013), who show that a monopolist faces stronger incentives to introduce a new product than a duopolist, thanks to price coordination with its existing product (see discussion in Section 2.1).
[94] The authors also show their model can be generalised to any number of symmetric outsiders.
[95] The paper also looks at potential remedies, in the form of licensing innovation input or output, or transferring innovation capabilities.

(2018) with product market competition between the merging parties (based on the working paper version of the article). He shows that for an intermediate region of the value of innovation to consumers, there is a trade-off between greater innovation post-merger but higher prices (while in other regions there is no trade-off, and consumers are harmed by the merger). He then shows that even in this region, consumer welfare is higher absent the merger with Bertrand competition with homogeneous goods, and with Cournot competition with homogeneous goods and linear demand and cost. Valletti also notes, in line with Moraga-González and Motchenkova (2026), that in a model of process innovation a merger reduces consumer welfare absent post-merger technology transfers between the parties when assuming the same functional form for demand as Mukherjee (2022).

3.2.2 Mergers in markets with asymmetric firms

3.35 **Vuong and Baranes (2021)** extend the paper by Motta and Tarantino (2021) by considering a model with two high-cost symmetric firms and a third competitor with lower costs, under a specific demand model (Singh-Vives). The paper shows that a merger between the two high-cost firms (i.e. a merger between 'laggards') reduces the merging firms' investment in process innovation while increasing the outsider's investment level, as in Motta and Tarantino (2021). Furthermore, they find that when the outsider's initial cost advantage is sufficiently high, the resulting increase in its investment can more than compensate for the reduction in the merging firms' investment. Consequently, the merger can stimulate aggregate investments and, for sufficiently strong asymmetries, enhance consumer surplus (even absent spillovers and efficiencies).

3.36 **Haucap, Rasch, and Stiebale (2019)** extend previous work to an environment with asymmetries in the cost of carrying out R&D. They consider a setting with two firms with low R&D costs, and a third competitor with higher R&D costs. The merger involves the high cost firm and one of the two low cost firms. In the baseline model, it is assumed that the more efficient R&D technology can be applied to the product of the high cost firm after the merger (i.e. there is a voluntary technology transfer). The paper finds that the impact of the merger on innovation incentives of the merger insiders and outsiders can either be positive or negative, depending on the degree of asymmetry between firms and on the degree of R&D intensity. The paper also includes an empirical estimating exercise of the effect of pharmaceutical mergers on innovation—discussed in more detail in Subsection 5.1.1.

3.37 **Padilla, Piccolo, and Reynolds (2024)** consider a setting with two incumbent firms and two potential challengers that need to incur a fixed cost of entry. The paper investigates the impact of a merger between the two potential challengers. Firms offer differentiated products and compete in both prices and quality. Absent the merger, the challengers need to decide whether to enter the market. If they do, they are assumed to compete with the other challenger (if it enters) and with one of the two incumbents. The authors show that, depending on the level of entry costs, there is an equilibrium where both challengers enter, one where both refrain from entering, and one where they enter stochastically (according to a mixed strategy equilibrium). Under this third scenario there is a potential coordination failure between the challengers, with either no entry (which is inefficient) or unprofitable entry (where the challengers are not able to cover the cost of entry). A merger between the two challengers allows them to solve the entry coordination problem, and optimally enter with one or two products. However, the merger may reduce the number of product varieties and lead to higher quality-adjusted prices. The authors show that the merger can lead to lower quality-adjusted prices and higher consumer surplus if entry costs are sufficiently high, and hence the entry coordination problem is sufficiently significant. The authors also consider a case with synergies in the level of entry costs (i.e. the two challengers can save some of the

entry costs post-merger when they enter with both products). This expands the set of circumstances where the merger can lead to higher consumer surplus.

3.2.3 Technology transfers and knowledge spillovers

3.38 A number of papers consider the impact of mergers where there are procompetitive benefits in the form of voluntary technology transfers post-merger, and the internalisation of involuntary knowledge spillovers. Box 3.1 below provides an overview of some relevant empirical evidence on spillovers and technology transfers, whereas the rest of this Subsection covers the theoretical literature.

Box 3.1 Empirical evidence on spillovers and technology transfers

The academic literature on innovation and competition has considered the magnitude and sources of social benefits from **involuntary knowledge spillovers** between competing firms. These spillovers arise when knowledge generated by one firm is not fully excludable, so that the other firms can benefit from it without a market transaction or agreement. For example, the knowledge capital model[96] has long been the dominant approach to estimate the private and social returns to corporate R&D—with many studies identifying pervasive spillovers and a large wedge between social and private returns to R&D.[97] Other papers have recognised that some inter-firm knowledge spillovers between firms may be excludable and tradeable through technology markets, for example licensing, patent sales, R&D alliances.[98] In those cases, spillovers reflect **voluntary technology transfers**, rather than involuntary knowledge spillovers, allowing firms to appropriate part of the value created for other firms.

Griffith, Lee, and Van Reenen (2011) study whether knowledge spillovers are geographically localised by national borders and whether this 'home bias' has weakened over time, drawing on more than 2.1 million USPTO patents from 1975 to 1999.[99] The main finding is that home bias has fallen over time, indicating reduced importance of distance, although this decline is weaker in high-tech sectors, and models not taking into account unobserved patent characteristics substantially overstate the role of home bias.

Bloom, Schankerman, and Van Reenen (2013) investigate how to separately identify technology spillovers and product market rivalry in firms' R&D, and how these two forces affect private and social returns to R&D. To do this, the authors set out a theoretical framework in which the two spillover channels have different implications across different firm outcomes (market value, citation-weighted patents, TFP, and R&D expenditure) and then construct firm-level proximity measures in technology space from the distribution of patenting across technology fields and in product market space from the distribution of sales across four-digit

[96] See Griliches (1979).
[97] See e.g. Jaffe (1986), Hall, Mairesse, and Mohnen (2010), Bloom, Schankerman, and Van Reenen (2013).
[98] See e.g. Arqué-Castells and Spulber (2022).
[99] In addition, their data covers over two million citation relationships from 1975 to 1999, split into 1975–'89 and 1990–'99, across seven inventor locations (Germany, France, Great Britain, Rest of the EU (Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and Sweden), and the rest of the world) and six technology groups (Chemical, Computers and communications, Drugs and medical, Electrical and electronic, Mechanical, and Others). The authors implement an econometric model which focuses on the first few citations to capture the role of geography for knowledge spillovers, controls for unobserved heterogeneity and quality differences of patents, and accounts for the fact that newly granted patents are less likely to get cited.

industries.[100] The core findings are that both technology spillovers and product market rivalry are quantitatively important, but technology spillovers are substantially larger. In the baseline specification, the estimated gross social rate of return to R&D is 55% versus a private return of 21%, implying a social return at least twice the private return and an observed level of R&D less than half the implied social optimum. The paper also finds heterogeneity across firms, with smaller firms showing lower social returns because they tend to operate in technological niches where spillovers are more limited.[101]

Akcigit and Ates (2021) and Akcigit and Ates (2023) both start from reviewing empirical evidence on a decline in US business dynamism, which—among other things—document a rise in concentration, markups, and profit shares alongside a decline in entry and productivity growth. Akcigit and Ates (2021) develop a theoretical framework which highlights reduced knowledge diffusion as a mechanism capable of jointly explaining several of the documented trends. Specifically, the study features an endogenous growth model with step-by-step innovation, competition between heterogeneous firms, and an exogenous knowledge diffusion (catch-up) process from leaders to followers. In this model, equilibrium outcomes are shaped by a composition effect (i.e. allocation across levelled versus unlevelled sectors) and an incentive effect (i.e. firms' R&D responses). The framework reproduces many of the observed patterns and shows that lower knowledge diffusion is consistent with higher concentration, positive markups, higher profit share, and a lower labour share. In their complementary paper, Akcigit and Ates (2023) develop a calibrated general equilibrium model to quantitatively assess the factors behind declining US business dynamism. The core result is that, while several mechanisms can partially match individual trends, a decline in knowledge diffusion between firms dominates as an explanation for the data: it accounts for more than 80% of most observed changes, whereas other channels typically explain less than 10% (except entry costs for firm entry). Mechanically, reduced diffusion increases leaders' technological advantage, raising markups and profit share, lowering labour share, discouraging follower innovation and entry, and shifting the economy towards more concentrated sectors, thereby amplifying the same patterns highlighted in Akcigit and Ates (2021). The quantitative framework also introduces new empirical evidence on rising patenting and inventor concentration consistent with reduced diffusion, reinforcing the interpretation of knowledge diffusion as the central force behind declining business dynamism.

Focusing on the role of voluntary technology transfer in the technology market, **Arqué-Castells and Spulber (2022)** consider how measurement of private and social returns to R&D changes once knowledge diffusion is allowed to occur not only through unintended spillovers but also through voluntary technology transfers (such as licensing or R&D alliances). They develop a generalisation of the knowledge-capital framework in which firms can benefit from external R&D through both channels, with technology markets playing a dual role as a source of secondary revenue for providers and as an additional source of external knowledge for adopters.[102] The core result is that once technology-market channels are

[100] The empirical application uses a panel of 715 US firms over 1980–2001, and the paper also reports IV estimates that use changes in firm-specific federal and state R&D tax prices to allow them to distinguish R&D spillovers from correlated shocks to technological developments.

[101] In a more recent study, Adhami (2026) provides a complementary estimate of knowledge spillovers by measuring the wedge between social and private returns to innovation through firm exit dynamics rather than patents or R&D expenditure, finding that the laissez-faire rate of innovation is underprovided by roughly a factor of two to three relative to the first-best.

[102] They estimate a product-market revenue equation for a panel of 3,897 publicly traded US firms from 1990 to 2014 that includes the conventional spillover pool and a newly constructed market-for-

incorporated, the observed gap between social and private returns to R&D is smaller than in the canonical spillovers-only approach, because conventional specifications tend to overstate spillovers and understate private returns by conflating spillovers with technology transfers. In addition, the study also emphasises significant gains from trade in markets for technology. A possible interpretation of these results is that voluntary technology transfer may act as an alternative to mergers for sharing knowledge.[103]

Source: Oxera.

3.39 **Atallah (2016)** includes an early analysis of endogenous efficiency gains from mergers in the presence of R&D spillovers (where firms invest in cost-reductions and the related R&D spillovers affect rivals' costs), considering quantity competition with homogeneous products, and both quantity and price competition with symmetrically differentiated products. Endogenous efficiency gains are defined as a reduction in costs brought about by additional R&D investments caused by a merger. When considering *quantity competition with homogeneous goods*, a merger is modelled as a reduction in the number of Cournot competitors, and hence the market is symmetric pre- and post-merger. In this case a merger leads to higher cost-reduction efforts because the increase in concentration (and hence individual output) makes a cost-reduction more profitable. Post-merger marginal costs are lower for all values of the spillover parameter except 0.5. The author also reports that prices increase with concentration, and welfare decreases.

3.40 When considering *quantity competition with product differentiation*, the paper looks both at a 2-to-1 merger, and a 3-to-2 merger.[104] For a *2-to-1 merger*, a merger leads to larger reduction in costs (compared to the pre-merger benchmark) if spillovers and/or product differentiation are sufficiently large. The reason is that when spillovers are high, R&D investments without the merger are depressed due to leakage to competitors, whereas this externality is internalised post-merger. High product differentiation means that pre-merger competition is softened, and firms invest less in R&D. This implies that a merger internalises a smaller negative externality, requiring a lower level of spillovers in order to generate an increase in innovation incentives. For a *3-to-2 merger,* it remains the case that a merger leads to efficiency gains when spillovers and/or product differentiation are sufficiently high. However, the presence of an outsider to the merger reduces the likelihood of efficiency gains because spillovers continue to generate a leakage to rivals post-merger.

3.41 Finally, when considering *price competition with product* differentiation, the paper similarly looks at both a 2-to-1 merger, and a 3-to-2 merger. For a *2-to-1 merger*, the merger increases innovation incentives unless spillovers are very low. Cost reductions due to the merger are larger and more likely with price competition compared to quantity competition. For a *3-to-2 merger,* spillovers have two opposite effects on the merged entity: each merging product benefits from spillovers from the other product, but loses from spillovers due to leakage to the outsider (this is the case on two products post-merger, and hence is a stronger

technology pool, using within-firm variation and instruments based on tax-induced changes in the user cost of R&D capital.

[103] Similarly, Bergeaud, Schmidt, and Zago (2026) focus on the role of standardisation for knowledge diffusion and decompose the value created by R&D across distinct phases—the innovation phase following patent grant and the diffusion phase triggered by inclusion in an industry standard—finding that, while patenting generates persistent gains in firm value and TFP, standardisation contributes only short-lived competitive advantages through temporary markup increases.

[104] The paper also considers a 3-to-1 merger.

effect). The leakage effect is particularly pronounced if product differentiation is low as competition is stronger in that case. Overall, the merger leads to lower costs only if spillovers and/or product differentiation are sufficiently high (with the relevant threshold higher than in the case of quantity competition).

3.42 **Salinger (2019)** extends the standard Upwards Pricing Pressure logic, to develop a 'Net Innovation Pressure' index which accounts for innovation spillovers. He considers a simple merger-to-monopoly setting, with fixed product market prices, and shows that the impact of the merger on innovation incentives rests on the comparison between the innovation diversion rate (i.e. the rate at which a quality improvement by one party diverts sales from the other) and the spillover rate (i.e. the extent to which innovation by one firm benefits the other). If the spillover rate is greater than the diversion rate, the merger enhances innovation incentives. Salinger also discusses cases where the spillover rate is negative, e.g. settings which can be described as patent races, where greater innovation by one party makes innovation by the other party less effective.

3.43 **Régibeau and Rockett (2019)** present a general discussion of the relationship between mergers and innovation, building on the debate which followed the publication of the working paper versions of Motta and Tarantino (2021), and Federico, Langus, and Valletti (2017, 2018), and the related discussions of Dow/DuPont (for a policy-focused review, see Volume 1, Chapter 8). The paper contributes to the understanding of possible innovation efficiencies from a merger, including: knowledge diffusion within the merged entity; internalisation of spillovers; coordination of R&D investments (to avoid duplicative R&D efforts)[105]; benefits in the context of sequential innovation; and legal certainty. The paper clarifies the importance of understanding the effectiveness of technology licensing absent the merger, the breadth and enforcement of IPRs, hold-up concerns (depending on the feasibility of ex ante licensing), and the effect of a merger on legal certainty in industries where IPRs are not easily defined.

3.44 **Denicolò and Polo (2021)** study merger effects when firms can engage in innovation sharing post-merger. They consider a Cournot model of quantity competition with homogeneous goods, increasing marginal costs, and process innovation. They assume that pre-merger each firm can apply the benefits of investment in process innovation to their plant. Post-merger, the assumption of innovation sharing implies that a given process innovation can be applied freely to both plants. Given this assumption (and given that innovation is assumed to be deterministic), post-merger process innovation is carried out only in one research facility. The authors show that innovation-sharing may more than offset the contractionary output effect from the merger, making the merger procompetitive even in the absence of cost synergies in production and research. The output expansion effect from innovation sharing results from the fact that the merger results in lower marginal costs and hence greater output than pre-merger individual outputs of each firm. This increases the incentives for process innovation, leading to even larger output. The paper shows that the merger ultimately is procompetitive if marginal costs of production are sufficiently high, and the costs of R&D are in an intermediate range.[106]

[105] This effect is modelled in Régibeau and Rockett (2019, 2022) under the assumption that two firms making the same discovery can both exploit (non-excludability). For a discussion of this paper, see Subsection 3.2.3.

[106] Mukherjee and Ray (2024) extend the paper by Denicolò and Polo (2021) to the case with constant marginal costs, showing that mergers can be procompetitive also in this case (for some parameter ranges), given the assumption that R&D is not observable. Banerjee, Mukherjee, and Poddar (2025) further extend a setting with innovation sharing to a case with product differentiation and network

3.45 **Mukherjee (2022)** considers a duopoly setting with process innovation and voluntary post-merger spillovers. This is modelled by assuming that it is sufficient that one of the two labs succeeds in developing an innovation post-merger for both sellers to benefit from reduced marginal costs of production. Assuming the probability of failure in innovation is log-convex in R&D investments (which implies that the merged entity would not shut down one of the two labs after the merger, as in Federico, Langus, and Valletti (2017)) the impact of a merger on R&D investments is ambiguous. The paper shows that a merger reduces investments if R&D efforts substantially lower marginal cost and competition is intense (since business-stealing effects are stronger in this case). However, if either competition intensity is low or the marginal cost before R&D is already relatively low, the business-stealing effect is weaker and, as a result, a merger stimulates investments, and potentially benefits consumers. The procompetitive mechanism at work in this paper is implicitly based on synergies in R&D, as discussed by Valletti (2025) and Moraga-González and Motchenkova (2026). A merger in the setting considered by Mukherjee (2022) harms consumers absent the R&D synergy.

3.46 **Hwangbo and Lee (2026)** study the impact of mergers with spillovers, in a duopoly model based on Denicolò and Polo (2018). They establish that the spillover effect generates a free-riding externality absent a merger. The merger internalises this externality, potentially leading to stronger overall innovation incentives. Horizontal mergers increase innovation when the spillover effect dominates the business-stealing effect, and vice versa. This confirms the findings of previous work, e.g. Atallah (2016) and Salinger (2019).

3.47 **D'Annunzio, Jullien, Lefouili, and Madio (2026b)** study how R&D spillovers affect the impact of mergers on innovation incentives and consumer welfare in oligopolistic markets. The authors distinguish between internal spillovers (between insiders), incoming spillovers (from outsiders to insiders), outgoing spillovers (from insiders to outsiders), and correlated symmetric industry-wide spillovers (across all firms). They find that internal and correlated industry-wide spillovers can reverse the negative effect of a merger on the insiders' innovation incentives when spillovers are sufficiently strong, whereas incoming and outgoing spillovers do not generate such a reversal. The authors also examine the implications of spillovers for the effect of a 3-to-2 merger on consumer surplus. Their simulation results suggest that internal spillovers tend to make a merger less harmful, or even beneficial, to consumers, whereas incoming spillovers tend to make it more harmful, and outgoing spillovers have an ambiguous effect. Their findings also suggest that correlated symmetric industry-wide spillovers are often a mitigating factor, although to a lesser extent than internal spillovers.

3.48 Finally, **Faulí-Oller and Sandonís (2003)** develop a theoretical model comparing mergers and licensing as alternative mechanisms for transferring a cost-reducing innovation in a differentiated duopoly under both Cournot and Bertrand competition. The model assumes that one firm possesses a patented superior technology and can either license it to a rival using royalties and/or fixed fees, or merge with the rival to internalise production. The authors show that when both royalties and fixed fees are feasible, licensing dominates mergers from a welfare perspective, as licensing allows technology transfer while preserving downstream competition, unlike mergers which internalise competition. This implies that licensing may constitute a less anticompetitive alternative to mergers when feasible. However, when two-part tariff licensing instruments are restricted, licensing may distort

externalities, confirming that the impact of the merger on consumer surplus is ambiguous, depending on the extent of product differentiation and the strength and nature of network externalities.

output excessively or become privately unprofitable, in which case mergers may improve welfare or be necessary to ensure efficient technology diffusion.

3.2.4 Sequential innovation

3.49 **Das, Mayskaya, and Nikandrova (2026)** develop a sequential model of innovation incorporating uncertainty about the feasibility of any given innovation trajectory. In their framework, two competing firms can develop sequential innovations, by investing along a research path. Both firms can engage in a first (initial) innovation, and then in a second (follow-up) innovation, in a patent race setting (i.e. the first firm to successfully innovate effectively obtains a patent for the new technology). The research path for both innovations may be either fruitful or barren; a fruitful path yields product innovation in response to a stochastic R&D process, whereas a barren path never produces innovation. Initially, firms possess no knowledge of the path type, but acquire information over time by observing research activities and innovation outcomes of both themselves and their competitors (i.e. there is an information spillover). In the duopoly scenario, each competing firm has one unit of research intensity to devote to innovation, which determines the arrival rate of innovation. The merged entity has two units of research intensity to devote to its innovation efforts. In the baseline specification, the merger does not affect product market competition (i.e. the payoff of the merged entity is simply the sum of the payoffs of the two individual firms).

3.50 The authors define three channels through which a merger influences innovation, as follows.

- A *cannibalisation channel*, whereby the second (follow-on) innovation lowers the returns from the first (initial) innovation. The merged entity internalises this negative externality and may consequently reduce follow-on innovation efforts.
- An *appropriability channel*, which relates to the degree to which a firm can secure returns from its innovation activities. A merger enables the merged entity to exercise control over (and extract value from) a follow-on innovation, thereby enhancing incentives to invest in the initial innovation.
- An *informational channel*, whereby successful innovation by one firm discloses information about research path quality, generating an informational spillover that weakens investment incentives absent the merger because of free-riding. A merger internalises this positive informational and inter-temporal externality, accelerating the arrival time of the first innovation.

3.51 The authors establish that when research costs are sufficiently modest, a merger encourages innovation because the merged entity never suppresses the second innovation due to the cannibalisation effect, while increasing investment in the first, thereby accelerating its discovery. Conversely, if research costs are in an intermediate range, the impact of a merger on innovation is ambiguous, because it suppresses the second innovation (e.g. as in a 'killer acquisition'), but it also accelerates the first innovation. Finally, when research costs are substantial, the merger has no impact on innovation since neither independent firms nor the merged entity have incentives to pursue the second innovation, and hence no externalities are present.

3.52 In terms of consumer surplus, the impact of the merger is ambiguous. The authors provide an example using a representative consumer with quadratic utility and a setting where the first and second innovations compete with one another à la Stackelberg. They show that the effect of the merger on consumer surplus can be non-monotonic in the degree of product substitutability. For example, if the prior belief on the prospect of a successful innovation trajectory is low (i.e. there is more uncertainty about the feasibility of innovation, and hence stronger informational

spillovers and appropriability), a merger benefits consumers both at low and high levels of product differentiation. If instead there is less uncertainty about the prospects of successful innovation (and hence weaker informational spillovers and appropriability) it is more likely that a merger will harm consumers, for a sufficiently high level of product substitutability (where the cannibalisation effect is stronger).

3.53 The authors consider an extension of their model to account for the impact of a merger on prices. They determine that while price effects harm consumers, they also spur innovation incentives by reinforcing the appropriability channel and attenuating the cannibalisation channel. This implies that the merger either has no impact on innovation, or it increases innovation incentives. The impact of a merger on consumer surplus remains ambiguous in the extension with price effects, and depends amongst other factors on the strength of informational spillovers (as in the baseline model).

3.2.5 Diversity of innovation paths

3.54 Mergers can influence not only the magnitude of R&D investments, but also the diversity of R&D initiatives, and the trajectory of innovation.

3.55 **Letina (2016)** analyses the effect of changes in the intensity of competition on R&D portfolios. In the baseline specification, the author posits competition amongst symmetric firms that select a subset of research projects in which to invest. Innovation is stochastic and drastic, with all projects exhibiting ex ante symmetry in success probability but differing in fixed development costs. When selecting projects to develop, firms face a trade-off because inexpensive projects possess the same success probability as costlier ones yet attract more competitors. The author characterises the equilibrium R&D portfolio and establishes that R&D variety diminishes if the number of competing firms decreases. This is because firms invest in projects that are more expensive to evade competition, fostering greater diversity. As a merger attenuates competition, it also yields less variety in funded projects.

3.56 **Moraga-González, Motchenkova, and Nevrekar (2022)** investigate the impact of horizontal mergers on firms' innovation portfolios and consumer welfare. In their baseline environment where firms possess a fixed overall research budget[107] that they allocate across two research projects (A and B) in two separate markets, a given firm's investment in a given project exerts two opposing effects on rival firms. First, it produces a negative effect on them by reducing the probability that they prevail in the innovation contest for that project. This constitutes a conventional *business-stealing* effect. Second, a firm's investment in one project generates a positive effect on its rival by increasing the probability that they succeed in the innovation contest for the alternative project. This represents a novel effect, which the authors term a *business-giving* externality. A merger between two firms induces the internalisation of these two countervailing externalities. When projects differ in expected profitability, a merger results in an increase in the investment of the merging firms in the less profitable project. This implies that if the relatively less profitable project is also the project that appropriates a lower fraction of the social surplus, then a merger raises consumer surplus by increasing investment in it.

3.57 In the baseline setting, the paper analyses these merger effects assuming that innovation is winner-take-all. In this scenario, the merger may lead to higher

[107] The assumption of a fixed research budget can be motivated by considering a situation in which a fixed number of scientists can work on different projects, and it is expensive to find and hire new scientists, at least in the short run (see footnote 11 of the paper).

investment by the merged entity either in project A or project B. If, for example, the net effect of the merger is to increase investment in project B, and consumer surplus from this project is higher than that from project A, then the impact of the merger on the direction of innovation will tend to benefit consumers. In this case, there are no adverse ex post price effects, since innovation is winner-take-all. For example, the authors show that in the family of ρ-linear demands, a merger benefits consumers when the easier and more profitable project is also the one with the more concave demand. In the class of models with linear demands, a merger always benefits consumers.

3.58 The paper also considers a scenario where the research budget is not fixed, but endogenous. In this case the merger causes a drop in total investment. However, the beneficial effects of a merger on the direction of innovation remain the dominating influence on welfare outcomes if the cost of R&D is sufficiently convex.

3.59 Finally, the authors extend the analysis to study the case in which products are vertically or horizontally differentiated in one of the two markets, implying that the winning firm produces a high-quality good whereas the losing firms continue to produce a low-quality good. In this case, the merger may generate price effects (both with and without successful innovation). The authors rely on two numerical examples (reported in the working paper version) and show that mergers may still increase consumer welfare, when the difference in quality between the products is sufficiently large so that the price effects of the merger are more contained. As the low quality rises, or horizontal product differentiation falls, the price effects of mergers become more important. This tends to reduce the likelihood that a merger benefits consumers.

3.2.6 Procurement settings

3.60 **Loertscher and Marx (2019)** consider merger effects in procurement markets. The authors also consider an extension with cost-reducing innovation, which is relevant to the literature on mergers and innovation. The results of the paper indicate that without buyer power, mergers increase cost-reduction investment incentives for merging suppliers per plant while leaving rivals' incentives unchanged. With buyer power (modelled by allowing the buyer to commit to an optimal procurement mechanism), mergers increase rivals' investment incentives but generate ambiguous effects for merging suppliers. In this paper, incentives to innovate are modelled by examining the incremental profits from innovation for each firm pre- and post-merger, without considering the internalisation of innovation externalities between the merging parties.

3.61 **Pietola, Tarantino, and Zenger (2026)** model the impact of a merger on investment and consumer welfare in a baseline auction setting with efficient procurement. They establish that absent spillovers and synergies, mergers are neutral for innovation incentives (as the internalisation of investment externality exactly matches the impact from the loss of price competition). Consumers are harmed by the loss of price competition from the merging parties. Synergies can benefit consumers if there is sufficient competition after the merger. The internalisation of spillovers from a merger has two effects: the effect of internalising positive spillovers within the merged entity (internal spillovers), which enhances investment incentives; and the impact of internalising negative spillovers that arise through the effect on non-merging parties (external spillovers), which reduces investment incentives. With spillovers, the net effect of the merger on welfare and consumer surplus is ambiguous. In the symmetric case with diffuse spillovers and no synergies, the merger reduces the merging parties' investment and consumer surplus, if the number of competitors is above a given threshold.

3.62 The paper also considers an extension with a first-price auction. Assuming pre-merger symmetry, a merger leads to a reduction in investment (absent synergies and spillovers), with merger insiders reducing their investment and outsiders increasing theirs. Consumer welfare is reduced by the merger, as in the baseline setting. The authors also consider an example which confirms the baseline results with spillovers (e.g. the harm to consumers from a merger may be higher with positive spillovers).

3.2.7 Calibrated dynamic models

3.63 In this Section, we discuss papers that develop dynamic computational models of competition and derive quantitative results based on comparative static simulations. Structural models calibrated on real-world data are additionally discussed in Volume 1, Chapter 7 on empirical results.

3.64 **Pakes and McGuire (1994)** develop a dynamic model of differentiated product markets where firms invest to develop profit opportunities through uncertain research processes, with outcomes generating variation in product quality. The authors present a number of numerical simulations comparing several institutional arrangements. Under base-case parameters with low entry costs, the free-entry equilibrium exhibits substantial entry and exit occurring in approximately 20% of periods, with most entrants failing quickly while successful firms earn substantial returns. The industry typically supports three or four active firms. The authors also model an outcome with 'perfect collusion', which is equivalent to a merger-to-monopoly. This leads to significantly lower consumer welfare than the competitive equilibrium (a reduction of roughly two thirds), significantly less investment, and less entry.[108]

3.65 **Mermelstein, Nocke, Satterthwaite, and Whinston (2020)** employ a dynamic computational framework to examine merger policy in industries characterised by scale economies, where firms can reduce costs through internal capital investment or through mergers combining existing capital stocks. The authors model Cournot competition among firms possessing capital stocks that determine production costs via a technology exhibiting increasing returns to scale. Mergers generate scale economies (i.e. combining two identical firms' capital reduces marginal and average costs at unchanged output levels). The paper also assumes that firms endogenously propose mergers, while the antitrust authority evaluates proposals sequentially as they arise.

3.66 Examining the baseline case of duopoly markets, the results of the paper indicate that allowing all mergers leads to persistent monopoly or near-monopoly configurations with a reduction in total investment. There is entry-for-buyout under this scenario, with small firms investing in order to be acquired. Under a static consumer-surplus-based policy, almost all mergers are blocked. This remains the optimal policy under a dynamic consumer welfare standard (i.e. one that also accounts for entry-for-buyout effects). In this model, adopting a consumer welfare standard is superior to a total welfare standard also from an efficiency perspective, as it avoids inefficient entry.

3.67 **Hollenbeck (2020)** develops a dynamic oligopoly framework with vertically differentiated goods and endogenous investment, entry, exit, and mergers. In this setting, mergers can increase innovation rates via entry-for-buyout effects. In terms of effects on consumer surplus, the resulting positive long-run effect on innovation can outweigh negative short-run effects from higher prices, leading to higher

[108] For a discussion of the policy relevance of these results, see Whinston (2012).

consumer surplus when mergers are allowed. This is the case for example for relatively low cost of entry, sufficiently large gains from innovation, and limited product differentiation (implying lower contestability). Merger synergies (in the form of integration of innovation in existing products) make it more likely that mergers benefit consumers.

3.68 **Cavenaile, Celik, and Tian (2021)** develop and estimate a general equilibrium model combining Schumpeterian innovation, oligopolistic product market competition, and endogenous mergers and acquisitions. Firms can invest in R&D to improve productivity, while mergers generate potential synergies but also affect market concentration and competitive dynamics. The paper models existing merger policies by using HHI thresholds that mirror the US guidelines. They show that existing merger policies generate gains in growth and welfare, with complete elimination of antitrust enforcement resulting in welfare losses. Strengthening antitrust enforcement, defined as a reduction in HHI thresholds by 10%, could deliver higher gains and welfare improvements. The dynamic long-run effects of antitrust policy on social welfare are an order of magnitude larger than the static gains from higher allocative efficiency in production, with nearly all of welfare changes attributable to impacts on innovation and productivity growth. Stricter merger policy leads to less innovation by smaller firms (as profitable opportunities to merge diminish) but more innovation by large firms (to escape competition).

3.69 Finally, **Guthmann and Rahman (2026)** put forward a calibrated general equilibrium framework to quantitatively evaluate alternative merger policies. The model allows for merger synergies, knowledge spillovers between market leaders and laggards (defined as 'symbiotic competition'), and entry-for-buyout effects. Firms compete à la Cournot, investing in productivity enhancements, and facing merger opportunities arriving via a random process. The model is calibrated to match stylised facts from the US economy, under the assumption that all mergers leaving the number of firms in a market below three are blocked (this is designed to approximate current merger policy in the US).

3.70 In their calibration, the authors find that the optimal merger rule from a total welfare perspective would approve mergers only if the resulting number of firms in an industry is above a threshold of five, and that welfare de facto plateaus at this threshold.[109] This mirrors the results on the intensity of innovation: while the absolute level of innovation per firm is maximised in a duopoly (since duopolistic competition reduces wasteful replication of research and gives firms better returns to their investment, since there are fewer spillovers), there is an inverted-U relation between the level of research intensity over firm value, and the number of firms (with a peak at around five firms).

3.71 The authors study optimal merger review rules in the form of a concentration screen (based on the increase in the HHI), and a price rule (in the form of the highest price increase to be allowed post-merger). Thresholds for both rules are set to maximise total welfare. The paper finds that the optimal Delta-HHI rule would only allow modest increases in concentration (Delta-HHI = 10), and the optimal price rule would actually only allow mergers that *decrease* prices by around 0.5%. The results are driven by the adverse effects of mergers on innovation (as mergers reduce firms' incentives to innovate) and on 'symbiotic competition' (as competition leads to greater spillovers). The paper finds that the optimal price rule is slightly stricter under a consumer welfare standard (proxied by looking at working households that only supply labour). Overall the findings of the paper suggest that a static rationale

[109] Note that this rule does not imply that every market consolidates to this threshold number of firms, with market structure at any one time jointly determined by entry, exit, and mergers.

demanding that mergers do not decrease consumer surplus is a good policy heuristic to maximise social welfare too.

3.3 R&D cooperation and overlapping ownership

3.72 The literature on R&D cooperation precedes the recent literature on horizontal mergers, but shares similar insights. These are confirmed by more recent literature on overlapping ownership. This area of the literature provides insights on different scenarios (R&D cooperation only, output and R&D cooperation, and no cooperation), which can be directly informative for the case of merger-to-monopoly (assuming that cooperative arrangements span the whole industry), and provides some insights on the mechanisms at work in mergers more generally. It can also be informative for forms of cooperation other than mergers (i.e. R&D Joint Ventures).

3.3.1 R&D cooperation

3.73 **d'Aspremont and Jacquemin (1988)** build a two-stage theoretical duopoly model with linear demand and costs where firms choose R&D levels first and then compete in quantities (Cournot) in the product market. R&D generates spillovers (modelled as production unit costs declining with own and rival R&D). The paper looks at outcomes under three regimes: noncooperative in both stages, cooperative in R&D only, and full cooperation (monopoly). Results indicate that for sufficiently large spillovers, R&D cooperation raises both R&D spending and output relative to the fully noncooperative equilibrium. Monopoly raises R&D even more but reduces output compared to R&D cooperation due to the reduction of competition in the product market (despite the higher level of R&D).

3.74 **Leahy and Neary (1997)** generalise the results of d'Aspremont and Jacquemin (1988), by considering both a simultaneous and sequential model of R&D and product market competition, and considering both price and quantity competition in the product market. They show that R&D cooperation lowers output and R&D in a sequential setting, unless spillovers are sufficiently high. The paper also illustrates welfare results in a linear Cournot model with quadratic R&D costs. They find that competition (i.e. no R&D and output cooperation) leads to higher welfare than R&D cooperation for low levels of spillovers. In this setting a merger lowers welfare compared to the no-cooperation setting unless spillovers are even higher. A merger is always inferior to R&D cooperation, even at the maximum level of R&D spillovers (confirming the results of d'Aspremont and Jacquemin).

3.3.2 Overlapping ownership

3.75 More recent research highlights that industry cooperation induced by common ownership can reduce or enhance innovation and consumer welfare depending on market conditions, confirming results from previous research.

3.76 **López and Vives (2016)** develop a theoretical oligopoly model where common ownership is represented by the degree of profit internalisation among rivals. The model predicts that common ownership (and by extension an industry wide merger-to-monopoly, which can be modelled as the limit case of full profit internalisation) can stimulate R&D investments and improve both total and consumer welfare in competitive markets with sufficiently high technological spillovers. In the baseline model of homogeneous products and simultaneous R&D and output competition[110],

[110] Results are shown for three separate demand and R&D models, as considered by d'Aspremont and Jacquemin (1988), Kamien, Muller, and Zang (1992), and a constant elasticity of substitution model as in Dasgupta and Stiglitz (1980).

the model identifies three threshold levels of spillovers: for low spillovers, greater common ownership reduces both R&D and output; for intermediate spillovers, greater common ownership increases R&D but lowers output; and for high spillovers, both R&D and output are higher with higher levels of common ownership. The two threshold levels for spillovers that partition these three regions are generally increasing in the level of market concentration (i.e. higher levels of spillovers are required to make common ownership beneficial in markets with fewer firms, because 'free-riding' incentives are lower when the number of firms is small). Under a consumer welfare standard, the optimal degree of coordination increases with the level of spillovers and the number of firms. This standard is much stricter than a total welfare standard, significantly reducing the scope for the optimal degree of common ownership. Results are illustrated in a number of numerical simulations.[111] Their results suggest that evidence that coordination reduces R&D is a sufficient (but not necessary) condition to show that it will also reduce consumer welfare.

3.77 In the extension with sequential price competition between differentiated products (under linear and constant elasticity demand), **López and Vives (2019)** find that for low level of spillovers, symmetric cooperation reduces R&D spending and increases prices; for intermediate spillovers it increases R&D spending and prices; and for high spillovers it increases R&D spending and lowers prices. The optimal degree of cooperation under a consumer welfare standard remains below the corresponding levels under a total welfare standard. These results are in line with the baseline model of simultaneous output competition.

3.78 **Nevrekar (2022)** examines welfare effects of common ownership through investment allocation. The author considers a model where two symmetric firms allocate investments across two separate markets. The results show that, while in the absence of common ownership firms allocate investments symmetrically in both markets, for sufficient levels of common ownership (including full common ownership, i.e. a merger) firms cross-specialise (directing their investment budget towards a single market so that the industry has a unique specialist for each segment). Under these conditions, common ownership raises consumer welfare when one of the two markets is significantly more profitable, but the other one is socially more valuable. This is related to the innovation portfolio effects studied by Moraga-González, Motchenkova, and Nevrekar (2022).

3.79 **Shelegia and Spiegel (2024)** show that changes in ownership structure can improve consumer welfare (through greater innovation) depending on the symmetry of ownership stakes, the nature of innovation, and innovation costs. In their Bertrand duopoly model with homogeneous products—where firms choose investment levels in a stochastic R&D process which can reduce their costs to 0, before setting prices—common ownership is measured by partial cross-shareholding percentages. The model predicts that when innovation is non-drastic, an increase in partial cross ownership can benefit consumers for low innovation costs and if it reduces a pre-existing asymmetry in partial ownership stakes. However, in line with the previous literature, a symmetric increase in partial cross ownership (which is more relevant for a merger setting) harms consumers. On the contrary, when innovation is drastic, partial cross ownership may enhance consumer welfare under high innovation costs, making consumers better-off than under a full-scale merger

[111] These show, for example, that common ownership between firms typically harms consumers in a Constant Elasticity model even for high spillovers (unless the number of firms is sufficiently large), and that full common ownership (e.g. equivalent to an industry-wide merger) is beneficial from a consumer welfare standard under the set-up considered in d'Aspremont and Jacquemin (1988) only for high spillovers and a sufficient number of firms in the market (e.g. above six).

which would lead to a total internalisation of competitive externalities. The paper also shows consumers are better off under partial cross ownership compared to a merger in the case of drastic innovation, provided that the partial stakes are not too large.[112]

3.80 **Hurkens and López (2026)** analyse how overlapping ownership affects technology adoption incentives in a duopolistic innovation timing game. In the absence of overlapping ownership, the classic result from Fudenberg and Tirole (1985) shows that first-mover advantage drives a pre-emptive race where both firms compete to adopt early. The paper shows that beyond a certain threshold of common or cross-ownership, which can be relatively low, a second-mover advantage emerges (assuming that adoption costs are borne by managers as opposed to firms). This transforms the pre-emptive race into a waiting game where firms strategically prefer to adopt the technology last, ultimately delaying technology diffusion. The paper also considers an extension with a merger to monopoly. In this setting, a merger delays technology adoption compared to a competitive benchmark without common ownership.

[112] Mukherjee (2023) shows that mergers may increase R&D investments and expected welfare in industries with passive cross-ownership, for the case of product innovation and Bertrand competition with homogeneous products (welfare is higher with a merger if the extent of passive cross-ownership is sufficiently high).

4 Horizontal mergers: acquisitions of potential competitors (theory)

4.1 This Chapter provides a detailed paper-by-paper review of the literature summarised in Volume 1, Chapter 6.

4.1 Killer acquisitions and the loss of future product market competition

4.2 As with horizontal mergers involving incumbents, acquisitions involving smaller target firms can lead to a post-acquisition internalisation of competitive pressures when the target is a potential competitor. Below we consider how this can lead to so-called 'killer acquisition' concerns, where the acquirer simply shelves the target's innovations, to internalise an adverse business-stealing effect. We also consider how competitive harm may occur even if the acquirer continues developing the target's project but the acquisition eliminates future price competition between the merging parties—i.e. it can suppress future product market competition even absent shelving of the target's innovative project.

4.3 **Cunningham, Ederer, and Ma (2021)** focus on killer acquisitions concerns in the context of pharmaceutical acquisitions. In their theoretical model—developed to guide their subsequent empirical analysis based on pharmaceutical project-level data (discussed in Section 5.1)—a potential target owns a patented project that needs to be developed at a cost and which subsequently may or may not be successful. Prior to incurring the development cost, the project can be acquired by an incumbent, who then has to decide whether to develop the project or not. The incumbent cannot innovate independently. In the baseline model, products are vertically and horizontally differentiated and there is competition in price.[113] The model allows for potential development synergies brought about by the merger.

4.4 The authors show that in their set-up, the Arrow replacement effect is at work—i.e. the effect whereby the introduction of the new product diverts sales from the existing product.[114] Moreover, in the simplest setting absent synergies, the incumbent faces *weaker incentives* to develop the project than the entrant, as long as there is some product overlap between the acquirer and the target (i.e. the introduction of the new product would lead to a business-stealing effect). In this case, a killer acquisition occurs (i.e. the acquired project is acquired but not developed) if the degree of product overlap between the acquirer and the target is sufficiently large (the two products are close to each other), and for intermediate levels of the development cost.[115] For lower levels of overlap (i.e. more product differentiation between the products of the acquirer and of the target), the acquirer continues development (acquire to continue), but the acquisition still removes an independent future competitor and thus softens post-innovation competition.

4.5 The paper shows that in more competitive markets (defined by the number of differentiated competitors to the acquirer) the replacement effect is weaker, and hence there is a lower risk of killer acquisition. This is because more competition in the acquirer's product market reduces the profitability of maintaining incumbent

[113] The authors also consider an extension with Cournot competition in quantities, showing that their main results hold also in this setting.
[114] The authors show that this effect is also present under quantity competition in their demand setting.
[115] With high development costs neither the potential competitor nor the incumbent develops the project. The opposite is true with sufficiently low development costs.

rents and thereby shrinks the gap between the acquirer's and entrant's incentives to develop the project (e.g. business-stealing effects are diluted).

4.6 The paper also models the incentives of the incumbent to acquire the target. Acquisition incentives depend on the relative strength of the replacement effect, and the efficiency effect (i.e. the fact that a merger leads to less intense price competition and avoids a dissipation of industry rents, as in Gilbert and Newbery (1982)). The authors show that under price competition with differentiated products and absent synergies, the efficiency effect dominates the replacement effect. This implies that the incumbent always faces the incentive to acquire the potential competitor as long as the project would have been developed by the potential competitor absent the merger (and would therefore erode the incumbent's existing profits).[116] Depending on the degree of overlap, the acquired project is discontinued (acquire to kill) or not (acquire to continue).[117]

4.7 In this model sufficiently strong development synergies can lead to a procompetitive merger by increasing the probability that a new product is introduced and offsetting the loss of competition from the elimination of an independent competitor.

4.8 Taking the context of acquisitions by large tech companies, **Motta and Peitz (2021)** present a stylised model that, among other possible outcomes, incorporates killer acquisitions effects. In their model, a potential entrant faces an exogenous project development cost and subsequent success probability. The project would be a substitute for the incumbent's product or service.[118] Motta and Peitz assume that the target has the incentive to develop the project (i.e. the expected incremental profits from successful product introduction are larger than the costs of development) but that it may be resource constrained, and hence not able to finance the development cost. The incumbent, however, is not resource constrained. This generates a potential synergy from the merger similar to the one considered by Cunningham, Ederer, and Ma (2021)—albeit in terms of relaxing the resource constraint for development rather than increasing the probability of successful development. As in the baseline model of competition by Cunningham, Ederer, and Ma, Motta and Peitz assume that the Arrow replacement effect is at work (which they recognise is not necessarily innocuous).

4.9 Motta and Peitz show that in their model, the acquisition is anticompetitive if (i) absent the takeover, the target would have invested in the project but the acquirer decides not to (killer acquisition), *or* (ii) both the target and the acquirer would invest in the project (e.g. because development costs are sufficiently low) but the merger eliminates future price competition ('upgrade with suppressed competition'). The acquisition is procompetitive if absent the takeover, the target will not invest in the project (due to binding resource constraints) *and* the acquirer faces sufficient incentives to develop the project ('efficient upgrade'). In this case, the acquisition provides both for the ability and the incentive to develop the project.[119]

4.10 As in Cunningham, Ederer, and Ma (2021), Motta and Peitz model the acquisition incentives of the incumbent, and reach similar conclusions: if the potential

[116] See in particular footnote 20, 22, and Figure 2 in the paper.
[117] See also the similar case of a 'sleeping patent' in Gilbert and Newbery (1982).
[118] For a richer version of this model, see Fumagalli, Motta, and Tarantino (2022)—reviewed below.
[119] Motta and Peitz also consider a fourth, competitively neutral scenario, in which neither the target nor the acquirer would have developed the project, given the target's resource constraint and the acquirer's limited incentive to innovate ('dead project').

competitor would innovate absent the merger[120], the incumbent faces positive incentives to acquire the target to protect its monopoly profits (due to the efficiency effect), and may or may not subsequently develop the project (depending on the level of development costs).

4.11 Motta and Peitz conclude that, to understand the likely effects of a given acquisition, it is important to identify the likely counterfactual to that acquisition: in their model, if the entrant would have had the ability to invest, the acquisition cannot be procompetitive. In extensions to their baseline model, Motta and Peitz also discuss a case with outside investors, who are not resource constrained. In this case, the acquisition by an incumbent of the potential competitor is anticompetitive, compared to the counterfactual where the outside investor would instead acquire the target (since the potential competitor is no longer resource constrained).

4.12 Finally, **Fumagalli, Motta, and Tarantino (2022)** consider a model where there is asymmetric information on the viability of the potential competitor. The model also includes an antitrust authority that can pre-commit to a given standard of review. The model shows that the acquisition price conveys information on the type of target: a low acquisition price indicates the target is not viable (a 'separating' equilibrium), and hence that the merger is not anticompetitive; by contrast, a high acquisition price *may* imply that the target has the financial resources to develop the project alone, and that the merger is therefore anticompetitive. However, due to the presence of asymmetric information, the incumbent may offer a high price also to unviable targets (a 'pooling' equilibrium). The central result is that it can be optimal for the authority to commit to a sufficiently strict standard of review that prevents high-price early takeovers from arising at equilibrium, thereby inducing only low-price takeovers targeting constrained startups and raising expected welfare via a 'selection effect'.[121]

4.2 Entry- or investment-for-buyout

4.13 Section 4.1 discussed how the acquisition of potential competitors can incentivise an acquirer to shelve the product or more generally suppress future product market competition. However, the *prospect* of being acquired by an incumbent can also create an ex ante (pre-acquisition) incentive to enter or innovate in the first place. This is known in the literature as an entry- or innovation-for-buyout effect.[122] This

[120] In Motta and Peitz (2021) the potential competitor develops the project if it's not resource constrained. If the potential competitor is resource constrained, its outside option is 0, and the acquisition may still take place (e.g. if development costs are low, and the incumbent can engage in an 'efficient upgrade').

[121] Jin, Leccese, and Wagman (2025) provide a different perspective on informational asymmetry in the acquisition of potential competitors, arguing instead that acquisitions act as positive market signals that reduce uncertainty about a technology niche's prospects and crowd in venture capital (VC) investment. This paper is discussed further in Chapter 5 on empirical evidence, see Subsection 5.3.2.

[122] Cunningham, Ederer, and Ma (2021) indeed note that the overall effect on social welfare from prohibiting even exclusively killer acquisitions is a priori ambiguous, in part because these acquisitions may increase ex ante incentives for the creation of new drug projects (pp 654–655). Similarly, Motta and Peitz (2021) consider an extension to their baseline model in which the entrant first has to undertake costly effort to increase the probability of discovering the project in the first place—modelled simply as the probability of discovery being equal to some effort level $e \in [0,1]$ and the cost of effort $c(e)$ increasing and convex in e and that the expected profits from effort equal to $\Pi(e) = e\pi_e - c(e)$, where π_e is the entrant's expected payoff in the continuation equilibrium of the game. They show how prohibiting the acquisition by the incumbent can reduce the entrant's expected payoff in case of discovery and potential subsequent acquisition, and hence reduce its optimal level of effort undertaken to maximise the probability of discovering the project in the first place. Motta and Peitz do not present a formal balancing of the innovation-for-buyout effect and suppressed

effect may reflect a sharing of the rents flowing from protecting the incumbent's market power through the acquisition. It can also reflect an alternative mechanism where the source of the rent to the target flows from synergies such as a wider diffusion of the entrant's innovation by the incumbent.

4.14 Papers which include innovation-for-buyout effects and other competitive effects of mergers (e.g. entrenchment; or impact on the direction of innovation) are discussed in Section 4.3. Additionally, several papers consider the effect on the direction of innovation. These papers are discussed in Section 4.4.

4.15 One of the first papers discussing the entry-for-buyout effect is **Rasmusen (1988)**. He considers a simple model of quantity competition in which an incumbent and a potential entrant take turns in selecting their level of production capacity at sunk cost. If the entrant picks a positive capacity, the incumbent decides whether to buy them out or not. Given the sunk nature of the entry decision, the entrant is able to credibly commit to staying in the market post-entry while setting prices below average total cost (while above average marginal cost). This in turn incentivises the incumbent to buy out the entrant once it has entered. Although prices would be lowest in case entry occurs and the acquisition is prohibited, prohibiting this acquisition would remove the entrant's incentive to enter the market in the first place, leading to lower overall capacity and higher prices than in case of entry and acquisition, thus allowing such mergers to be welfare-enhancing for consumers.[123]

4.16 Rasmusen frames the entry-for-buyout effect in the context of an entrant effectively 'blackmailing' the incumbent through entry, incentivising the acquisition while in the process increasing overall capacity in the market. Framing the entry-for-buyout effect differently, Mason and Weeds (2013) refer to a situation in which entrepreneurs, when deciding on entry, are uncertain about their own prospects, and may wish to leave the market should profitability prove poor. Acquisitions then provide a profitable exit route in case of low-profitability entry, in turn giving entrepreneurs the incentives to enter. Similar to Rasmusen, *after* entry has occurred, prohibiting the acquisition is socially optimal as a means to maintain competition, but the prospect of such prohibitions may undermine the incentive to enter the market in the first place.[124]

4.17 To model this, Mason and Weeds assume a simple setting with only three players: an incumbent, an entrant, and the policymaker. The model follows a three-stage game: in Stage 1, the policymaker commits to a threshold level for the entrant's profitability above which a future acquisition would be prohibited and the entrant subsequently decides whether to enter or not; in Stage 2, the entrant's profits π are realised, and if entry occurred in Stage 1, the firms compete and the incumbent's profits decrease compared to the no entry case; in Stage 3, if entry occurred in Stage 1, a merger occurs if permitted (i.e. if the entrant's profits are below the threshold level), otherwise the firms compete.[125] The authors then show that the

competition. The calibrated dynamic models of mergers discussed in Subsection 3.2.7 also account for entry for buyout effects, since entry and mergers are endogenous in those models.

[123] Rasmusen also considers a final stage where, if the incumbent does not buy out the entrant, both firms need to decide whether to stay in the market or exit, and shows that entry is deterred if (i) the entrant's duopoly profit is negative and the incumbent's is not *or* (ii) the buyout price and the present value of the entrant's net duopoly revenues are both less than their capacity cost. Rasmusen also assumes that, once bought out, the entrant does not re-enter.

[124] Mason and Weeds additionally allow for merger-induced efficiencies in terms of technological or cost synergies.

[125] Note that in the model of Mason and Weeds, as with Rasmusen (1988), the acquisition occurs *after* the entrant has actually entered the market and started to compete. This excludes the killer acquisition scenario central to e.g. Cunningham, Ederer, and Ma (2021).

socially optimal level[126] for the threshold level for the entrant's profits needs to balance, on the one hand, an *entry encouragement effect*, where setting a higher value encourages more entrepreneurs to attempt profitable market entry, and, on the other hand, a *competition effect*, where setting a higher level increases the cases where there will be a loss of competition because the merger is permitted.[127] At an abstract level, this reflects the Schumpeterian idea that less intense ex post product competition tends to bring about more *ex ante* investment.

4.18 Mason and Weeds draw two key conclusions from their model. First, while the ex post optimal level for the threshold profitability level (in terms of total welfare) is zero, the ex ante optimal level is positive. They interpret this as implying that authorities should be more permissive of mergers motivated by financially distressed targets (i.e. low yet positive profits) in their application of a failing firm defence. Second, they conclude that cases where the target has a stronger bargaining position should be treated more leniently, as a higher bargaining power implies a larger entry-for-buyout incentive, all else equal. The authors find that more lenient merger policies can increase overall welfare by encouraging entry and short-run competition, provided that this effect outweighs the negative long-run effect on competition.

4.19 **Bisceglia, Padilla, Perkins, and Piccolo (2024)** develop a complementary mechanism linking exit conditions to ex ante innovation incentives in a setting with sunk investment and demand uncertainty. In their Bayes–Cournot framework, an entrant privately observes its demand realisation after investing and then chooses whether to remain active or take an exit option whose value can be shaped by merger control policy. A key result is that the relationship between the exit value and innovation is non-monotonic: a higher exit value initially stimulates investment by improving downside protection, but beyond a threshold it weakens incentives because the entrant expects to exit more often and therefore—under an assumption of limited bargaining power over the acquisition price—captures less of the return to innovation. At the same time, exit policy affects product-market conduct through a selection effect: when exit is more attractive, only stronger types remain, which softens incumbent behaviour under incomplete information. A regulator maximising consumer surplus therefore sets the lowest exit value that makes investment incentive-compatible, rather than eliminating exit rents altogether. Applied to merger control, the prospect of acquisition raises innovation incentives even if the entrant has no bargaining power at the takeover stage, and a more lenient policy can, counterintuitively, reduce the probability that the entrant leaves the market by inducing higher-quality investment ex ante.

4.20 The survey by **Teh and Wang (2026)** discusses how the prospect of acquisition shapes pre-acquisition innovation, distinguishing between startups' incentives to enter the incumbent's market and their choice of innovation direction.[128] To illustrate the entry-for-buyout effect, they consider a model where an entrant faces a random R&D cost to enter a market, and there is an existing incumbent. The realised value of the R&D cost is known by the entrant when deciding to invest, but it is not known to outside observers. A merger can take place after the investment

[126] Social optimality is defined here as a weighted average of consumer surplus and fixed costs. This nests the consumer welfare standard case as a special case with weight zero to fixed costs.
[127] Additionally, Mason and Weeds consider two other effects: a *synergies* effect, which captures the possibility that the loss of competition may be mitigated by merger-specific benefits (e.g. technological synergies), and a *sunk cost effect*, where greater entry also entails higher expected sunk costs, reducing social welfare (although obviously not consumer welfare, as these costs are incurred only by the entrant).
[128] See also Subsection 4.4.3 for a more in-depth discussion of the paper's results on direction of innovation.

in R&D, and is assumed to be profitable in the sense that it generates positive joint surplus. The resulting rents from a merger are shared between the incumbent and the entrant through bilateral bargaining. In this setup, the prospect of merging with the incumbent makes the entrant more likely to invest in R&D (i.e. the cut-off value of R&D costs below which entry takes place is higher if mergers are permitted). This effect is stronger if the entrant's bargaining power when negotiating the acquisition price with the incumbent is larger. In terms of impact on consumer welfare, a higher probability that an acquisition is approved leads to a trade-off between the ex ante effect of increasing the probability of entry, and the ex post effect of increasing the market power held by the incumbent firm (compared to the counterfactual with entry—see discussion above). Synergies (e.g. lower development costs for the incumbent) can mitigate the ex post market power effect, and tilt the balance in favour of allowing mergers of potential competitors. The survey further notes that, beyond this static trade-off, a commitment to approving acquisitions also increases the probability of entry, so expected consumer welfare may improve if this entry effect is sufficiently strong and consumers benefit greatly from increased entry, even if the acquisition harms consumers conditional on entry.

4.21 In both **Rasmusen (1988)** and Mason and Weeds (2013), acquisitions are a mechanism to share rents with the entrant from an anticompetitive increase in the incumbent's market power following the acquisition. The prospect of these anticompetitive rents generates the ex ante entry- or innovation-for-buyout incentive. However, the source of the acquisition premium may also be from merger-specific synergies. In particular, the acquisition may enable greater diffusion of the entrant's superior technology across the incumbent's existing customer base.

4.22 This mechanism is illustrated by **Phillips and Zhdanov (2013)**, who develop a model where a large, capital-rich firm competes in differentiated products with one or more small, capital-poor firms.[129] Firms can invest in R&D to obtain a demand-enhancing innovation. If multiple firms invest, they enter an R&D race, with only one successful innovator. If two of the firms merge, successful innovation can be applied to both products (i.e. the merger enables a voluntary technology transfer). After R&D outcomes are realised, the large firm may acquire a successful small innovator. In this case, the overall acquisition premium paid by the incumbent to the target comes from both (i) a market-power benefit (as in Rasmusen (1988) and Mason and Weeds (2013)) and (ii) synergies from applying the innovation to both the incumbent's and the target's product ranges. The key result is that the prospect of acquisition increases small firms' R&D incentives—especially if they have bargaining power when negotiating the takeover price with the incumbent.

4.23 **Letina, Schmutzler, and Seibel (2024)** present a model which allows for both innovation-for-buyout effects, and effects of mergers on the variety of R&D efforts. In their model both the entrant and the incumbent can innovate *before* a potential merger, and choose both the *level* and the *variety* of R&D.[130] Because both firms invest, they also need to decide whether to invest in different research projects or rather overlapping (duplicative) research.[131] Additionally, the model allows for the innovation to either turn out to be drastic, or non-drastic. Whereas drastic innovations by entrants replace the incumbent, non-drastic innovations allow the

[129] This paper also includes an empirical test of their model, which we discuss in Section 6.5.
[130] This is modelled by firms deciding which project space on a continuum between 0 and 1 to invest in, with a convex cost function and with only one project in this space resulting in a successful innovation.
[131] Given that only one project in the continuum between 0 and 1 turns out to be successful, duplicative research is wasteful in this model.

incumbent to retain some positive market profits.[132] Finally, the authors consider two scenarios for the cost of bringing an innovation to market (a high and a low commercialisation cost scenario). When the commercialisation costs are high, the incumbent will still market the drastic innovation but not the non-drastic innovation.

4.24 A key result of this paper is that a policy of prohibiting acquisitions weakly reduces the equilibrium probability of innovation, because it removes the entrant's buyout option and thus lowers R&D incentives. The innovation effect is strictly negative under high commercialisation costs (which may result in killer acquisitions and the discontinuation of non-drastic innovation), and may also apply under low commercialisation costs, depending on parameter values. In particular, there are cases with low commercialisation costs where the incumbent's incentives to commercialise non-drastic innovation are higher than those of the entrant, and hence determine the overall rate of innovation. As the incumbent's innovation incentives are not affected by the innovation-for-buyout effect, prohibiting mergers has no adverse effects in this case. As discussed by the authors, this condition requires that a non-drastic innovation increases incumbent monopoly profits significantly, whereas the entrant's duopoly profits would be low (e.g. due to first-mover advantages or network effects).

4.25 In their policy discussion, Letina, Schmutzler, and Seibel discuss the implications of their model for consumer welfare for cases where the prospect of acquisition increases ex ante innovation incentives. As they point out, prohibiting acquisitions in the case of high commercialisation costs is not detrimental to consumers if the chances of drastic innovation are low, because in this case innovation never reaches the market (i.e. there is a killer acquisition). In cases where there is a positive ex ante innovation effect, there is a trade-off with the ex post loss of competition. The authors study this trade-off using standard differentiated Bertrand and Cournot models, by relying on numerical simulations.[133] These simulations suggest that the net consumer welfare gains from prohibiting acquisitions tend to become smaller as the entrant's bargaining power and the intensity of competition (as captured by the degree of substitution) increase. However, only in the Cournot example do they ever become negative (i.e. prohibiting mergers harms consumer surplus), for relatively high values of the entrant's bargaining power and low product differentiation. This is never the case for Bertrand (price) competition.

4.26 Finally, in contrast to the prior papers looking into killer acquisitions concerns and innovation-for-buyout effects, **Guéron and Lee (2025)** study acquisitions of potential competitors in a dynamic learning environment where both the acquirer and the target gradually learn about the viability of the innovation over time. In their model, a monopolist incumbent faces an entrant developing a potentially disruptive innovation and can only access the innovation through acquisition. Learning occurs through Bayesian updating: innovation is feasible only in an unobservable favourable state, and firms revise their beliefs about that state as experimentation continues and success either occurs or fails to materialise.[134] Merger opportunities arise stochastically, after which the incumbent makes a take-it-or-leave-it offer and, if the acquisition succeeds, decides whether to continue or

[132] The timing of the model is as follows: first, the firms decide the level and variety of R&D efforts; second, the incumbent and entrant may bargain over an acquisition price (if acquisitions are allowed); third, the firm holding the patent on the innovation decides whether to commercialise the product or not; and fourth, product market competition occurs.

[133] See discussion in Section 9 of the paper (p. 21) and related Online Appendix.

[134] More specifically, the model assumes that innovation succeeds only in an unobservable 'good' state, where success arrives at some Poisson rate λ. As long as no success is observed, posterior beliefs about the good state decline according to Bayes' rule, and success causes beliefs to jump to one. Acquisition and innovation decisions are then governed by belief thresholds.

terminate R&D. The model incorporates merger-specific synergies and is extended to allow for (i) asymmetric information about the entrant's ability and (ii) imperfect appropriability of innovation returns. In the frictionless benchmark, merger and innovation decisions are characterised by belief thresholds, and private and social incentives for mergers are aligned ex post, although entrants overinvest in experimentation. Asymmetric information can delay or prevent efficient acquisitions and generates an innovation-for-buyout effect, while imperfect appropriability can lead to excessively early acquisitions and either over- or under-investment in R&D. The authors conclude that the welfare effects of acquisitions depend on the severity of informational asymmetries and the extent to which innovators can appropriate the returns from innovation.

4.3 Strengthening of dominance, entrenchment, and kill zone concerns

4.27 The above Sections have discussed how the acquisition of potential competitors can on the one hand (a) lead to reduced innovation and consumer harm through incumbents shelving targets' innovations or from reducing future product market competition, while on the other hand (Section 4.1) (b) facilitate an ex ante entry- or innovation-for-buyout effect that may increase overall entry or innovation rates relative to a situation in which such acquisitions are prohibited (Section 4.2).

4.28 In this Section, we discuss how acquisitions of potential competitors can lead to reductions in innovation over time by allowing an incumbent to *strengthen* its dominance or *entrench* its position. This in turn can reduce post-acquisition incentives to innovate for both the merging parties and (potential) other competitors. There are several mechanisms through which an acquisition of potential competitors can lead to entrenchment, including reduced market contestability, adverse network effects, and defensive innovations against the prospect of entry by other firms. We review these mechanisms and their relevant papers in turn in this Section.

4.3.1 Reduction in contestability

4.29 **Denicolò and Polo (2026)** develop a dynamic model of repeated innovation by new entrants. Their model aims to capture two opposing effects from acquisition of innovative entrants: the positive (short run) *innovation-for-buyout effect*, where acquisitions can enable faster diffusion of innovations by new entrants, and a negative (long run) *entrenchment effect*, where acquisitions increase the incumbent's captive base and reduce the outside option of the entrant in case of no acquisition, thus *reducing* their innovation incentives.

4.30 To capture these two effects, Denicolò and Polo consider a model where in each period there is a single incumbent, a competitor entrant, and a competitive fringe. Innovation is on quality and is incremental, and only the entrant can innovate. Incumbents have access to a captive base of consumers that can grow over time, for example because of consumer inertia. Each period is divided into three stages: first, an innovative entrant decides how much to invest in a quality-improving incremental innovation; second, if acquisitions are allowed, the incumbent and entrant bargain over the acquisition price;[135] and third, the remaining firms compete on price. If the entrant does not get acquired by the incumbent, it replaces the incumbent after the current period. Innovation only applies for two periods, such

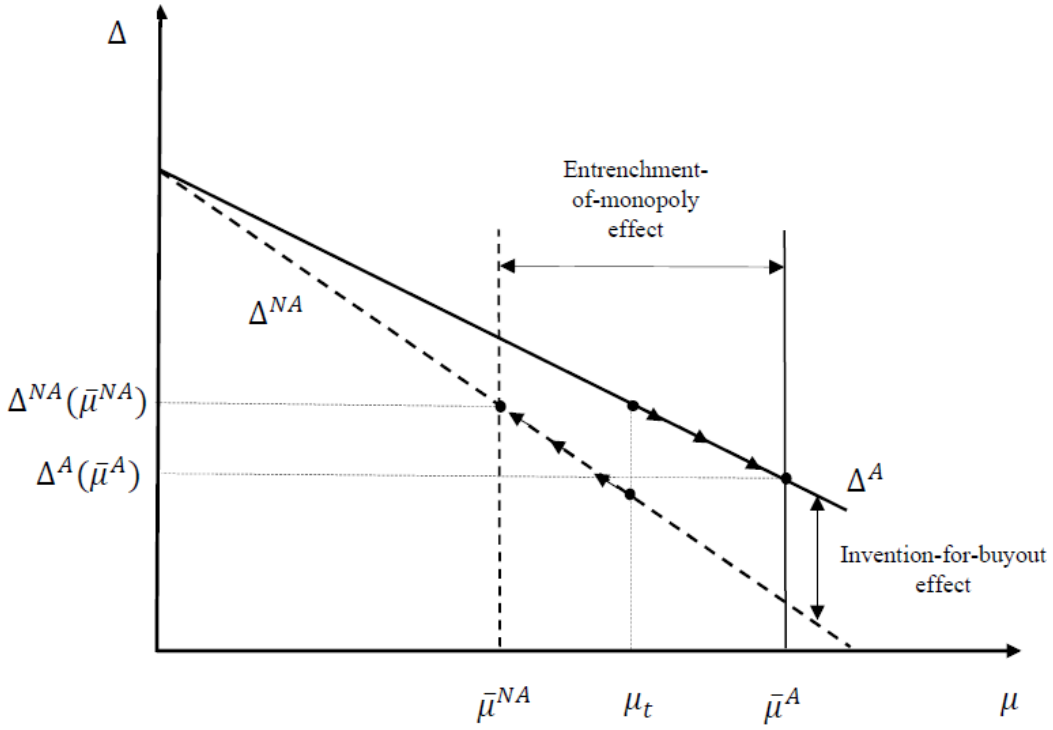
[135] Given that only the entrant can innovate while the incumbent has access to a wider customer base (given that a share of consumers is captive), bargaining is always efficient and the incumbent will always acquire the entrant if allowed.

that the quality of the competitive fringe at period t equals that of the (potentially acquired) entrant at period $t-2$.

4.31 Taking this setup, the authors solve for (i) the profit-maximising innovation rate of the entrant as a function of any *given* rate of captive consumers and (ii) the steady state level of captive consumers—both under acquisitions and no-acquisitions. They show that prohibiting acquisitions has two opposing effects. First, for any given level of captive consumers, blocking a merger reduces the equilibrium rate of innovation by preventing entrants from capitalising (through the acquisition price) on the incumbent's ability to supply the new product also to the captive consumers. This is a (short-run) innovation-for-buyout effect, similar to the ones discussed in Section 4.2 (in this case, it flows from the distribution synergies enabled by the merger). Second, allowing for acquisitions increases the steady-state share of captive consumers, which in turn reduces the entrant's future outside option when negotiating the acquisition price with the incumbent, and hence reduces innovation incentives.

4.32 Figure 4.1, reproduced from Denicolò and Polo, illustrates how the interaction of these two effects may mean that the entrenchment effect dominates the innovation-for-buyout effect, resulting in a lower overall innovation rate. Based on their model set-up, they conclude that prohibiting acquisitions is more likely to increase long-run consumer welfare if (i) the share of consumers that become captive is high, (ii) the bargaining power of the entrant is low (as this reduces the innovation-for-buyout incentive), and (iii) the policymaker is more forward-looking, placing greater weight on the long-run innovation losses from entrenchment relative to the short-run innovation gains from buyouts.

Figure 4.1 Innovation and entrenchment (Denicolò and Polo, 2026)



Note: Vertical axis Δ captures the entrant's innovation (or 'invention') rate and horizontal axis μ the incumbent's captive consumer base. The solid line (Δ^A) captures the dynamics in the incumbent's captive consumer base if acquisitions are allowed, and the dotted line (Δ^{NA}) in case acquisitions are not allowed. $\bar{\mu}^A$ is the steady-state captive base under acquisitions and $\bar{\mu}^{NA}$ under no acquisitions. Allowing for acquisition tilts the innovation curve upwards, increasing innovation for any *given* level of captive base (innovation-for-buyout effect), but also causes a shift downwards along the innovation curve by increasing the steady-state captive base (entrenchment effect).
Source: Denicolò and Polo (2026), Figure 1.

4.33 **Azzali, Denicolò, and Polo (2026)** extend Denicolò and Polo (2026) to competition between two differentiated ecosystems, where startups develop complementary products rather than substitutes capable of displacing the incumbent. They find that the leading ecosystem acquires each startup, generating an innovation-for-buyout incentive, but that serial acquisitions entrench its advantage, reduce future acquisition prices, and weaken long-run innovation. A policy preventing the leader from acquiring may raise steady-state innovation when the startup has sufficient bargaining power.

4.3.2 Exclusionary conduct

4.34 In Denicolò and Polo (2026), entrenchment is a consequence of past acquisitions, where the acquisitions enable the incumbent to increase its captive customer base. However, entrenchment can also happen as a consequence of the anticipation of future acquisitions. In an extension to their baseline model discussed in para. 4.9 above, **Motta and Peitz (2021)** discuss how an incumbent may be able to reduce the entrant's resources available to finance entry (e.g. through refusal to supply, degradation of interoperability, tying or bundling, or imitation of the entrant's products). The consequence is that potential entrants may not have sufficient resources to invest absent a merger. This reduces the price at which the incumbent

is able to acquire the target (by worsening the outside option of the target).[136] The incumbent faces incentives to engage in such exclusionary conduct if the short-run profit sacrifice from doing so is sufficiently low. The ability to reduce the potential entrant's outside option through exclusionary conduct makes such conduct and future acquisitions potentially complementary strategies to protect incumbency rents. As the potential entrant's outside option and expected payoff decrease as a result of such exclusionary conduct by the incumbent, the entrant's incentive to invest in innovation also decreases.

4.35 **Katz (2021)** analyses acquisitions of emerging competitors in markets characterised by competition for the market, where firms innovate to become the next dominant firm. In his dynamic framework, entry requires sunk R&D and, absent merger, entry triggers a period of head-to-head rivalry that determines which firm secures temporary dominance. An incumbent's acquisition of a nascent rival eliminates this competitive phase yet does not reduce the merged firm's joint continuation value when future entry occurs. As a result, such mergers are privately profitable even when subsequent innovation is rapid, implying that the prospect of future entry does not discipline acquisition incentives as it can in markets with ongoing in-market competition. Katz also shows that permissive merger policy has ambiguous and potentially negative effects on entrant innovation. Beyond standard entry-for-buyout effects, he identifies two channels through which innovation incentives may fall: first, allowing mergers can reduce incentives for marginal quality improvements when higher entrant quality lowers the gains from merger (for example, if the merged firm would otherwise retain the incumbent's technology); second, permissive policy can induce 'incumbency for buyout', where the incumbent invests strategically to worsen the entrant's outside option and extract more surplus in acquisition bargaining rather than to compete. This connects merger policy with exclusionary conduct, as strategies that weaken entrants' standalone prospects both depress pre-merger innovation incentives and raise the profitability of acquisition, reinforcing dynamic entrenchment concerns.

4.36 Similarly, **Motta and Shelegia (2025)** show that the incumbent's ability to imitate the entrant's product also creates a 'kill zone' for producing substitutes, diverting the entrant to develop complements instead. However, this paper does not consider specifically the effects of acquisitions of potential competitors—and hence we do not review it further here.

4.3.3 Network effects

4.37 A related mechanism underlies the results of the model in **Kamepalli, Rajan, and Zingales (2022)**, through the existence of network effects and incumbency advantage (as opposed to exclusionary conduct).[137] This paper shows that the anticipation of acquisition by an incumbent platform can dissuade consumers' early adoption of an entrant's product, thereby reducing the entrant's outside option and its incentives to invest in the first place.

4.38 Kamepalli, Rajan, and Zingales consider the case in which an incumbent multi-sided platform can acquire a competing entrant platform that offers a product of potentially higher quality to customers. They model platform competition involving two sets of agents: customers, who single home and incur a cost when switching

[136] As Motta and Peitz note (p. 8), this is similar to Saloner (1987)'s model where predation allows firms to acquire a rival at a lower price.
[137] In addition to a model on entrenchment and kill zone concerns through network effects, Kamepalli, Rajan, and Zingales also document various descriptive statistics indicative of kill zone dynamics following several acquisitions by Google and Facebook. These are discussed in more detail in Section 5.4 on empirical results.

from the incumbent to the entrant; and app developers, who can multihome at an additional development cost. Switching and development costs become zero once the entrant is acquired by the incumbent. The model assumes positive network effects between final customers and app developers and that only final customers benefit from the higher platform quality. The model also assumes imperfect information on the quality of the entrant platform, which may mean that some app developers decide to multihome while others do not. Platform monetisation happens on the advertisement side and is a function of the number of customers on the platform. New innovation is assumed to displace current innovation at some future time T. Before the intention to merge is announced, app developers decide (based on their understanding of the entrant's quality) whether to adapt to the entrant's platform and consumers subsequently decide (based on the entrant's quality and number of app developers) whether to switch. Taking the merger announcement to take place at time 0, the model assumes that the merger will take place only at time $m > 0$, where the parameter m proxies for the strictness of merger control: a 'liberal' merger control regime implies a low m (speedy integration), while a 'tough' merger control regime implies $m \geq T$ (which indicates the authorities never approve over the useful life of the technology).

4.39 In this model, it is ex post efficient to get all customers and app developers on the same platform, because of (i) the presence of the network effects from consumers to app developers and (ii) the switching and development costs involved in case consumers and app developers want to be active on the entrant platform prior to integration. This creates an ex post procompetitive effect from the incumbent acquiring the entrant platform, which it shares with the entrant through the acquisition price. However, the acquisition price that the entrant can expect is inversely related to the time it takes to integrate: the sooner the entrant is integrated with the incumbent, the lower the total incremental revenue for app developers from multihoming relative to waiting for platform integration, which in turn reduces the number of multihoming app developers and—by extension—the number of switching customers. These network effects reduce the entrant's standalone valuation, and hence its expected acquisition price and subsequent incentive to invest in entering the market in the first place.

4.40 Kamepalli, Rajan, and Zingales conclude that a more stringent merger control regime has two opposing effects on overall welfare:[138] on the one hand, it potentially increases the new entrant's payoff conditional on the merger, by incentivising more app developers to multihome in the meantime and in turn attracting more customers and thereby increasing the entrant's standalone valuation and outside option; on the other hand, it delays the moment when the quality improvement is enjoyed by all customers and it forces some customers to pay the switching costs and some app developers to pay for the development cost—expenses that could be prevented (or, framed differently, merger synergies that could be enabled) in a more lenient acquisition regime. The authors conclude that an optimal merger regime needs to balance these two forces. Finally, they show that higher incumbent bargaining power over the acquisition price reduces the first effect relative to the second effect, in turn increasing the optimal level of stringency of the merger regime. This is in line with the earlier results on entry- or innovation-for-buyout incentives, where these incentives are larger if the entrant has more bargaining power.

[138] Recall that the stringency of the merger control regime is proxied through a higher period m at which the acquisition is approved following the announcement of the intention to merge. If $m \geq T$, then authorisation will not occur over the useful life of the technology, which in the model is equivalent to a prohibition.

4.3.4 Defensive innovation

4.41 Where Kamepalli, Rajan, and Zingales propose a model where kill zone concerns arise from *anticipated* acquisitions of a potential competitor (in the context of multi-sided platform markets), **Teh, Banerjee, and Wang (2026)** propose a model where an incumbent's acquisition of an entrant can deter entry and distort innovation incentives of other *potential competitors*. The key mechanism is that ownership of the target's project allows the incumbent to strategically counter-develop in response to rival innovation, which changes rivals' expected post-entry payoffs.

4.42 The model features a dominant incumbent facing potential entry by two potential competitors: an early-stage 'non-target' entrant that can choose between (i) a project which, conditional on being developed (at fixed cost and with a fixed success probability), *directly competes* with the incumbent and generates a superior substitute; or (ii) an alternative project which, conditional on being developed, stochastically generates either a superior substitute to the incumbent or an independent product;[139] and a late-stage entrant that can only develop the project that always competes with the incumbent. The late-stage entrant is the acquisition target and is modelled as already having a direct substitute project. Competition with a new product against the incumbent is assumed to be tougher than against a rival entrant (i.e. profits for the entrant are lower when competing against the incumbent, if both parties innovate). The timing is as follows: in Stage 1 (project choice), the early-stage entrant decides which project to pursue; in Stage 2 (acquisition), the incumbent may acquire the late-stage entrant (i.e. target); in Stage 3 (project development), we either have that the early stage entrant and target (if independent) simultaneously decide whether to incur the fixed development cost, or (in the case of acquisition of the target by the incumbent), the development choice is sequential (with the incumbent deciding whether to incur the fixed development cost or shelve the project, after the investment by the rival);[140] and in Stage 4 (commercialisation), firms that successfully developed the superior products compete and earn profit depending on whether they are a monopoly or duopoly.

4.43 The authors show that, in this setup, the incumbent always acquires the target in equilibrium, and that such acquisitions can create an 'acquisition-induced kill zone' in which the non-target rival is deterred from choosing the first type of project and innovating in the incumbent's core market, as it is tougher to compete against the incumbent. This kill-zone effect arises when development costs are sufficiently low, so that the incumbent's credible threat to counter-develop reduces the rival's expected payoff from core-market entry. As a result, the direction of innovation of the non-target rival may be distorted away from the incumbent's market. Moreover, depending on the level of development costs, the development frequency of both the non-target rival and the incumbent may also fall. The paper also identifies a 'killer acquisition' region with high development costs, where the incumbent acquires the target only to shelve the project and never develops it. This can create

[139] Project development costs are fixed at cost K and success probability conditional on incurring the development cost is fixed at p. In case of an adventurous project, the probability of generating a superior substitute is $1-x$ and the probability of generating an independent project is x, where x is drawn from a common distribution and observed after project choice.

[140] The incumbent cannot develop a project if it did not acquire $E2$. Note that the acquisition by the incumbent of $E2$ changes the project development stage from a simultaneous move stage between $E1$ and $E2$ into a sequential move stage where first $E1$ decides on development, and then the incumbent does, through its control over $E2$.

a 'safe zone' where it becomes more profitable for the first entrant to compete directly with the incumbent (since the killer acquisition reduces competition).

4.44 The consumer welfare effects of allowing the acquisition by the incumbent are ambiguous, and depend on whether the merger leads to synergies, to a reduction in project development (by either the incumbent or the non-target rival), and/or to a distortion in direction of innovation by the non-target rival (to avoid competing with the incumbent). For example, in cases where a 'kill zone' effect is present, mergers reduce consumer welfare if development costs are sufficiently high.

4.3.5 Acquihires

4.45 **Benkert, Letina, and Liu (2025)** consider incumbent firms acquiring startups pre-emptively to keep them from catching up, specifically in the context of human capital and labour-driven acquisitions—so-called 'acquihires'. They examine whether acquihires can be inefficient even when the elimination of potential competitors as a motivation for an acquisition is ruled out (i.e. the startup operates in an unrelated market). The authors focus on the concern that an incumbent may acquire a startup pre-emptively to deny a competing incumbent access to talent that would otherwise strengthen that rival. In their model, the authors consider two competing symmetric incumbents and a startup, where acquiring the startup generates an efficiency gain (i.e. so that profits of the acquirer increase while those of the competitor decrease). The efficiency gain depends on the incumbent's (privately known) match quality with the startup. They show that firms may pursue acquihires for pre-emptive reasons: a low-match firm may acquire the startup to prevent a high-match rival from becoming more competitive. This behaviour leads to talent hoarding, defined as employing workers who would be more productive either at the startup or at a better-matched competitor. The paper further demonstrates that the overall effect of the acquihire on consumer surplus is ambiguous: while a high-match acquihire can increase consumer surplus, a low-match acquihire can reduce it due to the loss of the startup's independent activity. Extensions show that talent hoarding is less prevalent with simultaneous bidding, greater startup bargaining power, or many competitors, but more likely in concentrated markets.

4.4 Direction of innovation

4.46 The prospect of the acquisition of potential competitors can affect not just decisions on entry or level of innovation, but also the direction of innovation—including on whether entrants decide to compete directly with the incumbent or not, and whether to go for incremental or drastic innovations.

4.47 In this Section, we discuss the contributions from the literature on these questions, considering in turn the choice of entrants to either horizontally differentiate their product or not following entry, the choice of both entrants and incumbents to pursue differentiating or duplicative R&D efforts, the choice of entrants to pursue either drastic or incremental innovation, and the direction of innovation across different markets.

4.4.1 Product differentiation following entry

4.48 **Gilbert and Katz (2022)** study how the prospect of an acquisition affects a potential entrant's pre-merger choice on horizontal product differentiation. This is modelled as a location choice in a Hotelling framework, where a vertically differentiated entrant first needs to choose to enter either on the same location as the incumbent (i.e. imitation and no horizontal differentiation) or at the opposite end (i.e. innovation and maximum horizontal differentiation). Following entry and

the location choice of the entrant, a merger occurs whenever it is permitted by policy and increases joint profits, with the surplus split based on an exogenous bargaining parameter.[141] Finally, payoffs are realised, which are a function of the chosen locations and whether a merger is proposed and approved.

4.49 Taking this set-up, Gilbert and Katz show that the prospect of being acquired can distort the location choice in either direction. When mergers are prohibited, entrants will differentiate horizontally to reduce post-entry competition, unless the entrant has a vertically superior product, in which case it will instead choose to minimise horizontal differentiation with the incumbent to eliminate the incumbent's horizontal advantage. When mergers are possible, the entrant will have a greater incentive to minimise horizontal differentiation in order to maximise the gains from merging, provided (i) the chance of approval is sufficiently high, (ii) the entrant has sufficiently high bargaining power when negotiating the acquisition price, and (iii) it has a sufficiently superior product (such that its own outside option does not deteriorate excessively in case of head-to-head competition). This is the standard entry-for-buyout effect. However, the entrant will have a greater incentive to differentiate horizontally if the merger gains mainly come from post-merger horizontal product variety and price discrimination rather than reduced competition.

4.50 On the effect of different merger policies on consumer welfare, Gilbert and Katz consider both a *static* policy, in which the decision whether to prohibit a merger is made after entry and location decisions have been made, and a *dynamic* policy, in which a policy-maker can commit ex ante to a prohibition probability conditional on the entrant's entry and location decision (i.e. whether it differentiates or duplicates relative to the incumbent). From a static perspective, rejecting all mergers maximises consumer welfare, as the merger always eliminates price competition. However, an entrant's location may be biased away from the level which would maximise consumer surplus. This opens the door for an optimal dynamic merger policy which involves approving mergers with some probability to induce the entrant to invest in a direction that benefits consumers.[142] The authors present a numerical example where a small probability of approval of the merger (5%) increases consumer welfare by inducing the entrant to locate closer to the incumbent.

4.4.2 Entrant innovation which favours market leaders vs laggards

4.51 **Bryan and Hovenkamp (2020)** consider an entrant (referred to as startup) that develops a component that does not directly compete with existing firms, but that is used by them to improve their production process.[143] They consider two competing existing firms, a leader and a laggard. They show that if mergers are allowed, the startup is always acquired by the leader, because of market power persistence effects. This may result in a (type of) killer acquisition, where the

[141] The increase in joint profit comes exclusively from the reduction in price competition and—if the entrant differentiates—the possibility of second-degree price discrimination based on consumer location. The model does not include potential merger-specific synergies.
[142] Gilbert and Katz do not establish a universal ranking on whether it is better to steer entrants to no differentiation or full differentiation. Instead, this depends on the degree of vertical differentiation: in case of low vertical differentiation, consumers prefer undifferentiated entry, as the intensified price competition from undifferentiated products leads to large price reductions that more than offset the cost of lower product variety; while in case of large vertical differentiation, consumers prefer differentiated entry, as price competition is relatively weak anyway and the benefits from product variety dominate the loss from softer price competition.
[143] Note that this is not actually a horizontal merger or acquisition of a potential competitor, but instead the acquisition of a complementary product. We nevertheless still discuss this paper here, as it informs on the direction of innovation. The paper is also discussed in the context of non-horizontal mergers, in para. 6.33.

startup is only acquired to prevent the rival from catching up and imposing a stronger competitive constraint.[144] If the direction of innovation is endogenous, the startup prefers innovations that benefit the leader (as it can share some of the resulting profits from market power), resulting in an inefficient direction from a consumer welfare perspective.

4.52 In this paper, there is an innovation-for-buyout effect, as the startup benefits from selling to the incumbent. However, if the market is non-contestable (i.e. the laggard no longer constrains the incumbent), then the acquisition price that an incumbent will be willing to pay decreases, as the acquisition no longer allows it to take sales from the weaker firm, eliminating the innovation-for-buyout effect. In turn, this discourages future innovation.

4.4.3 Incremental or drastic innovation

4.53 **Cabral (2018)** develops a continuous-time dynamic innovation model with two asymmetric firms: a dominant 'giant' and a fringe 'dwarf', with each of these either the technology leader or the technology laggard. The degree of asymmetry is captured by an exogenous market dominance parameter. The dominant firm earns higher product-market profits than the fringe firm at the same technology level. Incremental innovation allows a laggard to become the leader. A drastic innovation allows the fringe firm to become the dominant firm. Only the laggard invests in incremental innovation, and only the fringe firm invests in drastic innovation. Because leadership alternates over time, overall innovation is measured by the long-run (steady-state) hazard rate, which depends on (i) how often each firm is the laggard and (ii) how much it invests when lagging. Although the paper does not model acquisitions specifically, the model does allow for the fringe firm to sell its technology leadership to the dominant firm, in case of successful incremental innovation. This causes the fringe firm to become the technology laggard again, though in return for some bargained transfer price.

4.54 Cabral considers four cases: (i) incremental innovation only absent technology transfers; (ii) incremental innovation with technology transfers; (iii) incremental and drastic innovation absent technology transfers; and (iv) incremental and drastic innovation with technology transfers. He shows that—in the first case of only incremental innovation and absent technology transfers—as market dominance increases, the dominant firm innovates more when it is the laggard (as it has more to gain when it regains leadership). In the steady state, the fringe firm is the laggard more often, so overall innovation declines as dominance increases. Cabral refers to this as the *shadow of Google effect*.

4.55 However, this changes in the second case, where the fringe firm is able to transfer its technological leadership to the dominant firm through Nash bargaining.[145] In that case, the fringe firm no longer innovates to become the technology leader, but instead to sell the innovation to the dominant firm. Cabral shows that, for sufficiently large dominance, (i) overall incremental innovation increases in the degree of dominance and (ii) overall incremental innovation is higher relative to the case of no transfers (i.e. no acquisitions allowed). This captures the *innovation-for-buyout effect*.

4.56 Finally, when considering drastic innovation, Cabral shows that results on the effect of market dominance and the availability of technology transfer change

[144] Although here the target is shut down, similar to Cunningham, Ederer, and Ma (2021), the competitive threat is actually from the rival as an alternative buyer rather than the target itself.
[145] The model assumes equal bargaining power. Immediate transfer of technological leadership is efficient, as the dominant firm benefits more from the technological leadership than the fringe firm.

fundamentally. In the absence of technology transfers, an increase in market dominance raises the value of becoming the dominant firm, in turn increasing the rate of drastic innovation (whereas it decreased the rate of incremental innovation). However, when technology transfers are allowed, the fringe firm anticipates that successful incremental innovation can be profitably sold (innovation-for-buyout effect), thereby increasing the opportunity cost of becoming the dominant firm through drastic innovation. Therefore, allowing for technology transfers reduces incentives for drastic innovation (relative to the no-transfer case). Cabral refers to this mechanism as the *complacency effect of technology transfer*: efficient markets for technology (and by analogy, mergers) stimulate incremental innovation but dampen drastic innovation, and competition for the market.

4.57 **Callander and Matouschek (2022)** focus on how the 'novelty' of innovation—how far a new technology departs from the incumbent's—interacts with product-market competition and merger incentives. In a Hotelling model of product differentiation, entrants choose not only whether to innovate but how radically to do so, with more novel innovations being both more uncertain in quality and more differentiated from the incumbent's product. A 'spatial Arrow effect' emerges: absent acquisitions, entrants innovate more boldly than incumbents because differentiation softens price competition, even though this reduces the probability of directly displacing the incumbent's product. However, allowing post-innovation acquisitions reverses this result. The prospect of being bought induces entrants to shift towards more incremental, less novel innovations that are closer to the incumbent's technology, since proximity raises the competitive threat they pose and thereby their bargaining value in a takeover. Mergers therefore increase the level or profitability of innovation while distorting its direction, suppressing radical innovation in favour of incremental projects designed to maximise acquisition rents. From a policy perspective, this provides a rationale for stricter merger control in innovative industries, as lenient policy can lead to more innovation-for-buyout but of lower novelty and weaker long-run competitive impact.

4.58 **Teh and Wang (2026)** discuss not only the level of innovation or the probability of entry (see Section 4.2), but also the direction of innovation chosen by an entrant—referred to as startup. In their framework, the startup may choose between alternative innovation paths, and the prospect of acquisition can affect that choice because the startup internalises part of the post-merger surplus through bargaining. The general insight is that acquisition incentives shift innovation towards the option that raises post-merger profits by more than it raises the firms' combined pre-merger profits. As a result, acquisitions may induce either more disruptive or less disruptive innovation, depending on the underlying profit trade-offs. The paper notes that, in most applications, the more disruptive direction is the one that more directly challenges the incumbent's market position. It also emphasises that the effect is often ambiguous in practice. For example, when innovation concerns the degree of product differentiation, acquisitions may encourage less disruptive innovation in some cases and more disruptive innovation in others, depending in particular on the relative quality of the startup's product.

4.59 **Bourreau and Gautier (2026)** study how startup acquisitions shape innovation in platform ecosystems. They model two competing platforms investing in probabilistic R&D to develop a new product that complements their core products, alongside a startup that operates only in an upstream technology market. The startup can transfer its technology through non-exclusive licensing or through acquisition, which confers exclusivity on the buyer. When acquisition is feasible, it prefers acquisition to licensing. The presence of the startup affects the platform incentives to invest in R&D via two effects: an insurance effect, because access to the startup's technology (if it is not acquired by a competitor) after failed R&D reduces the cost of failure, and a competition effect, because startup success lowers the return to a platform's innovation either by enabling the rival to access the technology or by forcing the

successful platform to pay to keep it away from the rival. A merger policy affects the two effects. Allowing some mergers increases platform R&D effort by weakening the insurance effect. If killer acquisitions are permitted, they occur in equilibrium and eliminate the insurance value of the startup. However, when the startup has sufficiently strong bargaining power, platform R&D can be higher under a complete merger ban than under a regime that allows all acquisitions. The latter effect arises because a platform may acquire the startup to prevent a competing platform from accessing the new technology. There is therefore a trade-off between ex ante inducements to innovate (in this case, by the incumbent rather than by the startup), and ex post loss of competition. In terms of the impact of mergers on consumer welfare, the central trade-off is between stronger innovation incentives and wider diffusion of innovation. Consumer surplus is highest under a full merger ban when R&D costs are very high, because innovation then comes only from the startup and acquisitions would merely monopolise it. When monopoly and duopoly yield similar consumer surplus (e.g. under price regulation), what matters is the probability of innovation, so allowing acquisitions is optimal. In other cases, simulations based on the Singh–Vives demand system show that consumer welfare is higher when prohibiting acquisitions for most parameter values.

4.60 An extension of the paper endogenises the direction of startup innovation: the startup chooses between a 'conventional' path, aligned with platforms' research, and an 'exploratory' alternative path (where only one path succeeds). The exploratory path makes the startup the sole source of the innovation (allowing it to escape competition in the technology market). This implies that startups are more likely to pursue alternative paths when mergers are allowed as they can better monetise their innovation, contrary to the results from previous work (e.g. Cabral, 2018). This shows that the effect on direction of innovation by a startup differs across models, depending on assumptions.

4.4.4 Impact of direction of innovation by potential competitor and by incumbents

4.61 **Dijk, Moraga-González, and Motchenkova (2024, 2025)** consider a setting where the prospect of an acquisition has an impact on the direction of innovation across different markets.[146] The basic setting (common across the two papers) is that firms have a fixed R&D budget, and can allocate their R&D efforts across a 'rival' market where a potential merging partner is present, and a 'non-rival' market that is independent of the activities of the potential merging partner. An acquisition alters the relative returns from innovating across the markets. This change in innovation incentives affects the overall impact of a merger on consumer surplus depending on the relative appropriability of (consumer) surplus in each market (i.e. the ratio of the incremental profits from innovation compared to the consumer benefit from innovation). Absent an acquisition, investment will be distorted if surplus appropriability is not symmetric—that is, if surplus appropriability is higher in market A compared to market B, the competitive outcome delivers overinvestment in market A. In this case, the merger improves the direction of innovation if it induces greater investment in market B and less investment in market A.

4.62 Specifically, **Dijk, Moraga-González, and Motchenkova (2024)** consider a setting where a potential entrant can invest in a product improvement, and can direct its research either towards an incumbent firm (a 'rival project'), or in a

[146] Moraga-González, Motchenkova, and Nevrekar (2022) similarly look at the effect of mergers on industry R&D portfolio allocation, but then in the context of mergers between existing firms. This paper is discussed in Subsection 3.2.5.

separate market (a 'non-rival project'), under a fixed R&D budget. If successful, the rival project results in a product of strictly higher quality than that of the incumbent. In case of failure, the entrant (or 'startup') still enters the incumbent's market, but with a product of (weakly) lower quality than the incumbent's. In the baseline model, the incumbent may acquire the entrant once the outcome of innovation by the entrant is known (e.g. as in digital markets); while in a second setting, the incumbent may acquire the entrant already at the stage of R&D (this is a scenario more tailored to pharmaceutical acquisitions of early phase drug development projects).[147]

4.63 The paper relies on the fact that the prospect of acquisition induces the startup to strategically distort its investment to maximise its acquisition rents (an investment-for-buyout effect). The prospect of merging with the incumbent shifts the startup's efforts *towards* the rival project if the incumbent gains more moving from (a) duopoly with high-quality entry to monopoly than from (b) duopoly with low-quality entry to monopoly—and vice versa.[148]

4.64 The paper shows that the prospect of acquisition can improve the direction of innovation and increase overall consumer surplus if the price effects of the mergers are not too large. The effect of a merger on the direction of innovation benefits consumers if the prospect of acquisition leads to greater investment in a non-rival market, and if this market is associated with sufficient consumer benefits. A similar result can also apply in the case where allowing for acquisitions leads to greater investment in the rival project, and surplus appropriability in the rival market is relatively low compared to the non-rival market.[149]

4.65 The authors present a numerical example of these effects in a model of vertical product differentiation, and illustrate the fact that there exists a range of parameter values (albeit limited) for which allowing for mergers increases consumer surplus due to the beneficial effect on the direction of R&D (p. 141).[150]

4.66 The paper also presents a scenario where a merger takes place before the target engages in innovation effort, and hence the acquirer takes over the R&D decision. In this case, the Arrow replacement effect is at work, because a successful rival innovation would cannibalise the incumbent's own existing product profits, so the merged firm internalises this business-stealing effect when choosing R&D effort.[151]

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[147] The authors discuss a number of extensions of their model, including drastic innovations (modelled as the success state yielding a product so high quality that the innovator monopolises the rival market, removing the innovation-for-buyout effect), multiple incumbents (affecting the profitability and incentive-compatibility of mergers, and thus the magnitude of merger surplus and portfolio incentives), horizontal differentiation in addition to vertical differentiation, and endogenous total R&D (modelled by allowing the startup to choose not only the allocation of its R&D budget across projects but also the size of the budget, with a convex cost of raising funds).

[148] This in turn depends on the parameters governing vertical quality differences and demand (i.e. consumers' willingness to pay for quality), which determine whether monopoly profit rises more in the high-quality-success state than in the low-quality-failure state relative to the corresponding duopoly profits.

[149] In the reduced-form part of the paper, consumer surplus is modelled exogenously. In a micro-founded section with Cournot competition with vertically differentiated products, consumer surplus is modelled explicitly (see discussion below in the main text).

[150] An increase in consumer welfare if mergers are allowed is, however, not possible if products are horizontally differentiated, as in this case the adverse price effects from the merger are larger, compared to the case with only vertical differentiation (p. 143).

[151] The authors discuss a number of extensions of their model showing similar qualitative results on the directions of distortions and consumer welfare effects, including drastic innovations (modelled as the success state yielding a product so high quality that the innovator monopolises the rival market, removing the innovation-for-buyout effect), multiple incumbents (affecting the profitability and

The results of this case are similar to the baseline case, in terms of the impact on the direction of innovation and on the incidence of cases with higher consumer surplus if mergers are allowed (p. 149).

4.67 **Dijk, Moraga-González, and Motchenkova (2025)** consider a modified version of the model in Dijk, Moraga-González, and Motchenkova (2024), where the main difference is that both an incumbent and a potential entrant decide where to allocate their fixed R&D budget. The prospect of an acquisition now affects the investment decisions of both the incumbent and the entrant. The incumbent can invest in two markets (a rival market A and an independent market C), while the potential competitor can invest in the rival market A, and a non-rival market B. In the baseline model, the incumbent invests after observing the outcome of R&D efforts by the entrant. If a merger is allowed, it takes place after all R&D efforts are realised.

4.68 The authors show that in this model there can be an innovation-for-buyout effect (inducing investment by the entrant in the rival market, to extract a share of market power rents), but also a strategic effect (due to the fact that investments in the rival market are strategic substitutes). In some cases (e.g. when the bargaining power of the entrant is sufficiently small), the strategic effect dominates the innovation for buyout effect, and allowing for mergers implies that the entrant invests less in the rival market, while the incumbent invests more. This can be seen as an 'incumbency for buyout' effect.

4.69 As in Dijk, Moraga-González, and Motchenkova (2024), the authors show that there are scenarios where allowing for acquisitions *improves* the direction of innovation, by moving resources towards markets with higher consumer surplus. This beneficial effect of a change in the direction of innovation can be sufficiently large as to offset the adverse price effects of the merger and increase overall consumer surplus (across the three markets). The authors present an example of these effects, in a model with vertical product differentiation and Cournot competition (as in Dijk, Moraga-González, and Motchenkova (2024)). This illustration shows that total consumer welfare may increase if allowing for mergers leads to greater investments by the entrant in the rival market and greater investment by the incumbent in the independent market. In this case, if consumer surplus in the independent market is sufficiently large, then overall consumer benefits may be higher with the merger, despite the ex post reduction in competition. Similarly, in cases where the entrant invests more in the non-rival market because of the prospect of an acquisition, then overall consumer welfare may be higher if the benefits from that market are sufficiently high. As in Dijk, Moraga-González, and Motchenkova (2024), the range of parameter combinations for which consumer surplus increases is relatively limited (p. 446). In the policy discussion of their results, the authors emphasise the role played by 'out-of-market' effects in their model, and they suggest that these need to be taken into account to capture the impact of a merger on the direction of innovation, and overall consumer benefits.

4.70 **Cabral (2025)** embeds innovation-for-buyout incentives in a calibrated model of entrant ('startup') R&D, incumbent acquisition, and merger review under uncertainty about whether an entrant is a complement or a substitute. The startup chooses innovative effort before its type is resolved; conditional on success, the incumbent and startup bargain over an acquisition price, and an agency applies a threshold rule based on the ex ante probability that the entrant is a competitive substitute. A central feature is that merger policy feeds back into both the level and

incentive-compatibility of mergers, and thus the magnitude of merger surplus and portfolio incentives), horizontal differentiation in addition to vertical differentiation, and endogenous total R&D (modelled by allowing the startup to choose not only the allocation of its R&D budget across projects but also the size of the budget, with a convex cost of raising funds).

the direction of innovation: a strict policy shifts innovative effort towards substitute (competitive) projects but reduces overall R&D (through investment-for-buyout effects), while more permissive policy raises R&D effort, but increases the incidence of killer acquisitions and leads to less disruptive innovation.

4.71 Calibrating the model to large digital platforms, Cabral finds that moving from a 'balance of probabilities' standard to a 'balance of harms' approach[152] yields sizable gains in consumer welfare, whereas a complete ban on acquisitions marginally reduces consumer welfare compared to a 'balance of harms' approach because it weakens innovation-for-buyout incentives. Specifically, the author finds that switching from no enforcement to the optimal threshold would imply a consumer welfare increase of 17.6%.[153] A switch to a balance of harms policy achieves a 15.4% increase in consumer welfare, that is, most of the gain from switching to the optimal policy. Finally, a total ban on mergers would imply a 35% decrease in consumer welfare. In terms of the direction of innovation, the impact of the merger stance is non-monotonic. A move from balance of probabilities to balance of harms induces innovation efforts to move in the direction of complementarity with respect to the incumbent (i.e. less disruptive innovation). A complete ban on mergers, however, would result in shifting innovation in the direction of substitute (competitive) projects.

4.72 Finally, **Bedre Defolie, Biglaiser, and Jullien (2026)** provide a complementary mechanism in which entrants ('startups') design their innovation strategy to maximise the expected acquisition price when multiple incumbents bid for it. In their model, two horizontally differentiated firms compete to acquire a startup, but the startup can choose the direction of its innovation (e.g. the relative fit of its innovation to each potential acquirer), thereby intensifying bidding competition. This endogenous fit choice tends to bias innovation towards the initially weaker firm to level valuations and spark an acquisition 'war'. A central implication is that acquisitions need not systematically reinforce dominance: decreasing dominance can arise when the weaker firm is sufficiently good at integrating the innovation (higher absorption capability), increasing its likelihood of winning the asset and leapfrogging the incumbent. More broadly, within the benchmark interior case, the probability of winning is driven more by relative absorption capabilities than by initial quality stocks: with equal absorption capabilities the firms are equally likely to acquire the startup despite initial quality asymmetry, while the firm with higher absorption capability is more likely to win. However, strong initial asymmetry can instead generate a pre-emptive or killer-type purchase where the leader buys an innovation that brings it little direct value simply to deny it to the rival. The privately optimal innovation direction (chosen to increase the acquisition price) can be socially distortive: the paper shows the direction of innovation in equilibrium minimises both industry profit and consumer surplus among all possible directions of innovation, with the innovator sacrificing some industry profit in order to equalise the firms' maximum willingness to pay. The authors conclude that merger policy assessments should account not only for post-acquisition product-market effects, but also for how anticipated bidding competition reshapes the type of innovation produced upstream.

[152] This implies that mergers are evaluated based on their impact on expected consumer welfare.
[153] There is virtually no difference in the calibrated outcomes between no enforcement and enforcement by balance of probabilities.

5 Horizontal mergers: empirical evidence

5.1 This Chapter provides a detailed paper-by-paper review of the literature summarised in Volume 1, Chapter 7.

5.1 Pharmaceuticals

5.2 We first discuss the papers examining how pharmaceutical mergers and acquisitions relate to innovation, and pay attention to whether or not the result may be given a causal interpretation. We pay particular attention to the design of the control groups and potential competitor effects. We also include papers which do not directly study mergers, but rather common ownership as a form of integration and coordination between competing firms. We conclude with a brief discussion on the potential drivers behind these results.

5.1.1 Effects of mergers and acquisitions on innovation

5.3 In an early descriptive study comparing the innovation performance of merging firms with non-merging firms, **Koenig and Mezick (2004)** study seven major pharmaceutical mergers, of which two in 'wave 1' (1989) and five in 'wave 2' (1994–'96).[154] To measure research productivity, they consider drug approvals by the Food and Drug Administration (FDA), specifically for drugs categorised as New Molecular Entity (NME), and assign more weight to NMEs which are considered as important therapeutic gains by the FDA or are handled with priority review.[155] Another indicator to capture research productivity used is patents obtained per research dollar expended. Using as the control group eight major pharmaceutical firms that did not merge during either wave 1 or 2 (which may include direct competitors),[156] they provide descriptive evidence that NME-based performance of the merged firms increased in the five to ten years after their merger, relative to that of non-merging firms, while results for patent-based performance were more mixed (i.e. negative for wave 1, positive for wave 2).[157]

5.4 Looking at the performance of 160 'R&D-oriented' pharmaceutical acquisitions (where the acquirer is a pharmaceutical company and the target has pipeline drugs) from 1994 to 2001,[158] **Higgins and Rodriguez (2006)** estimate, among other things, whether firms experience an increase in the risk-adjusted aggregate of their drug development pipeline—which they refer to as a 'Score' value.[159] Changes in this Score post-acquisition are used to measure improvements or deterioration in innovative performance. Methodologically, they estimate within-firm change in an acquirer pipeline 'Score' one year after acquisition. They find that about 71% of acquirers maintain or improve their Score post-acquisition in the year following the

[154] Wave one mergers include Bristol-Myers Squibb and SmithKline Beecham. Wave two mergers include American Home Products, Glaxo Wellcome PLC, Hoechst AG, Novartis AG, and Pharmacia & Upjohn.
[155] NMEs are novel drug compounds with active ingredients never before approved by the FDA and represent genuinely new therapeutic agents. In their results, Koenig and Mezick weigh superior category drugs (those identified by the FDA as important and priority drugs) by 2.5 relative to those in the lesser category (those identified as modest, little, and standard drugs).
[156] Non-merged companies include Abbott Labs, Eli Lilly & Co, Johnson & Johnson, Merck & Co, Pfizer, Roche Holdings Ltd., Warner Lambert, and Zeneca.
[157] As the authors themselves state, the intent of this study is not to provide an econometric analysis, but rather a 'scientometric' perspective on whether synergies can be detected in mergers.
[158] With a total sample of 160 acquisitions.
[159] The Score is calculated by summing all of a firm's drug pipeline projects, each weighted by the stage-specific probability of FDA approval. Higher Scores indicate more late-stage, higher-quality innovation rather than simply more projects.

acquisition. In cross-sectional regressions, they find that firms facing weaker or declining internal pipeline productivity (defined as 'desperate' and based on a 'Desperation Index' developed for this study) experience larger post-acquisition increases in research scores, particularly when the acquirer had prior alliances with the target. This is interpreted as evidence that firms suffering from internal R&D decline use acquisitions to replenish their pipelines, effectively outsourcing research activities. They also argue that pre-acquisition information access (e.g. via established alliances or partnerships) is associated with acquirer's success, consistent with information asymmetries in valuing intangible R&D assets and an ability to avoid the winner's curse by obtaining information about the true underlying value of the target firm prior to acquisition.

5.5 However, Higgins and Rodriguez do not net out the target's pipeline when considering the post-acquisition increase in the Score value, meaning that any acquisition of a target with some pipeline would increase the Score absent project discontinuations.[160] The analysis is only descriptive and does not rely on a matched non-acquiring control group, thereby limiting causal interpretation, and the post-acquisition period is limited to one year only.

5.6 **Danzon, Epstein, and Nicholson (2007)** look, among other things, at changes in R&D expenditure of hundreds of pharmaceutical firms around 'transforming' mergers[161] between 1988 and 2001.[162] To control for potential selection bias, they first estimate the firm's propensity to participate in a merger as an acquirer, a target, or as part of a pooling merger (i.e. a merger between firms of approximately the same size). Propensity scores are estimated based on lagged firm characteristics such as Tobin's Q, firm size, pipeline measures, sales and expense growth, and cash-to-sales ratios. The authors then consider how R&D expenditures change post-merger in each of the merging firms, controlling for firms' *ex ante* characteristics through the estimated propensity score. Considering up to four years post-merger, they find no evidence that mergers involving large firms[163] are associated with an increase in average R&D spending relative to similar firms that did not merge (which may include competitors). For small firms, they find that less financially sound firms[164] are more likely to engage in M&A, suggesting that small firms merge as an exit strategy. They also find on average a sharp decline in R&D for small firms in the first post-merger year, with no clear recovery on average—though the effect varies by merger propensity, with firms having a very high propensity experiencing a short-run increase in R&D expenditure.

5.7 **Grabowski and Kyle (2008)** use a large sample of project-level clinical development data covering 1990–2007[165] and focus on innovation output in terms of progression through different phases of clinical development. They estimate logit

[160] Specifically, the acquirer's post-deal Score is likely to increase mechanically: by construction, adding acquired projects to the portfolio would increase the Score, not because the acquirer became better at R&D.

[161] Transforming mergers are defined as transactions large enough to require post-merger reorganisation and to have an observable impact on firm performance, operationalised as deals valued at $500 million or more, or at least 20% of a firm's pre-merger enterprise value. As such, target firms in this analysis do not exit the market and are considered separate entities after the merger.

[162] The total sample consists of 383 pharmaceutical firms and 165 transforming mergers.

[163] Defined as firms reaching an enterprise value of $1 billion during the sample period and prior to the merger, which covers about 56% of firms in the sample.

[164] Measured by low Tobin's Q, low number of marketed drugs, and low ratio of cash to sales.

[165] The total dataset includes 3,327 Phase I projects (of which 1,683 advanced), 2,444 Phase II projects (of which 731 advanced), and 1,065 Phase III projects (of which 586 advanced), belonging to more than 4,500 firms.

regressions of stage-to-stage progression within five years on merger-timing indicators (pre- versus post-merger initiation), controlling for firm size and entry-year into the stage. They find that merger-related projects initiated after the merger are, on average, associated with a higher probability to advance to the next stage of development relative to projects of firms not involved in merger activity (which may include those of direct competitors). However, merger-related projects that were already initiated before the merger show no such positive association.

5.8 **Munos (2009)** considers six mergers involving large pharmaceutical companies and 24 acquisitions involving both small and large targets between 1989 and 2004,[166] comparing pre- and post-merger innovation output measured in terms of the target's expected annual rate of FDA-approved NMEs. He finds no descriptive evidence that mergers or acquisitions involving only large companies lead, on average, to increases in the combined expected annual rate of NMEs post-merger, concluding that, on average, M&As between large pharmaceutical companies neither create nor destroy value. By contrast, in acquisitions involving small targets, the expected annual rate of NMEs increases in 79% of cases, with the expected annual rate increasing by 118% in these cases (thereby creating value). While the numbers are interpreted as showing an absence of positive innovation effects, at least for larger pharmaceutical companies, the analysis relies solely on within-firm pre/post comparisons, lacking a matched non-acquiring control group, and is based on small samples, limiting causal interpretation.

5.9 Focusing on 27 large M&As in the pharmaceutical industry between 1988–2004, **Ornaghi (2009)** analyses the impact of consolidation on firms' innovative performance.[167] Innovation is measured as R&D expenditure (input), patent counts (output), and R&D productivity (patents per unit of R&D). The author compares post-merger outcomes to those of non-merging firms (possibly including rivals) matched using pre-merger observables (such as the share of drugs approaching patent expiration, the share of recently launched drugs, and stock market value). A robustness check restricts the control group to non-merging firms with similar technological activities. Considering up to three years after the merger, he finds that a merger is associated with deteriorated performance in terms of R&D expenditure, patent counts, and R&D productivity. Moreover, higher ex ante technological relatedness between merging parties does not translate into superior post-merger R&D performance—in contrast with the view that consolidation among technologically similar firms enhances innovative efficiency. He also finds that product relatedness (as opposed to technological relatedness) is positively associated with post-merger stock market value increases relative to the control group.

5.10 **Banerjee and Nayak (2015)** examine whether post-merger innovation outcomes differ between US domestic mergers and cross-border mergers involving US-headquartered acquirers between 1997 and 2007.[168] Innovation is measured by the annual number of FDA-approved new drugs. They find that domestic mergers are associated with a short-run increase in drug approvals that dissipates within roughly three years, whereas cross-border mergers are associated with larger and more

[166] Within the 24 acquisitions, 14 involved a small target and ten a large one. Large firms are those in the top 15 drug companies by sales over the sample period and including their predecessors and joint ventures. The classification is time-invariant.
[167] The panel covers 610 firm-year observations involving roughly 35–40 large pharmaceutical firms. Large firms are those with a stock market value exceeding $1 billion at least once and exclude pure generic producers. The precise number of firms is not provided in the paper, but can be inferred from the number of firm-year observations. The author does not distinguish between acquirers and targets, as the sample largely consists of 'mergers of equals' (i.e. firms of similar size).
[168] They analyse 983 domestic and 678 cross-border merger events.

persistent increases, lasting at least five years post-merger.[169] However, the overall effect on the merged entity is unclear, as the analysis focuses solely on acquirers' innovation intensity and cannot construct a 'merged entity' counterfactual. The authors also do not observe target-level characteristics and therefore cannot control for differences between domestic and foreign target firms.

5.11 **Valentini (2016)** focuses on the role of non-merging rival firms and investigates whether a firm's innovation strategy is influenced by its rivals' acquisition intensity. He finds evidence of a different mechanism: rivals that observe competitors' deals may accelerate their race towards innovation to exploit the temporary deceleration and myopic behaviour of merging firms engaged in post-acquisition integration.[170,171] The results show that an increase in rival firms' acquisition intensity is associated with a significant increase in a focal firm's technological performance and breadth of search in the technological space, supporting the hypothesis that competitors respond to rivals' M&A by broadening exploration and generating more impactful innovations.

5.12 **Fernald, Pennings, van den Bosch, Commandeur, and Claassen (2017)** examine the innovation effects of acquisitions and alliances for the 12 largest pharmaceutical firms between 1990 and 2013.[172] The key explanatory variable of interest is R&D expenditures relative to sales. The authors measure innovation output as the total number of FDA-approved NMEs and Biologics License Applications (BLAs). Using econometric methods,[173] the authors find that an acquisition is associated with lower innovation, particularly for biotech acquisitions. Alliances, particularly pharma alliances, are associated with higher performance. R&D intensity mitigates—and for pharma acquisitions reverses—the negative correlation of acquisitions and the outcome variables and increases that of biotech alliances and the outcome variables. In contrast, pharma alliances substitute for internal R&D at high levels of R&D intensity. The analysis focuses only on one party and relies on within-firm pre/post comparisons without a matched control group. Although they try to account for this using lags for five years, conclusions about combined-entity outcomes and causal interpretation of the results remain limited.

5.13 **Richman, Mitchell, Vidal, and Schulman (2017)** examine acquisition activity of 17 large pharmaceutical companies using five-year non-overlapping windows between 1985–2010 and relate it to innovation outcomes measured in the following five-year period. The authors show that while higher acquisition activity (measured by deal value and number) is correlated with lower R&D intensity, it is also correlated with more clinical trials and FDA approvals. They interpret this as evidence that acquisitions may function as a means of accessing externally generated innovation, as discovery increasingly resides with smaller and specialised firms while large incumbents retain advantages in regulatory approval and

[169] To address endogeneity in merger decisions, they employ propensity score matching based on observable lagged firm characteristics (such as R&D intensity, employment, and prior drug approvals) and classify firms based on their ex ante likelihood of merging. Post-merger changes in acquirer innovation are then compared to non-merging firms within the same strata (which may include direct competitors).
[170] The empirical analysis focuses on publicly listed EU-15 and Swiss pharmaceutical companies over 1998–2004, constructing an unbalanced panel of 63 firms. The author measures technological performance as well as breadth of search in the technological space through indicators based on patent counts and citations.
[171] These measures use indicators based on patent counts and citations and use random effects Tobit and linear fixed effects models.
[172] To that end, the authors look at a sample of 568 acquisitions (290 pharma and 278 biotech targets) and 1,270 alliances (552 pharma and 718 biotech partners).
[173] More specifically, the authors use a Poisson regression with firm and year fixed effects.

commercialisation. The analysis is largely descriptive and correlational, e.g. without a matched control group, limiting causal interpretation.

5.14 Focusing on 13 large mergers between the late 1990s and 2011,[174] **Ringel and Choy (2017)** compare firm performance in the three-year post-merger window to non-merger years for the same firms and define innovation as expected peak sales from FDA-approved NMEs relative to R&D expenditure[175] (using a four-year lag between spending and launch). The authors find that post-merger R&D productivity is on average significantly higher than in non-merger periods.[176] However, as with previous papers, the analysis focuses only on the merging firms pre/post R&D productivity (within variation), without a matched control group, limiting conclusions about the merged entity counterfactual and causal interpretation of their results. Additionally, their measure of innovation output—expected peak sales—includes also a potential price-increasing effect from mergers, as opposed to only innovation effects.

5.15 **Haucap, Rasch, and Stiebale (2019)** explicitly consider the effect of mergers on both the merged entity and its non-merging competitors, arguing that changes in competitive conditions may also affect rivals' innovation incentives. After setting out a separate theoretical model (as discussed in para. 3.36), they study horizontal pharmaceutical mergers between 1991 and 2007 for which the European Commission published a reasoned Phase 1 or Phase 2 decision containing market definition and competitor information.[177] The authors measure innovation using the number of European Patent Office (EPO) applications, the number of citation-weighted patents, and (for a subsample) R&D expenditure. They find that, on average, post-merger innovation declines for both the merging parties (e.g. more than 20% drop in European Patent Office (EPO) applications) and rivals (e.g. around 15–16% drop in EPO applications) relative to the control group, with effects persisting for up to four years and no evidence of recovery. These negative effects are concentrated in markets with high pre-merger R&D intensity and in technology classes where acquirer, target, and rivals exhibited overlapping pre-merger innovation activity, consistent with a reduction in competitive pressure (rather than e.g. organisational integration effects).[178] By using a control group excluding competitors, Haucap, Rasch, and Stiebale's analysis allows for a causal interpretation of the negative innovation effects on both the merging parties and competitors. In their robustness test,[179] the authors also find a negative effect of mergers on competitors' innovation incentives.[180]

[174] Large mergers involved those with a deal value above $20 billion and concerning the top 25 pharmaceutical firms.
[175] Expected peak sales is the estimated maximum annual revenue a drug is expected to generate over its commercial lifecycle, typically based on analyst forecasts.
[176] The authors use a 'self-controlled' observational design: they compare each firm's R&D productivity in the three years following merger completion to its own productivity in non-merger years before and after the merger, applying a four-year lag between R&D spending and expected peak sales to align inputs and outputs.
[177] This excludes Phase one decisions for which the Commission did not include market definition and competitor information in its decision. Overall, the authors include 65 mergers and around 1,900 pharmaceutical firms in their dataset, of which 381 affected firms covering 52 acquirers, 67 targets, and 319 competitors.
[178] The authors use a DiD approach where the control group is identified by matching firms based on pre-merger innovation levels, firm characteristics, and time trends.
[179] The robustness test consists of implementing an IV strategy (based on technological and geographical proximity among rivals) that is designed to identify effects on rivals.
[180] Haucap, Rasch, and Stiebale do express their outcome variable as the log of one plus the number of patents, to ensure observations with zero patents are defined. This transformation can make

5.16 In a study commissioned by DG Research and Innovation, European Commission, **Informa Pharma Consulting (2020)** focuses explicitly on drug development dynamics. The study considers a large project-level dataset covering more than 110,000 clinical trials and major horizontal and non-horizontal majority acquisitions of pharmaceutical companies[181] completed between 2010 and 2013.[182] Innovation is measured by progression and discontinuation rates of drug candidates and the study finds that acquisitions are on average associated with faster progression in early development stages, notably Phase 1 entry (+15%) and Phase 1–2 transitions (+58%) relative to the control group, but also significantly higher discontinuation rates (+53%) and a decline in late-stage (Phase 2–3) transitions (-26%).[183] It also finds that in therapeutic areas where acquirer and target had overlapping pre-merger clinical trials, the positive acceleration of development becomes statistically insignificant, while project discontinuations increase significantly in magnitude post-merger. While the study aims to create a balanced control group through a propensity score matching approach, the study does not obtain a balanced matched sample, and significant differences between firms in treatment and control groups with respect to matching variables such as firm size, R&D spending, and profit remain.[184]

5.17 **Cunningham, Ederer, and Ma (2021)** study so-called 'killer acquisitions,' whereby incumbent firms acquire innovative targets with the strategic intent to discontinue overlapping innovation projects in order to pre-empt future competition. After setting out a separate theoretical model (as discussed in Section 4.1), they empirically test its predictions using project-level data on more than 16,000 drug development projects initiated between 1989 and 2010, 4,637 drug-originating companies, and detailed information on acquisitions.[185] Innovation is measured by continued development activity or termination. Exploiting variation in whether the target's drug project overlaps with the acquirer's existing product portfolio—defined narrowly by therapeutic class and mechanism of action (MoA)[186]—they compare overlapping acquisitions to non-overlapping acquisitions and to non-acquired projects. They find that projects acquired by overlapping incumbents have about 23% lower probability of ongoing development activity and are significantly more likely to be terminated immediately, relative to comparable non-overlapping acquisitions.[187] These effects are concentrated in markets with weak existing competition and where the acquirer's overlapping product has substantial remaining patent life, consistent with a replacement-effect mechanism. The authors further

interpretation of the empirical results difficult. However, practice has shown that in most cases, doing this transformation or running a Poisson regression are qualitatively similar.

[181] The deals examined are those with a deal value above $50 million.

[182] Licensing deals and minority stakes are excluded. The sample covers 79 unique acquirers and 149 mergers.

[183] The authors use a DiD approach where the control group is identified via propensity score matching (based on pre-merger firm and indication characteristics) at the firm-indication-year level.

[184] By eliminating 'bad matches', the authors aim to address this issue by creating a restricted sample as part of a robustness check. However, also in this restricted sample, the authors do not obtain appropriate matches, in particular for the groups of very large and R&D-intensive acquiring firms, which limits causal interpretation of their findings.

[185] Approximately 22% of projects experienced an acquisition during development.

[186] MoA is the biological interaction involved in the drug achieving its desired end, including both the molecular target (e.g. beta adrenoreceptor, angiotensin I–converting enzyme) and the intended effect (e.g. agonist, antagonist, reducer, inhibitor).

[187] They use project-year panel regressions with fixed effects (project age, vintage (vintage fixed effects account for right truncation for more recently initiated projects, given the long development time lines for pharmaceuticals), firm, drug-level, and therapeutic class plus MoA) and propensity-score reweighting to address selection (where observations are given either more or less weight in the regression based on similarity with the treatment group—which may include competitors—in terms of pre-acquisition project characteristics).

show that overlapping acquisitions are more likely to occur just below antitrust notification thresholds and suggest strategic avoidance of scrutiny. They conclude that conservatively, 5–7% of pharmaceutical acquisitions in their sample qualify as killer acquisitions.

5.18 To further explore evidence on the potential for killer acquisitions, **Lear (2024)**, commissioned by DG Competition, European Commission, conducted an ex post evaluation of European transactions (including M&A, asset purchases, licensing agreements, R&D agreements, and others) in the pharmaceutical sector with a particular focus on a potential discontinuation of overlapping drug R&D projects. The report investigates the pervasiveness and characteristics of killer acquisitions in Europe. It does so by applying a large-scale and automated analysis to detect transactions followed by discontinuations of overlapping drug R&D projects.[188] The study builds on publicly available data on transactions in the European pharmaceutical sector over the period 2014–'18.[189] Within the sample, 240 of the transactions entailed the acquisition of a potentially substitutable drug R&D project. Out of these deals, the authors identified 183 cases in which a narrowly overlapping drug was discontinued after the transaction, for 92 of which—based on publicly available data—no technical or commercial reason could be identified to explain these patterns and thus could be considered as potential killer acquisitions.[190]

5.19 **Basant and Jaiswal (2022)** study the relationship between mergers and acquisitions and innovation using an unbalanced panel of publicly listed Indian pharmaceutical firms over 1999–2018,[191] distinguishing between mergers (full legal consolidation), acquisitions of shares (minority or majority equity stakes without consolidation), and acquisitions of assets (purchases of specific business units or assets but without equity transfer). Innovation is measured by R&D intensity (R&D expenditure relative to sales). Through econometric analyses,[192] the authors find that acquisitions of shares—but not mergers—are associated with a statistically significant and persistent increase in acquirers' R&D intensity. The authors further show that mergers or acquisitions combined with asset purchases are associated with an increase in R&D intensity, whereas asset purchases on their own do not appear to have a significant effect on R&D intensity. These results are robust to allowing for delayed effects.[193] However, the analysis focuses only on acquirers' innovation inputs and relies on within-firm pre/post comparisons without a matched non-acquiring control group, limiting causal interpretation. Additionally, as is common in many settings, the timing of mergers may be endogenous.

5.20 Looking at both innovation and drug prices, **Schutz (2023)** considers pharmaceutical M&As involving a pharmaceutical or biotech target between 2007

[188] The methodology proceeds in three steps. The first step identifies competitive overlap: a transaction is flagged only if both the acquirer's and target's pipeline drugs shared the same therapeutic indication and MoA. The second and third steps identify and classify discontinuations among those overlapping projects. A drug project is considered discontinued where clinical trial registries show no formal termination but at least two years of inactivity with no subsequent resumption. Since some discontinuations simply reflect genuine scientific failure, a machine learning algorithm (least absolute shrinkage and selection operator (LASSO)) is then used to separate discontinuations that look strategically motivated (i.e. the acquirer likely stopped the drug to eliminate a competitive threat) from those that appear to have innocent technical or clinical explanations. Transactions flagged by LASSO as potentially strategic are finally subjected to a manual, case-by-case review to assess whether the facts support a killer acquisition theory of harm.
[189] The sample covers 3,193 transactions.
[190] The study also evaluates past efforts of the European Commission to address potential killer acquisitions, and suggests improvement in the remedy design.
[191] The sample contains 217 firms.
[192] Using firm and year fixed-effects regressions with post-acquisition dummies.
[193] To test such robustness, the authors shift the post-event dummies forward by up to three years.

and 2016.[194] Innovation is measured using the combined entity's R&D expenditure as well as US primary patent filings (new molecules or active ingredients) and secondary patent filings (labelling, manufacturing, and other follow-on changes), drug discovery announcements, and progression through clinical trial phases. Prices are the acquirer's US prices, net of rebates and discounts. The author finds that firms engaged in M&As experience higher post-merger R&D expenditure but fewer patent filings, driven by declines in primary patents, and no significant improvements in drug discovery or clinical development outcomes.[195] She interprets this as consistent with a substitution away from internal invention towards external pipelines. In contrast, net drug prices increase by around 19% after M&As, with price effects being strongest when the merging parties' therapeutic portfolios overlap, although price increases are also observed in non-overlap cases.

5.21 Looking similarly at both innovation and drug prices, **Bonaimé and Wang (2024)** use a sample of mergers between 2013 and 2019[196] and look at acquirers' pre- and post-merger number of US FDA drug applications, distinguishing between initial applications (new molecules or active ingredients) and secondary applications (labelling, manufacturing, and other follow-on changes). They find that M&A is associated with higher total application activity, but the increase is entirely driven by secondary applications, with no evidence of increased new-drug development (initial applications), including over longer post-merger horizons or for biotech acquisitions.[197] Looking at prices—based on the National Average Drug Acquisition Cost survey, which measures average unit acquisition costs paid by US retail pharmacies—they find short-run price increases of around 2–3% in consolidating product markets.

5.22 Focusing specifically on the antidiabetic drug development, **Malek, Seldeslachts, and Veugelers (2025)**[198] use project-level data on 1,345 antidiabetic drug development projects between 1997 and 2017, of which 306 were affected at least once by an acquisition event.[199] They measure innovation through project termination, progression across clinical phases, and follow-on patenting and compare acquired projects to never-acquired projects.[200] On average, they find that acquisitions have a negative impact on target projects' innovation outcomes, as they have higher termination rates, less progression, and fewer new patents, with negative effects concentrated in early-stage deals—where the risk of failure is high and costs are low. However, positive innovation effects emerge when the acquirer is a product-market incumbent (has launched antidiabetic drugs) and an R&D incumbent (has an existing antidiabetic R&D portfolio), and when the target and acquirer projects are close in future product markets (MoA overlap) and close in

[194] The sample contains 740 pharmaceutical companies and 68 pharmaceutical M&As.
[195] The authors implement a matched DiD/event-study design, comparing firms engaging in M&A to observationally similar firms (potentially including rivals) that never engage in M&A (matched on pre-merger size, innovation activity, and financial characteristics).
[196] The sample contains 202 mergers involving 67 unique acquiring firms.
[197] To do so, the authors implement a matched DiD/event-study design, comparing acquiring firms to observationally similar non-acquiring firms matched on observable characteristics (which may include rivals).
[198] A related, earlier paper by Malek, Newham, Seldeslachts, and Veugelers (2024) investigates M&A patterns of R&D projects in the antidiabetics market. It finds that most M&As occur in early R&D stages, that most acquired projects are high-risk/high-gain novel projects, and that industry leaders in product markets are rather inactive in acquiring novel early-stage projects. However, it does not discuss any dynamic post-merger effects explicitly, and is not discussed here in more detail.
[199] 157 acquisition events in total, with 144 projects on the target side and 162 on the acquirer side.
[200] They use project-level regressions with various fixed effects (development stage, cohort, MoA, and patent count), supplemented by robustness checks based on matching acquired projects to technologically closest projects developed by a non-acquiring firm.

technology space (high patent-text similarity/'twins'), which the authors interpret as evidence of technological synergies rather than innovation suppression.

5.23 **Wabiszewski (2025)** looks at 43,206 drug development projects between 2000 and 2018, of which some are acquired startup projects.[201] Measuring innovation through progression across clinical phases and approvals, she specifies and calibrates a dynamic structural model of R&D, entry, and acquisitions to consider the drivers behind progression and approvals. Descriptively, she finds that across therapeutic areas, acquired projects in non-oncology markets show lower progression in early stages but higher progression in late stages, while in oncology markets they show higher progression rates at all stages (with statistically insignificant results only from Phase II projects). The structural model finds that weaker early-stage outcomes mainly reflect negative selection into acquisition rather than innovation-suppressing behaviour such as killer acquisitions, while superior late-stage performance is driven by economies of scale in development and regulatory capabilities of large firms. Counterfactual simulations indicate that banning startup acquisitions would increase approvals in small and medium non-oncology markets (where reduced contestability and weaker entry-for-buyout incentives would dominate) but reduce them in oncology and large non-oncology markets (where selection effects and economies of scale would dominate).

5.24 **Newham, Seldeslachts, and Banal-Estañol (2025)** study how common ownership can affect firms' decision to enter a market in the pharmaceutical industry. While not directly capturing innovation, market entry can reflect the competitive dynamic in a market and thereby influence firms' incentives to conduct R&D and innovate. The authors distinguish between branded firms on the one hand, which seek to develop new medication, and generic firms on the other hand, which aim to replicate existing medication at lower costs to then enter the market once regulatory protection for the brand firms expires. The authors develop a conceptual framework accounting for expected profits and the degree of common ownership,[202] and test their theoretical predictions by empirically studying a sample of 395 drug product markets and 34,144 potential generic-branded drug pairs in the US, focusing on products which experienced patent expiration between 2004 and 2014. They find that a one standard deviation increase in common ownership between a given generic and the brand decreases the probability of entry by that generic firm by 13–16 percent, whereas the entry-deterring effect of common ownership is larger for higher levels of common ownership.[203] Further heterogeneity analysis shows that the negative effect of common ownership on market entry is more pronounced in markets with higher pre-entry brand revenues, and is mainly driven by a decrease in entry by highly experienced generic manufacturers with high levels of common ownership.

5.25 **Dubois and Majewska (2026)** examine how mergers affect pricing and advertising in US pharmaceutical markets, and draw inferences on the effects on

[201] A total of 1,136 projects, corresponding to 186 acquired biotech startups.
[202] The model involves simultaneous generic entry, in which a generic's entry decision depends not only on its own profits but also on the brand's profit losses, weighted by the degree of common ownership.
[203] The authors address endogeneity by instrumenting pairwise common ownership with joint inclusion in the Dow Jones US Select Pharmaceutical stock market index. The idea of this IV is that when both firms in a pair are listed on the Dow Jones US Select Pharmaceutical Index, this increases common ownership through index investors who will hold shares in both companies to track the index. The identifying assumption is that joint index inclusion is exogenous to market entry decisions, meaning the index composition doesn't directly influence entry choices except through the common ownership channel it creates.

innovation and welfare. Using data on mergers from 2002 to 2014,[204] they document that prices typically rise post-merger while advertising often falls. A detailed analysis of the Pfizer–Wyeth case shows that reduced advertising amplifies price increases relative to standard predictions that hold advertising fixed, accounting for roughly 30% of the merger's profit effect. The paper also proposes a welfare framework incorporating innovation incentives: while lower advertising mitigates short-run consumer harm from higher prices, it also dampens the longer-run innovation gains tied to increased profits. Overall, both price and welfare effects (via innovation) are sensitive to post-merger changes in advertising. The paper makes predictions on the innovation effects of mergers, on the basis of estimates on the elasticity of innovation to industry profits as provided by other studies.[205]

5.1.2 Potential underlying drivers

5.26 Several studies investigate underlying mechanisms which may drive the relationship between M&As and innovation. **Wabiszewski (2025)** suggests several mechanisms which may increase innovation, such as economies of scale and scope, knowledge spillover, or the alleviation of financial constraints, as well as mechanisms which may hamper innovation, such as diseconomies of scale or strategic motives. She then argues that the net effect depends on which of these competing channels is dominating and structurally estimates a dynamic oligopoly model to show that selection on project quality into acquisition can play a central role in determining the innovation success of M&A: In particular, negative effects of M&A on innovation in early-stage projects can be explained through negative selection into acquisition, whereas later-stage success of acquired startups can be attributed to economies of scale in development and regulatory capabilities of large firms.

5.27 **Cunningham, Ederer, and Ma (2021)** propose another driver through which M&A can affect innovation, namely strategic firm behaviour. Specifically, they suggest that M&As affect innovation through the strategic acquisition and subsequent 'shut-down' of startups with overlapping innovation projects by the incumbent firm, in order to prevent future competition. This mechanism appears to be particularly pronounced in markets with low competition and where the acquirer's overlapping drug is relatively far from patent expiry.

5.28 **Comanor and Scherer (2013)** argue that M&A can affect innovation when they reduce the diversity of research efforts. The authors' argument is that technological progress in the pharmaceutical industry requires widespread dispersion of R&D initiatives across and within companies through the exploration of multiple parallel development paths. As descriptive evidence, they review the portfolio of Phase II and Phase III clinical trials that were ongoing during 2009 and 2010 for five leading US pharmaceutical firms, and provide suggestive evidence that the number of parallel paths is reduced and ultimately leads to lower industry-wide research diversity after a merger. This result is consistent with **Munos' (2009)** finding that 'large–large' mergers do not increase expected NMEs.

5.29 Separately, several empirical papers have considered the potential effect from workforce disruptions following mergers on innovation. For example, **Paruchuri, Nerkar, and Hambrick (2006)** use data on patent applications and track the

[204] The sample covers 144 mergers.
[205] The external elasticities of innovation to industry profits are set at 0.28 as lower bound (Dubois, de Mouzon, Scott Morton, and Seabright, 2015) and 4 as upper bound (Acemoglu and Linn, 2004). These are calibrated using variations in spending across-disease and over-time and estimating causal effects on innovation using an IV approach.

productivity of inventors in acquired companies.[206] They find that acquisitions lead to a significant decrease in inventor productivity (measured as citation-weighted patent count), and that this effect is particularly pronounced for workers who lose the most social status and centrality. Consistent with these results, **Verginer and Riccaboni (2025)**, using a sample of inventors involved in acquisitions of biotech firms from 1990 to 2010,[207] find that inventors are significantly more likely to leave the merged entity, become inactive, or experience a strong decline in productivity. In particular, they find that the reduction in productivity is driven by those inventors whose expertise closely matches the technological focus of the acquired company, whereas experienced inventors with skills that complement the acquiring firm's R&D focus tend to maintain or even enhance their productivity post-acquisition.

5.30 **Ornaghi and Cassi (2026)** use a large sample of target companies in the European pharmaceutical industry between 1988 and 2015 to investigate the role of the inventor in the dynamic between M&A and innovation. They find that acquisitions are associated with an increase in the likelihood of inventors to relocate to a different lab or to stop patenting entirely. The authors then quantify the foregone patents due to exiting inventors and find a significant decrease in productivity for both inventors who relocate to a different lab as well as for those who stay at the acquired target.

5.31 **Aggarwal and Hsu (2014)** empirically assess how entrepreneurial exits (initial public offering (IPO) versus acquisition) affect innovation, with more emphasis on the role of information confidentiality. To this end, they also examine how the different exit modes affect productivity of inventors who remain within the merged firms, of inventors who joined the firms, and those who left the firm post-acquisition. They construct a dataset of inventors in US-based biotechnology firms founded between 1980 and 2000[208] and show that, after IPOs, patenting quantity by inventors declines while citation impact rises. In addition, they show that M&As also lead to a decline in patent citations (although the effect of M&As is found to be smaller in magnitude compared to an IPO), while the quantity of patents increases following an M&A. They further show that the documented differences in innovation following IPOs versus acquisitions are not driven by inventor-level turnover patterns after the exit event.

5.2 Mobile telecommunications

5.32 We start with a detailed review of the published academic studies on competition, mergers, and investment in the mobile telecommunications sector. We then briefly review the additional publications, focusing on novel empirical analysis included therein.

5.33 Although all publications are reviewed based on their academic merit independent of affiliations or disclosures, we do note that many of the publications, including academic papers, are written by authors affiliated with industry participants. Annex A2 provides an overview of all relevant disclosures.

[206] More specifically, they examine 3,933 inventors in 62 acquired companies.
[207] The sample covers over 15,000 individuals involved in 1,375 acquisitions.
[208] The inventor-level data set contains 12,769 inventors.

5.2.1 Academic publications

5.34 In this Section, we summarise the empirical academic papers that rely on reduced-form estimations of mergers and investment inputs (generally CAPEX) or output, followed by those that rely on structural models.

Reduced-form studies of mergers and investment

5.35 Several papers have considered how, across countries, changes in mobile telecom market concentration (generally measured in HHI) or consolidation (generally measured in terms of changes in number of operators) are related to investment. Although these changes in consolidation are not exclusively driven by mergers, mergers are a key source of consolidation given that entry (number of firms) is regulated.

5.36 **Jeanjean and Houngbonon (2017)** study the relationship between the number and asymmetry of operators and investment in the European mobile industry, using a yearly operator-level panel covering all 50 licensed mobile network operators (MNOs) in 17 Western European countries over 2006–'15. Investment is measured as the logarithm of mobile network CAPEX, while market structure is expressed in terms of the number of operators and market share asymmetry (defined as the difference between an operator's market share and the average). They find that in symmetric markets (i.e. with equally sized operators), CAPEX per operator is negatively associated with the number of operators.[209] This negative effect is larger for operators that lose market share more than average, because the marginal profit from investment is decreasing in the number of operators in the market. While industry-wide investment decreases in the short run following a reduction in the number of operators, they find that it increases in the long run, as operators gradually adjust to a higher steady-state level of investment.

5.37 Using a quarterly operator-level panel covering all licensed MNOs in 33 OECD countries over the period 2002–'14, **Genakos, Valletti, and Verboven (2018)** study the effects of market consolidation (measured as the number of operators and the HHI) on both prices (measured as the best available deal for a fixed usage profile and adjusted for purchasing power parity) and investment (measured as CAPEX and CAPEX per subscriber) in mobile telecommunications. Investment is measured using operators' CAPEX, both in levels and per subscriber. They find that a hypothetical four-to-three symmetric merger, i.e. a merger in a market in which all four parties have comparable market shares prior to the transaction, would increase end user prices by 16.3% on average (assuming fixed usage profiles and assuming unchanged quality).[210] In addition, the study finds that while investment

[209] The authors achieve this result by estimating a dynamic investment equation with lagged investment to capture adjustment costs, using a two-step GMM (Arellano–Bond) approach with operator and year fixed effects, where current investment depends on past investment to reflect adjustment costs (i.e. the gradual adjustment of network capital due to deployment constraints, sunk costs, and technological path dependence), instrumenting several of the explanatory variables. For example, the instrument for the number of firms is the political ideology of the government, which relies on the assumption that governments more supportive of welfare-state intervention are more likely to influence market structure (e.g. licensing decisions, merger policy), while political ideology is assumed not to affect operators' investment directly, conditional on controls.

[210] To reach this conclusion, the authors use a fixed-effects panel model with country and quarter fixed effects, exploiting a variation from entry (where an operator receives a licence) and exit (where two operators merge) both across time and across countries. To address endogeneity concerns—particularly when using HHI—they employ as an instrument regulatory variation in mobile termination rates. More specifically, they use the difference between the most- and least-regulated operators' termination rates, which they argue is a valid instrument because it affects concentration

per operator increases by 19.3%, the effect on total industry investment does not change significantly.

5.38 **Grajek, Gugler, Kretschmer, and Mişcişin (2019)** ask whether within-market horizontal mergers in European wireless telecommunications increase static efficiency (lower prices) or dynamic efficiency (higher CAPEX), and whether there is a trade-off between the two. It uses operator-level quarterly panel data for 62 carriers in 17 European countries from 1998–2011, and studies five domestic mergers (two 4-to-3 and three 5-to-4).[211] The results show substantial heterogeneity across cases: in Denmark and the Netherlands, mergers are associated with higher post-merger prices for merging firms and/or rivals (for example, in Denmark, the estimated post-merger price increase is about €0.073 for the merged entity and €0.060 for rivals), together with significantly higher CAPEX for both groups (i.e. the merging firms and rivals), while in Austria and Greece prices decline relative to control markets but CAPEX of both groups falls or does not rise significantly.[212] The authors interpret their finding of increasing (decreasing) prices after a merger being correlated with increasing (decreasing) investments as indicative of a trade-off between static efficiency (lower prices) and dynamic efficiency (higher investment).

5.39 Looking at a cross-section of cellular market areas in the US between 2012–'13,[213] **Woroch (2020)** estimates an inverted-U relationship between the degree of radio spectrum concentration (i.e. HHI of operators' shares of spectrum holding) and subscriber penetration rates (as measured by the number of mobile subscriptions per 100 adults), with positive marginal effects in the sampled market, i.e. more concentration being associated with more penetration.[214] Woroch does not claim causality from concentration to penetration, but instead links this result to efficiency-based explanations, showing strong and positive associations between spectrum concentration and several network quality and coverage measures at the operator level (such as overall network quality index, reliability score, speed score, and 4G coverage), which in turn are positively associated with operator penetration.

5.40 Finally, using a quarterly operator-level panel covering 104 licensed MNOs in 29 European countries over the period 2011–'21 (spanning the 4G investment period and the beginning of 5G investment period), **Bahia and Castells (2023)** estimate a dynamic fixed-effects panel model with country and quarter fixed effects. They look at the relationship between market structure and operator-level investment by focusing on market concentration[215] and profit margins (measured by EBITDA margins), on the one hand; and investment intensity (measured as CAPEX per mobile connection), on the other hand. They find an inverted-U relationship between

through asymmetric regulation while being unrelated to retail pricing and investment decisions, conditional on controls.

[211] In Austria T-Mobile/tele.ring, in Denmark TeliaSonera/Orange, in the Netherlands KPN/Telfort as well as T-Mobile/Orange, and in Greece TIM Hellas/Q-Telecommunication.

[212] The analysis relies on a DiD design, estimating separate models for merging firms and rivals and excluding same-country rivals from the control group to avoid spillover contamination. Prices are proxied by revenue per minute, dynamic efficiency by the logarithm of CAPEX, and the regressions control for minutes of use, mobile and fixed penetration, GDP per capita, as well as country and time effects.

[213] The total sample covers ca. 700 market areas.

[214] The author also derives an inverted-U relationship between HHI and penetration rates. However, the author finds the majority of all sampled markets to have spectrum HHIs that lie in the increasing part of the inverted-U. The squared-HHI coefficients are small in absolute value, have large standard errors, and are statistically indistinguishable from zero.

[215] Measured primarily by the HHI and the two-firm concentration ratio.

concentration (and profit margins) and investment at the operator-level.[216] However, this inverted-U relationship is not statistically significant at the country level. Their result is consistent with the possibility that, as the number of operators rises, aggregate CAPEX may increase mechanically via duplication even if investment per operator falls.

5.41 The above papers provide insights on the empirical relationship between market consolidation and investment levels. However, they do suffer from several shortcomings when interpreting the effect of mergers on investment. First, in terms of interpretation, they do not consider mergers specifically, but instead consider market consolidation which, while strongly affected by mergers, may also be affected by other effects such as market entry or—when looking at HHI—changes in relative market shares independent of mergers.[217] Moreover, even when concentration changes are driven by mergers, many transactions in the relevant periods were cleared subject to remedies. Consequently, the estimated effects should be interpreted as the effects of market consolidation as implemented under the prevailing remedy regime.

Table 5.1 European Commission mobile mergers since 2012

Country	Year	Merging parties	Outcome
Austria	2012	Hutchison 3G Austria/Orange Austria	Phase II remedies
Ireland	2014	Hutchison 3G UK/Telefónica Ireland	Phase II remedies
Germany	2014	Telefónica Deutschland/E-Plus	Phase II remedies
Denmark	2015	TeliaSonera/Telenor Denmark	Phase II withdrawal
Spain	2015	Orange/Jazztel	Phase II remedies
Italy	2016	Hutchison 3G Italy/Wind	Phase II remedies
UK	2016	Hutchison 3G UK/Telefónica UK	Prohibition
Netherlands	2018	T-Mobile NL/Tele2 NL	Phase II clearance
Spain	2024	Orange/MásMóvil	Phase II remedies

Note: This table lists the main national mobile telephony merger cases reviewed by the European Commission since 2012 and their outcome. The table does not include merger cases reviewed by national competition authorities.
Source: Oxera.

5.42 Second, these papers generally focus on investment. Most of these studies focus on CAPEX (per subscriber or per operator), rather than the deployment and performance outcomes that ultimately matter for consumers' quality, such as download speed, latency, and geographic coverage. This is important, because, in mobile networks, consolidation can generate technical scale efficiencies: constant (or even lower) aggregate investment can still translate into higher delivered quality

[216] To address the endogeneity of market structure, they instrument concentration using the concentration of 3G spectrum holdings and a regional HHI measure (average regional concentration excluding the country), and instrument EBITDA margins using time since network launch. These instruments are argued to be exogenous to quarterly investment decisions but are strongly correlated with current market structure, reflecting regulatory allocation of spectrum and long-run cost and scale conditions rather than short-run investment shocks.

[217] For example, if a leading firm increases its market share from 40% to 50% while three other firms see their market share decrease from 20% to 16.7% each, HHI increases from 2,800 (= 40^2 + 3 x 20^2) to ca. 3,337 (= 50^2 + 3 x 16.7^2), even in absence of any merger.

if the same capital is deployed on a more efficient network configuration. In particular, as discussed in **Elliott, Houngbonon, Ivaldi, and Scott (2025),** mobile telecom networks feature two main sources of economies of scale: first, economies of density, where combining networks reduces average transmission distances, increasing download speed (or reducing cost) for a given level of network investment; and second, economies of pooling, where combining network capacity and users smooths congestion when demand fluctuates. This means that more can be achieved with the same fixed investment—or the same at a lower investment cost—when combining separate networks. Elliott et al. is discussed in more detail in para. 5.50.

5.43 Third, the cyclicality of investment in the sector and technological change (2G-5G) hamper the external validity of the studies in terms of drawing conclusions for current and future circumstances. The mobile telecommunications sector generally follows investment cycles that may correlate with merger period, in which case any observed changes in investment may simply be due to changes in the investment cycle rather than the merger. Additionally, the technological regime during much of the sample period in several studies covers early transitions (i.e. from 2G to 3G and 4G) that may differ from later transitions (e.g. from 4G to 5G), where investment measures may be subject to different scale economies.

Reduced-form studies of mergers and product quality

5.44 Related to the second limitation noted above, several papers have looked specifically at performance in terms of investment output, rather than input.

5.45 **Wellmann (2019)** studies how different market structure characteristics affect mobile network quality. He uses data collected from a third-party crowdsourcing app to capture mobile network quality for 48 MNOs from 14 European countries between 2011 and 2016. To measure mobile network quality, the author constructs two measures, namely the share of network connections with 3G and 4G, as well as the number of connections which exceed 1Mbps, 2Mbps, and 3Mbps by operator and per quarter. The results suggest that fewer mobile operators are associated with improved mobile network quality.[218] However, the analysis does not examine individual merger events directly, but instead focuses on changes in market concentration, which may arise from a range of market developments and not only mergers alone.

5.46 Using a quarterly country-level panel covering 21 European countries over the period 2011–'18, **Aimene, Jeanjean, and Liang (2021)** examine the relationship between number of operators and country-level unit prices for voice (price per minute) and data (price per megabyte). They use a DiD approach in which they compare, before and after a merger, countries experiencing a merger (Austria,

[218] To account for possible endogeneity of the number of operators as well as market concentration measured by HHI, he then applies a fixed effects model with an IV approach. A first instrument employed is 'multinational contacts'. Wellmann exploits the fact that European mobile telecommunication players often belong to larger (and fewer) multinational groups. The author argues that this ownership structure facilitates collusion and therefore is correlated with competition and market shares, but without directly affecting network quality through any other channel than competition. A second instrument used is asymmetry in mobile termination rates i.e. wholesale prices which operators transfer to terminate calls on each other's networks. The author exploits that these prices are regulated, whereas smaller operators benefit from more favourable price schemes than larger operators. This asymmetry in regulated mobile termination rates is exploited to instrument competition in a market. The study also controls for market size, varying demand between rural and urban areas, regulatory differences between countries, and technological developments in mobile network infrastructure over time.

Germany, Ireland, Italy, and Norway[219]) with a control group of 16 countries for which they conclude no merger has taken place.[220] They find that while unit prices for voice increase following consolidation, unit prices for data decline. They interpret this divergence as reflecting stronger dynamic efficiency effects in data services, where higher technical progress and scale economies in cost reduction mean that higher consolidation can nevertheless lead to lower prices, despite a static price-increasing effect of increased market power. Consistent with this mechanism, they find that—relative to the control group—the decrease in data unit prices is accompanied by higher data traffic. However, several of the studied mergers were cleared subject to remedies, so the estimates reflect the impact of consolidation as implemented under remedy conditions, rather than an unconditional merger counterfactual.

5.47 However, even if some studies suggest a positive relationship between mergers and quality indicators such as network coverage and speed, this still leaves open the question of how consumers perceive or value these improvements. For example, improvements in technical performance do not automatically translate into greater consumer welfare if they are not valued much by consumers relative to higher prices.[221]

Structural models and welfare effects

5.48 Calibrated structural economic models allow for counterfactual simulations, to identify what would be the market outcome—in terms of both investment and prices—when varying the number of firms or combining two separate firms under single ownership.

5.49 **Houngbonon and Jeanjean (2019)** develop a simple Cournot model in which firms compete in quantities and invest in technology that reduces their marginal cost. The number of firms has an *a priori* ambiguous effect on consumer welfare, as a decrease in the number of firms increases static harm from market power while potentially increasing dynamic benefits from increased firm-level fixed investment in marginal cost reducing technology (given the larger user base), which get partially passed on to consumers.[222] They show that the sign of the effect of number of firms on consumer welfare depends on the elasticity of demand, the shape of the marginal cost function, and the magnitude of the effect of the number of operators on equilibrium investment levels. The dataset is based on a yearly operator-level panel covering licensed MNOs in 18 European countries over the period 2007–'15.[223] Counterfactual simulations show that as the number of operators goes down, operator-level investment indeed increases as it becomes more profitable to invest in technology that reduces marginal cost. Country-level investment, however, does decrease. They also estimate that prices per megabyte follow a U-shaped pattern in number of operators, driven by the interplay between static competition

[219] The merger in Norway included in this study is Telia / Network Norway, which was cleared by the Norwegian Competition Authority and thus is not listed in Table 5.1 above.
[220] This research design allows the authors to identify the link between M&As and price per minute and price per megabyte while accounting for underlying cost trends which may affect prices, on the assumption that the countries in both groups equally benefit from a decrease in costs per megabyte.
[221] For a discussion of the valuation of internet speed and quality, as well as the drivers of broadband traffic, see for example Kenny, Kenny, and Gehan (2023) and Rabbani, Bogulski, Eswaran, and Hayes (2024).
[222] The authors consider reductions in number of firms as exogenous.
[223] The authors recover demand elasticities via GMM using (i) lagged prices to address simultaneity between price and unobserved quality and (ii) mobile termination rates as instruments that shift costs but do not directly affect data demand. On the supply side, the relationship between investment and marginal cost is identified through a combination of non-parametric (Lowess) and parametric GMM techniques using lagged investment as instruments to address endogeneity.

effects (more firms increasing price competition and thus lowering prices) and dynamic investment effects (fewer firms enabling higher per-operator investment in cost-reducing technology, which eventually lowers marginal costs and prices). When there are few operators, high investment reduces unit costs and price per MB, but as the number of operators increases beyond three, reduced investment raises marginal costs and pushes prices back up. Thus, they conclude that the optimal number of operators from a consumer welfare perspective is three operators.

5.50 **Elliott, Houngbonon, Ivaldi, and Scott (2025)** develop a structural model that explicitly accounts for both economies of density (shorter average transmission distances when fewer networks serve a given area) and economies of pooling (more efficient congestion management when users and spectrum are combined) on the supply side of telecommunications.[224] On the demand side, they account for plan choice and data consumption. Quality enters in terms of download speed. Based on an October 2015 snapshot of the French market for mobile-only residential plans, the demand model is estimated and cost parameters recovered assuming profit maximisation.[225]

5.51 The paper distinguishes between a short-run analysis, in which infrastructure is fixed, and a long-run analysis, in which infrastructure investment is endogenous. In the long run, the authors consider a setting with symmetric firms, in which total industry bandwidth is allocated equally across operators, and analyse how the number of firms affects prices, infrastructure investment, and download speeds.[226] They find that with a reduction in the number of firms there is both an increase in equilibrium prices (because of market power effects) and an increase in download speed (because of economies of scale). These economies of scale are mainly driven by economies of pooling rather than economies of density: although economies of density increase as firms invest in more base stations serving closer customers (thereby increasing channel capacity per unit of bandwidth) the authors note that the differences in channel capacity from increasing density are trivial, meaning firms do not see significant gains in data transmission through this channel. In contrast, economies of pooling have a large impact, with channel capacity being roughly inversely proportional to the number of firms, driven by its proportionality to the bandwidth operated. From a consumer welfare perspective, the authors find that reducing the number of firms has a negative effect when the market contains fewer than five firms, only a small positive effect when five or more firms are present, and that consumer surplus is maximised when the market consists of around eight firms. By contrast, total surplus is maximised at around four firms.

[224] To that end, the model combines a structural model of the telecommunications market with telecommunications engineering models. On the supply side, firms set prices and invest in infrastructure (base-station density), with download speeds determined endogenously via so-called path-loss (reflecting economies of density) and queuing models (reflecting economies of pooling).
[225] The dataset used includes data on subscriptions and data consumption by plan and municipality for a single MNO, Orange Mobile; mobile phone plan terms and market shares for the other three MNOs (SFR-Numericable, Bouygues Telecom, and Free Mobile) and the largest mobile virtual network operator (El Telecom); measured download speeds (collected by Ookla via its online Speedtest service); detailed publicly available data on mobile network infrastructure (location of all mobile base stations, number of antennas, and frequencies operated by each network operator); and income distribution data. As active network sharing is relatively common in rural areas but not in urban areas, they only consider municipalities with a population greater than 10,000—resulting in a total of 589 municipalities covering 43.5% of the French population.
[226] As the authors note, these long-run counterfactuals should not be interpreted as merger analyses because they assume firms have symmetric bandwidth allocations and plan offerings. A merger between two firms would instead generally lead to asymmetries.

5.52 In the short run, where infrastructure is assumed to be fixed, the authors simulate hypothetical 4-to-3 mergers. Although mergers generate efficiencies through economies of pooling and, to a lesser extent, economies of density, leading to improvements in network performance such as higher download speeds, they find that these direct efficiencies are outweighed by the increase in market power. As a result, all simulated 4-to-3 mergers reduce consumer surplus.

5.53 Relative to reduced form studies reviewed above, this paper resolves several shortcomings. In particular, it looks at investment outputs (download speeds) rather than CAPEX alone, it explicitly models engineering-based scale economies, and it delivers welfare-based counterfactuals grounded in a structural model specific to the mobile telecoms market—including differentiated price competition and infrastructure investment decisions (base-station density). It also goes beyond exogenous changes in number of symmetric operators by analysing mergers specifically.

5.54 **Lin, Tang, and Xiao (2026)** look at the effect of a hypothetical 4-to-3 merger in the US between T-Mobile and Sprint in 2016 on subsequent 4G-LTE deployment.[227] They propose a new structural empirical methodology to estimate discrete games (here: whether to deploy 4G-LTE in an area), taking into account that some payoff-relevant state variables depend on unobserved factors that also affect the profitability of future decisions.[228] Lin, Tang, and Xiao estimate an empirical game of market entry between the four major operators—AT&T, Verizon, T-Mobile, and Sprint—across thousands of geographically dispersed (mainly rural) census tracts between 2015 and 2018.[229] Existing 3G network deployment and 4G-LTE deployment in neighbouring tracts are measured as per December 2015. They find that existing network assets indeed significantly and positively affect firms' 4G-LTE deployment decisions, which they argue reflects the role of cost synergies and economies of scale for the profitability of 4G-LTE deployment decisions.[230] They

[227] 4G-LTE (Long Term Evolution) is a wireless broadband technology that succeeds 3G. While 4G-LTE was widely marketed as 4G, the original LTE specification did not fully meet the 4G standards as set by the International Telecommunication Union.

[228] In other words, they are endogenous. More specifically, in this context, the authors take into account that the profitability of 4G-LTE deployment depends on two payoff-relevant state variables that are endogenous: (i) existing 3G deployment in an area, which in principle reduces the cost of 4G-LTE deployment because of the possibility of re-using existing spectrum and infrastructure with upgraded equipment (e.g. towers and facilities); and (ii) neighbouring 4G-LTE deployment, which in principle reduces the cost of 4G-LTE deployment because of economies of scale and network expansion from nearby markets. Lin, Tang, and Xiao point out that treating these two state variables as exogenous would bias the estimated profitability of future 4G-LTE deployment, because both depend on unobserved factors that also affect profitability, such as market conditions or firm ability. To account for this endogeneity in payoff-relevant state variables in an environment involving strategic interaction, they develop a control function approach that explicitly models the source of endogeneity in a Bayesian game with incomplete information, where firms observe their own payoff shocks but not those of their rivals.

[229] As relevant geographic area, they look at census tracts, which are relatively homogeneous geographic units designed by the US Census with respect to population characteristics, economic status, and living conditions (typically containing about 2,500–8,000 people). In total, their study examines 2,582 census tracts.

[230] They do so by using lagged demographics of neighbouring tracts as instruments, applying their empirical method to estimate how each provider's endogenous network investment influences its decision to deploy 4G-LTE services in the markets of interest. The underlying idea of this IV is that the year-2000 demographics of neighbouring census tracts shaped demand conditions during the 3G rollout era, thereby predicting how much 3G and early 4G infrastructure was built in those areas, which in turn lowers the cost of subsequent 4G-LTE deployment in the focal market through shared facilities and spatial spillovers. Being fifteen years removed from the deployment decisions under study, these lagged demographics are argued not to affect current entry payoffs directly. The validity of the IV may be violated when spatially persistent unobservables (such as terrain or structural

then use the estimates of these structural effects to study the effect of a hypothetical 2016 T-Mobile/Sprint merger in the US on 4G-LTE deployment. They find that, while the merged entity becomes a stronger competitor with more assets,[231] the proposed merger would substantially reduce the overall 4G-LTE deployment across the markets, with overall 4G-LTE deployment occurrences decreasing by 21.88% relative to a no-merger scenario and the population served by at most one provider only increasing by 23.15%. The authors find that a hypothetical divestiture remedy that creates a new entrant would largely offset the merger's negative effects, by restoring entry and coverage. This paper only considers the effect on 4G-LTE deployment and does not consider any concurrent price effects.

5.2.2 Reports from public institutions and industry participants.

5.55 Subsection 5.2.1 focuses on academic papers. For completeness, this Subsection presents key insights from empirical studies carried out by or for public institutions and other industry participants.[232]

5.56 **OECD (2014)** studies how different mobile market structures across OECD countries affect competition, investment, innovation, and consumer outcomes, with particular attention paid to changes in the number of MNOs. The authors carry out case studies, in which they collect descriptive evidence from recent market developments in different countries with respect to different outcome variables (e.g. prices, network sharing, subscriptions). They include countries which have either reduced the number of MNOs from four to three (Australia and Austria),[233] countries which have increased the number of MNOs from three to four or five (Brazil, Canada, Colombia, France, Israel, and Luxembourg) as well as countries that have maintained four operators (Sweden, UK, and US). The report finds that—based on the reviewed cases—countries with a larger number of operators have a higher likelihood of more competitive and innovative services being introduced and maintained. The authors argue that a higher number of operators drives the entire market to become more dynamic and competitive and encourages other operators to improve their services with respect to price, quality, and services. Additionally, based on the reviewed countries, the report highlights the importance of voluntary network sharing agreements (NSAs), arguing that these can significantly reduce costs and are more likely than full mergers to result in savings being passed on to consumers.

5.57 **WIK Consult (2015)**, in a study commissioned by Ofcom, conducts an empirical analysis in eight European (UK, Austria, France, Germany, Ireland, Italy, Netherlands, Spain) and four non-European (Australia, Japan, South Korea, US) countries to provide insights on the effect of competition on investment and

economic geography) remain correlated across neighbouring tracts over time, or when county-wide demand conditions create a direct link between neighbouring tracts' historical demographics and current entry profitability.

[231] The authors note that an estimated 11,000 Sprint cell sites would be retained to improve capacity and/or coverage in the new network. In their counterfactual simulation, they implement the after-merger network integration by taking either (a) the union (up to 100%) or (b) the maximum of T-Mobile's and Sprint's coverage at the census block level. The authors note, however, that the two methods yield very similar results, because, in census blocks where both are active, they serve mostly at 100% coverage.

[232] Padilla, Klein, Reynolds, and Wickens (2024) review the empirical evidence on four-to-three mergers between MNOs in Europe, the US, and the UK. As this study does not provide any novel empirical analysis, it is not reviewed further in this synopsis.

[233] The studied mergers may be subject to remedies, and, as such, conclusions on market outcomes of transactions in these countries have to be treated carefully.

consumer outcomes in the mobile sector. Using annual data from 230 mobile operators for the time period 2005–'13,[234] the study regresses measures for competition (the HHI or the number of operators) on investment, measured as CAPEX and CAPEX per subscriber. The study does not identify a significant association between competition and investment. However, the underlying empirical methodology, including the specification of the regression model, is not spelled out and the study appears to not go beyond studying associations.

5.58 **Frontier Economics (2015)**, in a study commissioned by the GSMA, studies the effects of four-to-three mergers on prices and investment in the mobile market. They use quarterly data provided by GSMA between 2000 and 2014 for European MNOs.[235] They run fixed effects regressions in which they investigate the relationship between market concentration (i.e. HHI, or alternatively as a binary variable for a fourth player in the market) and investment (i.e. CAPEX per subscriber) as well as prices (i.e. average revenue per minute). With respect to investment, Frontier Economics does not find evidence that higher competition is associated with more investment. In addition, they conclude that there is no clear relationship between the level of competition and prices, and hence that mergers do not automatically lead to a price increase in the market. Instead, they identify technological developments, such as the provision of 4G, or economic circumstances, such as the GDP per capita, as relevant drivers of the prices.

5.59 Several institutions have conducted ex post assessments of specific mobile mergers to directly evaluate their effects. For example, the **Austrian Competition Authority (2016)** evaluated the joint impact of two mergers in the Austrian mobile telecommunications sector that occurred effectively at the same time in 2012: Hutchison 3G/Orange Austria and Telecom Austria/Yesss! (as sold by Orange). In their ex post assessment, they use monthly data for the years between 2011 and 2014, retrieved from Austrian MNOs. The data includes information on every mobile tariff for private customers, including the number of regular and new subscribers, monthly, and annual fees. The study then aims to isolate the price effect which can be attributed to the mergers with the help of merger simulations for a static Bertrand oligopoly model with nested-logit demand, which allows them to predict how prices would have evolved in the counterfactual scenario in the absence of the merger. They find that the mergers lead to an increase in prices by 14–20%.

5.60 Studying the same merger, but with a focus on network coverage and quality rather than prices, **GSMA (2017)** analyses the effects of the Hutchison 3G and Orange Austria merger on 4G network coverage, download speeds, and upload speeds. The study applies two methods: first, a DiD approach, which compares pre- and post-merger changes in Austria (and Hutchison) to changes in the control group while controlling for supply and demand factors (e.g. spectrum, population density, income), and second a synthetic control method, which builds a weighted combination of non-merger countries/operators that best matches Austria's pre-merger trends and then compares post-merger outcomes to this data-driven 'synthetic' counterfactual. In contrast to the findings of the Austrian Competition Authority, GSMA finds significant and positive impacts for Austrian consumers, with an increase in 4G population coverage by 20–30 percentage points and a significant increase in network coverage and quality, which mainly materialised two years after the merger.

[234] The study examines 50 mobile operators.
[235] The data considers all EU countries excluding Cyprus, Estonia, Luxembourg, Malta, and Slovakia (because of data unavailability). The exact number of operators is not disclosed.

5.61 A subsequent study carried out by **GSMA (2020)**[236] evaluates the impact of competition on quality, innovation, and prices in Europe's mobile communications market between 2011 and 2018. They use cross-sectional panel data including 99 operators across 29 countries to run panel regressions, in which they aim to identify a relation between network quality (measured as download/upload speed and latency), network coverage, or investment (measured as CAPEX per operator) and market concentration.[237] To address endogeneity concerns, they employ an IV approach.[238] They find that higher concentration is associated with more investment per operator, but they do not find any statistically significant results with respect to overall network quality or 4G coverage.

5.62 **Ofcom (2020)** conducts an empirical analysis in which they apply both panel data methods as well as synthetic control methods to study the effects of mobile market concentration and consolidation[239] on investment (measured as country-level CAPEX) and quality (measured as average download speed), without taking into account potential effects of market concentration on prices. Using quarterly data for operators from 2000 to 2018 from 28 European countries,[240] the authors capture 46 changes in market structure.[241] They show that investments are lower in more concentrated markets, and that an increase in market concentration is not associated with higher network quality on average. Based on these results, they compare two mechanisms: on the one hand, higher concentration could imply less competition on quality, and thus lower investment and network quality; on the other hand, MNOs in concentrated markets might work more efficiently, and less investment is required to achieve the same or better network quality. Exploring the relationship between concentration and network quality outcomes,[242] the study finds no evidence that the efficiency channel dominates.

5.63 There are also studies that combine quantitative analysis with case studies of individual mergers. **Frontier Economics (2021),** in a study commissioned by UK telecoms operator Three UK, studies the impact of mobile mergers on quality by combining econometric analysis and case studies. Using quarterly operator-level data for 30 European countries between 2011 and 2019 (for average download

[236] This study has also been circulated in a slightly different version as Abate, Bahia, and Castells (2020).
[237] Market concentration is measured as number of players in the market, the HHI, and the Lerner index, i.e. price-cost markup, proxied using EBITDA data.
[238] In the first specification, they instrument the HHI in the 4G market by using the transformation of share of spectrum holdings from past 3G auctions. The conceptualisation and construction of this instrument require further clarification. It appears that the authors reconstruct an HHI index based on operators' shares of 3G spectrum holdings (allocated in auctions typically conducted in the 2000s) and use this spectrum-based HHI as an instrument for contemporaneous 4G market concentration in a 2SLS framework. However, the precise transformation from spectrum shares to the instrumented HHI, as well as the justification of the exclusion restriction (i.e. why historical spectrum allocations affect current outcomes only through 4G concentration), is not stated. In the second specification, they instrument the Lerner index by using the amount of time since the operator launched its first network in a given country. The underlying idea is that more time spent in a market allows operators to implement efficient, cost-reducing processes, which directly affect firms' market power, but without affecting network coverage and quality.
[239] Which is measured as HHI as well as number of operators.
[240] The study aims to address endogeneity concerns by relying on an IV approach. Specifically, the authors use two-quarter lag of HHI as an instrument for current HHI, under the assumption that the lagged HHI is a predictor for current HHI, while not affecting current investment and network quality directly.
[241] Out of which 12 are mergers, 33 are entries, and one is an exit.
[242] The exact method by which the study evaluates the efficiency channel relative to network quality is not fully detailed in the paper, leaving some ambiguity regarding how the comparison between mechanisms is operationalised.

speeds) and 2009 to 2020 (for other variables), they estimate the effect of mergers and entry on investment (measured as CAPEX per subscriber) and average download speeds with panel data regressions. They do not find any significant associations between mergers or entry and investment or download speed. Complementary case studies of mergers in Ireland (between Three and O2 in 2013) and Austria (between Three and Orange in 2012) suggest, however, significant improvements in network coverage and quality (captured as download speed). The authors point out that these benefits require time to materialise: in the case of Ireland, improvements took several years to materialise, whereas benefits of the Austrian mergers materialised more rapidly. Frontier Economics attributes this difference in the required time span to the idiosyncratic nature of network integration.

5.64 **Lear, E.CA Economics, Fideres, Prometeia, University of East Anglia, and Verian (2024),** commissioned by DG Competition (European Commission), examine the operator market using a quarterly dataset of 29 countries (with 23 EU countries, Canada, US, Japan, South Korea, Australia, and New Zealand) between 2009 and 2019.[243] They consider, in particular, the fact that virtual network operators lease capacity from mobile operator networks to provide their services to consumers.[244] They find a strong, positive relationship between prices and market concentration, where the role of virtual network operators appears to be negligible and does not impose a competitive constraint on incumbent firms. The study further investigates the impact of market concentration on investment (i.e. country-level CAPEX) and finds a negative association. In addition, the study finds that an increase in the number of MNOs (i.e. a decrease in concentration) is associated with a 10% increase in country-level investment, whereas an additional virtual network operator is related to only a small increase in investment (0.3%).

5.3 Digital markets (excluding Big Tech acquisitions)

5.65 We first discuss the papers related to digital hardware markets, including electronic equipment, semiconductors, telecommunication equipment, and HDDs followed by a discussion of papers related to digital software markets.

5.3.1 Hardware markets

5.66 One of the earliest studies looking into the relationship between R&D activity and mergers and acquisitions in digital hardware markets is **Blonigen and Taylor (2000).** They use a balanced panel of electronic and electrical equipment firms (e.g. semiconductors, communications equipment, and electronic components, as well as computer and office equipment) between 1985 and 1993[245] and combine this with data on firm financial information and acquisition counts.[246] The authors find that firms with higher R&D intensity (R&D expenditure over revenue) undertake

[243] This study is largely based on the same dataset as Bahia and Castells (2023). The main difference is that this study spanned the 4G investment cycle (2009-'19), whereas Bahia and Castells consider instead 2011-'21, which excludes part of the 4G investment cycle and includes part of the 5G investment cycle.
[244] The study uses a cross-country panel data approach and addresses potential endogeneity of the HHI by using two different instruments. The first instrument is the number of MNOs, relying on the assumption that changes in the number of operators through entry or merger affect prices only indirectly via market concentration. The second instrument is the within-country standard deviation of mobile termination rates, which captures regulatory-induced differences between operators and is assumed to influence HHI without directly affecting prices.
[245] With a total of 1,953 firm-year observations and 217 firms in total.
[246] The authors control for firm size, profitability, leverage, and cash flow and use negative binomial models, with GMM estimators with fixed effects as an alternative estimation approach.

significantly fewer acquisitions, both across firms and within firms over time, interpreted as consistent with a 'make-or-buy' trade-off where more R&D-intensive firms buy fewer targets and vice versa. However, this early study is correlational and does not identify causal effects of mergers on innovation, or vice versa.

5.67 Studying the global semiconductor industry between 1989 and 1999, **Gugler and Siebert (2007)** assess whether horizontal mergers and research joint ventures (RJVs) generate net efficiency or market power effects.[247] They exploit the industrial-organisation prediction that rising post-event market shares indicate that market power is dominated by efficiency gains—such as production rationalisation (i.e. reorganising or consolidating production across firms based on their productivity), increased bargaining power towards input providers, internalisation of positive externalities from R&D, improved managerial structure, sharing risks associated with uncertain technologies and large sunk costs, and diffusion of know-how and process innovation-driven cost reductions. Comparing mergers and RJVs,[248] they find that RJVs often achieve merger-like efficiencies with fewer anticompetitive risks: mergers increase insiders' market shares by about one percentage point within three years, while RJVs generate similar per-firm gains (0.52 percentage points) and larger cumulative gains for all participants.[249] Efficiency effects are stronger in microcomponents, where product differentiation and entry limit market power, than in memory markets, where commodity-like products amplify market-power effects.

5.68 **Kapoor and Lim (2007)** examine how acquisitions are related to the productivity of inventors in the US semiconductor industry. Tracking inventors from acquired firms in the US between 1991 and 1998,[250] they find that acquisitions are associated with a sharp and persistent decline in inventors' patent count relative to nonacquired peers. Although their patent count converges to that of acquiring-firm inventors over time, it does so at lower levels, suggesting no overall efficiency improvements. They find that inventor patent count is higher when acquiring and acquired firms share similar routines and when skills overlap is moderate, suggesting an inverted U-shaped relationship. They also find that inventor patent count is lower when the acquirer is large relative to the target. This study remains correlational.

5.69 **Gantumur and Stephan (2012)** examine whether and how M&As are related to firms' innovation activities in the telecommunications equipment industry, asking both what drives firms to engage in M&As and how such activity affects subsequent innovation performance. The study first estimates merger propensities as a function of innovation-related firm characteristics (e.g. R&D intensity and patent-based indicators), and then employs a propensity score matching approach to compare post-merger innovation outcomes of merging firms with a counterfactual of similar non-merging firms which may or may not be direct competitors of the merging firms, controlling for pre-merger characteristics. The analysis uses a firm-level panel

[247] They use a panel of 263 firms and 1,433 firm-year observations.
[248] The sample contains 111 mergers and 244 RJV firm-years.
[249] To that end, the authors estimate dynamic panel models of market-share evolution at the four- and six-digit NAICS level, using event-time dummies up to three years post-event and an endogenous switching model to correct for self-selection. They estimate a two-step endogenous switching model. They first use a probit selection equation that predicts merger or RJV participation based on firm characteristics (e.g. size, patents, scope) and expected market-share gains. Then, they estimate the dynamic market-share equations separately for participants and non-participants while including inverse Mills ratios (which capture the influence of unobserved factors conditional on selection). As market shares may experience unobserved productivity shocks, they are instrumented with firms' accumulated patent stocks, which proxy for persistent technological efficiency driving market shares but plausibly uncorrelated with short-run market-share shocks.
[250] In total, they study 318 inventors from 50 acquired firms.

from a sample of M&As in the US between 1988–2004.[251] The results show that firms with higher R&D intensity, larger patent stocks, and greater absorptive capacity (measured as the stock of accumulated patents over time) are more likely to engage in acquisitions, while lower R&D productivity (measured as a ratio of citation-weighted patents to R&D expenditure) also increases acquisition likelihood. In contrast, lower patent intensity is associated with participation in pooling mergers.[252] The authors argue that firms with higher R&D intensity and large knowledge stocks have higher absorptive capacity to identify and integrate external technologies, while low R&D productivity signals knowledge inertia, making acquisitions an attractive strategy to access complementary capabilities and overcome internal innovation constraints. Regarding outcomes, mergers are associated with a statistically significant increase in innovation performance (measured primarily through patent-based indicators and R&D intensity), mainly by reinforcing R&D intensity and compensating for weak prior technological capabilities as mergers enable firms to expand their knowledge base and explore complementary technologies. This effect is particularly driven by firms with previously low research productivity or declining inventive portfolios, which use acquisitions either to explore new technological trajectories or to pool complementary assets in order to offer more integrated and comprehensive product solutions.

5.70 Looking at the consolidation in the HDD industry from 13 firms to three global players (Seagate Technology, Western Digital, and Toshiba) between 1996 and 2016, **Igami and Uetake (2020)** study how mergers, innovation, and entry and exit jointly shape competition. They use industry- and firm-level data that covers aggregate quarterly shipments and prices covering 83 quarters, firm-level market shares for major producers, and a monthly record of mergers, innovation, entry, and exit.[253] They find that while mergers increase market power, they also generate efficiency gains through productivity synergies (combining complementary engineering teams, knowledge diffusion, and sharing organisational capabilities) and rationalisation (reallocating production to the more productive firm).[254] Innovation incentives, reflected in R&D investment, decrease sharply as the industry consolidates to about three firms, while positive R&D effects from a higher number of firms plateau after the number of firms reaches four. The authors also consider the effect of adopting different merger prohibition thresholds on the number of firms in the industry and subsequent consumer welfare.[255] They find a

[251] The sample contains 302 M&As, involving 186 acquirers, 22 targets, and 94 partners in pooling mergers (in which merging firms participate neither as an acquirer nor as a target, but as an equal partner combining resources with another firm). Mergers among firms active in the telecommunication equipment industry are identified based on firm SIC industry codes and thus can contain both horizontal and non-horizontal M&As.

[252] A pooling merger refers to a transaction in which the participating firms are treated as merger partners, rather than as a distinct acquirer and target, and combine their respective resources and technological capabilities.

[253] In total, the dataset contains 605 firm-quarter observations and 248 firm–decision observations.

[254] To that end, they estimate a finite-horizon dynamic oligopoly model with stochastically alternating moves, in which firms endogenously choose mergers and innovation (defined as a discrete decision to lower marginal cost, i.e. process innovation). They combine instrumental-variable demand estimation, Cournot-based inference of marginal costs from market shares, and a dynamic discrete-choice model estimated via maximum likelihood. To estimate their dynamic discrete-choice model, they use Rust's nested fixed-point algorithm, which solves firms' dynamic optimisation problems by repeatedly computing the value functions via backward induction for a given parameter vector and then updating the parameters to maximise the likelihood of observed merger, innovation, entry, and exit choices.

[255] Note that the adoption of a merger prohibition threshold at a particular level is not necessarily the same as an industry actually consolidating to that level, as the threshold constrains future

negative effect on consumer welfare from a merger prohibition threshold allowing mergers to fewer than three firms. Consumer welfare benefits from stricter merger thresholds of prohibiting mergers leading to fewer than four, five, or six firms are modest. Based on these counterfactual simulations, the authors conclude that the current rule-of-thumb policy, which stops mergers when three or fewer firms exist, strikes approximately the right balance between procompetitive effects of blocking mergers, and value-destruction side effects (e.g. an increase in net exit by firms, and weaker entry-for-buyout effects).

5.71 Igami and Uetake model innovation choices in the HDD industry as reductions in marginal cost, i.e. process innovation, and their estimates of innovation are only indirect in that they are conditional on their model. Looking instead at directly observed measures of R&D intensity, patent counts, numbers of new models introduced, and quality-adjusted unit prices, **Bennato, Davies, Mariuzzo, and Ormosi (2021)** study how innovation evolved after the 5-to-3 consolidation of the industry following three mergers in 2011–'12: Seagate/Samsung, Western Digital/Hitachi, and Toshiba/Hitachi's 3.5-inch assets—where the last merger followed from a divestment remedy imposed in the second merger. Using firm-level quarterly data over 2007–'16 and constructing counterfactual no-merger paths,[256] they find a significant increase in the post-merger R&D intensity (i.e. R&D expenditure divided by revenues) but a decrease in patent activity, which they argue likely reflects reduced duplication and defensive patenting.[257] They find that R&D productivity—estimated by looking at the association between R&D intensity and number of new models or lower quality-adjusted unit prices—increased for Seagate, which they interpret as synergies from the elimination of duplicative R&D efforts and combination of complementary technological assets. For Western Digital, they find a decrease in R&D productivity, which they ascribe to the more severe hold-separate restrictions that delay coordination and slow the translation of R&D into new models or quality improvements. Moreover, they also find an increase in the citation intensity of the patents post-merger.

5.3.2 Software markets

5.72 Looking specifically at the US cloud computing market between 2010 and 2019, **Doan and Mariuzzo (2026)** examine how mergers are associated with innovation as measured by the annual number of cloud-related patents. Their dataset consists of 145 acquiring firms and 177 targets, with the final dataset looking at 51 mergers between 2011 and 2014.[258] The authors employ a DiD design and match merged

mergers rather than directly determining market structure, which may endogenously settle at a higher or lower number of firms.

[256] Via a matrix completion approach (drawing on untreated firms/periods, including flash-storage firms), which is a causal panel data technique that estimates the unobserved 'no-treatment' outcomes for treated units by treating those treated observations as missing and imputing them from the pattern of observed outcomes for untreated units and periods. It models unobserved time-varying confounders via a low-rank (latent factor) matrix and recovers this matrix (and other parameters) by minimising prediction error. The fitted counterfactuals are then used to compute treatment effects (with uncertainty obtained by bootstrap).

[257] Defensive patenting refers to the practice of obtaining patents primarily to protect incumbents' market position by blocking, deterring, or complicating rivals' innovation—for example to deny competitors freedom-to-operate, discourage challenges, or secure bargaining power—rather than to advance new commercially used technologies. For causal inference they use a matrix completion method. This method relaxes the parallel trend assumption, a key assumption of the DiD model, by generating a counterfactual scenario from the observed elements of untreated units and periods.

[258] The reduction in the number of mergers studied is because they restrict mergers to 2011–'14 to allow for a 3-year patent event study, require complete firm-level financial data for matching, and pool multiple same-year acquisitions by the same acquirer into single observations.

firms to non-merging firms with similar pre-merger innovation, size, and financial characteristics (which may include direct competitors). They find that mergers are on average followed by increases in combined patent counts by around 45–66% within three years post-merger, relative to the three years pre-merger and the control group. However, they also find that the estimated innovation gains are substantially larger for market-leading acquirers (Amazon, Microsoft, Google, Salesforce, Oracle, Adobe, and IBM) and for firms specifically operating multi-sided platform business models (Amazon, Microsoft, Google, Salesforce, and Oracle), while smaller for non-leading firms (Cisco, Rackspace, Dell, VMware, Hewlett-Packard, SAP, and EMC). They argue that leading firms primarily prefer to acquire young firms with innovative ideas or complementary technologies, while also being constrained by merger control enforcement from buying established firms that are generally less innovative. In contrast, non-leading firms prefer to acquire established firms for their customer base and data, in order to catch up with the leaders. The authors also find that acquisitions of public targets amplify innovation, driven by selection and integration channels, with public targets having more established R&D and patent portfolios and greater transparency, which reduce information asymmetries and integration frictions and facilitate post-merger scaling of innovation. They do not find an independent effect from deal value.

5.73 Looking at the global market for enterprise software between 2012 and 2019, **Eisfeld (2025)** studies how acquisitions of VC-funded startups affect entry, focusing on the trade-off between an ex ante entry-for-buyout incentive and ex post entry deterrence following lower expected profits for any future entrant. She constructs a panel using data on startup entry, acquisitions, and IPOs combined with a product-level dataset that defines markets via text similarity.[259] In the sample of acquisitions of VC-funded startups, only 11% are horizontal under the text-based market definition.[260] She first estimates staggered DiD event studies comparing entry before and after large acquisitions,[261] and then estimates a dynamic structural model with forward-looking potential entrants deciding whether to enter or not.[262] The reduced-form results show that large acquisitions by strategic acquirers significantly reduce subsequent startup entry, while acquisitions by financial buyers or industry outsiders have no effect. Results from the structural model suggest that the entry-for-buyout channel raises entry on average, but high-value acquisitions by strategic incumbents deter entry ex post because of lower expected profit in case of future entry. Counterfactual analysis implies that banning all acquisitions would reduce entry by about 16%, whereas selectively blocking only high-value transactions from strategic acquirers would increase entry by roughly 1–1.5% in affected markets.

5.74 **Alezra and Berquier (2024)** assess how acquisitions affect innovative output at the level of acquired firms. Using a panel combining Crunchbase data on millions of firms with a bespoke global patent database (OpenPat), they implement propensity score matching and DiD designs to construct counterfactual innovation output for targets. Based on their baseline Poisson regression, they find that acquisition is associated with a substantial post-deal decline in patenting—around a 27% reduction in patent output (ca. 23% after controlling for closures)—with effects operating on both the extensive margin (a 10.3 percentage point higher probability of ceasing innovation) and the intensive margin (lower likelihood of higher patent

[259] The market-quarter panel covers 489 markets, over 20,000 firms, and about 24,000 products.
[260] With no material difference between types of acquirers described in the previous footnote.
[261] Large acquisitions are defined as transactions above $100 million, with $50 million as a robustness threshold. She uses markets without acquisitions as controls.
[262] The model considers expected flow profits, stochastic exit via acquisition or IPO, and evolving market structure, using a two-step revealed-preference approach with forward simulation.

volumes). Descriptive evidence shows that targets often exhibit strong pre-acquisition innovative performance, are close to acquirers in terms of technology and sector, and experience higher post-acquisition closure rates, especially where technological overlap is high and for acquisitions by large incumbents, consistent with concerns about the dampening of independent innovation trajectories. At the same time, the authors stress how the prospect of acquisition may itself stimulate early-stage innovation and entry (i.e. innovation-for-buyout).

5.75 Focusing instead on a potential positive market-level signalling effect of acquisitions in the technology sector, **Jin, Leccese, and Wagman (2025)** study the effects of acquisitions of VC-backed technology startups on subsequent entrepreneurial activity and investment in related business areas. Using data from Crunchbase on US VC-based technology ventures,[263] they analyse majority-control acquisitions between 2014 and 2016[264] and compare them to a matched set of comparable ventures that remained independent. Rather than defining markets discretely, they model the technology space as continuous and use textual similarity of business descriptions to construct 'business/industry niches' (BINs) around each focal venture, tracking VC investment, entry, and exit within these niches over time. They find that on average, VC investment roughly triples in nearby niches following an acquisition. Additionally, the probability of new VC-backed entry rises by about 7%, and exit rates (via IPO or a merger or acquisition) increase modestly.[265] These effects are stronger in less crowded niches and in niches with higher prior M&A or VC activity. They interpret these results as consistent with acquisitions conveying information about market potential and reducing information asymmetries faced by investors. They find no evidence that acquisitions by large technology platforms dampen VC investment relative to acquisitions by other non-financial buyers.[266] Acquisitions by financial buyers are associated with even stronger positive investment responses, which the authors attribute to the stronger signalling value of private equity buyouts, reflecting valuation expertise and market-timing ability, but also the absence of entry-deterrence concerns.

5.76 In a study by the Joint Research Centre of the European Commission, **Bello, Rabellotti, Ravanos, and Smallenbroek (2025)** examine whether acquisitions of EU-based companies operating in digitally intensive sectors affect innovation outcomes as measured by the number of EPO patent families filed by the target firm.[267] They use a cross-country firm-level panel covering the period 2009–'20 and focus on targets that filed at least one EPO patent during the period.[268] They use a staggered DiD design (but their control group may include direct competitors also affected by the merger).[269] They explore the heterogeneity of the merger effect by acquirer origin (EU versus non-EU) and by targets' pre-acquisition innovation

[263] Although the dataset may contain also hardware technology startups, our assumption is that this mostly contains software firms, as startups generally have scalable, capital-light business models that are more typical of software rather than hardware.
[264] The sample contains 2,023 acquisitions.
[265] They do so by using DiD designs with propensity score matching, event studies, and staggered-treatment estimators.
[266] Large technology platforms include Alphabet, Amazon, Meta, Apple, Microsoft, but also Cisco, Verizon, IBM, and some large non-tech conglomerates active in tech M&A. Other non-financial buyers include for example publicly listed former startups such as Airbnb and Twitter, as well as diversified incumbents like Walmart and Johnson & Johnson.
[267] They look at targets within the 2-digit NACE level, which includes both firms active in digital manufacturing and in software, ICT, and professional and R&D services.
[268] This leads to a sample of around 1,100 acquisitions by innovative acquirers and about 91,500 firm-year observations across roughly 11,700 firms.
[269] To correct for selection into acquisition, they combine their design with augmented inverse probability weighting using propensity scores based on firm age, size, patent stock, profitability, capital intensity, and country, industry, and year-fixed effects.

intensity. They find that acquisitions lead to a persistent decline in target-firm patenting—around 20–22% within six years, which is driven entirely by highly innovative targets, for which patenting falls by about 45%. Effects for low-patenting firms are statistically insignificant. The geographic origin of the acquirer (EU versus non-EU) does not significantly affect the magnitude of the effect. The authors suggest that the decline in patenting for highly innovative targets may be driven by strategic motives to suppress competitive innovation. However, the study also clarifies that it does not examine the impact of acquisitions on the innovative activity of the acquirer, nor the technological relatedness between the two firms, and that decreases in target innovation may also be driven by the centralisation of IP within the acquiring firm, shifts from patenting towards secrecy or commercialisation, or the discontinuation of duplicative R&D projects in ways that do not harm overall innovation outcomes. Additionally, innovation is measured only via patents, which may be restrictive particularly for software services where innovation is less centred around patents.

5.77 Finally, looking at 2016 and 2017 M&A activity among app developers, **Kummer, Mariuzzo, and Zhang (2026)** investigate how these M&As reshape the non-price business decisions of app developers on the Google Play Store, focusing on product variety, innovation-related activity, portfolio reallocation, and monetisation choices.[270] They find that M&As shift developer effort from portfolio expansion towards within-portfolio optimisation. Specifically, following M&As, developers perform additional updates while reducing the creation of new apps and the purchase of external apps. The authors then distinguish between transaction types (mergers versus acquisitions and horizontal versus non-horizontal M&As). Relative to matched non-M&A counterfactuals, mergers have positive effects on app updates but no significant impact on app variety, whereas acquisitions show negative impacts on new app launches, app variety, and other app-related metrics, suggesting a strategy of streamlining assets and operational efficiency. Acquisitions also affect monetisation strategies, suggesting more experimentation in pricing formats. Relative to non-M&A counterfactuals, non-horizontal M&As further limit portfolio growth by reducing new launches and purchased apps, while horizontal M&As instead stabilise portfolios by reducing removals, dismissals, and sales. Both horizontal and non-horizontal M&As lead to increased update activities relative to the counterfactuals. Price responses are found to be small in magnitude and mainly concentrated among paid apps, indicating that post-M&A adjustments operate predominantly through non-price channels.

5.4 Big Tech acquisitions

5.78 We first discuss the papers related to effects on the target and killer acquisition concerns, followed by papers looking instead at the effects on future potential competitors, entry, and VC financing.

5.4.1 Effect on target: killer acquisition concerns

5.79 Based on work conducted for the UK's Competition and Markets Authority, **Argentesi, Buccirossi, Calvano, Duso, Marrazzo, and Nava (2021)** provide an ex post assessment of 299 acquisitions by Amazon, Facebook, and Google between 2008 and 2018, with particular attention to Facebook/Instagram and Google/Waze.

[270] Using a dataset covering eight million apps and 1.8 million developers over the period 2015–'19, the authors analyse 1,387 M&A events (comprising 126 mergers and 1,261 acquisitions) that occurred between 2016 and 2017. Their empirical approach combines matching on pre-treatment developer and app characteristics with a staggered DiD design (as M&As do not occur simultaneously and treatment timing varies across developers).

In terms of empirical analysis,[271] they first classify targets by (i) age and (ii) primary business activity (communication apps and tools, developer tools, physical goods and services, digital content, advertising tools, AI/data analytics, cloud and storage, and related categories; based on own desk research using public sources rather than standard industry classifications). They document that nearly 60% of targets were four years old or younger and the majority of deals are not direct overlaps with the acquirer's core product, but involve adjacent or complementary activities. Based on the early acquisition timing (target firms were still young and experimenting with business models) and functional adjacency (target firms were active in business activities adjacent to the acquirer's main platform services), they conclude that many targets, even if not current rivals, could plausibly have evolved into future competitors to the acquirer's core services. Considering the Facebook/Instagram and Google/Waze mergers, they also document pre/post usage and engagement, finding that the targets experienced substantial growth and functional expansion within the incumbent's ecosystem. However, they do not conduct any counterfactual analyses of these mergers, nor frame their assessment as a merger retrospective with causal identification of effects on innovation or quality.

5.80 Looking at 175 Alphabet (Google), Apple, Meta (Facebook), Amazon, and Microsoft (GAFAM) acquisitions between 2015 and 2017, **Gautier and Lamesch (2021)** compile a dataset consisting of deal-level information on acquirer identity, target age, geographic origin, funding history (rounds and amounts), user group, and post-acquisition product status, assembled from Crunchbase, firms' 10-K filings, and manual tracking of product outcomes. The main descriptive finding is that around 60% of acquired products are discontinued, often within a year, where discontinuation is defined as no longer being supplied, maintained, or updated under the original brand name. Using Probit regressions, they also find that younger startups and acquisitions in the acquirer's core revenue segment (defined as the main income segment plus the user segment for social media platforms) have a significant correlation with discontinuation. However, the analysis is primarily descriptive, and Gautier and Lamesch explicitly state they cannot distinguish concerns around digital killer acquisitions from integration motives.

5.81 Extending this descriptive work on product discontinuation by looking at 329 GAFAM acquisitions between 2015 and 2021, **Gautier and Maitry (2024)** use detailed manual tracking of product outcomes to distinguish between (i) continued, (ii) integrated, (iii) inactive, and (iv) explicitly killed products. They find that fewer than one-third of acquired products remain available under their original brand, while around 58% are either inactive or explicitly discontinued. Probit estimates show that younger and less-funded targets are significantly more likely to be discontinued, and that Apple exhibits a particularly strong propensity to terminate acquired products, consistent with a unified branding strategy. While overall discontinuation is widespread, explicit 'killer' discontinuations—defined by formal shutdown announcements—are found to be statistically more likely when the target operates in the acquirer's main revenue-generating segment. The authors do emphasise that their evidence cannot establish anticompetitive intent or causal effects on innovation.

5.82 Focusing on the mobile app industry, **Affeldt and Kesler (2021)** study how GAFAM acquisitions affect prices, innovation, and data collection of any acquired apps within the Google Play Store. The authors construct a product-level dataset by web-scraping the Google Play Store quarterly from October 2015 to October 2019,

[271] In addition to the empirical analysis, Argentesi et al. (2021) also systematically discuss theories of harm in digital markets and qualitatively evaluate the reasoning of UK authorities.

covering between one and 2.5 million apps per quarter and over 30 million app–quarter observations, which they match to 54 identifiable GAFAM-acquired apps during the same period. The paper applies descriptive before–after comparisons and reduced-form cross-sectional comparisons between acquired and non-acquired apps and between continued and discontinued targets, looking at app and in-app prices, update frequency (as a proxy for innovation), number of installations, ratings, and privacy-sensitive permissions. The authors find that half of acquired apps, typically smaller and less innovative ones, are discontinued and that surviving apps tend to become free but are associated with increased data collection post-acquisition. Beyond the acquired apps themselves, GAFAM acquisitions are also associated with reduced innovation among rival developers: competing apps experience a lower probability of receiving updates following an acquisition, with the decline driven primarily by fewer feature updates. The evidence further suggests that affected developers reallocate innovation efforts towards unaffected apps and become less likely to launch new apps in markets where GAFAM acquisitions have occurred. As with the previous studies, this paper does not provide any causal interpretation of these acquisitions on dynamic effects.

5.83 After documenting a secular shift in the US from startup exit via IPOs to exit via acquisitions between 1985 and 2019, **Ederer and Pellegrino (2023)** show that this shift coincides with a rising opportunity cost of going public, reflected in an increasing entrant productivity premium.[272] Using text-based measures of product similarity from firms' 10-K business descriptions, they document that dominant technology firms—particularly GAFAM—have become increasingly insulated from product-market competition, supplying products with more unique characteristics and occupying low 'centrality' positions in product-market networks. They argue that these patterns are consistent with the hypothesis that extensive acquisition activity by dominant incumbents has contributed to higher barriers to entry and rising oligopoly power, though the evidence is again merely suggestive rather than causal.

5.84 **Ivaldi, Petit, and Ünekbaş (2024)** provide a retrospective, case-based analysis of European merger decisions involving large technology firms, looking at product-market outcomes and competitor responses. Using a sample of 12 transactions reviewed by the European Commission and involving major platforms (e.g. Apple, Google, Microsoft, Meta),[273] they propose a conceptual framework under which killer acquisitions are defined as those that lead to three post-merger patterns: (i) disappearance of the target's products, (ii) weakening of rivals, and (iii) reduced entry or innovation or competitive events in the industry. Relying on competitors' disclosures (notably SEC filings) to capture rival perceptions, sales dynamics, and industry developments, they find that in most transactions, targets' products or services continued to be developed or commercialised post-merger, rival firms did not exhibit consistent signs of weakened competitive performance, and industry-level indicators—such as new product launches, entry, and other competitive events—did not show a generalised decline in market dynamism. However, this study remains a qualitative case-study design without a clear counterfactual, limiting causal inference. Additionally, harm to competition can also occur even without the disappearance of the target's product, but through the internalisation of the counterfactual competition between the acquirer and the target.

[272] The entrant productivity premium measures how much more productive an entering firm is compared to the minimum productivity required to profitably enter the market. Thus, a higher entrant productivity premium provides suggestive evidence of higher barriers to entry.
[273] The final set of cases considered includes Apple/Shazam, Microsoft/LinkedIn, Microsoft/Skype, Facebook/WhatsApp, Google/Fitbit, Apple/Beats, Microsoft/ZeniMax, Microsoft/GitHub, SAP/Sybase, Oracle/Micros, Activision/King, and Verizon/Yahoo.

5.85 Looking at 252 GAFAM acquisitions between 1996 and 2021 for which the target had at least one US-granted patent before the acquisitions (out of 859 GAFAM acquisitions in this period in total), de **Barsy and Gautier (2024)** examine how acquired technologies are developed after takeover. They compare the patents related to these acquisitions to non-acquired but GAFAM-cited patents.[274] They proxy innovation by forward patent citations made by the acquiring firm and track the evolution of citations before and after takeover, controlling for patent age, calendar time, and firm-level heterogeneity, and benchmark these trends against comparable non-acquired patents with a DiD design. They find that an acquisition increases forward patent citations by the acquirer but only temporarily. After about 1.5 years, there is no longer a significant impact of the acquisition on the acquirer's forward patent citations. As citations by non-acquirers do not decline (ruling out simple technology-maturity explanations) and the decline in acquirer citations is more pronounced in technologies where the GAFAM acquirer is already strong, the authors interpret these results as indicating that a competitive motive could be driving the decline in forward patent citations of the targets.

5.86 Looking at more than 1,000 acquisitions by GAFAM firms and other major technology incumbents (Cisco, Intel, and Qualcomm) between 1996 and 2021, **Ederer, Seibel, and Simcoe (2025)** study the relationship between these acquisitions and patent-based innovation metrics. Linking acquisition records to patent and employer–employee data, they implement event-study and DiD designs at two levels: the technology-class level[275] and the patent level.[276] They document that acquisitions are concentrated in technological domains where acquirers already have patenting experience and that patenting activity in these domains typically accelerates prior to acquisition relative to matched control CPC groups, indicating selection into fast-growing technologies rather than pre-emptive suppression of nascent rivals. Post-acquisition, patenting within affected technology classes grows primarily when acquisitions are followed by further deals in the same domain, consistent with cumulative investment strategies, while isolated acquisitions show little effect. At the patent level, acquired patents receive significantly more forward citations after acquisition, including from third parties, suggesting increased diffusion and visibility. At the same time, the authors document substantial post-acquisition workforce attrition—exceeding 50% within three years—and show that citation gains are weaker when employee retention is higher, consistent with knowledge spillovers operating through labour mobility rather than internal integration. Overall, while not ruling out killer acquisitions in individual cases, the authors interpret the evidence as suggestive that, on average, patent-relevant digital acquisitions are associated with sustained or amplified innovation rather than systematic suppression.

5.87 Looking at 470 GAFAM acquisitions between 2009 and 2018, **De Melo e Lemos and Mendes Resende (2025)** provide a classification that distinguishes nascent competitors (young firms already offering a complete and substitutable product in the acquirer's market, albeit exerting limited competitive pressure) from potential competitors (firms active in adjacent markets that could become effective competitors subject to successful entry, scaling, or expansion into the acquirer's market). They reserve the term 'killer acquisition' for intentional post-merger shutdowns aimed at protecting a dominant position. The authors apply a multi-step

[274] More specifically, they compare 541 patents related to these acquisitions to about 70,000 non-acquired but GAFAM-cited patents.
[275] Defined as narrowly delineated six-digit Cooperative Patent Classification (CPC) groups, where innovation is measured by the number of patent applications filed within a CPC group in a given year.
[276] Defined at the level of individual patents owned by acquired firms, where innovation outcomes are measured using forward patent citations relative to other patents in the same CPC group and year.

qualitative screening based on target age, activity overlap and plausibility of competitive threat (based on a qualitative interpretation of public, deal-level descriptive information), and post-acquisition operational status. They find that the vast majority of acquisitions involve young firms supplying inputs, talent, or complementary technologies, consistent with integration or expansion strategies rather than horizontal elimination. Nevertheless, they identify 26 transactions (around 5.5% of the sample) as involving nascent competitors or potential killer acquisitions. While emphasising data limitations and the absence of causal identification, the study concludes that the risk of killer acquisitions in digital markets appears relatively infrequent though non-negligible.

5.4.2 Effect on other firms: kill zone concerns

5.88 Rather than considering concerns around killer acquisitions, where harm occurs through the discontinuation of the target's activities and future competitive threat post-acquisition, several papers consider concerns around kill zones, where harm occurs through the discouragement of future entry—effectively through a form of entrenchment.

5.89 In addition to the theoretical model discussed in Subsection 4.3.3, **Kamepalli, Rajan, and Zingales (2022)** provide descriptive event-study evidence showing that, following major acquisitions by Facebook or Google, VC investment and deal count in technologically close sectors decline sharply relative to other software acquisitions. They argue that this is consistent with a mechanism in which the expectation of rapid acquisition by an incumbent can itself suppress entrepreneurial entry and VC financing, even absent any post-acquisition shutdown. In a multi-sided platform model with network effects and adaptation costs, the prospect of early acquisition weakens third-party developers' incentives to commit to an entrant, thereby reducing user adoption, the entrant's standalone value, and ultimately the acquisition price. Anticipating this dynamic, venture capitalists rationally scale back investment.

5.90 Looking at a large panel dataset covering VC deals and GAFAM acquisitions across hundreds of technology industry segments worldwide between 2010 and 2020,[277] **Prado and Bauer (2022)** examine the relationship between these acquisitions and VC funding. Employing a staggered DiD approach, they find that GAFAM acquisitions are associated, on average, with increases in subsequent VC deal counts and funding in affected industry segments. These positive effects are statistically significant though transitory, typically fading after several quarters, and are observed both globally and within the US and Europe. The authors interpret these results as consistent with acquisitions serving as a positive signal of market potential and as an attractive exit opportunity for venture capitalists, which may stimulate entry and financing in related segments. At the same time, they emphasise that their analysis focuses on short-run funding responses and does not rule out longer-term deterrence effects on entry.

5.91 Looking at technology acquisitions by GAFAM firms relative to technology acquisitions in total, including by large technology companies and private equity firms, over the period 2010–'20,[278] **Jin, Leccese, and Wagman (2023)** use a technology taxonomy developed by S&P Global Market Intelligence to provide a descriptive comparison between GAFAM acquisitions and those by other top

[277] More precisely, the panel dataset covers 32,367 VC deals and 392 GAFAM acquisitions across 173 technology industry segments.
[278] More precisely, the sample examines 595 technology acquisitions by GAFAM firms relative to 35,844 technology acquisitions in total.

acquirers. They find that while GAFAM firms complete more technology acquisitions per firm and tend to acquire younger and more consumer-facing targets, their acquisitions are substantially less concentrated across technology categories than those of other top acquirers. The authors document an 'acquire-adjacent-and-then-expand' pattern, whereby GAFAM firms initially acquire targets in adjacent categories and subsequently broaden their acquisition scope. They find no evidence that GAFAM entry into a technology category through acquisition is associated with a subsequent slowdown in acquisition activity by other firms in the same category.

5.92 Looking at 772 GAFAM acquisitions between 1990 and 2020, **Gugler, Szücs, and Wohak (2025)** provide a joint assessment of the effects of these acquisitions on VC investment and patenting at the level of the affected technology groups.[279] They find that GAFAM acquisitions have a large negative effect on early-stage VC investment in affected areas, consistent with kill-zone mechanisms. At the same time, they find that the average effect on patenting is positive after 2010, suggesting intensified development and diffusion of technology post-acquisition. The authors also document substantial heterogeneity: around 14% of acquisitions reduce both VC investment and patenting, which they interpret as plausibly harmful transactions. These cases are more likely when deals are not publicly disclosed and when targets are more mature, while stronger competition among GAFAM firms[280] mitigates negative effects.

5.93 Looking instead at the product-market level, **Koski, Kässi, and Braesemann (2026)** study the effects of acquisitions by GAFAM plus IBM on subsequent market entry and VC financing. They define narrowly defined product markets, at a global level, between 2002 and 2021[281] based on a product-level industry taxonomy provided by Crunchbase that classifies startups according to their core products. They estimate causal treatment effects of the first acquisition by one of the acquirers within a product market and construct comparable control markets with similar pre-acquisition growth trajectories and industry characteristics.[282] In their preferred specification,[283] they find that entry rates and VC funding decline after acquisitions in affected markets relative to the control group. The authors emphasise that these deterrent effects may coexist with short-run efficiency gains within incumbents and other explanations such as that the acquisition of a particular startup signals that the market for similar firms is saturated or that the most promising target has already been taken, thereby discouraging future investment and producing a cooling effect.

5.5 Other specific sectors

5.94 This Section covers any remaining sector-specific empirical studies outside of those considered above. Some of these have been grouped within a wider category, and collectively they cover the categories of chemical industry, general manufacturing, aviation, medical sector, and LCD panels.

[279] Rather than focusing on targets or acquirers, they define treatment at the level of semantically proximate VC technology groups and narrowly defined patent classes, and employ matched DiD and staggered event-study designs.
[280] Which is captured by cosine similarity of 10-K product descriptions or similarity of patent portfolios across technology classes.
[281] In total, the sample contains 742 product markets.
[282] To do so, they use a staggered dynamic event-study design, exploiting variation in the timing of the first acquisition across product markets, and combine this with coarsened exact matching (CEM).
[283] Which involves balanced CEM data with five post-treatment years.

5.5.1 Chemical industry

5.95 Looking at leading global chemical firms between 1980 and 1991, **Ahuja and Katila (2001)** examine how acquisitions affect subsequent innovation output, distinguishing between technological and non-technological deals.[284] They find no significant relationship between non-technological acquisitions and subsequent patenting. For technological acquisitions, a larger absolute acquired knowledge base is associated with higher innovation output, though the effect is modest (a one-unit increase corresponds to roughly a 0.04% increase in patenting over four years). In contrast, a larger relative acquired knowledge base (the target's knowledge base relative to the acquirer's, capped at one) is associated with lower innovation output, consistent with integration and disruption costs. Finally, technological relatedness—measured as the overlap between the firms' knowledge bases relative to the acquired firm's knowledge base—exhibits an inverted-U relationship with innovation, suggesting complementarities at moderate overlap but diminishing returns when knowledge bases are too similar or too distant. However, the absence of an explicit counterfactual and remaining issues around endogeneity and selection bias limit the causal interpretation of these results.

5.5.2 General manufacturing

5.96 Several empirical papers consider the relationship between mergers and acquisitions and firm performance for all or most of the manufacturing firms within a country. These papers have looked at firm performance in terms of productivity or R&D spending. Some studies also examine cross-border M&As in the context of general manufacturing, focusing on how R&D activities may shift geographically between countries following such transactions.

5.97 Considering virtually all Swedish manufacturing firms,[285] plants, and employees (ca. 1.9 million) between 1985 and 1998, **Siegel and Simons (2010)** study the effects of plant-level ownership changes on productivity. Looking at plant-level TFP, they find a 'V-shaped' pattern in plant productivity around the time of the acquisition:[286] plants that change owners become less productive prior to acquisition, but

[284] The paper compiles a list of the largest chemical companies worldwide (as identified from industry trade publications) at the start of the period, which after consolidating subsidiaries and dropping cases with insufficient data consists of 30 European, 26 US, and 16 Japanese firms. In total the sample contains 72 chemical firms involved in 534 acquisitions. First, the 'knowledge base' of each firm is measured as the number of unique patents obtained in the five years prior to acquisition plus all distinct patents cited by those patents. Acquisitions are classified as technological if the target's technology (i.e. its knowledge base) was reported as a motivation or transferred asset, or if the acquired firm had patented in the preceding five years—criteria met by 283 of the 534 acquisitions. Innovation output is measured as the number of successful US patent applications per year. Using Poisson models with distributed lags of up to four years, estimated via generalised estimating equations (GEE) and including pre-sample patent counts to control for unobserved firm heterogeneity, the authors control for R&D inputs, firm size, diversification, foreign acquisitions, and technological acquisitions for which patent data are unavailable.

[285] Manufacturing firms here are those firms whose primary production activity is classified as manufacturing under Swedish industry codes, which covers activities such as food and beverages, textiles and apparel, wood and paper products, chemicals and pharmaceuticals, rubber and plastics, basic and fabricated metals, machinery, electrical equipment, and transport equipment manufacturing. The sample contains ca. 9,000 firms and ca. 19,000 plants in total, affected by ca. 3,500 plant-level ownership changes.

[286] TFP is measured at the plant–year level as the residual from an industry-specific Cobb–Douglas production function, using plant output and inputs of labour, capital, and materials. They compare plants experiencing an M&A to comparable non-M&A plants within the same industry (defined at the 5-digit SIC level, which can include direct competitors), and use panel data regressions with various controls and industry, time, and age fixed effects.

experience statistically significant improvements in productivity after the ownership change—relative to non-M&A plants. Over a five-year pre/post window, they estimate that plant productivity increases by around 1.7%. They also find evidence of post-merger downsizing, with output and employment declining by -8.9% and -12.2%, respectively, and productivity rising mechanically rather than through true efficiency gains; and of workforce 'upgrading' (increases in experience, the share of college-educated workers, and earnings). Firm-level performance does not decline following these ownership changes. They interpret the findings as consistent with improved sorting and matching of plants and workers to more efficient uses.

5.98 **Cefis and Marsili (2015)** investigate whether involvement in M&As triggers distinct patterns of innovative behaviour across firms, with particular attention to two properties of innovation dynamics: persistence in innovation and the ability to cross the 'innovation threshold' (i.e. the minimum level of innovative effort a firm must overcome to become an innovator, such as sunk costs associated with introducing a first new product). The authors argue M&As may give merging firms access to externally proven resources, capabilities, knowledge bases, and complementary technologies that would be costly or difficult to build internally, and therefore may make it easier to overcome the innovation threshold. The empirical analysis combines innovation survey data with registry data and draws on a panel of Dutch manufacturing firms with ten or more employees over the period 1994–2002.[287] The analysis first reveals that the probability of being a persistent innovator rises steadily with firm size, while the probability of exiting innovation states is highest for small firms and lowest for large firms. The study then shows that while M&A involvement helps SMEs primarily by enabling them to cross the innovation threshold, large firms (which are already persistent innovators ex ante) benefit most from M&As in sustaining innovative output. With respect to non-innovative large firms, the authors find that those become more likely to achieve innovative sales, but are not more likely to be involved in innovative activities (i.e. through introducing new products or generating new knowledge through R&D activities). The authors interpret these different outcomes as indicative of M&As in large firms being driven by market or strategic motives (such as achieving market dominance or entering new sectors) rather than by the pursuit of enhanced internal innovative capabilities.

5.99 Using a panel of Spanish manufacturing firms from 1990 to 2008, **Cefis and Triguero (2016)** look at how M&As are related to the acquirer's innovation sourcing strategies—distinguishing between internal ('make') and external ('buy') R&D.[288] They use a two-stage regression approach[289] and find that both internal and external R&D decline in the post-merger period, with effects materialising

[287] While the study reveals the total number of firm-survey wave observations (13,901), the number of distinct firms in the sample is not disclosed. A firm's innovative status is captured by two complementary binary indicators: engagement in innovative activities (such as introducing a new product or service, or positive R&D investment/innovation expenses) and positive turnover with innovative sales. To examine how a firm's past innovation behaviour shapes its future innovative status, the authors track how firms move between innovative and non-innovative states over time, comparing M&A active and non-active firms separately across three size classes, accounting for firm-specific characteristics.

[288] The sample contains 4,629 firms in total, out of which 406 firms were involved in 514 M&As. Manufacturing firms here are those firms whose primary activity is classified in manufacturing according to the Spanish CNAE/NACE industrial classification.

[289] Looking at R&D expenditure and taking into account that many firms report zero R&D expenditure, they model R&D as a two-stage decision (i.e. whether to conduct R&D and, conditional on doing so, how much to spend), and then examine the acquirer's total R&D intensity (R&D expenditure divided by revenue) as well as its decomposition into in-house R&D and external R&D (including contracted-out R&D, licences and patents, and technology acquisition from external sources).

around three years after the event and with the average reduction larger for external R&D. They interpret these patterns as consistent with post-merger rationalisation of R&D capacity and vertical integration of knowledge—i.e. replacing externally sourced technology with the acquired firm's knowledge base. However, the paper relies on within-firm fixed-effects comparisons without a matched counterfactual or explicit strategy to address selection into M&A, which means that changes in R&D intensity may reflect pre-existing trends or shocks driving both M&A activity and R&D decisions, limiting causal interpretation.

5.100 **Entezarkheir and Moshiri (2018)** examine whether mergers are associated with changes in innovation among publicly traded US manufacturing firms and whether these associations vary by market share, industry, and time horizon.[290] The results show a positive and statistically significant association between mergers and innovation across specifications. The positive association is stronger for firms with larger (pre-merger) market shares and varies across industries. Dynamic estimates further indicate that the long-run association exceeds the short-run association, suggesting that innovation gains linked to mergers become more pronounced over time. However, the paper's instrumental-variable strategy assumes that prior merger experience influences current innovation only through the merger decision itself, and not through other factors such as persistent firm capabilities or managerial quality.

5.101 Focusing on the role of common ownership (defined as indirect corporate networks of at least two competing firms held by overlapping sets of institutional investors) instead, **Gibbon and Schain (2023)** investigate whether common ownership in large European manufacturing firms contributes to the observed long-run rise in markups, and whether its effects on markups and innovation are heterogeneous with respect to the technological characteristics of industries.[291] The main findings show a positive effect of common ownership on firm markups that is significantly increasing with the degree of technological spillovers in an industry. For firms directly held by common institutional investors, common ownership is also associated with a positive effect on citation-weighted patents in high-spillover industries, while outsiders (i.e. competing firms not directly commonly owned) show no significant innovation response. These findings are presented as consistent with the theoretical predictions of López and Vives (2019) (as discussed in para. 3.76).

5.102 Finally, **Demirer and Karaduman (2024)** study whether mergers improve productive efficiency in electricity generation, focusing on acquisitions of US power plants and asking how ownership changes affect plant-level efficiency and through which mechanisms. The analysis uses a sample of 505 transactions covering 3,515 generator ownership changes over 2000–'23. Using hourly data on production outputs and inputs (consumption of fuel), the authors construct a quantity-based efficiency measure (heat rate). Implementing a DiD estimator, the authors compare the efficiency of acquired plants to those not involved in acquisitions. Results show

[290] The authors use an unbalanced panel of 642 mergers between 1980 and 2003 and measure innovation primarily through citation-weighted patent stocks. They employ firm and time fixed-effects models, instrumental-variable specifications based on acquiring firms' prior merger experience, propensity-score matching combined with DiD, and dynamic panel models.

[291] The sample consists of 7,229 large European manufacturing firms (more than 250 employees and over EUR 50 million in average turnover) drawn from 35 European countries over the period 2005 to 2016. The treatment is a binary indicator taking the value one in markets in which at least one additional investment by an institutional investor creates common ownership links between competitors for the first time. To address selection bias stemming from non-random investment decisions by institutional investors, the authors apply a propensity score reweighting estimator combined with panel fixed-effects regressions. Markups are inferred structurally and innovation output is measured by forward citation-weighted patents.

that acquired generators experience an average efficiency increase of about 2%, with gains rising to 5% when ownership changes occur at the subsidiary (direct owner) level and no statistically significant change when only parent ownership changes. Efficiency improvements are found to begin about five months after acquisition and stabilise after eighteen months. To better understand the nature of efficiency gains, the authors also analyse other dimensions of plant performance beyond efficiency and find that acquisitions are associated with higher generation, higher capacity utilisation, and a reduction in outages.

5.103 A structural decomposition attributes three-quarters of the efficiency gain to improvements in productive efficiency (i.e. through improving the performance of individual generators) and the remaining share to dynamic efficiency (i.e. optimising production allocation dynamically within a plant to reduce adjustment costs), with little evidence for portfolio reallocation effects (i.e. through improving the allocation of production across generators). Further analysis indicates that improvements in productive efficiency operate primarily through operational changes rather than capital investment: about 55% of acquired plants replace managers within one year, and incoming managers are 5 percentage points more likely to hold a master's degree and 4 percentage points more likely to hold a bachelor's degree, while there is no significant increase in CAPEX or non-fuel costs. This finding is argued to be consistent with efficiency gains arising from operational improvements (e.g. personnel training, adopting best practices) rather than equipment upgrades through capital investments. Additional analyses indicate that acquiring firms are on average 1.7% more productive than target firms, and that the acquired assets initially underperform the seller's other assets by about 3%, consistent with patterns where more productive firms purchase underperforming plants and raise their performance after acquisition.

5.104 **Wei, Wang, and Ma (2025)** investigate whether M&A activity promotes the optimal allocation of industry resources through technology diffusion or whether it leads to market power.[292] The baseline results show M&A is positively associated with industry-level productivity. This positive effect holds separately for both acquiring and non-acquiring firms, though the gains of acquiring firms are significantly greater, which the authors argue reflect the proactive diffusion through direct technology integration outweighing passive spillover to non-participants. In addition, this asymmetry raises average industry TFP while simultaneously widening the inter-firm productivity gap. Heterogeneity analysis reveals that M&A more strongly promotes efficient resource allocation in industries at the maturity stage, with low R&D intensity, low government support, and weak IP protection.

5.105 Other studies in the context of general manufacturing focus on the role of cross-border M&As, in which the involved companies are based in different countries. A key question surrounding cross-border M&As is how R&D activities change following the transaction, and, in particular, if and how R&D activities relocate geographically between host and target country. Studies on cross-border M&As are situated frequently in the context of general manufacturing industries, since these industries

[292] The study looks at 2,938 M&As from Chinese listed companies in high-tech manufacturing industries covering the period 2015 to 2023, aggregated into 834 industry-province observations. The study constructs an industry-level panel and estimates a two-way fixed-effects model, using the natural logarithm of total M&A transaction volume as the core explanatory variable and the mean TFP of firms within an industry as the measure of industry resource allocation efficiency. Control variables include industry concentration (captured by HHI), R&D intensity, profitability, industry age, regional openness, and regional economic development level. To disentangle the dual mechanisms, the paper separately examines the TFP of acquiring and non-acquiring firms, and employs a mediation framework using the knowledge stock of firms (technology diffusion channel) and the HHI (market power channel).

are typically larger and include many firms, which makes it easier to assemble sufficiently rich and comparable firm-level datasets across different countries than in more narrowly defined sectors or country-specific settings.[293]

5.106 For example, **Bertrand and Zuniga (2006)** examine the effects of domestic and cross-border M&As on industry-level R&D investment. Drawing on a panel of 14 OECD countries and 17 manufacturing sectors over the period 1990–'99, they relate private R&D expenditure at the industry level to the cumulative number of domestic and cross-border M&A transactions in each industry during the preceding three years.[294] They find that M&A activity is not linked to higher domestic R&D investment, indicating a weak overall relationship between the 1990s M&A wave and innovation. However, positive effects are observed in low-technology industries, while no significant effects are found in high-technology sectors. Although domestic and cross-border M&As show no major overall differences, the effects vary across industry groups: domestic M&As are positively associated with R&D investment in low-technology sectors, but negatively in medium-technology industries. By contrast, inward cross-border M&As are linked to higher R&D investment in medium-technology industries, while outward cross-border M&As show no significant relationship with R&D investment. The authors conclude that foreign acquisitions do not generally reduce domestic R&D activity and may even increase R&D investment in some sectors.

5.107 Investigating the effect of foreign acquisitions on the R&D activity of French target firms over the period 1994–2004, **Bertrand (2009)** focuses on horizontal cross-border acquisitions[295] and shows that foreign acquisitions have a positive and long-run impact on R&D budgets. Three years after the takeover of the firm, aggregate R&D investment grows by almost 15%. The author also provides heterogeneous analysis distinguishing this effect for internal and external R&D (i.e. outsourced R&D activities) and shows that acquisitions lead to a higher level of both components, with an increase materialising one year after the acquisition. R&D is more contracted out to local research providers, in particular to public laboratories and universities, while no significant increase is found for R&D outsourced abroad. Investments in internal development, as well as in basic and applied research, increase significantly. The growth of R&D spending is financed by a rise in internal resources and by increased financing from foreign partners, especially parent companies.

5.108 To investigate which domestic firms are acquired by foreign multinationals and whether foreign acquisitions increase firm-level innovation, **Guadalupe, Kuzmina, and Thomas (2012)** use panel data of Spanish manufacturing firms from 1990–2006.[296] They combine a theoretical model, which illustrates how the selection and innovation decisions are jointly determined, with empirical analysis.[297] The core

[293] For cross-sectoral studies on cross-border M&As, see Section 5.6.
[294] In total around 50,000 transactions, including only mergers exceeding a transaction value of $1 million. The authors estimate a generalised R&D investment model in which private R&D is specified as a multiplicative function of past R&D expenditure, M&A activity, and several control variables, including labour costs, foreign competition intensity, and corporate taxation.
[295] The sample contains 123 acquisitions that occurred between 1995 and 2001 and involved innovative manufacturing firms. To address potential selection bias, the study combines a propensity score matching approach, where propensity scores are estimated using a probit model and matching is conducted within the same industry and year, with a DiD estimation strategy.
[296] The survey data contains yearly information of approximately 2,800 firms on ownership, productivity, exports, and specific innovation activities (product, process, new machinery, organisational practices, and foreign technology adoption).
[297] They first estimate selection into foreign acquisition using linear probability models and show strong positive selection: foreign firms 'cherry-pick' the most productive domestic firms. To address selection when estimating the treatment effect of foreign acquisitions on innovation, they exploit the

empirical findings are that, even after accounting for positive selection, foreign acquisition raises sales (18%) and labour productivity (11%) and significantly increases innovation: acquired firms are more likely to innovate, purchase new machinery, adopt new organisational practices, and assimilate foreign technologies. The evidence supports a mechanism in which foreign parents expand subsidiaries' market access through export channels and thereby increase the incentives and returns to investing in innovation, rather than simply transferring a uniform superior technology to any acquired firm.

5.5.3 Aviation

5.109 Two empirical papers investigate the potential role of learning-by-doing and coordination as potential dynamic efficiencies following three mergers in the US aviation sector (aircraft and passenger transport).

5.110 Looking at the 1997 Boeing/McDonnell Douglas merger in the market for medium-sized wide-body aircraft, **An and Zhao (2019)** examine potential dynamic efficiency effects of this merger, defined as cost reductions and productivity improvements arising from learning-by-doing and potential within- and cross-firm spillovers. After documenting a decrease in post-merger aircraft prices relative to both the pre-merger period and other aircraft categories, they develop a dynamic oligopoly game with learning-by-doing to explain this price drop.[298] Their estimates indicate strong within-firm spillovers and negligible cross-firm spillovers, implying that the merger allowed Boeing to internalise and redeploy McDonnell Douglas's experience more efficiently. Counterfactual simulations based on the model's structural assumptions show that, once learning-by-doing is accounted for, the merger can generate substantial dynamic efficiencies that outweigh increased market power (estimated at $5.14 billion gain in consumer surplus when including dynamic efficiencies and $0.92 billion static loss when excluding these efficiencies).

5.111 Looking at the Delta/Northwest (2008) and Continental/United (2010) mergers in the market for domestic airline passenger transportation services, **Chen and Gayle (2019)** provide a retrospective analysis of how these mergers affect product quality rather than prices. They develop a theoretical motivation in which mergers can improve quality through network integration and operational efficiencies (which they call the coordination effect) while also reducing quality through reduced competition (which they call the incentive effect). Quality is measured using 'routing quality', defined as the ratio of nonstop distance to itinerary distance, which captures travel convenience and is validated through a demand model. Using reduced-form DiD regressions, they find that both mergers increased routing quality in markets where the merging airlines did not compete prior to the merger, but reduced routing quality in markets where they were direct competitors. They also find that the quality effects of mergers exhibit a U-shaped relationship with pre-

panel structure of their data and combine a propensity score reweighting approach with a fixed effects estimator.

[298] In this model, firms' marginal costs decline with accumulated production experience, with the learning parameter getting transposed to the merging party post-merger, i.e. voluntary within-firm spillovers. There may also be (involuntary) cross-firm spillovers from this experience. They calibrate and estimate the model using aircraft-level data on prices, deliveries, and characteristics combined with firm-level production and cost information, recovering demand parameters via a nested logit model and identifying learning-by-doing and spillover parameters from the joint evolution of prices, quantities, and accumulated production experience over time, which are then used to simulate counterfactual merger and no-merger outcomes. Due to limited data availability, the learning curve is estimated through cost information for an aircraft produced by Lockheed, which was not part of the analysed Boeing/McDonnell Douglas merger and which the authors recognise could lead to a non-negligible difference in the learning curve and affect the model's performance.

merger competition intensity, particularly for the Continental/United merger (with quality improvements lowest at moderate levels of competition, because firms are close enough substitutes for the merger to sharply weaken quality incentives, but not so competitive that low pre-merger profits already limit incentives for costly quality provision). When translating these quality changes into welfare using estimated demand elasticities, they find economically meaningful consumer welfare losses in overlapping markets that can offset gains elsewhere. Overall, the study shows that merger-related dynamic efficiencies through coordination can coexist with, and in some markets be outweighed by, reduced incentives to provide quality.

5.112 Similarly, **Doi and Ohashi (2019)** also investigate the role of product quality, measured by flight frequency, in the context of the 2002 merger between Japan Airlines and Japan Air System.[299] Results from reduced-form regressions show that the merger (including remedies) lowered prices on average while increasing flight frequency and passenger volumes. On merger-to-monopoly routes, prices increased but flight frequency and passenger numbers also rose. The authors then estimate a structural model and run counterfactual simulations[300] which show that, because of endogenous flight adjustments, the merger led to improvements in both consumer surplus (by 3.2%) and social welfare (by 5.8%), with consumer welfare increasing in a statistically significant fashion only on routes not affected by the merger. Moreover, the authors also estimate that the merger reduced the merged carrier's marginal costs by roughly 3–4%, with efficiency gains more pronounced in marginal costs per flight than in marginal costs per passenger and larger on higher-volume routes. In addition, the authors show that non-merging operators responded to the merger by increasing flight frequency on merger-to-oligopoly routes. Finally, the authors also find that the slot-transfer remedies imposed by the competition authority had only limited effects on merger outcomes, largely because they did not induce entry on the merger-to-monopoly routes where adverse competitive effects of the merger were concentrated.[301]

5.5.4 Banking

5.113 Several papers investigate the effects of M&A activities in the banking sector, focusing on their impact on lending behaviour, efficiency, competition, and firm value.

5.114 Examining US bank mergers from 1985–'96, **Houston, James, and Ryngaert (2001)** determine whether mergers create shareholder value and, if so, where these gains are sourced.[302] First, the authors provide descriptive evidence by comparing market stock reactions (measured as abnormal returns) of acquirer and

[299] Using monthly route-level observations for 274 routes from the Japanese domestic airline market between 2000 and 2005, the authors first conduct a DiD analysis and then estimate a structural model in which airlines simultaneously choose prices and flight frequencies while consumers choose among air-travel alternatives in a nested-logit demand framework. The supply side incorporates endogenous quality choice and allows the authors to recover marginal costs per passenger and per flight and to simulate counterfactual market outcomes.

[300] On the demand side, consumers choose among airline products in a nested-logit framework, where demand depends on fares and flight frequency. On the supply side, airlines simultaneously choose prices and flight frequencies, allowing product quality (flight frequency) to respond endogenously to market conditions.

[301] The estimates also reject the hypothesis that the merger facilitated coordinated effects between merged and non-merged airlines. The authors compare a model in which airlines continue to set prices independently after the merger (Bertrand competition) with a model allowing for greater post-merger coordination. Because the independent-pricing model fits the data better, they conclude that the merger does not appear to have increased coordination between the merged carrier and its rivals.

[302] The sample contains 64 large (exceeding 1985 inflation-adjusted $400 million of deal value) mergers in total.

target firms around the announcement date of the merger. They find that the market value of the acquiring bank decreases, whereas the market value for the target bank increases, resulting in an overall increase of the combined market value of both parties by 13% on average. Second, for a subsample of 41 mergers, the authors obtain explicit management forecasts of cost savings (e.g. by eliminating redundant managerial positions) and revenue enhancement (e.g. by cross-selling of bank services) caused by the merger. Using this information, they estimate the present value of the projected merger gains and run cross-sectional OLS regressions relating the estimated present value of projected gains to announcement-period market stock reactions. This approach allows them to assess whether markets place greater weight on projected cost savings or revenue synergies. The authors find that the primary source of expected merger-related gains is cost-savings, mainly stemming from the opportunity to cut costs by eliminating overlapping operations and consolidating backroom operations, whereas revenue-enhancements (which may include both dynamic efficiencies that increase demand and market power effects) are far less important.

5.115 **Sapienza (2002)** studies the effects of bank mergers on individual business borrowers using a dataset of private Italian banks and Italian manufacturing firms from 1989 to 1995.[303] The author uses panel OLS regression with firm and time fixed effects to examine how consolidation affects the credit conditions offered to existing borrowers of the merging institutions. She finds that in-market mergers (i.e. mergers between banks previously operating in the same geographical market) involving banks with small local market shares are associated with lower interest rates, consistent with efficiency gains. For these mergers, interest rates decrease up to 41 basis points. The decrease in interest rates is smaller for out-of-market mergers, i.e. mergers between banks previously operating in different geographical markets. On the contrary, for in-market mergers involving a target with sufficiently large market shares (above 6.15%), the market power effect dominates the efficiency gain effect, and interest rates increase significantly (by up to 80 basis points). The author also examines how the effects of consolidation vary across borrowers. She finds that for borrowers with many banking relationships, even very large mergers are linked to a decrease in interest rates, suggesting that borrowers with more bank relationships have more bargaining power than borrowers with fewer bank relationships. Finally, the author runs a Probit regression to study the probability for a loan contract to be terminated after a merger. She finds that small borrowers of target banks are more likely to have their lending relationship discontinued after the merger.

5.116 **Coccorese and Ferri (2020)** study the wave of mergers among Italian mutual cooperative banks (BCC) and focus on the potential trade-off between cost efficiency gains and loss in banking diversity (i.e. the coexistence of different banking models, in particular small and locally oriented banks alongside larger banks) resulting from consolidation. The authors use annual balance sheet data on banks of all types (i.e. not only BCCs) between 1993 and 2013.[304] They find that statistically significant

[303] The sample contains 819 private Italian banks and 9,068 Italian manufacturing firms. During this time period, 138 mergers occurred involving the banks in the sample. For each firm, the data contains quarterly information on loan contract terms (e.g. interest rates) made with each bank.

[304] The sample contains 1,079 banks in total. The authors adopt a two-step empirical strategy. First, the authors exploit the whole sample of banks to apply a stochastic frontier analysis (a stochastic frontier analysis estimates the best possible performance (e.g. minimum cost) given firms' inputs and then measures how far each firm is from that benchmark. Importantly, it separates deviations into random noise (bad luck, measurement error) and actual inefficiency) to estimate annual, bank-level cost efficiency scores ranging between 0 and 1. Second, focusing on the subsample of BCCs, they regress the estimated efficiency scores on a set of merger dummies (never merged, before the first merger, merged once, merged twice, etc.), while controlling for additional bank-level

cost efficiency gains materialise only for approximately 5% of mergers, namely for BCCs that merge three times, and the gains become larger with the fourth merger (an increase of 6.6% relative to the sample mean). However, this only considers the estimated cost efficiency scores, not subsequent retail prices. The authors also argue that the subsequent increase in BCCs' size may weaken the position of smaller borrowers.

5.5.5 Medical sector

5.117 A diverse set of empirical papers have studied different markets related to the medical sectors. **Karim and Mitchell (2000)** study how firms in the US medical sector between 1978 and 1995 use acquisitions to achieve long-term business reconfigurations, focusing on product line addition, retention, and deletion as forms of changing resourcing.[305] They compare post-acquisition evolution of business reconfigurations across acquirers, targets, and non-acquiring firms and find that acquisitions are associated with substantially greater reconfiguration, and that targets tend to experience more pronounced change than acquiring firms—which the authors argue is consistent with a view in which acquisitions enable and accelerate the reshaping of business scope. The paper also distinguishes 'path-dependent' (resource-deepening) adjustments from 'path-breaking' (resource-extending) change. While resource-deepening is more prevalent on average, acquisitions also facilitate extension into substantially different resources in identifiable circumstances. Although business reconfigurations can be associated with various post-merger benefits and harms, the paper does not identify what these are. Additionally, the simple comparison between acquiring, targets, and non-acquiring firms, without controlling for endogeneity or selection effects, limits the causal interpretation of the results.

5.118 **Valentini (2012)** focuses on how M&A relates to the quantity and quality of inventive output within the US industry for medical devices and photographic equipment between 1988 and 1996. Inventive output is measured in terms of patent counts, while the quality is measured alongside three commonly used patent-quality metrics: impact (forward citations), generality (breadth of citing fields), and originality (breadth of cited prior art).[306] The author finds that M&As are associated with an increase in patenting volume of the acquirer relative to the control group, but with declines in impact, originality, and generality—consistent with a shift towards more incremental, narrower inventions even when total patented output rises. The paper interprets this pattern through a combined resource- and incentive-based lens, arguing that while knowledge recombination and scale can raise patenting counts, post-deal organisational incentives and integration frictions may tilt R&D towards shorter-horizon, lower-variance projects.

5.119 Finally, **Atella, Ceschin, and Decarolis (2025)** provide an ex post evaluation of prices and quality following the 2015 Zimmer/Biomet merger in Italy, which

characteristics. To account for the bounded nature of their dependent variable, the authors apply both a double-censored Tobit model as well as an OLS regression with a logistically transformed version of the cost efficiency score. They discuss potential endogeneity of a BCC's decision to merge and test for it within an IV framework, concluding that a BCC's decision to merge is exogenous. To account for potential selection bias, i.e. systematic differences between the group of merging and non-merging BCCs, the authors employ a propensity score matching approach.

[305] The dataset includes more than 3,000 firms that offered more than 200 product lines. The US medical sector is defined here at the product-line level, encompassing all US firms with at least one medical-related product line (e.g. pharmaceuticals, medical devices, diagnostics), rather than relying on a single SIC industry classification.

[306] The author applies a matching estimator to compare 159 acquiring firms to up to four observationally similar non-merging firms (which can include competitors).

involved the public procurement of orthopaedic prostheses. Using contract-level procurement data for all Italian tenders above the reporting threshold between 2012 and 2019, their baseline estimates indicate that the merger led to a 7.6% reduction in discounts over the reservation price (i.e. an increase in net prices), and that these price effects are concentrated in the first three post-merger years and attenuate thereafter.[307] Beyond prices, they report no detectable short-run deterioration in clinical quality (using revision interventions). However, they do find a post-merger decline in patenting activity, measured in terms of simple patent counts, though this is presented as a descriptive rather than causally identified innovation outcome.

5.5.6 LCD panels

5.120 Providing an industry-wide analysis of innovation and market structure in the global LCD panel industry between 2001 and 2011, **Igami, Kusaka, Qiu, and Tran (2025)** combine data on prices, quantities, costs, and fabrication-plant investments with a structural model. Exploiting product-level sales data and cost information,[308] the authors quantify the welfare contributions of product innovation (larger panel sizes and expanded product variety) and process innovation (vintage capital embodied in new fabrication plants and learning-by-doing). They find that product innovation accounts for 71% of total welfare gains over the period, while process innovation contributes close to 35%,[309] with substantial heterogeneity across segments and stages of the product life cycle—product innovation being particularly important in the emergence of LCD TVs, and process innovation dominating in more mature notebook and monitor markets. Despite large positive social returns to innovation, industry-wide private returns are mediocre, with substantial heterogeneity across firms. Using counterfactual merger simulations that aggregate firms' incentives to invest, the authors show that while the effect on static total surplus (i.e. total surplus not taking into account any merger-specific efficiency gains or feedback from dynamic incentive effects) is almost always negative, approximately two-thirds of simulated mergers in all different combinations considered (7-to-6, 6-to-5, etc.) lead to decreases in investment incentives, and one-third of all mergers lead to increases in investment incentives.[310] They also conclude that these effects are highly heterogeneous.

5.6 Cross-sectoral studies

5.121 In this Section we discuss empirical papers related to mergers and acquisitions and their effect on innovation, but not specifically related to specific sectors. The papers are clustered by academic field—business and management studies, IO, and

[307] They implement a DiD design in which pacemakers (and related cardiac stimulation devices) serve as the control group—which they motivate with reference to broadly stable concentration trends and comparable procurement features.
[308] This cost information is based on the engineering model of unit cost by display search, which is an engineering-based cost model that replicates the average unit manufacturing cost for each product (defined by size, resolution, and backlight type) at any fabrication plant of any firm in each quarter. The model breaks down costs by key materials and components and separates cash costs from depreciation.
[309] The authors compute the welfare gains from both product and process innovations by hypothetically eliminating each type of new product and new process at a time and then compare actual and counterfactual welfare outcomes for both scenarios. Thus, the shares of individual welfare contributions of both product and process innovations come from separate counterfactuals and do not necessarily have to add up to 100%.
[310] The only exceptions are two-to-one mergers, in which 95% of all mergers have a positive investment incentive effect; however, the authors refer to mergers in this combination as 'knife-edge cases' being 'too special for any broader policy implications'.

corporate finance—in part to highlight the relevant methodological advantages and limitations.

5.6.1 Business and management studies

5.122 Within business and management studies, empirical research on mergers and acquisitions and innovation primarily treats acquisitions as strategic and organisational decisions that reshape firms' internal capabilities, knowledge bases, and incentive structures. These studies typically draw on theories of knowledge relatedness, capabilities, absorptive capacity, organisational control systems, and managerial cognition, and frequently combine firm-level quantitative data with surveys, case studies, or patent-based measures of firms' knowledge base.[311]

5.123 The main comparative advantage of these papers is that they provide qualitatively detailed considerations on possible mechanisms affecting innovation, often using surveys, case studies, and patent-based constructs. However, the evidence in these studies is often based on small and non-random samples, self-reported data, with limited use of counterfactuals or exogenous variations, which limits the strength of the causal identification.

5.124 Considering whether acquisitions curtail the 'championing process' whereby organisation members internally promote new products and processes in firms, **Hitt, Hoskisson, Ireland, and Harrison (1991)** provide an early study on how acquisitions correlate with R&D intensity (R&D expenditure over sales) relative to industry average and patent intensity (patents over sales). Relying on 191 US acquisitions between 1970 and 1986 across 29 industries, they find a significant decline in both (industry-adjusted) R&D intensity and patent intensity following acquisitions. This early study only relies on a pre/post comparison of acquiring firms, without a matched non-acquiring control group, which weakens a possible causal interpretation of their findings.

5.125 **Hitt, Hoskisson, Johnson, and Moesel (1996)** use a CEO-level survey to examine how firms' participation in the market for corporate control—through acquisitions and divestitures—relates to internal strategic and financial control systems and to internal (i.e. R&D, new product development) versus external innovation (asset purchases).[312] Combining survey and firm-level data of US industrial manufacturing firms, the authors test an integrated model that examines how activity in the market for corporate control, internal control mechanisms, and

[311] There is also a substantial body of largely conceptual work within strategic management that considers for example the so-called 'dynamic capabilities' of firms to sense and seize opportunities over time—see in particular Teece, Pisano, and Shuen (1997), Eisenhardt and Martin (2000), Hagedoorn and Duysters (2002), Teece (2007), Helfat, Finkelstein, Mitchell, Peteraf, Singh, Teece, and Winter (2009), Teece (2018), and Schilke, Hu, and Helfat (2018). Related work applies routine-dynamics and process perspectives to M&A integration and synergy realisation—see, for example, Mirc, Sele, Rouzies, and Angwin (2023). While this literature provides an alternative perspective on how and when mergers may generate dynamic effects, some of its central concepts are difficult to operationalise empirically. Moreover, because much of the evidence is case-based or qualitative, it typically provides a different form of empirical support from causal empirical work in economics, business studies, and finance, with more limited scope for isolating causal effects. See e.g. Arend and Bromiley (2009) for a critical reflection. We therefore abstract from this literature in our synopsis.

[312] They contacted 776 US industrial manufacturing firms that reported R&D annually from 1985–'91 and held at least $25 million in assets, receiving 286 responses, of which 36 were later excluded because their divestiture programs had already concluded (i.e. they were no longer actively restructuring).

firm innovation are related.[313] They find that firms more active in acquisitions and divestitures rely more on financial controls (i.e. objective, short-term, outcome-based criteria such as return on investments (ROI), cash flow, accounting returns, and formal MIS reports) and less on strategic controls (i.e. subjective, strategy-oriented, long-term evaluative processes based on strategic criteria and rich information exchange, including formal and informal face-to-face interactions between corporate and business-unit managers). This governance shift is associated with lower internal innovation, while more active acquirers are also more likely to pursue innovation externally. The authors argue that engagement in the market for corporate control reshapes organisational context and incentives in ways that systematically disadvantage internally generated innovation. However, the identified relationships remain correlational and potentially endogenous, limiting causal claims about whether and how mergers and divestitures drive changes that affect innovation.

5.126 **Cassiman, Colombo, Garrone, and Veugelers (2005)** analyse how technological and market relatedness between merging firms determine post-merger innovation outcomes. They develop a conceptual framework distinguishing mergers between technologically overlapping (substitutive) and technologically complementary firms, with product-market rivalry further moderating effects. Empirically, they study EU M&A cases in medium- and high-tech sectors using detailed case studies and a structured questionnaire covering more than 50 indicators of R&D inputs, outputs, performance, organisation, and mission.[314] The evidence suggests that technologically complementary mergers are associated with higher post-merger R&D effort and stronger gains in R&D productivity, consistent with scope economies and knowledge synergies. By contrast, technologically substitutive mergers are linked to R&D cutbacks, greater rationalisation, loss of key personnel, shorter R&D horizons, and weaker efficiency gains, with these negative effects more pronounced when the firms were product-market rivals—although many results lack strong statistical significance. The authors also note that many deals were primarily market-driven rather than innovation-driven, supporting their argument that R&D outcomes reflect not only knowledge complementarities but also indirect effects of product-market integration and restructuring.[315]

5.127 The deal-level and in-depth case study design allows Cassiman, Colombo, Garrone, and Veugelers to observe the specific organisational mechanisms through which mergers reshape R&D processes. At the same time, unavoidably, the small, non-random, self-reported sample, and absence of a control group put limits on the ability to generalise and to draw causal inference about the effect of M&A on innovation.

5.128 Building on earlier work by Ahuja and Katila (2001) that looks at the chemical sector (see Subsection 5.5.1), **Cloodt, Hagedoorn, and van Kranenburg (2006)** focus on the role of the size and relatedness of the acquired knowledge base for acquiring firms in high-technology industries. Using a panel of firms in aerospace and defence, computers and office machinery, pharmaceuticals, and electronics and

[313] The authors use factor analysis to identify latent constructs (activity in the market for corporate control, internal control systems, innovation) and path analysis to estimate directional links among them.

[314] The sample contains 31 EU M&A cases involving a total of 62 firms. Interview data from senior R&D and strategy managers are cross-checked with company documents, and principal component analysis is used to build synthetic deal-level indicators capturing multidimensional changes in the R&D process rather than firm-level aggregates.

[315] **Cassiman and Colombo (2006)** situate these findings within a broader framework on M&A and innovation, incorporating additional conditioning factors (e.g. motives, cross-border integration, prior ties) and elaborating the mechanisms through further case narratives.

communications, they analyse M&A events between 1985 and 1994.[316] They find results consistent with those of Ahuja and Katila, that is, the technological relatedness exhibits an inverted U-shaped relationship with innovation, indicating that moderate—rather than very high or very low—knowledge overlap is most conducive to post-merger innovation. However, Cloodt, Hagedoorn, and van Kranenburg do find that non-technological deals are associated with lower post-merger innovation performance, and that the innovation benefits of large technological acquisitions are short-lived, suggesting stronger integration frictions and faster knowledge obsolescence than in the chemicals setting. As with Ahuja and Katila, the absence of an explicit counterfactual and remaining issues around endogeneity and selection bias limit the causal interpretation of these results.

5.129 **Desyllas and Hughes (2010)** examine whether high-technology acquirers improve post-acquisition innovation and which firm characteristics shape outcomes. Studying acquisitions by US high-technology firms[317] over 1984–'98, they combine firm financial data with measures of R&D intensity (R&D/assets) and R&D productivity (patents per unit of R&D).[318] On average, acquirers show an initial dip followed by increases in R&D intensity, but no systematic improvement in R&D productivity. Effects are heterogeneous. In related acquisitions (acquirer and target share the same 3-digit SIC code), a larger prior knowledge base is linked to higher post-merger R&D productivity, consistent with stronger absorptive capacity. In unrelated deals, greater knowledge concentration is associated with lower productivity, consistent with core rigidities (where entrenched capabilities and routines limit adaptation and integration of new knowledge). Financial structure also matters: higher leverage levels are associated with R&D productivity gains (monitoring effects), while rapid leverage growth constrains R&D intensity, indicating financing pressures and short-termism.

5.130 **Makri, Hitt, and Lane (2010)** examine how the nature of knowledge relatedness between merging high-technology firms shapes post-merger inventive performance, distinguishing explicitly between 'similarity' and 'complementarity' in both 'scientific' and 'technological' knowledge domains. Using a sample of mergers and acquisitions completed in 1996 in the drug, chemical, and electronics industries,[319] they analyse post-merger invention outcomes through patent-based indicators, focusing on invention quantity, quality (e.g. citation intensity), and novelty, and estimate the effects of different relatedness configurations on these outcomes. The results show that complementarities in both scientific and technological knowledge are consistently associated with higher-quality and more novel post-merger inventions, while similarities tend to support more incremental

[316] Their sample contains 347 firms participating in 2,429 M&A events. Innovative performance is measured through patent counts, and the empirical strategy relies on panel count-data models (random-effects negative binomial) with distributed lags, combined with GEE to address serial correlation and unobserved heterogeneity. Similar to Ahuja and Katila, the authors control for the number of non-technological acquisitions, the absolute and relative size of the acquired knowledge base, and technological relatedness between acquirer and target.

[317] High-technology firms are defined by SIC codes.

[318] The sample contains a panel of 2,624 acquisitions in total. To address acquisition endogeneity, they apply propensity score matching to construct counterfactual non-acquirers based on lagged firm characteristics capturing size, performance, financial structure, and innovation profile (which may include direct competitors). They estimate post-acquisition changes over three years, controlling for deal characteristics and pre-merger attributes such as knowledge base size and concentration, and leverage.

[319] The sample contains 95 M&As in total. The authors use 1994–'96 as the pre-merger baseline window and track within-firm changes in invention outcomes three to five years after completion. They construct fine-grained measures of knowledge relatedness based on firms' patent and science profiles, allowing them to separate science from technology and to capture both overlapping and complementary knowledge positions.

invention in existing domains. In particular, complementary science is associated with exploratory search and more discontinuous innovation, whereas similarity mainly facilitates exploitation through absorptive capacity. However, the study uses only a sample of completed mergers, without a non-merging control group or exogenous variation, which limits the causal interpretation of the results.

5.131 Similar to Makri, Hitt, and Lane (2010), **Sears and Hitt (2023)** highlight how differences in the merging entities' knowledge base can affect post-merger innovation performance. They study how the effects of mergers on post-acquisition integrative invention performance (defined as patents jointly developed by pre-acquisition target and acquirer inventors) depend on differences in the quality of technological capabilities between targets and acquirers. In addition, they examine if and how structural integration of the target into the acquiring firm influences this effect. Drawing on a framework centring around knowledge-exchange among workers, the authors argue that larger quality differences generate perceptions of asymmetrically beneficial exchange among knowledge workers, which may be detrimental to the development of productive collaborative relationships and thus reduce integrative invention. They test these hypotheses using a sample of acquisitions of small technology targets in the US completed between 1994 and 2004.[320] Employing regression techniques which correct for selection effects, the results show that greater differences in technological capability quality are negatively linked with the number of integrative inventions. According to the estimates, an increase in the difference in the quality of technological capabilities by one standard deviation is associated with a decline in the number of integrative inventions by approximately 45 percent. However, structural integration of the target nullifies this negative effect, which indicates that integration facilitates interaction, knowledge exchange, and, thus, integrative inventions. The study therefore implies that post-merger innovation performance of the combined entity depends on both technological capability alignment and post-merger integration choices.

5.132 **Humphery-Jenner (2014)** examines whether antitakeover provisions (ATPs) mitigate managerial myopia in hard-to-value (HTV) firms that are exposed to opportunistic takeovers and shape innovation and value creation. Using a sample of US acquisitions undertaken between 1990 and 2005,[321] the study combines event-study methods with cross-sectional regressions to compare acquisition outcomes across HTV and non-HTV acquirers, and across entrenched and non-entrenched governance structures—i.e. the author compares different types of acquisitions against each other, not against a non-acquisition control group.[322] He finds that, conditional on being HTV, entrenched acquirers generate significantly higher announcement returns, stronger post-merger valuation, and greater increases in

[320] The sample contains 243 acquisitions in total. Small technology targets have 500 or fewer employees. Integrative inventions are measured as the count of jointly developed patents within five years post-acquisition. Differences in technological capability quality are measured as the absolute gap between the target's and acquirer's average patent quality, which is calculated from citation-weighted patents prior to the acquisition and standardised within patent class and year to reflect each firm's technological capabilities relative to its peers.

[321] The sample contains 3,935 acquisitions in total.

[322] HTV status is proxied using industry classifications (e.g. software, medical) and analyst-based uncertainty measures, while entrenchment is captured by a corporate governance index that measures how strongly a firm is protected by ATPs. Short-run value effects are measured through five-day cumulative abnormal returns, long-run performance through industry-adjusted Tobin's Q, and innovation-related outcomes through post-acquisition increases in R&D expenditure and whether value-creating deals involve high-technology targets. The identification strategy relies on interaction terms between HTV and entrenchment indicators and control variables.

R&D expenditure than comparable non-entrenched HTV firms, with no evidence of systematic overpayment.

5.133 **Colombo and Rabbiosi (2014)** investigate the mechanisms through which technological similarity between acquiring and acquired firms may influence post-acquisition innovation performance in horizontal acquisitions. The authors link technological similarity to two forms of post-acquisition reorganisation of R&D (rationalisation of acquired R&D operations and replacement of the acquired firm's R&D top manager) and to two intermediate outcomes (R&D productivity improvements and R&D personnel disruption). The analysis draws on a sample of 31 horizontal acquisitions involving European firms in medium- and high-technology industries. The study relies on interview data collected from firms' top managers, including assessments of post-acquisition R&D productivity and innovation performance measured through changes in patenting activity, the development of new technological competencies, and the speed of technological knowledge creation.[323] The results show a direct negative association between technological similarity and post-acquisition innovation performance, suggesting that acquisitions between firms with more overlapping R&D operations exhibit worse innovation outcomes. Additional findings suggest that this relationship is not mediated by R&D reorganisation. Rather, replacing the acquired firm's R&D top manager is associated with modest productivity gains that contribute positively to innovation outcomes. However, these gains are insufficient to offset the overall negative effect.

5.6.2 Industrial organisation

5.134 Within IO, the empirical papers looking at mergers and acquisitions and their effect on innovation generally treat mergers and acquisitions as changes to the industrial structure and competitive dynamics, often relying heavily on quasi-experimental or panel econometrics and the construction of counterfactuals through matching and DiD analysis. The focus lies predominantly on market-level and firm-level innovation outcomes, competitive effects, and implications for market power, industry concentration, and product-market performance, rather than on internal organisational processes. From the same angle, empirical papers within IO study how international changes in market structure, competitive pressure, and knowledge reallocation following cross-border M&As affect innovation outcomes.

5.135 The considered papers have a comparative advantage in terms of focusing on causal inference through for example quasi-experimental designs, large panels, and explicit counterfactuals that estimate treatment effects of mergers. This focus on causal identification is largely a development of more recent years; earlier studies in the literature often relied on correlational analyses.

Mergers and innovation

5.136 **Zhao (2009)** examines both whether innovation shapes the propensity to acquire and how completed versus failed bids affect subsequent innovative output. The paper uses a cross-industry sample of US acquisitions announced between 1984 and 1997.[324] Innovation is measured using patent counts (quantity) and citation-

[323] Given the relatively small sample size, the authors employ partial least squares estimation, a structural equation modelling technique that estimates the relationships among the study's key components simultaneously.

[324] The sample contains 1,053 acquisitions in total. The sample starts from all SDC-announced US deals (1984–'97) and is restricted to public bidders moving from <50% to >50% ownership (≥90% if completed) with value ≥$1m, non-utility manufacturing firms matched to Compustat–NBER patent data, ≥3 years of pre/post data, only the first bid per bidder in a three-year window, and cases with

weighted patents (quality).[325] The empirical approach combines matched control firms with panel regressions that relate pre-bid innovation levels and growth to acquisition decisions and post-bid innovation outcomes.[326] The author finds that bidders do not patent less than non-bidders in quantity terms, but exhibit significantly lower citation intensity and weaker recent citation growth prior to bidding, consistent with firms with declining innovation quality turning to acquisitions. More innovative bidders are less likely to complete deals. Post-transaction, successful bidders do not underperform matched firms in innovation, though failed bidders do experience significant declines—suggesting net gains from acquisitions on innovation. Gains are also concentrated among previously less innovative acquirers, suggesting acquisitions can alleviate internal innovation deficiencies rather than systematically crowding out R&D.

5.137 **Szücs (2014)** examines how horizontal mergers affect firms' innovation inputs, distinguishing explicitly between acquiring firms and targets and thereby addressing heterogeneity that is often obscured in pooled analyses. Using a panel of merging firms drawn from transactions notified to the European Commission and the US FTC between 1990 and 2009,[327] he finds that targets that continue to exist as separate reporting entities experience substantial and persistent declines in both R&D growth and R&D intensity, while acquirers' R&D growth is only slightly and mostly insignificantly lower than that of matched controls. However, acquirers' R&D intensity falls, largely reflecting strong post-merger sales growth rather than sharp cuts in R&D spending. The author discusses how the findings are consistent with post-merger rationalisation and the exploitation of acquired technological assets, with innovation retrenchment concentrated on the target side.

5.138 Looking instead at how a relaxation of merger control affects the innovation behaviour of merging firms, **Morzenti (2023)** considers how a change in US pre-merger notification rules that exempted many transactions from review affected innovation activity.[328] The results indicate that, following the policy change, innovation among firms involved in newly non-notified horizontal mergers declined by around 30% relative to the counterfactual change observed for comparable unaffected or non-horizontal mergers. Effects are particularly pronounced for patent quality and process innovation. The paper also documents an increase in such non-notified horizontal mergers, consistent with reduced deterrence, and finds industry-level patterns of higher concentration and lower R&D intensity. The paper considers the effects from a shift in merger control, rather than the occurrence of mergers

a matched non-bidding firm in the same Fama–French industry–year (sales ±25%); the final 1,053 deals represent about 10% of the 10,457 initially identified transactions.

[325] With corrections for truncation, technology-field differences, and time trends.

[326] Innovation outcomes are measured over a three-year period. Matching is based on industry–year and size band, which can also include direct competitors.

[327] The sample contains 398 merging firms (265 acquirers and 133 targets). The paper links merger data to acquirer and (where available) target balance-sheet information on R&D expenditure, sales, and other characteristics, and follows firms for up to six years post-transaction. The author relies on a DiD design with propensity score matching used to construct separate, pre-merger comparable control groups for acquirers and targets (which can, however, include also direct competitors). Innovation is measured through R&D expenditure growth and R&D intensity (R&D expenditure over sales), focusing on input incentives rather than output success.

[328] The study measures innovation in terms of citation-weighted patent output (alongside measures of patent quality, originality, and distinction between process and product innovation) and by using a novel text-based methodology to classify horizontal mergers (a neural-network-based natural language model is trained on patent titles and abstracts (around seven million patents), and patent-level semantic similarity is used to infer technological proximity between merging firms). The study uses a DiD design to compare horizontal non-notified mergers (treated) to notified or non-horizontal mergers (controls)—where the control group may include direct competitors.

themselves, which means that estimates capture the impact of reduced scrutiny on a specific subset of mergers rather than a general merger effect.

5.139 **Chan, Irlacher, and Koch (2025)** examine how horizontal mergers between multiproduct firms reshape firms' product scope and international trade patterns. Using comprehensive Danish register data between 1996 and 2015, the authors construct a large panel of domestic horizontal mergers identified through establishment-level ownership changes.[329] They find that, relative to the combined pre-merger portfolios of acquirer and target, merged firms reduce overall domestic product scope and reallocate sales towards core products, increasing sales concentration. At the same time, acquirers expand along the export extensive margin, selling more products to a larger set of, on average, more distant and costly destinations. Product-mix reallocation is found to account for a substantial share of post-merger export growth.

5.140 **Martinez Cillero, Napolitano, Rentocchini, Seri, and Zaurino (2025)** study whether technological acquisitions (defined as acquisitions of firms holding patent assets) contribute to higher market power among acquiring firms and whether this operates through innovation-enhancing synergies or innovation-shielding via acquired patents. They use a global firm-level panel of publicly listed companies between 2008 and 2020.[330] The authors find that technological M&As increase acquirers' markups by about 2% on average relative to non-technological M&As, with stronger effects for top R&D investors, US-based firms, and high-tech manufacturing sectors.[331] They also find that the stock of patents obtained through acquisitions has a persistent positive effect on markups, while post-merger patenting flows do not account for the markup effect—consistent with an innovation-shielding mechanism via IP consolidation rather than productivity-enhancing new knowledge creation. However, because the counterfactual is other M&A activity rather than no acquisition, the results should be interpreted as evidence on the relative effects of technological versus other acquisitions among large incumbents, rather than the overall effect of acquisitions per se.

5.141 **Newham, Jaggi, and Posth (2026)** examine whether acquisitions of technologically distant targets induce larger post-deal shifts in acquirers' innovation trajectories than acquisitions of technologically proximate ones. Using data on US M&A transactions from 1988–2015 matched with detailed patent data, the authors construct novel measures of changes in the technological orientation of acquirers based on patent text embeddings.[332] They document a large and statistically

[329] The dataset contains more than 4,500 mergers and also covers domestic production and firm–product–destination export flows. Their empirical strategy combines an event-study framework with a DiD design, where they compare post-merger outcomes of acquirers against a synthetic control group of non-merging firm pairs matched on pre-merger characteristics and merger likelihood (which can, however, include direct competitors).

[330] The final sample contains 8,314 firms, linked to financial and ownership data with transactions and patent records. Causal effects are identified through a staggered DiD (a staggered difference in difference takes into account that treatment is adopted at different points in time) and event-study approach. The control group consists both of firms that have not yet been involved in an acquisition as well as firms involved in non-technological M&As.

[331] Firm-level markups are estimated following the De Loecker–Warzynski production-function approach. The De Loecker-Warzynski method calculates markups by measuring the gap between an input's contribution to production and its share of revenue. While a competitive firm pays for an input (like materials) exactly what that input adds to its bottom line, a firm with market power 'under-utilises' the input to keep output low and prices high. The method uses this efficiency gap to back out the markup without needing to know the firm's actual marginal costs.

[332] To construct novel measures of technological orientation and of the pivot in acquirers' innovation direction, the authors apply Google Patent Embeddings and compute cosine similarities between acquirers' and targets' portfolio embeddings. The sample comprises 1,269 completed M&A

significant pivot in the acquirer's innovation trajectory towards the technological profile of the target, a reorientation that begins at announcement and increases monotonically across the 8-year post-deal observation window. Heterogeneity by pre-deal technological relatedness reveals that deals between technologically distant acquirers and targets produce the largest and most immediate directional shifts, consistent with the merger being used to initiate a change in innovation strategy and bridge a technological gap, whereas deals between technologically proximate firms show no further shift towards the target's technology and appear driven instead by consolidation of overlapping R&D efforts. Focusing on the subsample of acquisitions where targets hold clean technology patents, 'dirty' acquirers (i.e. those whose pre-acquisition patent portfolios are concentrated in high-emission technologies) exhibit a significant pivot towards their target's clean technologies that is approximately three times as large as that observed for non-dirty acquirers, a reorientation corroborated by increased citations to the target's clean patents and increased clean patent filings by the acquirer post-deal.

5.142 Instead of focusing on the merging firms themselves, **Stiebale and Szücs (2022)** highlight the role of non-merging rivals' responses to M&As with respect to a number of outcome variables, including (among other things) investment (measured through changes in tangible assets), innovation (measured by citation-weighted patent applications), and markups (inferred through structural estimation of production functions). The authors construct a dataset of merger cases that were notified to the European Commission between 1999 and 2007 across a broad set of industries. By exploiting market definitions provided by the European Commission as part of their competitive assessment to identify rival firms for each merger, the authors can link those merger cases to competitors.[333] The results show that non-merging rival firms experience significant declines in investment and innovation following a merger, but experience higher markups. Combining both results, the authors derive that the observed increase in mark-ups is likely not to be driven by reductions in marginal costs following productivity enhancing investments or innovation, but rather by increases in prices.

5.143 Finally, as discussed in more detail in Subsection 3.2.7 on calibrated dynamic models, **Cavenaile, Celik, and Tian (2021)** develop and estimate a calibrated general equilibrium model to evaluate merger policy which combines Schumpeterian innovation, oligopolistic product market competition, and endogenous mergers and acquisitions, with merger policy modelled using HHI thresholds that mirror existing US guidelines. Calibrated to US data, the authors find that complete elimination of antitrust enforcement reduces welfare by around 0.5% and lowers long-run annual growth by around 0.02 percentage points, driven by reduced innovation among large market-leading firms (superstars) and a shift in merger activity towards less synergetic transactions. Conversely, strengthening enforcement by reducing HHI thresholds by 10% yields welfare gains of approximately 2% and increases long-run annual growth by around 0.08 percentage points. These results are driven by the dynamic effects of merger policy on innovation and productivity growth, which are an order of magnitude larger than the static gains from improved allocative efficiency. Stricter merger policy has heterogeneous effects on innovation incentives: it reduces innovation by smaller firms, for whom the probability of a

transactions involving US public and private firms, matched to firm-level patent data. Counterfactual pseudo-deals (i.e. pairs of firms resembling the actual acquirer and target in observable characteristics but for which no transaction occurred) serve as the control group, and dynamic average treatment effects are estimated using a staggered DiD estimator.

[333] The sample contains 194 merger cases in total, which can be linked to 576 competitors. To address the non-random occurrence of mergers, the study uses propensity score matching to create a control group of similar non-merged firms not affected by the mergers and applies a DiD estimator to compare changes between rivals and control group.

profitable acquisition diminishes, while increasing innovation by larger firms seeking to escape competitive pressure.

5.144 Similarly, **Guthmann and Rahman (2026)** develop a calibrated general equilibrium model which incorporates merger synergies, knowledge spillovers between leaders and laggards (defined as 'symbiotic competition'), and entry-for-buyout effects. Firms compete à la Cournot, invest in productivity improvements, and face stochastic merger opportunities (see detailed discussion of the model in Subsection 3.2.7). Using a calibration to US data,[334] the authors find that allowing all mergers increases the merger rate (from approximately 4.45% to 11.60%) and reduces annual economic growth by around 0.25 percentage points, from 2.34% to 2.09%. The authors also find that both the absolute level of innovation per firm as well as innovation intensity relative to firm value follow an inverted-U relationship with the number of firms, with innovation intensity relative to firm value peaking at around five firms. The absolute value of innovation per firm is maximised in duopoly markets, as competition between two firms reduces wasteful duplication of research and allows firms to capture a greater share of the returns to innovation.

5.145 The simulations presented in the paper suggest that the optimal merger rule from a welfare perspective (proxied by representative household utility) does not allow mergers that reduce the number of firms below five, but that a higher threshold rule (six or seven firms) yields almost the same welfare. Welfare differences relative to a merger threshold of three or four firms are small (especially compared to a policy of allowing all mergers). The authors also find that optimal merger review rules are stringent (allowing for only a limited increase in concentration or no positive price effects). Price policy outperforms market concentration rules, as it also reflects information on synergies and demand. The simple price policy of only allowing mergers that do not raise prices outperforms non-price policies based on concentration or number of firms.[335] Thus, the 'static' rationale demanding that mergers not decrease consumer surplus is a good policy heuristic based on the paper's calibrations. These results are driven by the negative effects of mergers on innovation and knowledge spillovers.

5.146 **David (2021)** studies the aggregate implications of M&As by developing and estimating a general equilibrium search-and-matching model with heterogeneous firms, endogenous merger decisions, and firm entry and exit. The model is estimated to match key empirical moments on merger patterns, including sorting, merger premia, and repeat acquisition observed in almost 58,000 domestic US transactions announced between 1977 and 2007. At the micro-level, results show that both complementarities and productivity improvements are needed to explain observed merger activity. At the macro-level, results show that M&As significantly contribute to aggregate productivity, output, and consumption through resource reallocation and improved firm selection and new entrepreneurship: relative to an economy without M&A, mergers raise steady-state output by 14% and consumption by 4%. The analysis also finds that there are inefficiencies in the search and matching process in the economy, implying scope for welfare-improving merger policy such as a flat tax on merger gains.

[334] The model is calibrated to match a set of stylised US moments, including GDP per capita growth (1.5–1.7%), average markups (25–30%), the dispersion of firm productivity, firm exit rates (3.5–4.0%), merger rates (about 4.5%), merger value gains (4–17%), and firms' R&D expenditure-to-revenue ratios (2–5%). Externally calibrated parameters are drawn from estimates of labour supply elasticities, demand substitution elasticities, and productivity spillovers. Internally calibrated parameters include a 3% expected merger synergy.

[335] The optimal price policy allows mergers as long as price changes immediately post-merger do not exceed −0.5% (hence requiring synergies).

Research joint ventures

5.147 Other cross-sectional empirical studies in the IO literature focus on RJVs (i.e. agreements made between two or more firms to jointly conduct R&D), specifically the determinants of their formation and their implications for firms' R&D investment, knowledge spillovers, and performance.[336,337]

5.148 For example, **Röller, Tombak, and Siebert (1997)** examine why firms form RJVs, asking whether internalising R&D spillovers, cost-sharing, product market complementarities, and firm heterogeneity explain RJV formation and its implications for firm-level R&D. The authors develop a theoretical duopoly model with asymmetric firms and differentiated products that predicts that higher-cost firms have stronger incentives to join RJVs, that large cost asymmetries and high product substitutability reduce the low-cost firm's incentive to cooperate, that RJVs are more likely among firms producing complementary products, and that membership tends to occur among similarly sized firms. The empirical study draws on data from RJVs filed in the US between 1985 and 1994.[338] The results indicate that similarity in firm size significantly increases the probability of joint participation, that the net effect of RJVs on firm-level R&D varies across industries and venture size (with larger RJVs associated with greater R&D investment) but reflects an important role for cost-sharing as an incentive to form RJVs, and that complementarities are not pervasive across all industry pairs but are significant for certain (possibly vertically related) industries, where joint ventures are more likely to occur.

5.149 **Banal-Estañol, Duso, Seldeslachts, and Szücs (2022)** examine whether and how RJVs shape technology and product market spillovers and, in turn, firm performance. Specifically, they ask whether RJV insiders differ from outsiders in their exposure to the total spillover pool and whether spillovers from RJV partners differ from those of non-partners. The study draws on data for publicly traded firms from the US observed over 1985–2000.[339] Results indicate that RJV participation reduces the negative impact of business-stealing effects from rivals' R&D in the product market space. Firms that cooperate in an RJV with close product market competitors are able to spend less on their own R&D, leading to a higher firm value (measured by Tobin's Q) than non-participating firms. In the technology space, RJV participants are better able to benefit from the R&D conducted by technologically similar firms (i.e. they absorb knowledge spillovers more effectively), allowing them to spend less on their own R&D in response, and resulting in additional benefits from the RJV.

Cross-border M&As

[336] Relatedly, Hagedoorn and Duysters (2002) study strategic alliances as an alternative to M&As as a means to access external sources of innovative capabilities. While they investigate conditions under which firms prefer one or the other option, they do not investigate dynamic post-merger effects directly, and hence are not discussed here in more detail.
[337] Although we refer here to RJV, in line with the literature, a more appropriate reference may be research cooperation, to differentiate from forms of cooperation that also relate to the product market.
[338] Specifically, the sample contains 174 RJVs with 445 participating firms combined with firm- and industry-level data. Theoretical predictions are tested by estimating a two-equation system that endogenises RJV formation and its impact on R&D expenditures.
[339] The sample contains 830 firms in total, out of which 185 participate in a total of 458 RJVs. To measure technological spillovers, the authors construct spillover pools (i.e. weighted sums of rivals' R&D spending) where the weights reflect how closely related firms are, either technologically (based on the overlap in their patent portfolios based on 407 technology classes) or in the product market (based on the overlap in their sales across industries based on 762 SIC segments).

5.150 A number of cross-sectoral studies examine cross-border M&As, in which the involved companies are based in different countries, and their effects on various innovation outcomes. Despite including firms active in general manufacturing, these studies also include firms in knowledge-intensive services, such as information technologies or telecommunications.[340]

5.151 For example, **Stiebale and Reize (2011)** investigate how foreign acquisitions affect both innovation inputs and output in target firms.[341] The study uses German survey data on innovation characteristics with ownership information from balance sheet data for the years 2002 to 2007.[342] Their results indicate that acquisition through a foreign acquirer significantly lowers the probability that a target firm conducts any R&D at all. Among target firms that continue investing into R&D, R&D intensity is estimated to decline by about 76%. The authors suggest that this pattern may reflect a relocation of research activities to the parent company's headquarters or that a foreign acquisition leads to rationalisation and thus to a reduction in R&D activities in target firms. In contrast, the analysis does not reveal statistically significant effects of foreign acquisitions on innovation outputs. Because innovation outcomes are modelled conditional on predicted R&D intensity, the impact of foreign acquisitions on innovation output operates indirectly through changes in R&D activities.

5.152 Highlighting the role of cross-border acquisitions as a channel for accessing foreign technologies and markets, **Stiebale (2013)** examines their impact on the domestic R&D expenditures of acquiring firms. In contrast to the previous study focusing on target firms, this paper shifts attention to acquiring firms and relies on a related but distinct firm-level dataset that combines German survey data, balance sheet information, and M&A transaction data, covering cross-border mergers during the time period 2002 to 2007.[343] The results indicate that cross-border acquisitions have a positive effect on the acquiring firm's domestic R&D intensity, increasing the R&D-to-sales ratio by about 1.5 percentage points on average, with substantially larger effects in knowledge-intensive industries, for acquisitions in which acquiring firms invest more in product than process innovations, and for acquisitions in technologically developed countries. These effects do not appear for domestic acquisitions or greenfield investments (i.e. new firms or production units founded by foreign investors). The authors suggest this indicates that the effects are driven by the cross-border element of the acquisition, which provides access to complementary technologies and new markets, rather than reflecting general foreign direct investment (FDI) effects or market power effects alone.

5.153 Extending this perspective beyond acquiring firms' domestic R&D intensity, **Stiebale (2016)** investigates how cross-border M&As affect innovation in the

[340] For cross-border M&As in general manufacturing industries, see Subsection 5.5.2.
[341] Innovation inputs are measured as a firm's propensity to conduct R&D as well as its R&D intensity i.e. R&D expenditure per employee. Innovation outputs are measured as share of sales generated with innovative products, as well as indicator variables for the introduction of product and process innovations.
[342] The final sample includes 304 target firms being acquired by a foreign acquirer. To account for endogeneity of M&As as well as potential selection bias of firms into mergers, Stiebale and Reize implement a simultaneous equation model which explains the propensity of a foreign acquisition, the probability that a firm engages in R&D, and the amount of R&D expenditures simultaneously.
[343] The sample contains 389 cross-border mergers in total. To address unobserved firm heterogeneity and the endogeneity of foreign acquisitions, the paper estimates a non-linear two-equation model in which the decision to undertake a cross-border acquisition and the decision on R&D intensity are determined simultaneously. Identification relies on variation in the minimum distance to Western European markets (used to capture differences in the costs of entering foreign markets) and on (unexpected) industry-level market growth in Western European countries.

combined firm and whether they lead to a relocation of innovative activity across countries and between acquiring and target firms. Unlike the earlier Germany-focused studies, this paper uses a broader European firm-level panel dataset, covering European[344] cross-border M&As over 1997–2008 in manufacturing and knowledge-intensive services, and combines balance-sheet data with patent-based indicators (including citation-weighted patents), as well as R&D expenditures.[345] Across specifications, Stiebale finds that cross-border M&As increase innovation output in the merged entity by more than 20% within three years, with the strongest effects when both acquirer and target have large pre-acquisition patent stocks.[346] The author suggests that this highlights the importance of complementary knowledge assets for the effect of cross-border M&A on innovation. However, innovation activity is reallocated geographically: patenting rises in the acquirer's home country but declines in the target's country, especially when pre-acquisition innovation gaps (measured as differences in patent stocks) are large, suggesting a reallocation of R&D to the more efficient part of multinational firms.

5.154 Building on this analysis, **Stiebale (2025)**, in a study commissioned by the European Commission, updates and extends his previous work by incorporating more recent data (1997–2023) and including transactions involving acquiring or target firms outside Europe. The descriptive sample covers 110,629 completed M&As in which either the acquirer or target is headquartered in the EU and operates in manufacturing or knowledge-intensive non-financial services, with patent applications per year as the main outcome variable. The study employs an event-study DiD design to estimate dynamic treatment effects. The evidence is consistent with earlier findings, and shows that cross-border M&As are associated with asymmetric innovation responses: patenting declines in the target country but increases in the acquirer's country.

5.6.3 Corporate finance

5.155 Different papers within the corporate finance literature study the effects of mergers and acquisitions on both target and acquiring firms and provide evidence on the distribution of gains and the longer-term consequences of these transactions.

5.156 Within the corporate finance literature, mergers and acquisitions are primarily analysed as corporate investment, governance, and asset reallocation decisions, with emphasis on value creation in terms of stock returns, cash flow, or value-based productivity improvements. The focus is less on internal organisational processes or industry structure and more on capital market reactions, accounting performance, and productivity measures. The literature largely examines mergers using one of two methodologies: stock market event studies, where abnormal stock market returns around merger announcement dates are used to estimate expected merger synergies, and studies looking at broad performance measures such as cash flows,

[344] The sample contains 941 mergers from the following countries: Germany, UK, Netherlands, Ireland, Belgium, France, Austria, Switzerland, Luxembourg, Spain, Italy, Portugal, Greece, Malta, Cyprus, Sweden, Norway, Finland, Denmark, Iceland, Estonia, Latvia, Lithuania, Croatia, Czech Republic, Romania, Russia, Serbia, Slovakia, Slovenia, Ukraine.

[345] To determine the original location of the innovation, inventor addresses of patents are used as a proxy. To address endogeneity of cross-border acquisitions and unobserved firm-level heterogeneity, the paper applies propensity-score matching combined with DiD, dynamic count data models, and linear and non-linear IV approaches exploiting changes in the adoption of international accounting standards which are aimed at reducing information asymmetries in international transactions.

[346] As control groups, the author uses both non-merging firms and firms which are involved in domestic M&As. Results hold for both specifications.

valuations, and productivity, often relying on before-and-after comparisons or differences across deals.

5.157 A number of common limitations emerge across the studies reviewed. In particular, many analyses face concerns related to the endogeneity of merger decisions and selection (i.e. which firms choose to merge) that are only partially addressed by their empirical methods, making it difficult to draw strong causal conclusions about post-merger performance changes. Additionally, as some studies measure merger synergies with (changes in) stock price valuations, it is worth noting that stock price changes are informative of merger benefits to shareholders (including effects through increased market power) but not necessarily of those to consumers. Finally, as with many other empirical papers, the papers considered here only study average merger effects, which may deviate from those in any one specific transaction; and the samples studied may differ from those commonly considered by competition authorities.

5.158 Below, we first consider the papers that look at M&As and corporate performance, followed by papers considering, in turn, private equity acquisitions, common ownership, and human capital considerations.

Do mergers succeed? M&As and corporate performance

5.159 A large body of work in corporate finance considers the effect of M&As on corporate performance, particularly shareholder value creation.

5.160 In early work looking at the effect of takeover announcements on the merging parties' share prices, **Jensen and Ruback (1983)** review the empirical literature on the market for corporate control and show that takeover announcements generate positive returns for target shareholders (around 20–30%), while acquiring firms' shareholders generally earn near zero returns. This implies, according to Jensen and Ruback, that overall gains are largely captured by target firms. The authors interpret these results as evidence that takeovers act as a governance mechanism that reallocates corporate resources to more efficient managers.

5.161 **Bradley, Desai, and Kim (1988)** similarly examine whether successful tender offers create synergistic gains for targets and acquirers and how these gains are divided. Using 236 matched target-acquirer takeover contests involving NYSE/AMEX firms between 1963 and 1984,[347] they conduct event studies based on cumulative abnormal returns. They find that tender offers increase combined firm value by 7.4% on average. Target shareholders capture most gains, while acquirer returns are small and decline over time. Greater bidding competition is associated with higher target returns and lower acquirer returns.

5.162 **Roll (1986)** develops the 'hubris hypothesis' of takeovers, whereby managers overestimate their ability to identify undervalued targets and consequently overpay. The paper reinterprets existing event-study evidence on mergers and tender offers. Roll concludes that target gains may largely represent transfers from bidders, while aggregate takeover gains are small or statistically inconclusive. The author argues that this is consistent with managerial valuation errors and overbidding, in addition to synergies, tax benefits, or improved management.

5.163 **Morck, Shleifer, and Vishny (1990)** further examine whether managerial objectives drive value-reducing acquisitions. Using 326 US acquisitions completed between 1975 and 1987, combining CRSP, COMPUSTAT, acquisition, and industry

[347] NYSE/AMEX firms are companies whose shares were listed on either the New York Stock Exchange (NYSE) or the American Stock Exchange (AMEX).

data, they first measure bidder announcement returns relative to target value. Cross-sectional regressions then relate these returns to target growth, bidder performance, industrial relatedness, financing, and bidding competition. They find lower bidder returns when acquisitions (i) diversify into unrelated industries, (ii) involve rapidly growing targets, or (iii) are undertaken by poorly performing bidders. The authors conclude that their results are consistent with managers pursuing growth, diversification, or job security at shareholders' expense.

5.164 **Servaes (1991)** examines how target and bidder Tobin's Q relate to takeover gains.[348] Using 704 US mergers and tender offers between 1972 and 1987, with complete bidder data for 384 transactions, the study combines CRSP, COMPUSTAT, and deal characteristics. Market-model event studies estimate target, bidder, and combined abnormal returns, followed by cross-sectional OLS regressions controlling for payment method, hostility, bidder competition, timing, and relative size. Returns are higher when high-Q bidders acquire low-Q targets, suggesting that better-performing firms create more value, by acquiring poorly performing firms. Cash-financed deals also generate higher returns.

5.165 **Franks, Harris, and Titman (1991)** re-examine the post-merger share-price performance of acquiring firms. Earlier literature suggested that mergers initially appear beneficial but ultimately destroy value for acquiring shareholders due to negative long-run abnormal returns. The authors revisit this conclusion using improved risk-adjusted benchmarks. Examining 399 US takeovers between 1975 and 1984, they show that the previously reported negative long-run returns for bidders are largely driven by benchmark errors. When multi-factor benchmarks that more accurately adjust for risk are used, the evidence of systematic post-merger underperformance by acquiring firms largely disappears.

5.166 An early empirical study looking instead at accounting-based measures of corporate performance post-merger, rather than stock price performance, is **Healy, Palepu, and Ruback (1992)**. This paper considers the 50 largest US industrial mergers completed between 1979 and 1984 and looks at industry-adjusted cash flow returns on market-valued assets. They find that merged firms exhibit statistically significant improvements in operating cash flow returns relative to their industries in the five years following completion. They find that this is driven primarily by gains in asset productivity rather than reductions in long-term investment, as CAPEX and R&D intensity are maintained in industry-relative terms. Performance improvements are stronger in mergers between firms with overlapping businesses, which they argue is consistent with operating synergies. The performance gains arise from higher sales relative to assets (asset turnover), not from reductions in investment intensity, which they show remains industry-normal. They also find that post-merger cash flow gains are positively associated with announcement-period abnormal stock returns, which they interpret as evidence that equity market reactions reflect expectations of real economic improvements in corporate performance.

5.167 Rather than looking at announcement abnormal returns, **Agrawal, Jaffe, and Mandelker (1992)** examine acquirers' long-run stock performance after mergers. Using 765 mergers between NYSE acquirers and NYSE/AMEX targets from 1955–1987, they calculate monthly abnormal returns for five years after completion. Two methodologies adjust returns for firm size and beta risk.[349] Acquirers underperform

[348] Tobin's Q is the ratio of the market value of a firm to the replacement cost of its physical assets and is a common indicator of the attractiveness of new investment, where firms invest when the market valuation of capital exceeds its replacement cost.

[349] Beta risk refers to the systematic, non-diversifiable risk of an investment, measured by the sensitivity of its returns to movements in the overall market. The adjustment is done using the

by approximately 10% over five years, with results robust across specifications and particularly pronounced outside the 1970s. Tender-offer acquirers do not significantly underperform. The authors argue that the evidence does not support slow market adjustment to merger announcements as the explanation.

5.168 Looking similarly at long-term acquisition gains, **Loughran and Vijh (1997)** examine whether these depend on deal form and payment method. Using 947 US acquisitions completed between 1970 and 1989, identified from CRSP and classified through the Wall Street Journal and Capital Adjustments Register, they compare five-year buy-and-hold returns with size- and book-to-market-matched firms. They find that long-run acquirer performance relates strongly to payment method, with stock mergers underperforming by 25.0% whereas cash tender offers outperform by 61.7%. The authors attribute this divergence to payment-method signalling and acquisition mode: stock may be used when acquirer shares are overvalued, while cash tender offers may generate greater disciplinary gains by replacing inefficient target management—although the authors do not consider potential endogeneity.

5.169 **Andrade, Mitchell, and Stafford (2001)** review merger activity, value creation, and post-merger performance. Using approximately 4,300 completed mergers between publicly traded US firms from 1973–1998, drawn from CRSP and COMPUSTAT, they combine descriptive analysis, announcement-period event studies, long-run return evidence, and operating-performance regressions. Merger activity clusters strongly by industry, with deregulation explaining nearly half of activity after the late 1980s. Mergers generate positive combined announcement returns, largely accruing to targets, while acquirer returns are near zero. Post-merger operating margins improve modestly relative to industry benchmarks, although the authors conclude that long-run stock-return evidence is methodologically fragile.

5.170 Replicating Healy, Palepu, and Ruback (1992) using a sample of large US acquisitions between 1981 and 1995,[350] **Ghosh (2001)** similarly finds apparent post-acquisition cash flow improvements relative to industry medians. However, he shows that merging firms systematically outperform industry peers prior to acquisitions, implying selection bias. Employing a matched-firm design that controls for both size and pre-event operating performance, he finds no evidence of overall improvements in operating cash flow returns or cash flow margins following acquisitions. Moreover, the study shows that, on average, sales growth and cost reductions relative to matched firms are not significantly different post-merger. Ghosh does find that cash flow increases are positively associated with acquisitions that are made with cash rather than stock acquisitions, which he argues is because cash deals are more likely to come with stronger monitoring and performance pressure.

5.171 Using plant-level data, **Maksimovic and Phillips (2001)** study whether transactions in the market for assets result in productivity gains. They use a US Census Bureau database that includes US manufacturing plants over 1974–'92[351] and relate plant-level measures of TFP (estimated from production functions based

Ibbotson Returns Across Time and Securities (RATS) approach, which estimates a separate cross-sectional return regression for each month relative to an event. The regression intercept represents the average abnormal return in that month, while the market-risk coefficient may vary over time. Monthly intercepts are then cumulated to measure long-run abnormal performance, avoiding the assumption that firms' betas remain constant throughout the post-event period.

[350] The sample contains 315 acquisitions.

[351] The sample includes roughly 50,000 US manufacturing plants (covering primarily plants with more than 250 employees, plus some smaller establishments), with information on output, capital stock, and investment, labour input, materials, plant age, SIC industry codes, and ownership changes.

on output value)[352] to ownership changes. They find that assets are more likely to be sold when plants or divisions are relatively less productive, when they belong to peripheral rather than core segments of multi-segment firms, and when firms face stronger productive opportunities or more favourable demand conditions in other segments, while buyers tend to be more efficient producers, especially in their main lines of business. Post-transaction evidence indicates that transferred plants experience productivity improvements under new ownership, consistent with assets moving to higher-valued uses.

5.172 Delving deeper into the sources of merger gains, **Devos, Kadapakkam, and Krishnamurthy (2009)** decompose synergies into operating improvements, tax benefits, and market power effects. They use Value Line cash flow forecasts[353] for large US industrial mergers completed between 1980 and 2004.[354] They quantify average total synergies at 10.03% of the combined pre-merger equity value, of which only 1.64% arises from tax savings, while 8.38% reflects operating synergies.[355] They also find that the operating synergies are not associated with higher revenues or margins, but rather reductions in CAPEX and working capital investment. The authors interpret this as consistent with improved resource allocation rather than increased market power—although they do not explicitly consider whether increases in market power may result in lower CAPEX and working capital investment. Synergies are larger in focused mergers where bidder and target operate in the same industry—and in acquisitions by high book-to-market (value) firms, where book to market is defined as the ratio of the book value of equity to the market value of equity, which the authors explain is consistent with greater scope for eliminating overlapping investments and more disciplined, efficiency-oriented deal making.

5.173 Using a novel text-based measure of firm similarity derived from 10-K product descriptions, **Hoberg and Phillips** (2010) examine whether mergers are driven by asset complementarities. Using firm-year product descriptions between 1997 and 2006 and matching this to firm-level corporate performance data,[356] they show that mergers are far more likely between firms with high product similarity. They also find that transactions with greater pairwise similarity and larger gains in differentiation with rivals are associated with higher abnormal stock market returns around announcement, improved ex post cash flows, sales growth, and evidence of new product introductions, especially in more competitive product markets—which the authors argue is driven by the fact that the asset complementarities of the merging parties enable new product creation and differentiation from rivals.

5.174 Considering instead how firms 'redraw their boundaries' after whole-firm acquisitions, **Maksimovic, Phillips, and Prabhala (2011)** match US Census

[352] Productivity is measured as plant-level TFP, estimated from a trans-log production function using Census data on each plant's real shipments (value-based output) and inputs—capital, labour, and materials—with plant fixed effects. TFP is then the residual (plus the plant fixed effect) relative to industry averages, capturing how much more (or less) output a plant produces than predicted given its inputs.

[353] Value Line is an investment research service that publishes standardised analyst forecasts of firms' financial statement items, cash flows, and valuation metrics.

[354] The sample contains 264 mergers in total. Synergies are defined as the increase in the present value of capital cash flows of the combined firm relative to the sum of the present values of the stand-alone acquirer and target—where capital cash flows include after-tax operating profits minus investments in fixed and working capital plus interest tax shields.

[355] Estimated gains are found to correlate with announcement-period stock returns, which the authors argue supports the credibility of the forecasts used. Robustness tests comparing forecasts with realised cash flows and alternative discounting assumptions yield similar patterns.

[356] The sample contains 49,408 firm-year product descriptions in total.

plant-level data to mergers, tracking the disposition and performance of acquired plants. They first document extensive short-run restructuring: acquirers sell about 27% and close 19% of target plants within three years of the acquisition. They find that plants are more likely to be kept when they match the acquirer's core industry, strengthen core rather than peripheral segments, and when the acquirer shows strong productivity in peripheral operations and faces favourable demand, while financially constrained acquirers are more likely to divest. Estimating plant-level TFP and controlling for the probability of being retained or sold,[357] they find that retained plants experience significant post-merger productivity and plant-level operating margin improvements, while sold plants do not.

5.175 **Li (2013)** examines how takeovers generate value by linking plant-level productivity changes to stock market gains using US Census manufacturing data matched to mergers from 1981–2002.[358] Estimating plant-level TFP, the paper shows that acquired plants reduce CAPEX, wages, and employment, especially among nonproduction workers, while output remains roughly unchanged—implying, according to the author, higher efficiency rather than scale expansion, with gains driven by input reductions rather than revenue growth. The paper also argues that investment efficiency improves, as targets' CAPEX becomes more responsive to industry investment opportunities, particularly when acquirers are conglomerates with active internal capital markets. The paper further shows that cross-sectional differences in target productivity improvements (ΔTFP) explain variation in combined announcement abnormal returns, that targets with larger productivity gains receive higher takeover premiums, and that acquirer returns rise when those gains are large relative to acquirer size.

5.176 Using patent data matched to US M&A transactions over 1984–2006[359], **Bena and Li (2014)** examine how corporate innovation characteristics shape merger incidence, pairing, and post-merger outcomes. They show that acquirers tend to hold large patent stocks but have relatively low R&D intensity, whereas targets invest heavily in R&D but exhibit weaker patent output growth, suggesting acquisitions match firms with complementary innovation stocks and R&D capabilities. At the pair level, multiple measures of technological overlap—based on patent class proximity, shared knowledge bases, and cross-citations—significantly increase the likelihood of a transaction, supporting a technology-synergy motive, although this effect weakens when firms also overlap strongly in product markets, consistent with competitive or antitrust frictions.[360] The authors find that mergers between technologically related firms lead to higher post-merger innovation output (measured by a Patent Index that scales firm patent counts by technology-class–year medians). The authors argue that these findings go beyond pure selection and support the presence of synergies from combining innovation capabilities as an important driver of acquisitions.

5.177 **Alhenawi and Krishnaswami (2015)** examine how merger synergies affect post-merger performance and value. Using 316 US mergers completed between 1998 and 2007, obtained from SDC and matched with CRSP and COMPUSTAT segment data, they track merged firms for five years and distinguish related from unrelated transactions. As output variables, they consider Tobin's Q and excess value.[361] Both

[357] Based on pre-merger productivity, its role as a core versus peripheral plant, and observable characteristics of the acquiring firm.
[358] The sample contains 1,430 mergers in total.
[359] The sample contains 2,572 transactions in total.
[360] Their identification strategy relies on withdrawn bids as a control group (which may lead to rivals being included in the control group).
[361] These are analysed using Heckman two-stage selection models and nonlinear instrumental-variable estimations to address endogenous merger choice.

measures decline in the first post-merger year but subsequently improve, indicating that synergies materialise only gradually. Related mergers exhibit positive excess value, whereas unrelated mergers remain discounted despite stronger subsequent improvements. According to the authors, market power, economies of scale and scope, internal capital-market activity, and refocusing primarily explain value changes in unrelated mergers, whereas related mergers may instead facilitate technology and innovation transfers.

5.178 **Mulherin, Netter, and Poulsen (2017)** provide a survey of the historical and modern corporate finance literature on mergers and acquisitions. Reviewing both pre-2011 and more recent research, they conclude that the most robust finding in the literature is that M&A transactions generate positive aggregate shareholder wealth effects at announcement, with gains accruing primarily to target shareholders while bidder returns are typically close to zero on average. They also note that these average bidder effects mask substantial heterogeneity related to deal design, payment method, governance, managerial quality, and bidder experience. Beyond announcement returns, the survey reviews evidence on operating performance, restructuring, productivity, and industry effects, concluding that many studies are consistent with synergies and efficiency gains, but that identifying the precise source of value creation remains difficult because observed gains may also reflect market power, bargaining dynamics, or measurement issues. The authors further stress that results are sensitive to datasets, time periods, and empirical design, cautioning against strong causal claims in much of the M&A literature.

5.179 **Li, Taylor, and Wang (2018)** examine whether overvalued acquirers distort the allocation of targets by outbidding firms with greater potential synergies. Using 2,503 US merger bids involving publicly traded acquirers and targets between 1980 and 2013, drawn from SDC and CRSP, they structurally estimate an auction model through simulated method of moments. The model jointly captures bidder synergies, equity misvaluation, cash constraints, offer premiums, and payment methods. Opportunistic acquirers (i.e. those that are overvalued) crowd out higher-synergy bidders in approximately 7% of transactions, causing an average synergy loss equal to 9% of target value in those deals, but only 0.63% across all deals. However, opportunistic bidders substantially raise acquisition prices, redistributing gains from undervalued to overvalued acquirers.

5.180 **Renneboog and Vansteenkiste (2019)** provide a comprehensive survey of the empirical literature on mergers and acquisitions and focus on firm performance around and after takeovers. They confirm that takeover announcements typically generate large positive returns for target shareholders, while acquiring returns are on average small or close to zero. The survey also shows that long-run performance of acquiring firms is often weak or heterogeneous, and that deal outcomes depend on factors such as payment method, acquiring-target characteristics, managerial behaviour, and corporate governance conditions.

5.181 **Wu and Chung (2019)** examine how corporate innovation affects both the likelihood of becoming an acquisition target and the takeover premium using US M&A transactions from 1980–2011 matched with patent and R&D data. Innovation output is measured by firms' competitive patent stocks and forward citations within technology classes, and innovation input by cumulative R&D spending relative to industry peers. Using a logit model, the authors show that firms with greater innovation output and R&D investment are more likely to be acquired, more likely to receive unsolicited and multiple bids, and command higher takeover premiums. According to the authors, the cross-sectional patterns point to technology synergies rather than pure market power: the relationship between premium and innovation is stronger when bidder competition is greater, when acquirers operate in more competitive product markets, and when technological proximity in the acquirer's

industry is lower, which are settings where price-increase motives are less plausible. Consistent with this interpretation, acquirer announcement returns and post-acquisition operating performance are positively related to target innovativeness, suggesting that premiums reflect expected gains from combining complementary knowledge assets.

5.182 **Hu, Li, Li, and Wang (2020)** examine whether prior acquisition experience improves mega-deal outcomes. Using 3,544 US acquisitions valued above $500 million between 1980 and 2016, they measure experience by the number of previously completed acquisitions. Linear probability models, announcement-period event studies, fixed-effects panel regressions, buy-and-hold abnormal returns, and operating-performance analyses are employed. Acquirers with more than 12 prior acquisitions are 3.57% more likely to complete mega-deals. For completed transactions, highly experienced acquirers generate an average announcement-period gain of $50.6 million (in absolute terms) and achieve stronger short- and long-run stock and operating performance relative to less experienced acquirers. According to the authors, the findings point towards organisational learning in acquisition execution and integration.

5.183 **Wang and Wu (2020)** examine how managerial private benefits of control affect takeover-market efficiency. Using 169,487 US public-firm-year observations and merger data between 1980 and 2015, they structurally estimate an industry-equilibrium model using simulated method of moments. Managerial control benefits have a 'dark side' by encouraging value-destroying acquisitions, blocking value-enhancing takeovers, and increasing overpayment. However, they also have a 'bright side': managers facing takeover threats exert greater effort to avoid losing control. The estimates suggest that control benefits induce 17% of value-destroying deals and block 12% of beneficial deals, but also accelerate underperforming firms' recovery by 14% and increase the value generated by an active takeover market by 21%.

5.184 **Beneish, Harvey, Tseng, and Vorst (2022)** study the role of unpatented innovation in merger value creation using purchase price allocation (PPA) disclosures from US public-to-public mergers during 2001–'15, which report the fair value of acquired technology and in-process R&D.[362] Using an industry-level regression that relates acquired innovation values to targets' pre-merger patent stocks, they decompose these fair values into patented and unpatented components. They show that traditional proxies such as patents and R&D expenditures understate innovation's contribution: in deals recognising innovation-related intangibles, the aggregate fair value of innovation is 1.6 times capitalised R&D, and many targets with patents or R&D receive zero innovation value in PPA, implying misclassification if only observable measures are used. Decomposing acquired innovation into patented and residual unpatented, they find that unpatented innovation represents a larger share of synergies (in terms of combined announcement abnormal return) than patented innovation. In subsamples of targets without prior patents, allocations to technology and in-process R&D, as clean measures of unpatented innovation, predict higher merger synergies and acquirer gains but lower target gains—consistent with weaker target bargaining power due to proprietary information disclosure.

5.185 **Ismail and Mavis (2022)** develop a direct measure of CEO overconfidence based on synergy forecast error, defined as the difference between forecasted and subsequently realised operating synergies. Using 497 completed acquisitions of US public targets by US listed acquirers announced between 1993 and 2013, they

[362] The sample contains 1,035 mergers in total.

combine relevant company and deal statistics with manually collected synergy forecasts from SEC filings. Cross-sectional OLS regressions examine takeover premiums and five-day acquirer abnormal returns, supplemented by validation tests and a Heckman selection model. The authors conclude that CEO overconfidence indeed predicts value destruction in acquisitions: higher forecast errors are associated with 8.07% higher takeover premiums and 2.86% lower acquirer announcement returns, equivalent to approximately $294 million in value destruction for the average acquirer. High-error CEOs also undertake more diversifying acquisitions and exhibit more subsequent leverage. Interestingly, they also exhibit subsequent higher capital expenditure and innovation (measured by the number of patents in the first year after acquisition).

5.186 **Cumming, Jindal, Kumar, and Pandey (2023)** provide a descriptive bibliometric review of mergers and acquisitions research in finance and accounting rather than a conventional narrative review focused only on deal outcomes.[363] Using a sample of 1,418 articles from 52 high-quality journals over 1970–2022, they map publication trends, leading journals, and authors, collaboration networks, influential studies, major research themes, and emerging future directions. The authors note that one major stream of the literature examines the effects of mergers on corporate performance using shareholder returns, operating outcomes, and valuation measures. They report that the most established finding is that merger announcements generate positive combined shareholder wealth effects, with gains accruing primarily to target shareholders, while bidder returns are on average small and highly heterogeneous. Beyond announcement effects, the review identifies a large body of work linking post-merger performance to factors such as governance quality, method of payment, managerial characteristics, ownership structure, and deal design. The authors also summarise evidence consistent with operating improvements in some settings, including stronger profitability, valuation, and restructuring outcomes, but stress that results vary considerably across transaction types and institutional contexts. As such, the review characterises the evidence on post-merger corporate performance as mixed and context-dependent rather than uniformly positive or negative.[364]

5.187 **Ellahie, Hshieh, and Zhang (2025)** develop an ex-ante measure of acquisition quality—implied return-on-equity improvement (IRI)—which estimates the minimum increase in target return on equity (ROE) required for the acquirer to break even on the purchase price. The authors interpret a higher IRI as an indicator of lower acquisition quality, because it implies a more demanding break-even improvement in post-acquisition ROE. Using 2,352 US public-firm M&As between 1980 and 2018, they estimate OLS models linking IRI to post-acquisition operating and market performance. Acquirers in the highest IRI quartile experience an 11-percentage-point greater ROE decline over the following three years. They also face higher operating costs, tighter financial constraints, lower investment, and larger goodwill impairments. Higher IRI is also associated with CEO overconfidence,[365]

[363] A bibliometric review quantitatively maps the structure and evolution of a research field using publication, citation, and network analyses, whereas a narrative review qualitatively synthesises and interprets prior findings.

[364] More broadly, the paper classifies finance research into themes such as takeovers as governance mechanisms, drivers of mergers, merger processes, bank mergers, cross-border mergers, shareholder wealth effects, and the role of advisors and ownership structure, while accounting research focuses on governance, valuation, takeover prediction, and financial reporting issues. They also emphasise that the wider M&A literature is diverse, methodologically varied, and still developing.

[365] CEO overconfidence is measured using the 'Holder 67' indicator: a CEO is classified as overconfident if they retain vested stock options that are, on average, more than 67% above the current share price, rather than exercising them. This behaviour is interpreted as excessive optimism about the firm's future share price.

weak incentives (compensation structures that are only weakly aligned with shareholder value), limited due diligence, and greater difficulty estimating synergies, suggesting that higher IRI primarily reflects synergy overestimation and overpayment.

5.188 **Kepler, McClure, and Stewart (2026)** study how accounting rules regarding intangible capital (e.g. customer lists, patents, brands, and in-process R&D) impact US M&A enforcement, and how such an effect impacts product market competition. Specifically, they examine US transactions by publicly traded firms between 2001 and 2020 that fall within the turnover bounds for which their asset valuation determines whether they are reportable.[366] In their initial descriptive analysis, they compare g deals to reportable deals using OLS specifications with filing-year and industry (and, in robustness, acquirer) fixed effects. Consistent with the hypothesis that deals escaping ex ante merger review can generate anticompetitive rents, they find that deal premia are roughly 10 percentage points higher for non-reportable transactions, and it is larger when the deal consolidates overlapping product markets. Moreover, they find an increase over the mean abnormal return for reportable deals that consolidate product markets for both the acquirer and the rivals, consistent with an effect that softens competition in the industry. In a subsequent event-study design of acquirers' markups around acquisitions, they find that markups increase by about 26 percentage points over the three years following a non-reportable acquisition that consolidates overlapping product markets, which is an 11.3% increase relative to the sample mean markup. They further show that this markup increase is concentrated among deals involving intangibles associated with developed product markets, especially brands and technologies, whereas deals involving neither brands nor technology show no significant markup effects.

5.189 Separately, Kepler, McClure, and Stewart examine undeveloped product-market consolidation in the pharmaceutical industry.[367] They estimate OLS regressions and find that non-reportable transactions are more likely to involve overlapping drug-development projects than reportable transactions. They further show that, conditional on overlap, acquired overlapping projects are more likely to be discontinued in non-reportable deals and that this difference is larger when the target project is in Phase 3 and when market concentration is high. While these project-level results are estimated with OLS, the authors conduct additional checks, including comparisons to the acquirer's internally developed projects, to mitigate concerns that non-reportable acquirers simply have higher baseline discontinuation rates. They interpret the overall evidence as consistent with the view that accounting-driven non-reportability may facilitate consolidation that can soften competition, particularly where intangible assets are central. Thus, these results suggest that the growth of intangible assets may exacerbate market power through non-reportable consolidation.

Private equity acquisitions

[366] Their sample contains 1,918 US transactions in total. They identify 'non-reportable' deals as those that are subsequently not reportable because of the exclusion of internally generated intangible assets from Generally Accepted Accounting Principles (GAAP) book values. In the US, if turnover is between a certain lower and upper bound ($90m and $360m in 2019), then deals are only reportable if the target and acquirer have assets above certain levels ($18m for the target and $180m for the acquirer in 2019). This last criterion is called the size-of-person (SoP) test. The paper then compares otherwise reportable deals that fail the SoP test with those that pass the SoP test. The otherwise reportable deals are identified by adding the fair value of identifiable intangible assets and goodwill recognised in post-merger purchase price allocations to the target's GAAP book assets. In contrast to the US, notification thresholds in the EU are effectively only based on turnover levels.

[367] Their sample contains 169 horizontal deals.

5.190 One limitation of many corporate finance papers using stock market valuations is that share-price changes may reflect market power effects as well as procompetitive or competitively neutral efficiencies. Focusing instead on acquisitions by private equity buyers—who generally have no or limited competitive overlap with targets—**Acharya, Gottschalg, Hahn, and Kehoe (2013)** examine whether buyouts create value through operational improvements rather than leverage or favourable sector timing, and whether deal-partner human capital explains heterogeneity in outcomes.[368] Using deals between 1991 and 2007, they find that average buyout returns are positive, with around one-third of gross internal rates of return attributable to abnormal performance and about one-half to leverage. Portfolio companies also outperform sector peers operationally, with higher EBITDA margins and valuation multiples during private equity ownership. Cross-sectionally, higher abnormal performance is associated with stronger sales and margin improvements. Ex-consultants and ex-industry managers perform better in organically focused deals, while ex-bankers and ex-accountants perform better in acquisition-driven deals, which the authors interpret as evidence that task-specific managerial skills are an important source of value creation in private equity.

5.191 Looking similarly at the effects of private equity buyouts, **Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda (2014)** examine whether such buyouts lead primarily to job losses or instead to restructuring and productivity gains.[369] Using US firm- and establishment-level data over 1980–2005, their establishment- and firm-level regression approach shows that target establishments experience greater job destruction, with employment falling by around 3% relative to controls over two years and 6% over five years. However, at the firm level, these losses are partly offset by greater greenfield job creation, acquisitions, and divestitures, so net employment falls by less than 1% over two years. The main effect of private equity buyouts is therefore increased job reallocation: target firms' job creation and destruction exceed controls by about 14 percentage points over two years. In manufacturing, they find TFP gains of about 2.1 log points, driven mainly by accelerated closure of low-productivity plants and entry of high-productivity plants.

5.192 These papers on private equity transactions are not necessarily directly applicable to mergers typically assessed by competition authorities, as the merging parties usually have limited horizontal overlap. However, they are still informative on the potential sources of merger-related efficiency, and can generally isolate the synergies independent of any market power effects exploiting the absence of horizontal overlap. These studies find that acquisitions may lead to efficiencies through a number of channels (including: stronger governance and managerial incentives; operational improvements that raise sales and margins; owner-specific expertise and more effective oversight; financial restructuring and improved capital discipline; and productivity-enhancing reallocation of labour and assets through the closure, divestiture, or restructuring of lower-performing units and expansion of more productive ones).

Common ownership

[368] The authors use proprietary deal-level data on 395 buyouts combined with transaction cash-flow, operating, and listed-peer benchmark data. They decompose gross deal internal rates of return (IRRs) into: (i) abnormal performance (enterprise-level outperformance net of leverage and sector returns), (ii) sector exposure, and (iii) incremental leverage. They then relate abnormal performance to sales growth, EBITDA margins, valuation multiples, and deal-partner backgrounds.

[369] The authors use US Census Bureau linked firm- and establishment-level data and track around 3,200 US buyout targets and 150,000 establishments over 1980–2005 to compare targets to controls matched on industry, size, age, and prior growth.

5.193 Two empirical papers already discussed look at the effect of common ownership on innovation in specific sectors—**Newham, Seldeslachts, and Banal-Estañol (2025)** in pharmaceuticals (see para. 5.24) and **Gibbon and Schain (2023)** in European manufacturing firms (see para. 5.101). As discussed, these papers find that common ownership tends to soften competitive pressures between firms, leading to reduced entry and output in some settings, while in others its effects on innovation are heterogeneous—sometimes dampening incentives (e.g. by discouraging entry) and sometimes increasing innovation among commonly owned firms, particularly in environments with strong technological spillovers.

5.194 Below, we discuss additional empirical papers on common ownership that are not related to any specific sector.[370]

5.195 Using patent citations to trace the diffusion of technological knowledge, **Kostovetsky and Manconi (2020)** highlight the role of common ownership as a vehicle for innovation diffusion across firms. Although not studying product-market mergers directly, the study is relevant to merger analysis because it examines common institutional ownership as a form of partial integration between competing firms and studies whether this ownership structure facilitates the diffusion of innovation across them. To do so, the study combines patent data with institutional ownership data as well as balance sheet data for a sample of publicly traded US companies over the period 1980–2010.[371] The authors first document a cross-sectional association showing that a one percentage point increase in common ownership is associated with 1.5% more patent citations between two firms and a 10–40% shorter time to first citation. These results are confirmed also when controlling for potential endogeneity of common ownership.[372] The authors also establish that overlapping board membership does not account for the results, whereas the increase in citations is primarily driven by geographically distant firms, consistent with common ownership facilitating attention to innovation when informal channels are limited due to geographic distance. In a complementary analysis, the authors exploit mergers between financial institutions and compare patent citations of treated firms (i.e. those which were held by the acquiring and target investors) to those of untreated firms (i.e. control firms which are in the same industry, are held by non-merging financial institutions, and are closest in market capitalisation to the treated firms). Results are consistent with the finding that increasing common ownership is associated with higher patent citations between firms.

5.196 Looking at a broad cross-section of publicly listed US firms, **Kini, Lee, and Shen (2024)** examine how common ownership affects product market competition and innovation—captured by changes and expansion in firms' product offerings. The authors analyse a panel of US public firms over 1997–2017 using a DiD design that exploits mergers between financial institutions as exogenous shocks to common ownership, which mechanically increase cross-holdings and enable causal identification. The results show that increases in common ownership lead to higher fluidity,[373] greater product development, and increased investment, consistent with an efficiency channel whereby common owners internalise knowledge spillovers and

[370] Although not all empirical papers that look at common ownership would be classified as corporate finance papers per se, for convenience we discuss these together in this Subsection.
[371] The sample size is reported at the firm-quarter level. However, the corresponding number of distinct firms in the sample is not disclosed.
[372] Endogeneity is controlled through two identification strategies: a regression discontinuity design exploiting exogenous variation in institutional ownership around Russell 1000/2000 index reconstitutions, and a DiD approach centred on mergers between financial institutions.
[373] Fluidity is a text-based measure of product-market threat, capturing how much a firm's competitors change their 10-K product descriptions relative to the firm's own product space. Higher fluidity indicates greater competitive movement or disruption by rivals.

stimulate innovation. The procompetitive effects are strongest in industries conducive to spillovers (e.g. low concentration, high technological proximity) and weaker where market power is more relevant.

5.197 Similarly, **Antón, Ederer, Giné, and Schmalz (2025)** investigate, both theoretically and empirically, how corporate innovation depends on common ownership. Theoretically, the paper proposes two mechanisms: on the one hand, when technological spillovers are strong, firms have inefficiently low incentives to innovate, as they may not capture the returns from innovation. With common ownership, this appropriability problem is mitigated and common ownership can stimulate innovation. On the other hand, common ownership can internalise business-stealing effects. To empirically investigate which of these two effects dominates, the authors use data from the universe of publicly listed US corporations from 1985 to 2015.[374] On average, the relation between common ownership and innovation is ambiguous, but the interaction patterns are consistent with the theory: innovation is more positively related to common ownership when technological proximity is high and more negatively related when product market proximity is high. On average, an increase in common ownership is associated with lower innovation for roughly half the firms (i.e. those with relatively strong product market spillovers to commonly owned peers) and with higher innovation for the other half (i.e. those with relatively strong technological spillovers).

5.198 Relatedly, **Feyler, Heim, Spiegel, and Szücs (2026)** investigate whether horizontal minority stake acquisitions (i.e. where one firm buys a less-than-50% stake in a direct rival) affect the subsequent innovation activity of both parties involved. Using patent data spanning 34 countries over 2001–2019,[375] the authors find that horizontal minority stake acquisitions lead to a persistent decline in innovation for both the acquiring and the target firm: patent counts and citations fall by 9–15% within five years for both parties. The decline is not uniform across a firm's technology portfolio but is concentrated in the technology classes where the two firms' innovative activities directly overlap, while non-horizontal minority acquisitions (i.e. between firms that do not share technology space) have no detectable effect. This within-firm, within-technology-class pattern is argued to point to reduced competitive incentives rather than financial constraints, managerial distraction, or post-deal disruption, since those alternative mechanisms would depress innovation across the board rather than selectively in contested technology areas.

Human capital, acquihires, and labour market power in M&As

5.199 A further stream of the corporate finance literature highlights the role of human capital as a key driver of firm value, studying how labour-related complementarities and labour market power shape merger likelihood, stock market reactions, post-merger performance, and the allocation and incentives of skilled workers and inventors. In particular, a number of more recent studies circle around the idea of

[374] They combine firm-level measures of technological proximity (based on patent class overlap) and product market proximity (based on text-based product similarity from 10-K filings) with measures of common ownership (measured as profit weights), and estimate panel regressions of innovation inputs (scaled R&D expenditures) and outputs (citation-weighted patents and the stock market value of patents) on common ownership and its interactions with technology and product market spillovers, controlling for standard co-determinants of innovation.

[375] The final estimation sample contains 1,082 targets and 579 acquirers. To address the non-random selection of firms into such deals the authors construct control groups via propensity score matching, restricting potential controls to firms active in the same patent classification classes. Treatment effects are then estimated using a staggered DiD estimator.

so-called acquihires.[376] Acquihires are labour-motivated acquisitions which occur when a company acquires another company primarily to gain its employees rather than its products or customers. The goal is to integrate the targets' skilled talent and inventors, to benefit from their technological knowledge and capabilities, accelerate innovation processes, and strengthen the acquiring firm's competitive advantage through the absorption of high-quality human capital.

5.200 For example, **Ouimet and Zarutskie (2020)** examine whether labour-motivated acquisitions are associated with differential post-merger employment outcomes at the target, and if mergers can function as a mechanism to acquire and reallocate talent between firms.[377] The results show a positive relation between an increase in skilled labour and post-merger employment growth at the target. The authors interpret this result to suggest that some firms are targeted as a means for the acquirer to access their human capital.

5.201 While not examining acquihires directly, **Wang (2024)** contributes to the debate by providing evidence supporting the view that acquisitions can serve as a mechanism for reallocating inventor human capital towards more productive matches. The paper investigates whether M&A transactions lead to a reallocation of inventor human capital across firms and how such restructuring affects innovation productivity.[378] The results show substantial post-merger restructuring driven primarily by target inventors: their departure rate increases by 5.6 to 5.9 percentage points relative to matched controls, whereas acquirer inventors experience a 1.4 to 2.3 percentage point decline in departures. External hiring continues at pre-merger rates, leaving the overall inventor workforce size broadly unchanged. At the inventor level, productivity rises within the combined entity, with inventors filing more patents and producing more citation-weighted patents. The results also indicate that effects are driven by non-top performers and inventors with greater technological overlap with their post-merger employers, consistent with M&As reducing inventor labour market frictions and reallocating inventors to more productive matches.

5.202 **Lee, Mauer, and Xu (2018)** examine whether and how human capital relatedness between firms affects merger likelihood, merger gains (measured as stock price reaction to the deal), and post-merger operating performance as well as changes in employment, wages, and labour productivity.[379] Results show that the likelihood of a merger is increasing in human capital relatedness. In particular, this effect is distinct from, and not subsumed by, product market relatedness. The authors further find that human capital relatedness is also associated with an increase in

[376] Benkert, Letina, and Liu (2025) discuss acquihires theoretically (see para 4.34).

[377] To identify mergers in which targets were associated with more skilled labour force, the authors measure the usage of the term 'skilled' in the firms' 10-K filings. Using data on 1,800 M&As with a public US target and by public or private US acquirers between 1995 and 2005, the authors estimate cross-sectional OLS regressions with fixed effects to relate the labour-motivation measure to post-merger employment changes in target firms, using both establishment-level raw employment growth and establishment-level excess employment growth that adjusts for industry and firm size trends through matching with unmerged control firms.

[378] Using an inventor–firm matched dataset, the author tracks inventors' career trajectories around 845 US public M&A deals between 1984 and 2017 and classifies them as retained, departed, or newly hired. Wang combines a propensity score–matched control sample of non-merging firms with a DiD estimator and runs the analysis at the firm and inventor levels.

[379] Based on public industry-level employment data, the paper constructs measures of human capital relatedness between firm pairs, bounded between zero and one, with one indicating perfect alignment between the human capital profiles of two firms. Using a sample of 2,644 US public firms which engaged in 1,474 mergers across various industries between 1997 and 2012 and a matched control group of non-merging firms (matched on vertical relation, product similarity, number of segments, total assets, and market-to-book ratio).

the combined announcement return (i.e. stock price reaction to the deal), and is positively related to post-merger operating performance (measured as the ratio of operating income to total net sales). To explain the improvement in post-merger operating performance, the authors examine the effect of human capital relatedness in M&A on wages, employment, and labour productivity. They find that, while post-merger employment and wages decline, labour productivity rises when human capital relatedness is high, showing that merger effects may arise through greater bargaining power for the acquiring firm over the merged workforce and the elimination of redundant labour.

5.203 Whereas Lee, Mauer, and Xu (2018) suggest that part of the gains from mergers between firms with related human capital may arise through greater bargaining power over the merged workforce, **He and Xue (2025)** examine this mechanism more directly by investigating how M&As influence innovation through changes in firms' labour market power over inventors.[380] The authors use longitudinal data on US inventors linked to survey, census and administrative employee–employer information and patents. Using a dynamic DiD design, they compare inventors at merging firms to matched counterfactual inventors in non-merging firms.[381] The study finds that high-impact inventors[382] experience declines in outcomes following a merger with patenting falling both at target firms and at acquirer firms. Patent quality also declines, with a stronger drop in high-citation patents. Results also show that the estimated negative effects are larger in high-concentration product markets and smaller in high-synergy mergers. On average, the negative labour market power effect dominates potential gains from innovation synergies, leading to an overall decline in inventor productivity and earnings following mergers.

5.7 Potential competition and acquisitions of small innovative companies

5.204 Many of the papers on horizontal mergers and acquisitions discussed above also cover acquisitions of potential competitors including studies in pharmaceuticals[383] and, in particular, digital markets.[384] In the last section of this Chapter, we review the additional papers on the acquisition of potential competitors that are not covered elsewhere in the report. In this literature, the term 'startup' is typically used to refer to small innovative companies.

5.205 Volume 1, Chapter 6 and Chapter 4 in this Volume discuss the theoretical literature related to the acquisition of potential competitors, considering concerns around killer acquisitions and suppressed future product market competition and entrenchment, as well as potential offsetting entry- or innovation-for-buyout mechanisms and effects on the direction of innovation. Volume 1, Chapter 7 and

[380] The authors use individual-level, longitudinal data on US inventors linked to survey, census and administrative employee–employer information and patents, covering around 3,300 mergers between innovative firms over 2005 to 2017, including about 21,500 inventors in target firms and 109,000 in acquiring firms.
[381] Matching is based on characteristics including the same two-digit NAICS industry code, meaning they operate in the same broad sector, though not necessarily in direct competition with the merging firms, as two-digit NAICS groupings are too broad to guarantee product-market rivalry.
[382] High-impact inventors are those for whom the merger has a high predicted impact on labour market power, defined as inventors who are already in above-median pre-merger inventor labour-market concentration and who also face an above-median increase in concentration caused by the merger.
[383] This includes in particular Cunningham, Ederer, and Ma (2021), Lear (2024), Malek, Seldeslachts, and Veugelers (2025), and Wabiszewski (2025).
[384] For example Kamepalli, Rajan, and Zingales (2022), Alezra and Berquier (2024), Eisfeld (2025), and Jin, Leccese, and Wagman (2025), but also many others discussed in Sections 5.3 and 5.4.

this Chapter cover empirical studies that also touch on issues related to potential competition—particularly in the context of digital markets (see Section 5.3 just above). This Section covers additional (empirical) papers studying potential competition.

5.206 Although not directly related to innovation or investment, **Goolsbee and Syverson (2008)** examine how incumbents' pricing behaviour responds to the threat of future entry in the US airline industry. The analysis uses a sample of US Department of Transportation ticket data from 1993–2004, combined with information on Southwest Airlines' network expansion to identify routes where entry becomes more likely.[385] They find that incumbents cut fares substantially in response to entry threats, with more than half of the total price response occurring before actual entry. In other words, they find that the threat of future entry incentivises firms to be more competitive. They also find evidence consistent with entry deterrence, as the pre-emptive price cuts are weaker or absent where entry is effectively pre-announced and therefore harder to deter—although they do not have enough statistical power to reject the possibility that airlines implement similar price cuts on threatened routes.

5.207 As discussed in para. 4.22, **Phillips and Zhdanov (2013)** develop a theoretical model in which the prospect of a takeover can strengthen small firms' incentives to invest in R&D, as large firms can deploy successful innovation across the broader product base of the acquiring firm. This incentive effect is stronger if the small firm has more bargaining power over the acquisition price and can therefore capture a larger share of the acquisition surplus. Using data on US firms between 1984 and 2006, they find that higher takeover activity by the acquiring firm and takeover likelihood are associated with higher R&D for small firms, while the relationship is substantially weaker for large firms, consistent with smaller firms' R&D incentives increasing with the probability of being acquired.[386]

5.208 **Fons-Rosen, Roldan-Blanco, and Schmitz (2024)** provide an empirical assessment of how startup acquisitions affect innovation and economic growth by combining micro-level empirical evidence with a calibrated endogenous growth model.[387] They find that acquisitions have, on average, no significant effect on the number of citations (interpreted as the implementation of startup ideas by the authors), although acquisitions by firms in the same industry reduce implementation relative to unrelated acquisitions. These estimates and other empirical observations, such as the average acquisition premium or the frequency of startup acquisitions, are then used to calibrate a Schumpeterian growth model with endogenous startup entry, incumbent innovation, and acquisition decisions. Counterfactual simulations show that banning startup acquisitions (i) lowers the

[385] Exploiting discrete increases in entry probability when Southwest begins operating in both endpoint airports of a route, the authors implement an event-study-style framework with route–carrier and time fixed effects.

[386] In the empirical part of the paper, they estimate firm-level panel regressions of R&D intensity using a panel covering 11,288 non-financial, non-utility firms across 181 three-digit SIC industries, with 84,471 firm-year observations over 1984–2006. They address endogeneity concerns using lagged industry M&A activity and an instrument-variable approach where they instrument the likelihood of takeover with unexpected mutual fund flows that affect firm valuations and, in turn, the takeover probability.

[387] The authors assemble a dataset linking US startup acquisition transactions for 2000–'20 to patent-level innovation outcomes and firm-level financial data. They estimate the causal effect from acquisitions on patent citations. The authors use a matched patent-level DiD approach where each acquired startup patent is matched to similar non-acquired patents based on pre-acquisition characteristics, and compare changes in forward citations for treated versus matched control patents before and after the acquisition (with the treatment effect identified by the post-acquisition divergence in citation trends).

startup rate, by removing entry- or innovation-for-buyout effects; but also (ii) increases incumbent innovation and the implementation of the startup ideas, because of the absence of (reverse) killer acquisition dynamics. Overall a startup acquisition ban lowers growth marginally.

5.209 In an OECD study using a cross-country firm-level dataset, **Berger, Calligaris, Greppi, and Kirpichev (2025)** examine whether acquisitions of startups by incumbents foster or stifle innovation.[388] They find that, on average, acquisitions lead to a substantial decline in patenting and patent quality among acquired startups relative to non-acquired startups, with no offsetting increase in innovation by acquirers. Negative effects are strongest for technologically or geographically overlapping firms, consistent with competition-reducing motives. The authors acknowledge the potential offsetting effect from the prospect of acquisitions on the incentives for startups to innovate ex ante (i.e. innovation-for-buyout), but they do not quantify these effects or incorporate them into a general assessment of the effect of a potential ban on startup acquisitions.

[388] The analysis combines the OECD/STI Startups Database (integrating Crunchbase and Dealroom), global M&A transactions from Orbis M&A, and patent data from PATSTAT, to compile a sample of more than 90,000 innovative startups across 60 countries and around 18,000 acquisitions over the period 2001–'21. To estimate post-acquisition effects, the authors implement staggered DiD comparing acquired startups to not-yet-acquired (and never-acquired) startups, controlling for firm fixed effects and industry–country trends, and corroborate the design using startups that received acquisition bids that were later withdrawn for reasons argued to be unrelated to innovation.

6 Non-horizontal mergers

6.1 This Chapter provides a detailed paper-by-paper review of the relevant literature in Volume 1, Chapter 8.

6.1 Firm boundaries and resolving external contracting frictions

6.2 Much of the early economics literature on non-horizontal integration is related to the wider question on what explains the boundaries of the firm—i.e. what complementary activities are brought under the internal control of a single entity and which are instead coordinated externally via market transactions. This literature considers questions around vertical integration (including both backwards integration, e.g. manufacturers acquiring their input providers in a 'make-or-buy' decision, and forward integration, e.g. a supplier acquiring a distribution channel), but it is also informative on questions around conglomerate integration.

6.3 Building mostly on the organisational economics literature, there are two general perspectives on what explains the boundaries of the firm: the earlier **transaction cost economics (TCE)** literature, which explains the boundaries of the firm with reference to the minimisation of transaction costs (e.g. contracting and governance costs) under conditions of incomplete contracts, uncertainty, and asset specificity; and the subsequent **property rights theory (PRT)** literature, which instead explains the boundaries of the firm with reference to the optimal allocation of residual control rights given their effect on ex ante investment incentives.[389] Both perspectives provide a procompetitive justification for firms pursuing non-horizontal integration. We discuss each in turn.

6.1.1 Transaction cost economics

6.4 In his seminal work, **Coase (1937)** raises the fundamental question of why certain activities are brought under internal control within the firm, whereas others are instead transacted externally. This work focuses on the balance that would need to be struck between internal and external transaction costs (e.g. contracting and governance costs).

6.5 Building on this work, authors such as **Williamson (1975, 1985) and Klein, Crawford, and Alchian (1978)** formalised the TCE theory, which explains the boundaries of the firm by reference to the minimisation of transaction costs under conditions of incompleteness of contracts, uncertainty, and asset specificity. The TCE literature views non-horizontal mergers, such as vertical integration, as a way of mitigating potential hold-up problems when contracts are incomplete—i.e. the problem that one party does not want to undertake mutually beneficial sunk and relationship-specific investments, given the subsequent vulnerability of that party to opportunistic renegotiations by the other party. TCE predicts that non-horizontal integration should be more beneficial and more common when there is greater relationship-specificity in investments and when contractual imperfections (e.g. the risk of opportunism under incomplete contracting) are more severe.

6.1.2 Property rights theory

6.6 Authors such as **Grossman and Hart (1986), Hart and Moore (1990), and Aghion and Tirole (1994)** developed the PRT, which focuses instead on how

[389] For a synopsis of the earlier literature, see for example Lafontaine and Slade (2007) and Bresnahan and Levin (2012).

ownership of assets affects investment incentives when contracts are incomplete and different parties hold residual control rights over assets.

6.7 Where TCE explains the boundaries of the firm by reference to the minimisation of contracting and governance costs, PRT explains them with reference to the allocation of residual control rights to ensure efficient investment incentives. Residual control rights give the owner the ability to decide how assets are used in situations not covered by prior agreements, which in turn affects incentives to make relationship-specific investments. In particular, the owner of an asset has stronger investment incentives, since it expects to capture a larger share of the ex post surplus through its stronger bargaining position, whereas the party that no longer controls its asset (e.g. managers) has weaker incentives because its bargaining position—and thus expected share of surplus—is lower.

6.8 PRT predicts that ownership of complementary assets should be allocated to the 'stage' (i.e. the specific activity in a set of complementary activities) where non-contractible investment is most important for joint value creation. This in turn predicts that non-horizontal integration is more beneficial and more common when investments are complementary and the gain in incentives for the controlling party outweighs the loss for the other party, whereas separation is more beneficial and more common when investments are substitutable or when preserving the incentives of a non-controlling party is relatively more important.

6.2 Non-horizontal integration and static foreclosure

6.9 Much of the TCE and PRT literature considers the motivations for integration between two firms, independent of any effects on outsiders. Other papers, particularly within the IO literature, also consider the effects of integration on overall market structure and competitive effects.[390]

6.10 Looking at an oligopolistic setting with both integrated and non-integrated firms, **Salinger (1988)** analyses the conditions under which vertical mergers give rise to (partial) foreclosure. The paper develops a two-stage Cournot model in which firms operate in both intermediate and final goods markets, with homogeneous products, linear wholesale pricing, and constant returns to scale. A key mechanism is that vertically integrated firms only supply internally and are not active on the intermediate goods market, which reduces residual demand faced by unintegrated upstream firms but also increases concentration upstream. This, in turn, can raise downstream rivals' costs. The main finding is that the overall price effect is ambiguous: while vertical integration eliminates double markups to the integrated firm (given the assumption of linear pricing), it may raise input prices and soften downstream competition by increasing the costs and reducing the competitiveness of unintegrated downstream rivals, thereby shifting market power towards the integrated firm.

6.11 Salinger does not consider whether vertical foreclosure emerges in equilibrium, nor whether unintegrated upstream and downstream rivals can adopt effective counterstrategies. **Ordover, Saloner, and Salop (1990)** develop a model that accounts for incentive compatibility and strategic responses. The model features two upstream firms supplying a homogeneous input to two downstream firms producing differentiated goods under price competition.[391] Firms may vertically integrate, allowing the merged entity to refuse supply or raise input prices to

[390] For an overview of the competitive effects of vertical mergers, see e.g. Salop and Culley (2014).
[391] Because upstream products are homogeneous, products are supplied at marginal cost under competition and vertical integration cannot lead to a procompetitive elimination of double markup.

downstream rivals, increasing their costs and softening competition. This, in turn, allows the integrated firm to increase its downstream market share, prices, and profits even in the absence of efficiency gains. The authors demonstrate that vertical foreclosure emerges in equilibrium, but only in case of a sufficiently small increase in the rival's input price which in turn raises the joint profits of the unintegrated upstream–downstream pair. In that case, the upstream firm's gain exceeds the downstream firm's loss, and the latter cannot profitably induce a counter-merger to restore the pre-merger outcome. If the input price increases too much, joint profits of the unintegrated firms fall and a counter-merger becomes profitable. To sustain foreclosure, the model assumes that the integrated firm can constrain the upstream price faced by rivals (e.g. by credibly committing to supply at a given price), thereby preventing excessive price increases and a drop in the joint profit of the unintegrated firms.[392] A limitation of the model by Ordover, Saloner, and Salop is that ex post it is profitable for the integrated upstream firm to undercut rivals' suppliers (which requires firms to be able to pre-commit to a given conduct).

6.12 **Hart and Tirole (1990)** instead allow for ex post bargaining with flexible contractual forms, in particular two-part tariffs, implying that input trade occurs at marginal cost with rents extracted through fixed fees. Within this framework, vertical foreclosure does not rely on a commitment to high input prices, but may still arise in equilibrium to address the impact of upstream 'opportunism'. The baseline model features two upstream firms supplying a homogeneous input to two downstream firms. Firms first choose whether to vertically integrate and then compete in the product market under imperfect competition. The authors consider a first variant of this model where one of the two upstream firms is much more efficient than its rival, and can be considered a quasi upstream monopolist.[393] In this setting, if contracts with the downstream firms are public, then there is no incentive to vertically integrate and to foreclose one of the downstream firms. However, if contracts are not observable, the efficient upstream firm is not able to commit to restrict overall output, and faces an ex post incentive to sell additional volume, leading to a lower equilibrium price.[394] In this model vertical integration with one of the downstream firms and foreclosure of the other downstream rival is a way to *restore* market power, and address a problem of *imperfect rent extraction* absent a merger.[395]

6.13 **Baake, Kamecke, and Normann (2004)** extend Hart and Tirole (1990) by allowing the upstream monopolist to make an observable ex ante capital investment that reduces marginal production costs. After choosing capital, the upstream firm secretly offers take-it-or-leave-it nonlinear contracts to downstream Cournot competitors. Under vertical integration, the monopolist can credibly implement the monopoly output level and therefore chooses the efficient capital stock conditional on monopoly output, while foreclosing non-integrated downstream firms. Under vertical separation, downstream competition undermines commitment to monopoly output, inducing the upstream monopolist to underinvest strategically in capital in order to raise marginal costs and limit ex post output expansion. The paper therefore shows that prohibiting vertical integration may distort investment incentives. In a parametrised example, the authors show that total welfare under vertical integration can exceed welfare under separation when downstream

[392] They also show that foreclosure does not arise in equilibrium under quantity competition with homogeneous goods, as the strategic substitutability under quantity competition causes joint profit of the non-integrated firms to always decrease and makes a counter-merger profitable.
[393] See also Rey and Tirole (2007).
[394] The mechanism is similar to the Coasian conjecture on the pricing policy of a durable good monopolist.
[395] For a broader discussion of vertical foreclosure as a way to address imperfect rent extraction (e.g. due to price regulation) see Fumagalli, Motta, and Calcagno (2018).

competition is sufficiently intense, although output is lower and prices higher under integration. Although the authors do not draw this conclusion, this implies that consumer surplus is lower.

6.14 When considering the effects on competitors, these papers on vertical integration generally consider 'static' foreclosure, in the sense that the integration is a mechanism to raise rivals' costs and increase own market shares and profits independent of any exit or changes to investment by rivals. That said, Hart and Tirole argue that foreclosure may also be dynamic in that '[t]his fall in the profit of [the downstream competitor] may cause it to stop investing or to exit the industry' (p. 209). Moreover, the static effect on input prices modelled in this part of the literature could affect future investment incentives if it relates to an important R&D input for downstream rivals of the merged firm.

6.3 Non-horizontal integration and incentives to invest

6.15 The earlier papers on vertical integration and foreclosure consider 'static' foreclosure in the form of increases in rivals' costs. However, later papers have considered how vertical (or, more generally, non-horizontal) integration affects incentives to invest—both of the merging parties and of outsiders.

6.16 The literature has identified **anticompetitive foreclosure mechanisms** that motivate a merger without any concurrent procompetitive effects (e.g. raising rivals' hold-up problems), but also more **general foreclosure mechanisms** that are indirectly related to effects that are in the first instance procompetitive (e.g. elimination of double markups or Cournot effects that subsequently discourage rival investment).

6.17 Below, we discuss in turn the papers that look at vertical mergers and those that consider conglomerate mergers.

6.3.1 Vertical mergers

6.18 **Bolton and Whinston (1993)** extend the PRT framework of incomplete contracting models in bilateral supply settings (in particular Grossman and Hart (1986)) to a multilateral setting with supply assurance concerns. They take a simple setting where three assets—one upstream asset and two downstream assets—are owned by agents under alternative ownership structures. The upstream asset produces an input used by both downstream assets. To focus the analysis on supply assurance concerns—and in contrast to Salinger (1988), Ordover, Saloner, and Salop (1990), and Hart and Tirole (1990)—the model assumes away any foreclosure motivations by assuming the two downstream assets do not compete with each other. Investment only takes place downstream: the downstream assets can increase customer valuation through non-contractable, unobservable investment (effort) choices made by managers. Each downstream asset serves a separate buyer with unit demand, and valuations depend on investment and a stochastic state. While the upstream input provider wants to supply both downstream assets, it faces a stochastic capacity constraint where it can only supply a single unit. Contracts are incomplete: only simple ex post spot transactions are feasible, so trade is determined via ex post bargaining once capacity and valuations are realised. In line with the property rights theory, ownership matters through its effect on ex ante investment incentives via bargaining payoffs. Bolton and Whinston show that while vertical integration improves supply assurance of the integrated downstream asset and increases its incentive to invest, the opposite happens to the non-integrated downstream asset. In that sense, vertical integration imposes a negative externality on non-integrated downstream firms. They further show that in case of sufficiently severe supply assurance concerns, vertical integration can be an equilibrium outcome even though non-integration would be socially optimal.

6.19 **Brocas (2003)** builds a theoretical model to show how vertical integration can arise as an efficient response to upstream innovation with licensing frictions. She develops a model with two upstream innovators who invest in process innovations used by two downstream producers. Each innovator is initially matched with one producer, and producers can only switch technology ex post by incurring a switching cost. The industry evolves as follows: first, the matched upstream innovator and downstream producer decide whether to integrate vertically. Second, each innovator chooses an investment effort that determines the probability of discovering a cost-reducing drastic innovation. Third, each upstream innovator is allowed to license its innovation, setting license fees when competing for downstream adopters. An important restriction is that an integrated firm cannot license or acquire the rival's technology. Brocas shows that absent integration, higher switching costs increase the ability of innovators to appropriate returns through licensing, because these generate lock-in effects. Conversely, efficient technologies with low switching costs may be underprovided, as innovators cannot fully capture their value and competition in licensing drives fees down. The paper shows that vertical integration may increase appropriability and investment incentives relative to licensing, when switching costs are not too high (so that innovators cannot fully extract rents through licensing alone). Vertical integration benefits consumers only when its positive effect on innovation and the survival of efficient technologies outweighs its tendency to restrict licensing and downstream competition.

6.20 **Banerjee and Lin (2003)** show that downstream oligopolists may invest more in cost-reducing R&D than a downstream monopolist, in an industry with a two-tier vertical structure. The intuition behind this result is that the output-enhancing effect of R&D allows upstream firms to increase their input price, which lowers the benefit of R&D to a downstream firm but also raises its rivals' costs. On balance, a downstream firm in oligopoly may invest more in R&D than a downstream monopolist, because of the raising rival costs effect. While the paper does not explicitly model vertical integration,[396] its logic suggests that integration would reduce the scope for opportunistic behaviour by the upstream firms, and further enhance investment incentives downstream (the merger may or may not benefit consumers, depending on any concurrent foreclosure effects—though this is not investigated in this paper).

6.21 **Innes (2006)** examines whether non-horizontal mergers, including vertical and multi-product mergers, can deter entry by prospective rivals, in a retail environment. He finds that integration leads firms to more aggressive price competition than separation (as they cannot sign contracts to pre-commit to softer price competition), reducing the profitability of both incumbents and entrants. Innes shows that this can make non-horizontal mergers privately optimal even when firms would otherwise prefer separation. This mechanism does not rely on foreclosure or raising rivals' costs, since upstream input markets are assumed to be contestable. In the application considered, mergers can improve welfare by limiting excessive entry and duplicated fixed costs, and may reduce consumer prices when the procompetitive pricing effect of integration outweighs the loss of variety from entry deterrence. However, in some cases, vertical mergers raise average prices relative

[396] The paper models a scenario with fixed price contracts as a solution to opportunistic behaviour by upstream firms.

to no-merger outcomes, so privately profitable mergers may also harm consumers.[397]

6.22 **Buehler and Schmutzler (2008)** consider the effect of vertical integration on downstream rival's incentives to invest in cost-reducing technology. In their model, two downstream firms face two initially independent upstream suppliers, in a linear Cournot model where downstream firms require one unit of an intermediate good produced by the upstream firms for each unit they produce.[398] First, downstream firms decide whether to integrate backwards by acquiring a supplier. This allows the integrated firm to obtain the input at marginal cost and eliminate double markups. Second, downstream firms invest in process innovation. Third, any remaining separated upstream firms set wholesale terms. Finally, downstream firms set retail quantities, with marginal costs determined by the preceding stages of the game.

6.23 Buehler and Schmutzler establish the following results: vertical integration increases the integrated firm's own investment and reduces the rival's investment; asymmetric integration (i.e. one integrated and one separated downstream firm) is an equilibrium outcome for a range of parameter values; and relative to a model without investment, full separation becomes less likely in equilibrium. The driving mechanism behind the decrease in investment by the non-integrated downstream competitor—which the authors refer to as an 'intimidation effect'—is the efficiency from vertical integration: by reducing its marginal cost, the integrated firm becomes a stronger competitor, reducing the incremental benefit to the non-integrated downstream firm from investing in cost-reducing technology. Buehler and Schmutzler do not present results on the impact of vertical integration on overall investment or consumer welfare.

6.24 Looking at upstream innovation, **Chen and Sappington (2010)** analyse how vertical integration affects incentives for upstream marginal-cost reducing innovation in a setting where a single upstream monopolist supplies competing downstream firms. They show that vertical integration tends to increase upstream innovation under Cournot competition but can either increase or decrease it under Bertrand competition, depending on the strength of direct innovation incentives.[399] The driving mechanism is that under Bertrand competition, raising rivals' costs through input design or other forms of disadvantaging rivals increases retail prices and lowers overall industry output, which weakens the return to cost-reducing innovation because the resulting margin gains are earned on fewer units sold. The integrated firm internalises this effect. In addition, the integrated downstream firm reacts less aggressively to cost reductions under Bertrand competition, since capturing rival sales also reduces upstream input sales to rivals, further dampening innovation incentives.

6.25 In contrast, under Cournot competition, disadvantaging the rival does not (in the model considered) reduce industry output, as industry output depends on the sum of marginal costs rather than their distribution across firms. In that case, vertical integration unambiguously strengthens innovation incentives by allowing the integrated downstream firm to internalise the full benefit of upstream cost

[397] In particular the paper finds, in relation to vertical mergers, that 'partial-merge equilibria (when only a subset of firms merge to deter entry) can yield higher average prices than no-merge counterparts' (see footnote 22).
[398] This builds on the model proposed by Salinger (1988), by endogenising vertical integration and allowing downstream firms to make cost-reducing investments.
[399] In this context, direct innovation incentives refer to the degree to which the innovator can privately capture cost reductions as higher margins, rather than having them competed away or passed on.

reductions, thereby increasing the effective return to innovation without reducing total industry output.

6.26 Moreover, under Bertrand competition, vertical integration is more likely to increase innovation and consumer surplus when direct incentives to innovation are weak (e.g. due to weak patent policy with spillovers, or tight cost-based regulation), but reduce innovation and consumer surplus when direct incentives to innovation are strong. This is because if direct incentives to innovate are weak, then input prices are close to realised costs, and process innovation leads to higher retail output. In this case, vertical integration leads to an additional source of profit from innovating (as the integrated entity captures the profit from additional downstream output). This effect is not present if direct innovation incentives are strong.

6.27 Looking at vertical integration in a market with upstream complementary IP holders and downstream producers, **Schmidt (2014)** analyses how different market structures affect royalties, output, entry, and innovation. He considers an upstream market with multiple patent holders supplying perfectly complementary inputs and a downstream market with firms requiring access to all patents. Upstream firms set linear royalties, after which downstream firms compete under a general demand structure. In extensions to the baseline model he also considers downstream entry and upstream innovation incentives: a potential downstream entrant first considers entering at a fixed cost; or upstream firms decide whether to pursue an innovation yielding additional upstream profit subject to inclusion by all existing patent holders in the standard. He shows that vertical integration between an IP holder and producer eliminates double markups within firms, but also introduces incentives to raise rivals' costs, potentially leading to higher royalties and overall lower output (e.g. depending on the functional form of demand). Moreover, vertical integration may lead to foreclosure of downstream entry.

6.28 **Reisinger and Tarantino (2015)** analyse vertical integration by an upstream monopolist supplying two downstream retailers with different marginal costs. They develop a model with secret two-part tariffs, comparing vertical separation with integration with either the efficient or inefficient retailer. If the upstream firm integrates with the efficient retailer, standard foreclosure effects arise (as in the setting in Hart and Tirole (1990)). If it integrates with the inefficient retailer, however, it may instead supply the more efficient independent rival on favourable terms, including below cost, to shift output towards the lower-cost firm. This 'output-shifting' effect can raise total output and consumer welfare, so vertical integration may be procompetitive where downstream cost asymmetries are sufficiently large. While the paper does not explicitly model investment effects, it is relevant to the dynamic effects literature insofar as it shows how vertical integration can improve productive efficiency.

6.29 In Buehler and Schmutzler (2008) and Schmidt (2014), vertical integration is associated with the procompetitive effect of an elimination of double markups, but may still lead to socially inefficient outcomes. **Allain, Chambolle, and Rey (2016)** instead consider a setting in which vertical integration is exclusively driven by an anticompetitive strategic mechanism that discourages downstream rivals' investment. Building on the TCE literature on vertical integration as a solution to hold-up problems in case of relationship-specific investments and incomplete contracting, they analyse how vertical integration can itself generate hold-up problems for downstream rivals. They develop a successive duopoly model with two upstream suppliers and two downstream firms, where the upstream firms each control an essential yet substitutable input (e.g. a patent, infrastructure, or database) and the downstream firms each decide whether to invest in a product that relies on this input (i.e. they make a discrete investment choice). Upstream firms can make the input available to the downstream firms in return for a share of

their profit, which is set only after investments by the downstream firms are sunk.[400] In the model upstream competition is effective in eliminating or limiting hold-up concerns absent the merger.

6.30 Allain, Chambolle, and Rey first consider a situation in which the upstream suppliers can pre-commit to being 'greedy' before investments are made (ex ante). In this case, the game is as follows: (i) each supplier can publicly pre-commit to leaving a particular share less than one to its partners; (ii) downstream firms decide whether to invest at cost or not; and (iii) each supplier offers each downstream firm a profit-sharing rule. Under vertical separation, suppliers will not pre-commit and will offer competitive profit-sharing rules, which induces the downstream firms to invest. Under vertical integration, however, the integrated upstream supplier has an incentive to pre-commit to a low profit sharing rule: this exposes the non-integrated downstream firm to being held up by the non-integrated upstream supplier, which will offer an only slightly better profit-sharing rule after investments are sunk, and can eliminate the downstream rival's incentive to invest at all. Second, Allain, Chambolle, and Rey show that their result also arises without ex ante commitment when the upstream supplier can instead decide to degrade the quality of the input after investments are made (ex post), and quality is not verifiable (and hence cannot be contracted upon).[401] Overall, vertical integration may result in anticompetitive foreclosure, by exposing rivals to a hold-up problem and reducing their investment. In an experimental test of this theoretical mechanism, **Allain, Chambolle, Rey, and Teyssier (2021),** find that vertical integration creates hold-up problems both when suppliers can pre-commit ex ante to appropriating a share of the profit and when they can degrade ex post the quality of their support.

6.31 To study the impact of vertical integration on innovation in an industry where innovation is relevant either in one market only (upstream or downstream) or both, **Liu (2016)** develops a model with a duopoly both in upstream (production) and downstream (distribution) markets. Upstream inputs are homogeneous and downstream firms have unit demand. At each level, firms may need to undertake risky investments to be active. After investments are made and any innovations realised, firms bargain over the terms of supply, which can create hold-up problems. The model has the following stages: upstream investment, downstream investment, bargaining over supply conditions,[402] and final product market competition. The baseline model assumes homogeneous upstream inputs, such that upstream profits are zero when both upstream firms innovate and hence upstream firms only earn positive profits when one of them succeeds and the other fails; but differentiated downstream competition.[403] In this setup, when innovation is only relevant downstream, vertical integration does not provide any advantages, as upstream competition eliminates any hold-up anyway. Liu shows, however, that when

[400] While the paper looks at a case where downstream firms may be subject to upstream hold-up, the authors argue that their analysis also applies 'upside-down' where investment takes place upstream, and the upstream firms are the ones that are subject to hold-up by the downstream firm.
[401] This ex post mechanism creates hold-up when degrading the rival's input reduces total industry profit. The paper shows that this condition holds in a variety of standard IO models. Although independent firms may decide to merge as well, as a counter strategy, the authors discuss how any subsequent merger is likely to be less profitable, and in any case does not resolve the hold-up issue when there are more downstream firms than suppliers.
[402] Bargaining follows a simple procedure where with probability 1/2, the upstream firms make take-it-or-leave-it offers, whereas with probability 1/2, the downstream firms do.
[403] More precisely, downstream competition leads to gross profit Δ in case a downstream firm is the only active firm and δ each in case both downstream firms are active, with $0 < 2\delta < \Delta$. Given the unit demand assumption, input prices do not affect downstream firms' gross payoffs in the final product market. This also means that the raising rivals' costs foreclosure effect as set out in Ordover, Saloner, and Salop (1990) does not occur here.

innovation is only relevant upstream (i.e. production), vertical integration amplifies a patent race with business-stealing incentives and leads to a prisoner's dilemma: although each pair of firms has an incentive to integrate (to eliminate hold-up), joint profits are higher under vertical separation (to avoid amplifying a privately costly patent race). He argues that repeated interaction may then allow firms to coordinate on a structure with vertical separation rather than pairwise integration—at the expense of consumers. When innovation is relevant at both levels, vertical integration alleviates under-investment, by eliminating hold-up at both stages, and becomes mutually beneficial to each pair of upstream and downstream firms, increasing industry profits and consumer welfare.

6.32 **Loertscher and Riordan (2019)** focus on 'make-and-buy' strategies, where a single firm procures inputs both internally and externally (from competing upstream suppliers). They consider a model where upstream costs are a stochastic function of (unobservable) investment (effort) and study the benefits and costs of vertical integration in this setting. They show that vertical separation increases the independent suppliers' market share and hence increases their marginal return from investing, thereby lowering expected procurement costs for the customer. Vertical integration entails ex post sourcing distortions as it reduces the incentive of independent suppliers to invest in cost reductions, but allows the customer to avoid paying an external supplier markup.[404] They find that the downstream customer prefers vertical integration when the expected benefit from eliminating double markups outweighs the harm from reduced upstream investment by the independent supplier. In a model with exponential cost distribution and quadratic cost, they show parametrically that vertical integration is preferable when the number of independent suppliers is small and/or the variance in costs is sufficiently high (both of which decrease upstream competition and increase double markups when sourcing externally). The authors note that if upstream firms were to supply other customers who benefit from cost-reducing investments, vertical integration might raise rivals' costs, as in Ordover, Saloner, and Salop (1990). This effect is, however, not modelled in the paper.

6.33 **Bryan and Hovenkamp (2020)** consider the ex ante investment incentives of an upstream component provider in a situation of two competing downstream firms, a leader and a laggard. As also discussed in para. 4.51, if the downstream firms can acquire the upstream component provider (which Bryan and Hovenkamp refer to as a startup), the startup is endogenously acquired by the leader, as increasing or at least maintaining the technology gap is more profitable to the leader than decreasing the gap is to the follower. As a result, technology diffusion is inefficient, harming consumer welfare relative to a situation where the laggard acquires the component or the component gets licensed to both firms. If the direction of innovation is endogenous, the component provider has an incentive to develop technologies that increase the leader's willingness to pay, resulting not just in an inefficient allocation of innovation (i.e. exclusive use by the leader) but also in an inefficient direction of innovation biased towards the leader rather than the laggard. Consequently, the prospect of acquisition by the leader distorts upstream R&D incentives, shifting innovation towards technologies that further entrench the leader's position.

[404] The model consists of three stages: first, the downstream firm decides whether to stay vertically integrated or whether to divest its upstream unit; second, all upstream suppliers make non-contractable and non-observable effort to reduce their costs, where costs are a stochastic function of effort and the realisation of each supplier's type; third, the downstream firm solicits bids from all suppliers in a reverse auction, where bids of non-integrated suppliers include a markup whereas the bid from the internal supplier, if present, is at marginal cost. The vertically integrated firm will source externally if the lowest external bid is lower than the cost of internal supply.

6.34 **Motta and Peitz (2021)** provide an alternative perspective on non-horizontal mergers, building on their stylised framework for mergers with potential competitors (see para. 4.8 for a further discussion of this paper). They consider an incumbent firm that is a monopolist in market A, and a potential competitor, with a risky project in a separate market B. If successfully developed, the project gives the potential competitor a monopoly position in market B, but might also give it, with a positive probability, the ability to launch a new product which would challenge the incumbent in market A. A merger between the incumbent and the potential competitor allows the incumbent to protect its monopoly power in market A, to the detriment of consumers. The logic follows from the same reasoning developed by Motta and Peitz (2021) in their baseline model where the potential competitor has a project to directly challenge the incumbent in its core market (see discussion in para. 4.8). This extension captures the idea that competitive risks for incumbents may come from a firm active in another (complementary or independent) market, which may build on success in such a market (in terms of customer base, data, technology) to subsequently enter the incumbent's core market. For example, a platform may fear the possibility of dis-intermediation by an access seeker that provides a complementary good at present, but that may be able to bypass the platform over time. A merger with the potential competitor in this case may ostensibly appear like a non-horizontal merger, but may in practice be best considered as a horizontal merger, in terms of its rationale and impact on competition.

6.35 Looking at the vertical market for ad intermediation services and publishers, **D'Annunzio, Russo, and Shekhar (2024)** develop a theoretical model of digital advertising ecosystems to analyse how vertical integration between ad intermediaries and publishers affects intermediary rents and content investment incentives. They consider two publishers and two intermediaries, comparing vertically separated and integrated structures, and highlight how integration confers a data advantage to the intermediary through exclusive access to consumer information. This informational asymmetry weakens competition in the intermediation market, enabling the integrated intermediary to extract an 'adtech tax' from independent publishers by strategically shading its bids for impressions. As a result, vertical integration redistributes surplus within the ecosystem: independent publishers receive lower advertising revenues and reduce investment in content quality, while the integrated publisher increases investment due to stronger internalisation of intermediation profits. The overall welfare effects are ambiguous, as integration may simultaneously exacerbate underinvestment by independent publishers while improving efficiency within the integrated entity.

6.36 **Chambolle and Guignard (2026)** study a vertical structure with a single downstream monopoly retailer and two upstream manufacturers—interpreted as a branded goods producer and a private label producer. The monopoly retailer may vertically integrate with the private label producer. Chambolle and Guignard consider the incentive of the two upstream manufacturers to invest in quality, depending on (i) whether the retailer is vertically integrated, (ii) the degree of retailer buyer power, (iii) the strength of one-way innovation spillovers from the branded goods producer to the private label producer, and (iv) whether the upstream manufacturers innovate simultaneously or whether the branded goods producer innovates first. Wholesale bargaining is assumed to be efficient (through two-part tariffs). The fact that there is a downstream monopolist means that the competitive externalities between the manufacturers are internalised: any business-stealing between producers merely shifts profits within the retailer, provided both products are available. Both manufacturers therefore share the common objective of maximising total industry profit, and any positive one-sided spillovers are mutually beneficial.

6.37 Following vertical integration, the integrated firm (i.e. retailer + private label) always invests more, because integration removes the hold-up problem and improves the retailer's bargaining position relative to the independent manufacturer following investment (as investment improves its outside option in negotiations). Whether the independent (i.e. branded) manufacturer invests more depends on timing, spillover, and the degree of buyer power. With simultaneous investment, the independent manufacturer invests *more* (resp. less) when spillovers are *high* (resp. low). The intuition is that sufficiently high spillovers turn investment into a complement: the independent manufacturer's higher investment also increases demand for the private label product, increasing total industry profit and offsetting the increased hold-up effect. Moreover, when buyer power is high, vertical integration resolves a larger hold-up problem, resulting in higher welfare even when spillovers are low and the independent manufacturer is discouraged from investing (under linear demand).

6.38 The authors also consider a case with sequential investment, where the independent manufacturer invests before the private label producer (in the case of vertical separation) or the integrated entity (in the case of vertical integration). In this case, vertical integration leads to greater innovation by the integrated firm (as in the case with simultaneous investment). The effect of investment by the independent manufacturer remains ambiguous. It increases with low spillovers and high buyer power (reversing the results of the case with simultaneous investment), or with high spillovers and low buyer power, but it falls in other cases. One finding of the paper is that the welfare effects of vertical integration are potentially negative when buyer power and spillovers are both low, as vertical integration in that case induces underinvestment by the independent manufacturer (both for the simultaneous and sequential setting).

6.39 Considering instead the effect of vertical integration on downstream entry incentives, **Faulí-Oller and Sandonís (2025)** discuss how vertical integration can encourage entry by raising non-integrated incumbents' costs, despite the increased competitiveness of the integrated firm due to the elimination of double markups. They consider a model with an upstream firm, two downstream firms, and one potential downstream entrant. The upstream firm offers two-part tariffs and faces an alternative (inefficient) supplier that can provide the same input at a higher cost, which determines the downstream firms' outside option. The downstream firms require one unit of input to sell one unit of output and compete à la Cournot. First, the upstream firm and one downstream firm decide whether to merge; second, the potential entrant decides whether to enter by incurring a fixed entry cost; third, the upstream firm offers a non-discriminatory, observable, take-it-or-leave-it two-part tariff;[405] fourth, each independent downstream firm chooses whether to accept or reject; and finally, all active downstream firms engage in Cournot competition. The authors show that the effect of vertical integration on entry is a priori ambiguous and depends on the efficiency of the alternative supplier (i.e. its cost level): when the external input provider is sufficiently efficient but not too efficient, the entry-encouraging effect from increased rivals' costs dominates the entry-discouraging effect from the elimination of double markups, so that vertical integration increases the entrant's post-entry profits and can induce entry that would not occur under separation. In most cases, this enhances overall welfare. However, there exists a (small) parameter region where vertical integration instead deters entry and reduces welfare.

[405] The presence of the inefficient outside option prevents an efficient two-part tariff that avoids double markups pre-integration, i.e. by setting the variable price equal to marginal cost.

6.40 **Israel and O'Brien (2025)** extend the bilateral contracting literature on vertical mergers to a setting with complementary upstream and downstream investment, endogenous downstream entry, and simultaneous bilateral Nash bargaining over private contracts. The model considers one upstream supplier transacting with two competing downstream firms that undertake demand-enhancing investments prior to bargaining, while one downstream firm may vertically integrate with the upstream firm. The game proceeds in stages: first, the upstream firm and one downstream firm decide whether to merge; second, downstream firms decide whether to incur a fixed cost of entry; third, upstream and downstream firms choose demand-enhancing investments; fourth, firms negotiate private nonlinear contracts through simultaneous bilateral Nash bargaining; and finally, downstream firms compete in prices. This model combines bilateral contracting externalities with a double moral hazard problem, such that independent firms fail to internalise the full returns from complementary investments and are additionally subject to hold-up in ex post bargaining. The paper shows that vertical integration can mitigate both sources of inefficiency, increasing upstream and downstream investment incentives. More specifically, the authors find that vertical mergers benefit consumers and the merging firms (and, in some cases, non-integrated rivals) when downstream products are either sufficiently close or sufficiently distant substitutes—the intuition being that when (i) products are distant substitutes, then the merger mainly mitigates hold-up and increases complementary investment with limited adverse price effects; whereas when (ii) products are close substitutes, the merger mainly mitigates bilateral contracting externalities that otherwise dissipate joint profits and depress investment incentives.[406] For intermediate levels of product differentiation, welfare effects depend on the relative importance and marginal cost of investment, with mergers more likely to increase consumer welfare when investment contributes significantly to value creation and the marginal cost of investment is sufficiently low.

6.3.2 Conglomerate mergers

6.41 Below, we discuss dynamic effects in conglomerate mergers, considering in turn general dynamic foreclosure concerns, data-related conglomerate effects, the concept of platform envelopment, and the concept of capabilities accumulation.[407]

Foreclosure concerns from conglomerate mergers

6.42 **Choi (2008)** examines the competitive effects of conglomerate mergers in markets for complementary products when a merged firm can engage in bundling, motivated in part by the GE/Honeywell merger. The paper develops a stylised oligopoly model with two differentiated suppliers in each of two complementary component markets (A and B), so that consumers purchase systems combining one unit of each component. It compares a pre-merger structure of four independent firms with a post-merger structure in which one producer of A merges with one producer of B and can use mixed bundling (selling components separately while also offering a discounted bundle), with extensions covering R&D incentives, pure bundling/technical tying, counter-mergers, and foreclosure. The key result is that the merger internalises pricing complementarities and therefore lowers the merged firm's bundled system price, but simultaneously raises the prices of its stand-alone components, which increases the cost of rival 'mix-and-match' systems and shifts

[406] The intuition is that the merger can sufficiently increase investment in the wider system and downstream demand such that even non-integrated rivals benefit from the expansion in total market value, despite facing stronger competition from the integrated firm.
[407] A recent static theory of conglomerate mergers is provided by Chen and Rey (2026). They develop a model showing that conglomerate mergers driven by demand-side synergies can raise stand-alone prices, harm competitors, and potentially reduce consumer surplus and welfare even without full foreclosure or explicit bundling commitments.

market share towards the merged bundle. Independent rivals cut prices but still lose profits, creating potential exit or foreclosure risks. Welfare effects are ambiguous absent foreclosure—some consumers gain from lower bundle prices while others lose from higher mixed-system prices—but numerical simulations suggest mergers are more likely to reduce consumer and total welfare when substitution between systems is strong. The dynamic extensions further suggest bundling can strengthen the merged firm's innovation incentives while weakening rivals' incentives, and technical tying may be used to exclude competitors.

6.43 **Etro (2019)** studies the impact of a merger between producers of complementary inputs facing potential entry. He develops a model with deterministic cost-reducing investment by two separate incumbents producing complementary components and probabilistic innovation by two separate entrants innovating to produce those same components, followed by price competition (in a set-up analogous to Choi and Stefanadis (2001)). Successful entry means entering at lower cost than the equivalent incumbent component. Etro shows that in this setting a merger between the two incumbents is profitable and increases their cost-reducing investment through standard Cournot complementarities (i.e. incentive to lower prices or improve quality of complementary products in case of joint ownership because of positive demand spillover effects to the other product). However, the merger also reduces the incentive of the entrants to invest in probabilistic innovation. If the merging firms are sufficiently efficient pre-merger and demand is sufficiently inelastic, expected consumer surplus is lower following the merger: the harm from the reduction in expected competitive pressure from entrants' innovation efforts dominates the benefit from the direct price-reducing effect of lower incumbent costs.[408] The merger always results in a reduction in consumer surplus with inelastic demand if the merged entity can commit to pure bundling post-merger. However, in an example with linear demand, the merger always benefits consumers (both with and without bundling) due to the internalisation of R&D and price externalities.

6.44 The link between the impact on rival appropriability and non-horizontal mergers is also explored by **Heidhues, Köster, and Kőszegi (2024)**, who offer a theoretical framework designed to study digital ecosystems, showing how integration facilitates rent extraction from complementors, allowing integrated platforms to capture the positive spillovers of network effects, while weakening innovation incentives for rival firms or potential future entrants. The mechanism operates through the control of critical 'access points'—such as app stores, search rankings, or API access—which function as bottlenecks for reaching users. This positional advantage enables the integrated platform to engage in strategic 'demand steering': directing user attention and traffic towards or away from specific complementary products. When a promising complementary entrant emerges (such as an innovative app or third-party service), the platform can credibly threaten to downgrade its visibility, restrict its API access, or promote competing first-party alternatives. This threat weakens the entrant's outside option in acquisition negotiations, as the complementor's standalone value depends on platform access. Consequently, the platform can acquire the target complementors at a discount relative to their value under neutral platform governance. While the presence of ecosystems is often positive for consumers in the short run (as the ecosystem gets access to better products through acquisitions), it negatively affects long-term incentives by rivals for entry and innovation (by suppressing takeover prices), which in turn harms consumers.

Data-related conglomerate mergers

[408] This mechanism is similar to the one in Buehler and Schmutzler (2008), where the elimination of double markups is shown to decrease rivals' marginal benefit from cost-reducing innovation.

6.45 Several papers examine data-driven conglomerate mergers in digital markets, where firms acquire targets primarily to access, combine, or exploit data across related markets. A common motivating case referred to in these papers (often among other cases) is the Google/Fitbit merger, which raised the question of whether consumer health and activity data collected through wearable devices could be combined with Google's existing datasets and capabilities to strengthen personalisation, targeted advertising, and expansion into adjacent digital health and related services markets.

6.46 **Chen, Choe, Cong, and Matsushima (2022)** study data-driven tech mergers in which consumer data collected in one market can be used for personalisation in a related market. The paper models two related duopoly markets: a data-collection market, such as wearable devices, and a data-application market, such as digital health services. A firm in the data-application market merges with a firm in the data-collection market, allowing the merged entity to use data from the latter to offer personalised products and personalised prices in the former, with the two markets linked by a consumption synergy. The key result is that the merger has asymmetric effects across markets: competition intensifies and prices fall in the data-collection market because the merged firm wants to expand its data scale, while prices generally rise in the data-application market because the merged firm can extract the benefits of personalisation through targeted pricing. Where the consumption synergy is sufficiently large, the merged firm may monopolise both markets, creating a dynamic trade-off: consumers may benefit in the short run from lower prices in the data-collection market, but lose in the long run if rivals exit and the merged firm's data advantage becomes entrenched. The authors also show that remedies such as data sharing or bans on below-cost pricing can reduce the risk of monopolisation, but may involve short-run consumer-surplus trade-offs across the two markets.

6.47 **Hagiu and Wright (2023)** develop a dynamic model in which an incumbent and entrant compete over time and improve product quality using customer data.[409] They allow firms to differ in their initial data stocks and bounded learning functions, with learning occurring either across users ('across-user learning') or through repeated use by individual users ('within-user learning').[410] The firm with the greater discounted learning advantage wins in every period, although a sufficiently superior entrant learning technology can overcome the incumbent's data lead. Although the baseline model of the paper does not consider mergers, an extension considers a situation where firms compete to acquire an exclusive third-party dataset. In this case, an incumbent at its learning threshold may acquire the data solely to deny it to the entrant, producing an inefficient 'killer data acquisition'. Note, however, that in this case the acquisition is complementary (i.e. not a potential competitor), and although the target data is discontinued ('killed'), the competitive threat comes from the third party competitor.

6.48 **De Cornière and Taylor (2024)** study data-driven mergers between firms active in what they refer to as 'data-connected' markets, where data generated as a by-product in one market can be used in another. The paper models a primary market A, where a firm collects data through consumer activity, and a secondary market B, where two firms may use that data. The analysis distinguishes between cases where data can be traded absent the merger and where trade is prevented by frictions such as privacy regulation, reputational concerns, or contracting problems. It also distinguishes between data uses that are unilaterally procompetitive, such as

[409] More specifically, they develop an infinite-horizon model in which an incumbent and entrant compete à la Bertrand and improve product quality using customer data.
[410] They solve for Markov-perfect equilibrium by two-dimensional backward induction.

product-quality improvement, and unilaterally anticompetitive, such as surplus extraction through targeted advertising or price discrimination. The key result is that merger effects depend critically on both data tradability and the use of data. If data improve product quality and cannot otherwise be traded, the merger benefits consumers in both markets by increasing data collection and improving the secondary-market product. If data trade is already possible, the merger instead reduces data-collection incentives and harms consumers in both markets. Where data are used to extract consumer surplus, the merger tends to benefit consumers in market A by inducing greater data collection, but harms consumers in market B regardless of whether pre-merger data trade is possible.

6.49 **De Cornière and Taylor (2025)** develop a model to characterise when firms' access to better data strengthens or weakens competition. Firms choose the mean utility offered to consumers, while data shifts the per-consumer revenue generated at any utility level.[411] The authors derive comparative-static tests based on whether the marginal revenue generated by better data increases with consumer utility (supermodular) or its proportional effect on revenue increases with utility (log-supermodular). On the one hand, data creates a positive 'mark-up effect': by raising the revenue earned from each consumer, it increases the incentive to offer greater utility to attract demand. On the other hand, this may be offset by a 'surplus-extraction effect', whereby data changes how much additional revenue firms can obtain by reducing the utility offered to consumers. Data is therefore procompetitive when used for product improvement or, under specified conditions, to mitigate moral hazard,[412] but anticompetitive in their model of personalised price discrimination. Procompetitive data may nevertheless support entry deterrence, because a data-rich incumbent credibly competes more aggressively, reducing entrants' expected profits. It may also produce tipping where additional customers generate data that improves offers and attracts further customers.

6.50 Although the paper does not model mergers, it suggests that merger control should assess how the combined firm will use acquired data, rather than data quantity alone: short-run improvements in consumer offers may coexist with increased entry barriers and longer-run entrenchment.

Platform envelopment

6.51 Platform envelopment refers to a strategy whereby a platform active in one market enters another platform market by combining or bundling its existing platform services with those of the target market, so as to leverage shared users, data, or technological assets. It explains how control over users, data, or technical components in one platform market can be leveraged into adjacent or otherwise related platform markets, potentially generating both efficiencies and dynamic foreclosure effects. Two conceptual papers set out the reasoning behind platform envelopment.

6.52 **Eisenmann, Parker, and Van Alstyne (2011)** introduce platform envelopment as an entry strategy in platform markets where network effects and switching costs make standalone entry difficult. An enveloper active in one platform market enters

[411] More specifically, they develop a static 'competition-in-utility' model in which each firm chooses the mean utility it offers consumers, demand depends on firms' relative utility offers, and data quality shifts the per-consumer revenue a firm can earn at any given utility level.
[412] In their insurance application, better data makes policyholders' effort more observable, relaxing the moral-hazard constraint and allowing insurers to offer more insurance at a given expected utility. Under constant absolute risk aversion, or constant relative risk aversion above one-half, this lowers the cost of providing additional utility, so the surplus-extraction effect reinforces the mark-up effect and data is procompetitive.

a target platform market by bundling the target functionality with its own platform, leveraging shared user relationships and, in some cases, common components. This can allow the enveloper to capture users from the target platform and thereby weaken the network effects that previously protected the incumbent. The authors present a typology of envelopment entry based on whether the two platforms are complements, weak substitutes, or functionally unrelated. Envelopment of complements is most likely to succeed where user overlap is high; envelopment of weak substitutes depends more on economies of scope that make a discounted bundle viable; and envelopment of functionally unrelated platforms may succeed where user overlap is high, price-discrimination benefits are significant, or economies of scope are available.

6.53 **Condorelli and Padilla (2020)** extend the platform envelopment framework to data-driven digital platforms. They analyse a dominant platform in an origin market that enters a target platform market with overlapping users by engaging in 'privacy policy tying', whereby users consent to the combination of data generated across both markets. This creates 'reverse' economies of scope: data from the target market can be monetised in the origin market, allowing the enveloper to fund free or low-priced services in the target market, monopolise that market, and protect its dominant position in the origin market. The mechanism is dynamic: the target platform may otherwise become a potential entrant into the origin market, while the enveloper has stronger incentives to price aggressively in the target market because doing so protects its origin-market rents. The welfare effects are ambiguous, since data combination may improve products and services, but may also reduce competition, privacy, quality, and innovation.

6.54 **Condorelli and Padilla (2024)** develop a formal theory of data-driven platform envelopment in which a dominant firm in a primary, data-intensive market enters a secondary, data-rich market to protect its core monopoly. They model a two-period entry game where the incumbent pre-emptively enters the adjacent market, prices aggressively (potentially below cost), and employs privacy-policy tying to combine user data across services. This generates a data advantage that raises profits in the primary market and can deter entry by rivals. The key result is that such strategies can lead to exclusion of more efficient competitors, sustaining monopoly power through data accumulation. Welfare effects are generally negative when foreclosure prevents entry in the primary market, though outcomes depend on whether data are essential for competition and on policy interventions such as data portability or restrictions on data tying.

Capabilities accumulation

6.55 Capability accumulation provides another way to analyse conglomerate mergers by focusing not on current product-market overlaps, but on the underlying assets and capabilities that allow firms to compete across different markets. This is particularly relevant in digital markets, where capabilities such as data, technology, user relationships, brands, and specialised talent may be redeployed across multiple adjacent markets and may therefore affect both merger efficiencies and dynamic competition.

6.56 Building on the resource-based view of competitive advantage from the management literature, **Chen, Elliott, and Koh (2023)** develop a theoretical model of capability accumulation to explain conglomeratisation, taking internet firms as motivating context. The paper starts with the premise that firms hold hard-to-imitate capabilities—such as technology, talent, data, brands, or customer bases—which determine their competitiveness across markets, while markets differ in the capabilities they value. Firms may merge to combine capabilities, demerge, procure unassigned capabilities, or enter, and the authors characterise stable industry structures in which no such reorganisation is profitable. The key result is

that the maximum size of the largest firm is bounded by the largest connected component of capabilities valued across markets: as more markets come to value the same capabilities, even small increases in capability overlap can trigger abrupt increases in feasible firm size. When capabilities are complementary and maintenance costs are not too convex, large conglomerates become a stable outcome. The mechanism is that mergers can beget further mergers: once a firm has accumulated capabilities useful across adjacent markets, additional acquisitions become more profitable, generating a cascade towards conglomeratisation. This provides a procompetitive rationale for non-horizontal mergers where combined capabilities create synergies across markets, but also highlights how scarce capabilities valued across many markets can support the emergence of large firms with broad competitive reach.

6.57 **Boa, Elliott, and Foster (2023)** build on the resource-based approach to business strategy to argue that standard product-market analysis in both horizontal and non-horizontal merger control may be insufficient where firms compete through capabilities that shape future products, innovation, and entry across markets. In their framework, mergers with fewer overlapping capabilities are more likely to be procompetitive, because combining distinct capabilities can improve existing products, enable new products, and increase consumer surplus in non-overlapping and overlapping markets. Conversely, mergers involving more overlapping capabilities generate fewer synergies and are more likely to reduce competition, particularly where the overlapping capabilities are scarce and cannot readily be deployed by rivals. The authors identify four mechanisms through which capability overlap raises concerns: (i) reduced scope for product improvements in non-overlapping markets, (ii) weaker offsetting efficiencies in overlapping markets, (iii) reduced prospects for strong future competitors when capabilities are scarce, and (iv) curtailed future innovation opportunities. The paper suggests that merger assessment should consider not only current product overlaps, but also the degree of overlap and scarcity in the merging firms' underlying capabilities.

6.58 Although the paper is primarily framed around horizontal mergers, the authors present its capability-based approach as particularly valuable in non-horizontal and innovation-driven settings, where conventional product-market analysis may provide limited guidance.

6.4 Foreclosure by integrated firms

6.59 The literature on non-horizontal mergers and foreclosure reviewed in the previous Section is part of a larger literature on foreclosure. This broader literature generally takes non-horizontal integration as given and then investigates the conditions under which foreclosure of rivals is profitable for an integrated firm, and harmful to competition.[413] The challenge with relying on this literature to look at the impact of non-horizontal mergers is that it does not study whether vertical integration is an equilibrium outcome, nor seek to offer a complete characterisation of the effects of integration, typically omitting the potential benefits from coordination of pricing and investment decisions by the merging parties (as it takes these as given). Notwithstanding these limitations, the findings of this literature on when an integrated firm may have the ability and incentives to dynamically foreclose rivals are insightful, and broadly applicable to merger control.

6.60 There are several papers in this literature that specifically look at dynamic foreclosure, e.g. foreclosure conduct with a view to preventing future market entry

[413] For literature reviews, see e.g. Rey and Tirole (2007) and Fumagalli, Motta, and Calcagno (2018).

or deterring investment by rivals.[414] A prominent example is the paper by **Choi and Stefanadis (2001)**. The authors consider a setting with an integrated incumbent producing two complementary goods, and facing potential competition in both markets. Entry is possible in each market subject to a stochastic R&D investment. The authors show that the integrated firm may have incentives to deter entry by rivals by committing to tying its two complementary goods.[415] Tying reduces the expected return of entry by each rival, since it implies that entry in one market is only profitable if entry is successful in the other market as well. In this setting, non-horizontal integration enables anticompetitive tying, to the detriment of consumers.

6.61 In another influential paper, **Carlton and Waldman (2002)** show that tying can enable an integrated incumbent to protect its market power in a primary market, by deterring entry in a secondary, complementary, market. They consider an integrated incumbent active in both the primary and the secondary market, and a potential entrant. The potential competitor is initially only able to enter the secondary market, but over time could also enter the primary market (e.g. say, because patent protection in the primary market has limited duration, or because the competitor needs time to establish its credibility as an entrant into the primary market). In the first variant of the model, the entrant faces a fixed cost to enter each of the secondary and primary markets. Depending on the level of these entry costs, the incumbent may have incentives to tie its products to stop the competitor from immediately entering the secondary market (where entry is feasible). This deprives the entrant of profits required to cover its costs of entering both the primary and secondary market in the future, enabling the incumbent to defend its profits in the primary market. The mechanism rests on a linkage between immediate entry into the secondary market and the prospects of future entry into the primary market.[416] This linkage may exist because of economies of scale (e.g. fixed costs of entry), or network effects (demand-side externalities).[417] Depending on the setting, a commitment to tie by the incumbent (e.g. through product design) may be required to deter entry.[418]

6.62 **Choi (2004)** analyses how tying affects innovation incentives, motivated by technology markets such as Microsoft's integration of Internet Explorer with Windows. The paper develops a dynamic extension of the tying framework in Whinston (1990) in which a monopolist in product A also competes with an independent rival in product B. The model has three stages: first, the monopolist in A decides whether to bundle A and B; second, firms invest in cost-reducing R&D in the tied-good market; and third, firms compete in prices in a Hotelling differentiated-products setting. Without R&D, tying is not profitable unless it induces rival exit, because it intensifies price competition. With R&D, however, tying changes innovation incentives: by increasing the tying firm's market share in the tied-good market, bundling raises its return to cost-reducing investment, while reducing the rival's expected market share and therefore its R&D incentives. The key result is that tying can be privately profitable even without rival exit, because the dynamic gain from capturing a larger share of innovation rents can outweigh

[414] An earlier influential paper in this literature is Whinston (1990).
[415] In this model, pre-commitment to tying (e.g. through technological integration) is necessary to affect the investment decisions of rivals.
[416] Fumagalli, Motta, and Calcagno (2018) show that this mechanism is common across several models of exclusionary conduct by dominant firms.
[417] These are considered in the second variant of the Carlton and Waldman (2002) model. Network effects imply that future sales of the primary and secondary market are more valuable if the entrant has been able to secure a customer base with current sales of the secondary good.
[418] Choi and Jeon (2021) and Choi, Jeon, and Whinston (2026) show how tying can be used to leverage market power in settings with two-sided markets (with non-negative price constraints) and network effects.

the static loss from tougher price competition. In the paper's deterministic R&D specification with horizontal differentiation, tying reduces total welfare[419]: it creates asymmetric R&D incentives, distorts market shares, and causes some consumers to forgo the tying good. Choi notes, however, that welfare effects may be ambiguous where R&D involves scale economies, uncertainty, or duplication, since tying may avoid costly R&D duplication.

6.63 Along similar lines as Carlton and Waldman (2002), **Fumagalli and Motta (2020)** consider a theoretical model with a vertically integrated incumbent that faces current potential competition in the downstream market and future competition in the upstream market. Entry in each market requires the potential competitor to incur a fixed cost. They find that while vertical foreclosure (in the form of a refusal to deal with a downstream competitor) may be loss-making in the short-run, it can have a dynamic rationale as a way to preserve the downstream monopoly and to extract rents from future entrants in the upstream market or as a way to prevent entry in both markets (and protect both the upstream and downstream monopoly). The mechanism is analogous to the one developed in Carlton and Waldman (2002), in that foreclosure in the market where immediate entry is feasible is a way to protect rents in a complementary market where future entry may take place. The authors also consider an extension where the upstream and downstream products are supplied by independent firms (i.e. there is no vertical integration) and can rely on contractual solutions (e.g. exclusive dealing) to deter entry. This shows that exclusive dealing can be used to replicate the outcome achieved by refusal to supply by an integrated firm.

6.5 Empirical evidence

6.64 Relative to horizontal mergers and acquisitions, the empirical literature on non-horizontal mergers and acquisitions is scarcer.[420] Several papers, however, look at the effects of non-horizontal integration on firm performance, including dynamic effects. These include applied econometric papers, corporate finance papers, and empirical business studies papers.

6.65 **Schoar (2002)** examines how corporate diversification affects productive efficiency, with a focus on whether conglomerates are more or less productive than comparable stand-alone firms. The paper uses plant-level data from the US Census Longitudinal Research Database for manufacturing plants owned by publicly traded firms, linked to COMPUSTAT data, covering 1977–'95.[421] The paper finds that diversified firms are, on average, more productive than stand-alone firms in the cross-section, but that increases in diversification reduce overall firm productivity: acquired plants improve productivity after acquisition, while incumbent plants experience productivity declines. Schoar interprets this as a 'new toy' effect, where managerial attention shifts towards newly acquired segments at the expense of existing operations.

[419] The paper does not contain an analysis of consumer welfare.
[420] As cited also in footnote 390, Lafontaine and Slade (2007) and Bresnahan and Levin (2012) provide an early synopsis of the empirical and theoretical literature on vertical integration and firm boundaries. On the empirical evidence on non-horizontal mergers and subsequent firm performance, they conclude that results are mixed but generally consistent with efficiency-based explanations, with limited systematic evidence of harm but also relatively little causal evidence linking integration to realised performance outcomes.
[421] Productivity is measured using plant-level TFP, estimated from industry-year Cobb-Douglas production functions, and the empirical analysis compares diversified and stand-alone firms while also using plant fixed effects and before-after estimators around diversifying acquisitions (i.e. it does not rely on control groups and suffers from potential causality issues).

6.66 **Ciliberto (2006)** examines whether changes in organisational form—specifically vertical integration and joint ventures between hospitals and physicians—affect hospitals' investment decisions, providing an empirical test of TCE and PRT.[422] The analysis uses panel data from US hospitals between 1994 and 1999, combining information on hospital organisational status, service offerings, and local managed care penetration, measured by the share of county populations covered by health maintenance organisations.[423] To test whether the effect of integration is stronger where contracting frictions are more important, the empirical strategy is to (i) estimate fixed-effects regressions that exploit within-hospital variation over time and (ii) interact organisational form indicators with measures of managed care concentration. The author finds that vertically integrated hospitals and joint ventures expand service offerings more rapidly than independent hospitals, consistent with improved investment incentives under unified control. Moreover, these differences are amplified in markets with higher managed care penetration, which supports in Ciliberto's interpretation the hypothesis that greater bargaining power of managed care organisations increases asset specificity and strengthens the investment advantages of integrated organisational forms.

6.67 **Li and Tang (2010)** examine how vertical integration affects firms' innovative performance and how this relationship interacts with external knowledge sourcing, focusing on both the quality and scope of innovation. The empirical analysis uses a panel dataset of US information technology firms from 1998 to 2004.[424] The results show an inverted U-shaped relationship between vertical integration and innovative performance, indicating that moderate integration is associated with more innovation—which could be driven by improved coordination, knowledge transfer, and appropriability. Excessive integration instead reduces innovation potentially due to reduced flexibility. Additionally, external knowledge sourcing positively affects innovation but interacts negatively with vertical integration at higher levels, suggesting, according to the authors, that highly integrated firms face barriers to absorbing external knowledge, thereby diminishing the innovation benefits of external collaboration. This study relies on correlational analysis, which limits the causal interpretation of the associations found.

6.68 Providing a more targeted test for the PRT (i.e. the idea that residual control rights and incentives motivate vertical integration), **Acemoglu, Aghion, Griffith, and Zilibotti (2010)** develop and empirically test a theoretical model involving incomplete contracts and bargaining power that predicts that vertical integration increases investment incentives for the owning party (typically the downstream producer) but reduces incentives for the non-owning party (the upstream supplier)—implying that integration is more likely when downstream technology

[422] The vertical relationship between hospitals and physicians is characterised by incomplete contracts and thus prone to hold-up problems. Vertical integration can solve these problems since 'a vertically integrated hospital owns the physicians' practices, gains full control over patients, and can thus ensure a steady stream of patients from its own physicians' (p. 65).

[423] The final sample contains 20,810 hospital-year observations, although investment regressions use fewer observations because the dependent variable is defined as the year-to-year change in services offered. Investments are measured by the change in the services provided by the hospital over time.

[424] The data contains information on financial data, patent data, and alliances to construct measures of vertical integration (measured in terms of value-added-to-sales ratio), innovation quality (citation-weighted patents), technological scope (patent diversity), and external knowledge sourcing (alliances and internationalisation) for 71 firms in total. The paper estimates negative binomial regressions for patent citations and Tobit regressions for technological scope, including quadratic terms in vertical integration to capture nonlinear effects and interaction terms with external knowledge sourcing, while controlling for firm characteristics, R&D intensity, and time effects.

intensity is relatively more important.[425] In line with the PRT and the theoretical model, the paper finds that vertical integration is more likely when downstream industries are more technology-intensive, and less likely when upstream industries are more technology-intensive—consistent with the theory that integration increases incentives for the owner but weakens incentives for the non-owner. Additionally, these effects are stronger when the supplier accounts for a larger share of production costs.

6.69 **Atalay, Hortaçsu, and Syverson (2014)** investigate whether vertical integration serves to transfer intangible inputs, such as managerial expertise, organisational knowledge, and firm capabilities.[426] The authors find that internal shipments of physical goods are rare (e.g. nearly half of upstream establishments ship nothing internally, and the median internal shipment share is very small), which indicates that vertical integration is generally not used to facilitate physical input transfers. Instead, vertically integrated establishments are larger, more productive, and more capital intensive, and acquired establishments begin to resemble their parent firms in production patterns and destinations. The authors argue that this is consistent with vertical integration primarily enabling the efficient transfer and deployment of intangible organisational capabilities rather than of physical goods.

6.70 Testing the PRT and emphasising the trade-off between innovation incentives and hold-up risk, **Frésard, Hoberg, and Phillips (2020)** examine how the stage of innovation development relates to vertical acquisitions and firm boundaries.[427] The results show that firms with high R&D intensity are significantly less likely to be acquired in vertical transactions, while firms with greater patenting intensity are

[425] The empirical analysis uses plant-level panel data from the UK manufacturing sector 1996–2001, linked to input-output tables to identify firm-industry-supplier relationships and measures of vertical integration, alongside industry-level measures of technology intensity based primarily on R&D expenditure relative to value added. The final sample contains 2,973,008 firm–industry-pair observations covering 46,392 manufacturing firms. The authors employ two measures of (backward) vertical integration: first, they use a dummy variable indicating whether the firm owns a plant producing a certain input necessary to produce a certain product. Second, they calculate how much of the inputs from a certain industry, necessary for the production of a certain product, the firm can produce in-house. The authors estimate linear probability regressions relating integration measures to producer and supplier technology intensities and input cost shares, including interaction terms and robustness checks with instrumental variables and alternative investment measures.

[426] They use establishment-level microdata from the US Economic Census 1977–'97 and the Commodity Flow Survey 1993–'97, which allow them to link firms' ownership structures with shipment flows, production characteristics, and input-output relationships across industries. Their core shipment-flow analysis uses about 67,500 establishment-year observations of upstream establishments reporting roughly 6.3 million shipments in the combined 1993 and 1997 Commodity Flow Survey, while the broader Economic Census data span establishments observed in the 1977, 1982, 1987, 1992, and 1997 censuses. The paper identifies vertically linked industries using input-output tables and shipment data and measures the share of upstream establishments' shipments sent to downstream establishments within the same firm, complemented by regression analyses comparing productivity, size, and capital intensity across integrated and non-integrated establishments and examining changes following ownership transitions.

[427] They use a large panel of publicly listed US firms from 1996 to 2013, combining financial data, patent data, merger data, and novel text-based measures of firm-level vertical relatedness constructed by linking product descriptions in firms' 10-K filings to input-output commodity vocabularies. The authors estimate regressions of firms' likelihood of becoming targets in vertical acquisitions on measures of unrealised innovation (proxied by R&D intensity, measured as R&D expenditure over sales) and realised innovation (proxied by patenting intensity), including firm controls and fixed effects. They further examine heterogeneity in these relationships by exploiting variation in proxies for hold-up risk and innovation incentive preservation (such as inventor mobility, patent litigation risk, product market concentration, and measures of employee retention incentives) to test whether the effects are stronger in settings where contractual frictions and incentive distortions are more severe.

more likely to be vertically acquired, consistent with vertical separation preserving incentives for ongoing innovation and vertical integration facilitating commercialisation of realised innovation and reducing hold-up. These effects are stronger in environments where innovation incentives are harder to maintain or hold-up risks are greater, and the findings are robust to alternative specifications and tests addressing reverse causality (via an exploration of R&D and patenting intensity around the acquisition) and alternative explanations.

6.71 **Lee and Lieberman (2010)** examine how established telecommunications firms choose between internal development and acquisition when entering new product markets. The key result is that acquisitions play different roles depending on where entry occurs: within a firm's primary business domain (defined as markets sharing the same root product classification as the firm's primary business), acquisitions are used to fill persistent gaps near existing products, whereas outside the primary domain they are used to extend the firm into new directions. This suggests that acquisitions to enter new product codes can serve both as exploitation of synergies within a primary business domain and as exploration of new areas of business.

6.72 **Zhang and Tong (2021)** examine how vertical integration affects firms' innovation outcomes, focusing on both the rate and the type of innovation pursued. Using a sample of US public firms involved in vertical M&As between 1980 and 2006,[428] the authors employ a DiD design that compares firms announcing and completing vertical M&As with firms announcing but not completing comparable vertical M&As for reasons unrelated to innovation. The results show that firms completing vertical M&As subsequently generate more patents and receive more patent citations. In addition, they experience an increase in innovation complexity, knowledge scope, and generality, while autonomous innovation (i.e. innovation that features relatively independent knowledge components) declines.[429] The authors interpret the results to show that vertical integration affects the direction of innovation, in particular through a shift in inventive activity towards more systemic innovation, characterised by greater knowledge interdependence, broader knowledge recombination, and wider technological influence. At the same time, firms devote less effort to autonomous innovation, which relies on relatively independent knowledge components and requires limited cross-domain coordination.

6.73 **Lee and Lieberman (2023)** revisit the choice between acquisition and internal development as modes of market entry through the lens of exploration and exploitation. The paper uses a comparative historical case study of Amazon and Alphabet, drawing on their business-entry histories and acquisition records, including evidence that Alphabet acquired firms at almost three times Amazon's rate over the period considered. The results show different diversification strategies: Amazon relied mainly on internal development, using acquisitions to strengthen established businesses and to enter domains initially outside its core, while Alphabet relied heavily on acquisitions within and around Google's core domain but used internal development for more radical 'moonshot' businesses outside it.

[428] The final sample contains 686 completed vertical M&As and 135 uncompleted vertical M&As. Vertical mergers are identified using a measure of vertical relatedness derived from input–output tables, which capture the flow of goods and services between the industries of acquiring and target firms.

[429] Innovation complexity is measured as the average interdependency among knowledge subcomponents used in patented inventions, based on patent subclass combinations. Knowledge scope is measured as the share of citations to knowledge sources that had not appeared in the firm's prior five years of patenting activity, and generality is measured as the breadth of technological domains influenced by a patent's subsequent citations. Autonomous innovation is measured as the share of recombination occurring within, rather than across, technological classes.

6.74 **Sandiumenge-i-Boy (2025)** examines how demand dynamics—specifically habit formation—reshape the efficiency and competitive effects of vertical integration, focusing on the trade-off between coordination efficiencies and foreclosure incentives.[430] The results show that habit formation strengthens firms' incentives to retain consumers, leading vertically separated firms to moderate margins and reducing coordination gains from integration by up to 35% relative to static benchmarks, while simultaneously increasing integrated firms' incentives to disadvantage non-integrated rivals. Counterfactual merger simulations indicate that vertical integration leads to smaller price reductions for integrated products and more severe foreclosure of non-integrated products when demand dynamics are strong, implying that these dynamic considerations attenuate efficiency gains and amplify anticompetitive risks.

6.75 As discussed in Section 5.3, **Eisfeld (2025)** studies how acquisitions of VC-funded startups affect entry, focusing on the trade-off between an ex ante entry-for-buyout incentive and ex post entry deterrence following lower expected profits for any future entrant. Only 11% of acquisitions are horizontal under the text-based market definition (with no material difference between types of acquirers). This means that the conclusions of the paper discussed earlier in the context of acquisitions in general apply particularly in the context of non-horizontal acquisitions.

6.76 **Chen (2026)** studies merger-induced efficiency gains in a network industry, using US freight railroads as the empirical setting. Network industries can involve both complementarities and substitutability: on the one hand, complementarities may follow from integrating geographically connected rail systems, allowing for the re-optimisation of routing and maintenance resources across integrated networks (i.e. scope-related network efficiencies/economies of scope) and the elimination of inter-railroad interchange costs (handoff delays, coordination frictions, and interchange operating costs); whereas on the other hand, firms may compete in overlapping origin-destination markets.[431] The paper finds substantial net efficiencies that more than offset increased markups on average, leading to lower prices overall.[432] The decomposition attributes the gains to several network mechanisms, including better routing, elimination of interchange frictions, and especially economies of scope from consolidating traffic and reallocating resources across the integrated network; simple routing-distance gains and interchange-cost elimination alone explain only part of the total cost reduction. Customers benefit through lower average prices, while merged firms also gain from lower costs and higher markups in some markets.

[430] The author develops and estimates a dynamic structural model of vertically related firms competing in prices over time, using NielsenIQ Consumer Panel and Retail Scanner Data covering household-level purchases, prices, and quantities across 333 counties in the Pacific and Mountain divisions of the US Census Bureau, spanning approximately five years before and five years after a series of vertical mergers. This is complemented with distributor territory maps, FTC merger investigation records identifying integration patterns, and cost shifters constructed from US government data sources. The model incorporates upstream input pricing, downstream retail pricing, and consumer demand with state dependence. The model is estimated using simulated maximum likelihood for demand and simulated moments for supply, while solving the dynamic equilibrium using deep reinforcement learning to approximate Markov perfect equilibria.

[431] The paper uses transaction-level shipment data from the Carload Waybill Sample, firm-level operational data from Class I Railroad Annual Reports, Commodity Flow Survey data, and geographic rail-network data, covering 1985–2005. It first provides reduced-form DiD evidence on post-merger price changes, then estimates a spatial equilibrium model of oligopolistic competition in which railroads choose prices, routing, and network resource allocation.

[432] In reduced-form estimates, shipment prices fall by about 9.5% after mergers, with larger declines of roughly 12% on routes that previously required inter-railroad interchange, versus about 6% on pre-existing single-line routes. In the structural counterfactuals, average shipment costs fall by 12.9%, prices by 8.8%, while markups rise by 7.2%.

Rival firms often reallocate resources away from markets where merged firms become more efficient.

7 Financial market frictions

7.1 This Chapter provides a detailed paper-by-paper review of the relevant literature in Volume 1, Chapter 9.

7.1 Non-diversifying mergers and acquisitions

7.2 Several papers specifically look at the financial synergies following non-diversifying mergers and acquisitions—generally defined as acquisitions occurring within the same industry classification (e.g. same 2- or 3-digit SIC).

7.3 **Almeida, Campello, and Hackbarth (2011)** provide a theoretical and empirical analysis of liquidity mergers, defined as within-industry acquisitions (same three-digit SIC code) in which a financially distressed firm is acquired by a liquid industry rival with the effect of reallocating liquidity and avoiding inefficient liquidation. The authors analyse 1,097 same-industry mergers in the US between 1980 and 2006, identifying potential liquidity mergers as acquisitions of targets with low interest coverage[433] but relatively high profitability. Using OLS and cross-section data at the 3-digit level, they regress the industry share of liquidity mergers (liquidity mergers divided by total mergers in the industry) on a measure of asset transferability, constructed as machinery intensity multiplied by what they call 'capital saleability' (the used-to-total CAPEX ratio), and include standard industry controls. The estimates show that liquidity mergers are more common in industries where productive assets are highly specific to the industry yet readily re-deployable among firms within that industry, consistent with the model's prediction that liquid rivals can efficiently absorb distressed-but-viable targets.

7.4 Building on Almeida, Campello, and Hackbarth (2011), **Erel, Jang, and Weisbach (2015)** provide further evidence on liquidity mergers using European data on targets across multiple sectors between 2001 and 2008. The authors construct a sample of European targets that become wholly owned subsidiaries, exploiting unconsolidated subsidiary-level financial statements available in many European countries to observe targets both before and after acquisition.[434] Consistent with Almeida, Campello, and Hackbarth, the authors find that targets' financial constraints decline significantly following acquisition, which they ascribe to improved access to external financing through the parent company and the risk-pooling benefits that arise from combining different assets. Consistent with the idea that financial relief is the main driver behind liquidity mergers, these positive effects are stronger for targets that were more financially constrained prior to acquisition and for smaller targets. Although the baseline results look at both diversifying and same-industry mergers together, in an extension the authors show that their results are generally robust when considering each subsample separately.[435]

7.5 **Duan and Jin (2019)** extend the liquidity-merger framework by explicitly linking ex ante differences in financial constraints to announcement-period synergy gains

[433] Measured as Compustat's *operating income before depreciation / interest and related expense.*
[434] The sample contains 5,187 acquisitions in total. It includes predominantly private and relatively small firms, and spans both domestic and cross-border transactions. The authors implement panel regressions with firm and year fixed effects, comparing pre- and post-acquisition financial constraints measures for the same targets. Financial constraints are proxied by cash holdings, the sensitivity of cash holdings to cash flow, and the sensitivity of investment to cash flow. The authors also examine changes in investment levels.
[435] Out of the 5,187 acquisitions in their sample, 3,465 deals have information on both the acquirer and the target SIC classification, of which 1,902 are in different industries (different two-digit SIC code) and 1,563 are in related ones. The authors note though that to some degree, all deals are diversifying deals, since they are kept in separate subsidiaries following the acquisition.

(measured in terms of stock market valuation). Using a sample of US within-industry acquisitions between 1983 and 2011,[436] they document a robust positive average relationship between this gap and combined abnormal returns, suggesting higher value creation when relatively unconstrained acquirers absorb more constrained targets. The effect is concentrated among high-growth and severely constrained targets and is stronger when acquirer governance is better, which the authors discuss is consistent with efficient internal capital reallocation in which the acquisition allows the acquirer to reallocate unused financial capacity to relieve the target's financing constraints, unlocking otherwise forgone positive net present value (NPV) projects. Additional tests show that both acquirer and target shareholders on average benefit, and that takeover premia increase with the constraint differential.

7.6 Another related stream within the literature deals with fire sales, in which a (potentially industry-wide) shock forces distressed firms to liquidate their assets at discounted prices. In case of an industry-wide shock, this can include a sale to a less-specialised buyer, as potential specialist buyers within the same industry are simultaneously financially constrained and unable to bid at fundamental values.[437]

7.7 Empirically, **Pulvino (1998, 1999)** shows in the context of US commercial aircraft transactions between 1978 and 1991 that financially constrained airlines receive lower prices than their unconstrained rivals when selling used narrow-body aircraft, with airlines with low spare debt capacity selling aircraft at a 14% discount compared to the average market price, with this discount being particularly pronounced during industry downturns.

7.8 A more recent study by **Franks, Seth, Sussman, and Vig (2022)** uses the same data on US aircraft transactions, but additionally incorporates the role of differences in aircraft quality maintained by financially distressed airlines. They find that, after controlling for the lower quality, the quality-adjusted re-sale discount for aircraft sold by bankrupt airlines is about one half smaller. Importantly, the authors find no evidence of systematic misallocation of assets to lower-productivity users, suggesting that the welfare losses previously attributed to fire sales may be overstated.

7.9 Looking at the buyer side of fire-sale transactions, **Meier and Servaes (2019)** investigate whether buyers benefit from acquiring assets from distressed sellers in fire-sale transactions and what this implies for the welfare consequences of fire sales. Drawing on an M&A event-study methodology applied to an exhaustive sample of 428 distressed acquisitions across industries spanning 1982 to 2012, the central finding is that buyers in fire sales earn abnormal announcement returns that are approximately two percentage points higher than in regular acquisitions. The authors attribute this premium primarily to the reduced bargaining power of distressed sellers, rather than to superior post-acquisition performance, and find that combined buyer–seller returns are no higher in fire sales than in regular M&A transactions—implying a redistribution of value rather than a net creation of it.

[436] The sample contains 802 within-industry acquisitions. Industries are defined at the two-digit SIC code. They measure total synergies as the cumulative abnormal return of a value-weighted acquirer-target portfolio and construct an index on the gap in financial constraints between target and acquirer. The gap in financial constraint is measured primarily as the difference between the target and the acquirer's Kaplan-Zingales index, which is a linear combination of five accounting ratios: cash flow to total capital, market to book, debt to total capital, dividends to total capital, and cash holdings to capital.

[437] The theoretical idea of fire sales has been introduced by Shleifer and Vishny (1992).

7.10 These studies document the existence and pricing consequences of fire sales. Such fire sales may involve a potential misallocation of resources to non-industry participants, as opposed to industry participants, resulting in a less productive counterfactual to a merger involving an industry participant.

7.2 Diversifying mergers and acquisitions

7.11 Rather than looking at within-industry mergers and acquisitions, several papers consider the potential financial synergies (or dis-synergies) that come with diversifying deals. In addition to considering potential increased access to internal capital markets, discussed above, these papers generally look at two contrasting mechanisms present specifically in the case of diversifying mergers and acquisitions:

- **the coinsurance effect**, which captures the idea that combining firms with imperfectly correlated cash flows reduces the joint probability of financial distress, lowers the deadweight costs of distress, and thereby decreases systematic risk to firms and their cost of capital; and
- **the diversification discount**, which relates to the empirical observation that diversified companies are often valued at a discount relative to comparable stand-alone firms. The diversification discount has been explained by inefficiencies in internal capital markets (particularly cross-subsidisation and misallocation of capital across segments)—in several papers referred to as 'corporate socialism'.

7.12 **Lewellen (1971)** provides one of the first papers to formalise the purely financial rationale of conglomerate mergers that does not rely on operating synergies or market misvaluation. He argues that when two firms with imperfectly correlated cash flows are combined, the resulting reduction in the probability of extreme low-income realisations lowers the risk of default faced by creditors. Because lenders focus on the lower tail of the earnings distribution when setting debt limits, this coinsurance effect increases the merged firm's debt capacity relative to the sum of the standalone firms' capacities.

7.13 Looking specifically at firms' internal capital markets, **Stein (1997)** develops a formal model in which corporate headquarters reallocates a fixed pool of resources across competing divisions under binding credit constraints. In contrast to 'arm's length' external finance, headquarters possesses control rights that allow it to engage in 'winner-picking': actively shifting resources from lower- to higher-return projects within the firm. In this model, investment by divisions depends not only on its absolute NPV, but also on its relative performance on organisational scope: while combining projects may enhance total borrowing capacity (e.g. via collateral pooling), expanding the number or heterogeneity of projects can weaken headquarters' monitoring and screening ability.

7.14 In a related contribution, **Stein (2003)** surveys the broader literature on asymmetric information, agency problems, and corporate investment and links explicitly the functioning of external and internal capital markets. Stein emphasises that both across-firm and within-firm capital allocation are shaped by common informational frictions: just as external investors face adverse selection and moral hazard vis-à-vis managers, headquarters faces analogous agency problems when allocating capital across divisions. The survey synthesises theoretical and empirical evidence showing that financing constraints can distort investment levels and composition, and that internal capital markets may either mitigate or exacerbate these distortions: while internal capital markets can reallocate liquidity towards high-return uses, they may also generate inefficiencies—such as cross-subsidisation of weaker divisions or managerial rent-seeking—that reduce marginal returns to

capital. This points towards a potential 'diversification discount' or 'corporate socialism' in case of conglomerate firms—discussed in more detail below.

7.15 **Cestone and Fumagalli (2005)** analyse theoretically how internal capital markets within business groups affect product market competition. They show that when groups allocate funds efficiently, internal liquidity is channelled towards affiliates facing tighter external financing constraints, effectively acting as a credit line. Crucially, outcomes depend on the overall level of internal resources: when resources are scarce, groups engage in 'winner picking' and may exit markets where affiliates face stronger competition; when resources are sufficiently abundant, they instead reallocate funds towards those affiliates—often the more financially constrained or competitively pressured ones—allowing them to remain active through cross-subsidisation.

7.16 **Hubbard and Palia (1999)** re-examine the 1960s conglomerate merger wave in the US through the lens of internal capital markets. The paper investigates whether positive bidder announcement returns in diversifying acquisitions (defined as transactions where the acquirer and target do not share any two-digit SIC code) reflected expectations that internal capital markets would alleviate external financing frictions in an era of relatively underdeveloped capital markets. The authors construct a sample of US acquisitions completed between 1961 and 1970 with stock return and accounting data.[438] The authors find that bidder abnormal returns are on average highest when financially unconstrained acquirers purchase financially constrained targets. They also find that acquirers generally retain target management, suggesting that management may have provided capital-specific operational information while the acquirer provided capital or capital-budgeting expertise.

7.17 **Fluck and Lynch (1999)** develop a theoretical model to explain why firms engage in conglomerate mergers and subsequently divest acquired units. The authors focus on mergers motivated by financial synergies rather than operational gains, modelling a setting in which a financially distressed firm with marginally profitable but positive-NPV projects cannot obtain stand-alone financing due to agency problems and unverifiable cash flows. In the model, a merger with a profitable firm relaxes financing constraints by leveraging the acquiring firm's internal capital market and managerial control benefits. The analysis characterises conditions under which mergers are value-increasing ex ante and divestitures are optimal ex post once project profitability improves. The key implication is that conglomerate mergers can increase combined firm value by enabling otherwise unfunded positive-NPV projects, while diversified firms may nevertheless trade at a discount (i.e. the diversification discount) because they internalise marginally profitable assets and incur coordination costs.

7.18 At the same time, conglomerate firms may face a 'dark side' of internal capital markets, including inefficiencies associated with 'corporate socialism'. For example, **Rajan, Servaes, and Zingales (2000)** and **Scharfstein and Stein (2000)** develop agency-based explanations for distorted capital allocation in conglomerate firms. Rajan, Servaes, and Zingales show that when divisions differ in resources and opportunities, internal bargaining over surplus can lead to inefficient transfers

[438] The sample contains 392 acquisitions in total. First, they conduct a standard short-horizon event study around the merger announcement date and compute bidder cumulative abnormal returns (CAR) using alternative benchmarks. Second, they explain cross-sectional variation in bidder CARs by estimating OLS regressions in which the dependent variable is the bidder's CAR and the key regressors are measures of the acquirer's and target's financing constraints—proxied by dividend payout ratios and investment rates—along with their interaction (unconstrained acquirer multiplied by constrained target), controlling for deal and firm characteristics.

towards weaker segments, reducing firm value and contributing to the diversification discount. Scharfstein and Stein further introduce divisional rent-seeking and CEO-level agency frictions, showing that managers of weaker divisions can secure preferential capital allocations, resulting in systematic cross-subsidisation and inefficient investment (which they refer to as 'corporate socialism').

7.19 **Doukas and Kan (2008)** examine how internal capital markets operate in diversified firms undertaking related acquisitions (defined as transactions in which the target shares the same two-digit SIC code as the bidder's core business segment) and unrelated acquisitions (defined as transactions in which the target's two-digit SIC code differs from that of the bidder's core business). They focus on whether further diversification leads to inefficient cross-subsidisation or efficient capital reallocation. They use a sample of acquisitions by US multi-segment bidders over 1991–'97.[439] They find that firms generally diversify when core segment cash flows and industry growth prospects are weak relative to non-core segments, and that post-acquisition capital is reallocated towards segments with stronger profitability. Diversifying bidders shift resources from less profitable core segments to more profitable non-core segments, with little evidence of inefficient 'corporate socialism'.

7.20 Providing empirical evidence that internal capital markets can help mitigate financing frictions, **Boutin, Cestone, Fumagalli, Pica, and Serrano-Velarde (2013)** document a 'deep-pocket' effect of internal capital markets within business groups. They use French administrative data from 1995 to 2004 on firm-level balance sheet and employment records with ownership information that allows a reconstruction of business group structures.[440] They find that entry rates are on average lower in industries where incumbent groups hold larger cash reserves, and higher where entrant groups are cash rich. Two mechanisms are proposed to explain these findings: business group affiliation may either work through a financial channel, by relaxing funding constraints and increasing cash reserves, or enhance affiliates' perceived efficiency, deterring potential entrants. The paper's findings suggest that the financial channel dominates, as the measured effect is stronger during economic downturns and in financially dependent sectors (e.g. innovation-intensive industries).

7.21 **Hann, Ogneva, and Ozbas (2013)** examine whether corporate diversification improves firms' cost of capital through a coinsurance mechanism. Contrary to the conventional view that diversification only reduces idiosyncratic risk (i.e. firm-specific, diversifiable risk), they argue that imperfect correlation of segment cash flows can lower systematic risk (i.e. non-diversifiable, market-wide risk). The empirical analysis uses a US sample of single- and multi-segment firms from 1988

[439] The sample contains 742 firm-year acquisitions in total, matched to segment data. The authors analyse pre- and post-acquisition segment-level cash flows, imputed market-to-book ratios, and CAPEX, and estimate logistic and cross-sectional regressions linking diversification decisions and segment investment to internal cash flow measures and 'growth opportunities' (proxied by segment- and firm-level imputed market-to-book ratios constructed from size-matched stand-alone firms within the same two-digit SIC industries).

[440] The data covers approximately 70,000 firms per year across manufacturing industries. They estimate sector-level entry equations relating sales-weighted entry rates to incumbent and entrant group cash holdings, controlling for firm efficiency, market structure, and sector and year fixed effects, and exploit cross-industry variation in financial constraints. Financial constraints are measured using cross-industry variation in asset tangibility (the share of tangible assets over total assets), industry growth, and industry innovativeness, proxied by the growth in EPO patents at the four-digit sector level. Lower tangibility, higher growth, and greater innovativeness are interpreted as indicative of tighter external financing frictions.

to 2006, combining segment data with analyst forecasts and bond yield data. They find that diversified firms have a significantly lower cost of capital than their stand-alone benchmarks, with economically meaningful magnitudes: moving from the highest to lowest cash-flow correlation quintile is associated with a 2–3% lower cost of capital and a 5–6% higher firm value.

7.22 Rather than looking at potential concerns from diversification following reduced incentives under corporate socialism, **Banal-Estañol, Ottaviani, and Winton (2013)** look at the concern that comes from risk contamination. They provide a theoretical model of the financial trade-off between joint and separate financing of two risky projects. In addition to considering the potential benefits from coinsurance (as considered by e.g. Hann, Ogneva, and Ozbas (2013)), the paper characterises conditions under which joint debt financing—e.g. through diversifying acquisitions—can increase expected default costs due to 'risk contamination', whereby the poor performance of one project drags a well-performing project into default. The paper develops a model of two projects financed through competitive debt contracts with bankruptcy costs and endogenous repayment obligations. The authors first solve a binary-return model and then extend the framework to continuous distributions, deriving an analytical decomposition of expected default costs into coinsurance gains and risk-contamination losses. Comparative statics show that joint financing is less attractive when default costs are high, returns are more volatile, negatively skewed, or positively correlated, and when mean returns are low. Calibrations indicate that risk contamination can dominate coinsurance in what the authors consider empirically plausible settings—implying for example that diversifying acquisitions can also reduce borrowing capacity and firm value under certain financial conditions.

7.23 Looking at the productivity and novelty of firms' R&D activity, **Seru (2014)** provides empirical evidence on how firm boundaries shape innovation incentives. He uses firm-level financial data, patent and citation data, and merger data over the period 1980–'98, with innovation measured using patent counts and citation-weighted patent metrics and organisational structure proxied by diversification and internal capital market activity.[441] The results show that firms acquired by conglomerates experience a significant decline in both the quantity and novelty of innovation. In line with concerns around corporate socialism, the proposed mechanism is incentive-based: centralised internal capital markets weaken divisional managers' incentives to undertake risky and novel R&D, as the threat of resource reallocation and bureaucratic oversight reduces the expected returns to pursuing uncertain projects. The author also finds that this effect is primarily associated with reduced productivity of existing inventors, rather than inventor exits, and that these effects are stronger in conglomerates with more active internal capital markets. Additional evidence shows that conglomerates respond by shifting innovative activity towards strategic alliances and joint ventures, and that decentralised R&D budgets mitigate these negative effects—consistent with the interpretation that internal capital allocation within conglomerates weakens incentives to pursue novel innovation.

7.24 **Kuppuswamy and Villalonga (2016)** examine whether the value of corporate diversification changes when external finance becomes severely constrained, using the 2007–'09 global financial crisis as a quasi-natural experiment. The paper studies whether diversified conglomerates gained relative to focused firms during the crisis

[441] The paper exploits a quasi-experiment based on failed mergers, comparing firms acquired in diversifying mergers (treatment group) with otherwise similar firms whose acquisitions failed for exogenous reasons (control group), and estimates DiD regressions to isolate the impact of conglomeration on innovation outcomes.

through two channels: a 'more-money' effect, whereby combining imperfectly correlated cash flows supports greater debt capacity (i.e. coinsurance), and a 'smarter-money' effect, whereby internal capital markets become more valuable when external capital allocation is impaired.[442] Using a quarterly panel of US firms from 2005Q1 to 2009Q4, they find that the traditional diversification discount shrank sharply during the crisis and, once endogeneity is accounted for, even turned into a diversification premium. Diversified firms also increased leverage relative to comparable focused firms, consistent with stronger borrowing capacity, and exhibited more efficient internal capital allocation during the crisis. The benefits were strongest for firms facing tighter liquidity positions or near-term debt maturities, suggesting that diversification can create value by insuring firms against adverse credit-market shocks and by reallocating scarce capital more effectively under stress.

7.25 Looking explicitly at the two opposing mechanisms of corporate diversification—coinsurance and the diversification discount—**Bielstein, Fischer, and Kaserer (2018)** examine how mergers and acquisitions affect firms' cost of capital through these mechanisms. Building on and extending the model of Hann, Ogneva, and Ozbas (2013)—discussed in para. 7.21 above—they develop a theoretical framework in which diversification reduces systematic risk by lowering expected distress costs, but may simultaneously increase systematic risk through inefficient internal capital markets that exacerbate cyclical losses. The authors analyse US takeovers between 1985 and 2014 in which acquirers obtain 100% of publicly listed targets.[443] They find that the coinsurance effect reduces the cost of capital by approximately 36 basis points for the average firm, whereas internal capital market inefficiencies increase it by about seven basis points. The net effect depends on the quality of the acquirer's internal capital market.

7.26 **Cornaggia and Li (2019)** test whether targets' superior bank access generates financial synergies that make them attractive acquisition partners to financially constrained acquirers. They use a dataset covering US transactions between 1981 and 1997[444] and find that firms in states with better bank access (i.e. lower financing constraints) are more likely to be acquired, and that post-merger firms increase leverage, rely more on bank debt, and face lower financing costs. These effects are stronger for small, private, and high-intangible acquirers—facing greater financing frictions or experiencing more pronounced growth needs—which thus gain the most from improved credit availability and expanded borrowing capacity. Although the study controls for industry relatedness, it does not distinguish results for horizontal or within-industry mergers.

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[442] The panel of US Compustat firms is complemented with segment data used to classify diversified versus single-segment firms. The authors estimate excess-value regressions, leverage comparisons, and tests of internal capital market efficiency before, during, and after the crisis, while also addressing endogeneity in firms' diversification choices by implementing a Heckman two-stage model as well as switching regression models as robustness checks.

[443] The sample contains 621 acquisitions. The authors combine M&A data with segment data, analyst forecasts, and credit ratings. The cost of equity is estimated using the median of five implied cost of equity models, while the cost of debt is proxied using rating-based bond yields. These are then aggregated into a weighted average cost of capital. The empirical design compares the realised post-merger weighted average cost of capital to a pre-merger 'synthetic' benchmark constructed from the standalone acquirer and target.

[444] The sample contains approximately 55,600 transactions, combined with state-level variation in interstate banking deregulation as an exogenous shock to credit supply. More specifically, the paper exploits staggered US interstate banking deregulations between 1978 and 1995, which lifted state-level restrictions on out-of-state bank holding companies acquiring in-state banks. Using state-pair and year panel regressions with fixed effects, they then relate cross-state acquisition flows to differences in bank access between target and acquirer states.

7.27 **Williamson and Yang (2021)** similarly consider whether acquisitions can alleviate financing constraints for acquiring firms. They consider acquisitions involving US public firms from 1985–2018, combining quarterly financial data with a time-varying financing constraint index.[445] They find that financially constrained acquirers experience significant post-acquisition reductions in financing constraints relative to matched non-acquirers, particularly in diversifying deals. These firms subsequently increase debt issuance and investment, while reducing cash holdings. Additionally, they earn more positive announcement returns, consistent with markets valuing the alleviation of financing frictions for the acquirer.

7.3 Mergers and acquisitions in general

7.28 Several papers look at the effect of M&As on the target's financial constraints, but without looking at whether these acquisitions are within or across industry.

7.29 **Mantecon (2008)** analyses the so-called 'listing effect'—whereby acquirers earn positive abnormal returns when acquiring private, but not public, targets—and links this to informational frictions in privately held firms and their weaker access to external finance.[446] The results are consistent with a mechanism where greater informational uncertainty and weaker access to external finance are associated with higher bidder returns, consistent with private targets facing financing frictions due to informational frictions absent the acquisition.

7.30 **Liao (2014)** assesses, among other things, whether corporate minority block acquisitions (5–50% equity stake) are driven by potential financing constraints of the target. Using a global sample of minority acquisitions between 1990 and 2009,[447] it relates the likelihood of being targeted and announcement abnormal returns to multiple proxies for financial constraints (including dividend payout status and established constraint indices), and analyses post-transaction financing and investment outcomes. Consistent with the idea that minority acquisitions can alleviate capital market frictions, the study finds that targets are, on average, more financially constrained, earn positive announcement returns—particularly when they are financially constrained—and subsequently increase external financing and investment. These effects are stronger when acquirers operate in industries 'related' to the target (same two-digit SIC code or industries with high input-output linkages, capturing both horizontal and vertical integration), consistent with a stronger certification effect when the acquirer possesses industry-specific information about the target's investment opportunities.

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[445] The sample contains 7,786 acquisitions. The financing constraint index is a composite measure based on a proxy that links investment behaviour to firm characteristics associated with external financing frictions including cash flow, leverage, dividends, size, and growth ('Whited-Wu' index), proxy based on firm size and age ('Hadlock-Pierce' size-age index), and credit rating status (investment-grade, non-investment-grade, or unrated). Firms are ranked on each component, the rankings are aggregated into a composite score, and a predicted continuous measure is constructed to capture time-varying differences in financing constraints across firms. They use a DiD analysis to compare acquiring firms with similar non-acquiring firms (matched using a propensity score matching) around acquisition events, looking at financing, investment, cash policy, and announcement returns.

[446] The study constructs a sample of 51 private firms that filed for an IPO during 1996–2003 but were acquired within 18 months of filing, allowing detailed accounting, ownership, and compensation data to be drawn from prospectuses. These firms are then benchmarked against 84 comparable IPO firms that successfully listed and were subsequently acquired. Methodologically, the author combines an event study analysis of bidder announcement returns with an OLS regression that related those returns to proxies for informational uncertainty, ownership structure, and financing constraints.

[447] The sample contains 43,109 minority acquisitions in total, focusing on 8,277 non-financial public targets matched to accounting and return data.

7.31 Looking at the effect of acquisitions on targets' financial constraints, **El Ghoul, Gong, and Guedhami (2025)** identify the internal and external channels through which acquisitions alleviate targets' constraints. The study uses European and predominantly private-firm data[448] on M&A transactions and financial statements, covering full acquisitions completed between 2007 and 2013.[449] The results indicate that targets' financial constraints are on average alleviated after acquisition not because they generate higher post-takeover earnings, but because internal financing improves—through greater discretion in earnings retention and increased access to interest-free intra-group borrowing from parent companies—and external financing strengthens, as targets increase debt issuance at lower interest rates, obtain more supplier trade credit, and collect receivables more quickly.

7.4 Venture capital financing and exit

7.32 **Lerner and Nanda (2020)** discuss the role of VC in financing innovation by providing descriptive evidence on the evolution of the VC industry during the preceding 40 years and by reviewing causal evidence on its economic impact. Focusing on the US VC industry, they document how VC-backed firms contribute to technological progress and high-growth entrepreneurship through staged financing, active governance, and performance monitoring that mitigate informational frictions and support scaling. They review empirical studies that exploit policy changes, changes in the VC monitoring ability, and shocks to investors' capital supply.[450] They highlight that VC-backed firms tend to exhibit higher innovative output (via patenting) and improved firm growth and survival[451] and (based on their own analysis) greater R&D intensity. However, the authors also emphasise how VC funding is concentrated in a narrow set of scalable technologies and poorly suited to long-horizon or 'tough tech' innovation, capital is increasingly concentrated among a small number of investors, and governance intensity may be weakening over time. These structural features may shape not only the rate but also the direction of innovation, with potentially adverse aggregate effects.

7.33 Lerner and Nanda also document that VC-exit is increasingly through acquisitions rather than IPOs,[452] and that firms that are going public do so later in their

[448] Private firms are not publicly listed on stock markets. On average, over 98% of targets and 70% of acquirers in the data are private firms.
[449] The sample contains 9,375 acquisitions, with pre- and post-deal accounting information at the subsidiary level. While the paper documents that the dataset contains ca. 47% industry-related deals (same two-digit SIC code) and ca. 53% other deals, results are not disaggregated between the two groups. The authors implement panel regressions with firm and year fixed effects, replicate investment–cash flow sensitivity tests, and analyse changes in retained earnings, intra-group liabilities, debt issuance, interest rates, and trade credit around the acquisition event.
[450] For example, Kortum and Lerner (2000) exploit, among other approaches, a policy shift that freed pensions to invest in the VC industry and thus spurred fundraising to show that VC activity in an industry is positively associated with higher patenting rates. Separately, Bernstein, Giroud, and Townsend (2016) exploit the introduction of new airline routes in the US that reduce travel times to proxy on-site involvement of VC-investors and show that an increase in monitoring is associated with an increase in both innovation and the likelihood of successful exit.
[451] For example, Howell, Lerner, Nanda, and Townsend (2020) empirically explore shifts in VC investment during recession and show (among other things) that VC-backed US firms file patents of higher quality and economic importance. Moreover, Chemmanur, Krishnan, and Nandy (2011) use US data on private and public firms and show that VC-backed firms are more productive than their non-VC backed counterparts, mainly due to increases in sales (rather than decrease in production costs). Puri and Zarutskie (2012), using similar data, show that failure rates of VC-financed firms are lower, although they are not more profitable than non-VC backed firms.
[452] This result is corroborated by later evidence found by Ederer and Pellegrino (2023), see para. 5.83.

lifecycle.[453] Although they do not discuss the effects of this trend on competition or innovation, nor what it means for merger policy, their reflections do provide the following implications for merger policy: first, VC-based firms disproportionately contribute to high-growth innovation and technological change, which means that their acquisition may eliminate economically significant future competitors; second, however, VC investors increasingly rely on acquisitions rather than IPOs for exit, and stricter merger enforcement could affect VC financing incentives. Lerner and Nanda discuss several options on how to improve the role of VC in financing innovations (e.g. broadening the range of technologies that attract venture funding, reforming venture fund structures and incentives to accommodate longer-horizon investments, and developing sector-specific investment and governance models)—none of which, however, relate to merger control policy.

7.34 Looking into the determinants of startup- or VC-exit via acquisition or IPO, **Bowen, Frésard, and Hoberg (2023)** examine how startups' position within technological cycles affects exit choices. They construct a text-based measure of technological dynamism, referred to as 'RETech' (short for rapidly evolving technology), using the description text of 6.6 million USPTO patents from 1930–2010,[454] and link this to a panel of US VC-backed startups.[455] Across several specifications, they show that startups innovating in rapidly evolving technology areas are significantly more likely to exit via IPO, while those innovating in stable areas are more likely to be acquired. They discuss how this pattern is consistent with the fact that rapidly evolving technologies raise a startup's stand-alone value by their potential to substitute existing technologies and accelerate IPOs. On the contrary, in more stable technologies integration gains are more salient because merger synergies tend to be higher. These arise from complementarities with existing technologies through incremental improvements, follow-on innovation, and improved coordination, thus favouring exit via acquisitions.

7.35 **Parry (2025)** studies how financing frictions shape startup outcomes in the US, why VC activity is lower in other developed economies, and whether financing constraints create bottlenecks to innovation in certain sectors. He also considers the role of acquisitions as an alternative source of startup liquidity to VC funding. Using microdata on US and UK VC funding rounds and exit outcomes for US startups funded for the first time between 2005 and 2015, he develops and structurally estimates an equilibrium model of the VC market featuring frictional matching between entrepreneurs and investors, staged financing, and financing risk arising from reliance on follow-on funding. He estimates that around 40% of VC-backed US startups shut down despite positive continuation value, consistent with premature termination driven by financing constraints. The model further shows that acquisitions provide an important alternative route to liquidity that can partially offset financing frictions—particularly for projects that have not yet reached commercialisation—thereby mitigating premature closure where follow-on funding is unavailable. He also shows that the lower VC activity in the UK relative to the US is not driven by project quality but rather by less advantageous financing conditions (tighter access to follow-on funding, reflected in fewer and more widely spaced funding rounds) and fewer potential acquirers. Finally, he shows that the

[453] Ewens and Farre-Mensa (2020) exploit the deregulation of US securities laws in the 1990s, which facilitated the process of raising capital privately, and show that the IPO decline is driven by founders taking advantage of their lower costs of being private to keep control by remaining private.
[454] More specifically, RETech is calculated as the average growth in usage of the words contained in a patent's description relative to the overall patent corpus—i.e. a text-based measure of whether the vocabulary used by a patent is becoming more or less prevalent across all contemporaneous patents.
[455] The panel contains 9,167 firms with 94,703 patents observed at the startup-quarter level. They estimate the determinants of startup exits using OLS, logit, and multinomial logit models comparing exit via IPO and exit via sellouts.

concentration of VC funding in software and services reflects the greater financing risk faced by long-horizon technologies.

8 Competition policy papers

8.1 This Chapter provides a detailed paper-by-paper review of the relevant literature in Volume 1, Chapter 10.

8.1 Academic work by US scholars (2000–'15)

8.2 During the 2000s and early 2010s, several policy papers written by US scholars addressed the relationship between competition policy and innovation, often on the basis of debates and experiences in enforcement, and insights from the literature. These papers generally consider the apparent tension between (i) the Schumpeterian view that scale and market power foster innovation and (ii) the Arrovian view that market power discourages innovation because of the cannibalisation of existing profits.

8.3 **Gilbert (2006)** provides a structured enquiry into the Schumpeterian hypothesis that large firms and concentrated markets are drivers of innovation. Gilbert surveys the economic theory of innovation, focusing on market structure and its relationship to competition, the distinction between product and process innovations, and the role of exclusive and nonexclusive rights to innovation. Gilbert notes '[i]t is not that we don't have a model of market structure and R&D, but rather that we have many models and it is important to know which model is appropriate for each market context'. He finds that exclusive rights generally lead to greater innovation incentives in more competitive markets, while nonexclusive rights generally lead to the opposite conclusion, although there are important exceptions.

8.4 The paper also reviews the large literature on empirical studies of innovation and finds some support for the predictions of the theory. Overall, Gilbert finds that there is modest support for the proposition that process innovations, which tend to be used internally, are more profitable for large businesses, because the benefits of process innovations are proportional to the level of production to which the innovations apply. For product innovations, the paper finds there is little evidence to support the Schumpeterian view that monopoly or highly concentrated market structures promote innovation, and some evidence supporting the conclusion that innovation thrives in more competitive markets.

8.5 Where Gilbert considers the relationship between competition (in general) and innovation, **Katz and Shelanski (2007a)** look specifically at merger control. They consider in particular whether the traditional presumption that more concentrated markets diminish price competition should apply to innovation effects too (on the basis of the relevant theoretical and empirical literature). They conclude that the economic evidence for the concentration-competition-welfare presumption is weak, except for a merger to monopoly (which can leave a firm facing little pressure racing to introduce innovation which would cannibalise its existing profits). Although they recommend a neutral presumption regarding the innovation effects of merger (other than a merger to monopoly), they also suggest that the specific facts of such transactions should be closely scrutinised for evidence on likely innovation effects ('neutrality of presumption does not imply neutrality regarding the desirability of rigorous merger enforcement').

8.6 Katz and Shelanski discuss a number of building blocks for a review of the impact of a merger on innovation, including market definition, competitive effects, and efficiencies. On the latter, they consider three types of innovation efficiencies that may be associated with mergers: (i) increased **capabilities** from combined complementary assets, (ii) increased firm **size** (which may give rise to greater ability to absorb risk or fund R&D), or (iii) less competition and greater product-market **profits**, which can then fund R&D. However, they also caution that there is

limited and mixed empirical evidence on these effects. Moreover, efficiencies may be achievable through less anticompetitive alternatives to a merger (e.g. licensing, joint ventures, or contracts).

8.7 Finally, Katz and Shelanski recommend the use of established tools of decision theory to address the role of uncertainty in mergers involving dynamic effects.[456] This is particularly relevant for mergers where innovation plays a central role, and may give rise to uncertain but potentially significant dynamic efficiencies. As they explain, a decision theoretic approach can be formalised as picking the course of action that yields the highest expected payoff to the decision maker, where the *expected value* of taking an action is equal to the payoffs associated with the different possible outcomes that can follow an action weighted by the probabilities that those outcomes occur if the action is taken. Under conditions of uncertainty, an expected value approach is superior to one which focuses on likely outcomes to the exclusion of unlikely outcomes. This approach is closely related to an error-cost approach.[457]

8.8 **Baker (2007)** revisits the Arrow v Schumpeter debate, and highlights four principles for the relationship between competition and innovation, which are relevant for antitrust policy:

- **Innovation rivalry (R&D competition) spurs innovation:** firms in a race to develop the same product/process exert greater innovative effort;
- **Pre-innovation product market competition spurs innovation:** firms innovate to escape existing competition (the 'escape competition' effect);
- **Post-innovation competition can deter innovation:** if innovators expect intense competition after innovating, expected returns fall, reducing R&D incentives;
- **Pre-emption incentives matter:** firms may innovate to deter rivals' R&D, strengthening their own incentives relative to competitors.

8.9 He then goes on to point out that antitrust policy is not a 'general-purpose competition intensifier', but can rather be focused on industry settings and conduct where enforcement can promote innovation. Through such selection, antitrust intervention can be designed to promote innovation systematically by strengthening innovation competition and pre-innovation product market competition, while avoiding excessive post-innovation competition that would instead undermine incentives to innovate. Baker also argues contemporary competition policy holds up well against this standard, and concludes that it is time to move beyond the 'Schumpeter versus Arrow' debate and to embrace antitrust as essential for fostering innovation.

8.10 Taking a similar approach to Baker (2007), **Shapiro (2012)** also revisits the apparent tension between the Arrow and Schumpeter views on the role of competition. He argues that—in the context of merger control—there is no contradiction between Arrow's position (which, for convenience, he simplifies to 'product market competition spurs innovation') and Schumpeter's position (which he simplifies to 'the prospect of market power and large scale spurs innovation'). He clarifies this by formulating three guiding principles that capture the perspectives of both Arrow and Schumpeter:

[456] This is further explained in Katz and Shelanski (2007b).
[457] For a further discussion on decision theory and error-cost framework in antitrust, see Salop (2026), in particular Chapter 2.

- **Contestability:** the prospect of gaining or protecting profitable sales by providing greater value to customers spurs innovation. Shapiro argues that the Arrow effect fits well with this principle, as firms with substantial pre-innovation sales have muted incentives to innovate. Similarly, the Schumpeterian notion that firms making major innovations are rewarded with post-innovation market power is consistent with the 'contestability' principle.
- **Appropriability:** increased appropriability (i.e. ability to capture returns from innovation) spurs innovation. Shapiro notes that this principle depends heavily on the extent to which a firm can protect the competitive advantage associated with its innovation from imitation from rivals. This fits well with the Schumpeterian approach, as rapid imitation would increase post-innovation competition and dilute the benefits from innovation.
- **Synergies:** combining complementary assets enhances innovation capabilities and thus spurs innovation. This principle relates to the *ability* to innovate, while the first two relate to *incentives*.

8.11 Shapiro argues that these three principles can usefully guide competition policy. He also sets out a conceptual and empirical basis for a rebuttable presumption that a merger between two of a very few firms who are important and direct R&D rivals in a given area is likely to retard innovation in the area (contrary to what he defines as the 'complexity proposition' that there should be no presumptions on the impact of mergers on innovation).

8.12 Reviewing the empirical literature, Shapiro concludes that while the relationship between competition and innovation is complex and context-dependent, the weight of the evidence supports the general proposition that greater competition—properly understood to refer to the degree of contestability and rivalry—tends to spur innovation.[458]

8.13 In his discussion of Shapiro (2012), **Whinston (2012)** suggests that the impact of a merger on innovation is likely to depend on the internalisation of R&D and pricing externalities between the merging firms, and the reaction of non-merging parties.

8.14 **Gilbert and Greene (2015)** review how US antitrust agencies have progressively incorporated innovation considerations into merger control under Section 7 of the Clayton Act, culminating in the more explicit treatment of innovation in the 2010 Horizontal Merger Guidelines. The paper combines a conceptual discussion of the Schumpeterian view that market power can support innovation and the Arrovian view that competition can strengthen incentives to innovate, emphasising that outcomes are context-specific and depend in particular on appropriability conditions. It then examines US merger challenges between 2004 and 2014 and finds that innovation concerns were raised in around one-third of all challenged mergers, and in a very high proportion of cases in R&D-intensive industries. The authors conclude that innovation has become a central dimension of merger enforcement, but argue that agencies should articulate alleged innovation harms more clearly and with greater specificity when bringing challenges.

[458] Shapiro also discusses in detail the Inverted-U theory by Aghion, Bloom, Blundell, Griffith, and Howitt (2005), which he concludes is 'elegant and instructive' (p. 386) but relies on strong and restrictive assumptions (e.g. two firms, no entry, homogeneous products, limited innovation paths) and, in any case, does not model a reduction in competition as a merger between competing firms. Shapiro points out that a merger in this model would be 'disastrous for innovation' as the merged entity would immediately cease all innovation.

8.2 Policy papers relating to the 'innovation theory of harm' in Dow/DuPont

8.15 The academic policy papers discussed above largely focused on the US context. Since the European Commission's 2017 decision in Dow/DuPont, further academic policy papers emerged—particularly from Europe—that looked specifically at innovation concerns in merger control.[459]

8.16 Building on the economic annex to the Dow/DuPont decision by the European Commission, **Federico (2017)** sets out a conceptual framework for assessing how horizontal mergers between rival innovators may affect innovation and consumers. Drawing on the economic literature, he identifies three main channels through which mergers affect innovation incentives (each linked to a distinct externality internalised by the merger):

- **Innovation competition:** mergers internalise a negative innovation externality between the merging parties which reduces post-merger innovation incentives;
- **Product market competition:** mergers also internalise a negative pricing externality that increases post-merger prices and changes post-merger margins/output, with ambiguous implications for innovation incentives; and
- **Appropriability:** mergers may also internalise a positive innovation externality between the merging parties—for example from knowledge spillovers, increasing innovation incentives.

8.17 On the first two channels, Federico emphasises that they must be considered jointly, as both affect incentives to innovate and consumer welfare. From a consumer welfare perspective, merger harm is not limited to innovation effects but also includes price effects, meaning the second channel may harm consumers even if it increases innovation. The interplay between these two channels determines where the loss of future competition from a merger manifests itself only or primarily through higher future prices, or through a combination of lower innovation effort and less intense future product market competition.

8.18 On appropriability, Federico distinguishes between **involuntary knowledge spillovers**, which a merger may internalise by reducing leakage of innovation returns and improving appropriability, and **voluntary spillovers**, where the merger enables knowledge transfers not previously feasible. He concludes that the pre-merger degree of appropriability—for example due to effective IPRs—is an important determinant of merger effects on innovation. Separately, he notes that mergers may also improve R&D productivity by combining complementary R&D assets and/or generating cost synergies.

8.19 As a policy matter, Federico concludes that innovation harms are more likely where a merger combines two of a limited number of effective innovators in the same R&D trajectory, with high and durable barriers to entry or expansion in R&D and limited countervailing procompetitive effects. He further suggests that merger control should assess not only current product overlaps, but also likely future competition based on the parties' R&D capabilities, pipelines, and incentives to innovate, using

[459] In March 2017, the European Commission found that the merger between agrochemical companies Dow and DuPont would have significantly lessened competition in part due to a reduction in R&D efforts by the merged entity, and required substantial divestment of R&D capabilities before approving the merger. This merger decision—together with the subsequent agrochemical merger between Bayer and Monsanto—revived the debate on the role of innovation in EU merger control. The related theoretical economic papers are discussed in Chapter 3.

concepts analogous to unilateral effects analysis such as concentration, closeness of competition, entry conditions, and efficiencies.

8.20 **Jullien and Lefouili (2018)** discuss the effects of horizontal mergers on innovation, based on a review of the relevant literature and their own research. They distinguish between a merger's effects on firms' **incentives** to innovate (through the coordination of merging firms' actions) and its effects on firms' **ability** to innovate (through reallocation of resources, pooling of assets, and exploitation of complementarities).

8.21 Considering first **product innovation**, they distinguish four effects of mergers on innovation incentives:

- **Innovation diversion effect:** the merged firm internalises the effect of one merging party's innovation on the other's sales, which may reduce or increase R&D incentives depending on whether innovation diverts demand from, or differentiates products relative to, the other party;
- **Demand expansion effect:** higher post-merger margins increase incentives to invest in demand-enhancing innovation;
- **Margin expansion effect:** lower post-merger output reduces the incentives by firms to innovate to increase their margins; and
- **Spillover effect:** the merger internalises technological spillovers between the parties, increasing incentives to invest in R&D.

8.22 On spillovers, they conclude that these are common in R&D (for example through imitation, disclosure, mobility, publications, or sequential innovation). A merger may internalise and increase spillovers by reducing incentives to exclude the other party from shared knowledge, creating economies of scale and scope in R&D.

8.23 For **process innovation**, they note that a merger may reduce incentives to invest in cost-reducing innovation because higher post-merger prices and lower output reduce the gains from lower unit costs. However, spillovers may offset this effect, and where investments are observable, the anticipation of strategic responses by rivals makes the overall impact ambiguous.

8.24 Overall, Jullien and Lefouili argue that the effect of a horizontal merger on innovation can be either positive or negative under reasonable conditions and therefore that a presumption that horizontal mergers harm innovation is not warranted.

8.25 **Denicolò and Polo (2019)** critically assess the innovation theory of harm, which they define as a concern that horizontal mergers would reduce innovation (absent spillovers and efficiencies), independently of their (static) effects on product market competition. They argue that recent formal work apparently underpinning the innovation theory of harm[460] depends on restrictive assumptions and thus does not fully account for possible innovation enhancing effects that can exist when competing firms merge. Denicolò and Polo argue that relaxing these assumptions can lead to different conclusions, showing that the economic underpinnings of the innovation theory of harm are in fact too fragile to serve as the foundation for a presumption that horizontal mergers have harmful effects on innovation.

8.26 The paper points to two examples of how mergers can promote innovation. The first is the case of **duplicative research**, where rival firms pursue the same or closely substitutable innovations. Denicolò and Polo explain that where duplication risks are

[460] Motta and Tarantino (2021), Federico, Langus, and Valletti (2017, 2018).

high and diminishing returns to R&D are limited, a merger may increase total R&D investment and the probability of successful innovation, by coordinating R&D efforts more efficiently across projects.[461]

8.27 Secondly, the paper emphasises the scope for **innovation sharing** resulting from a merger. Because technologies developed by one firm are often transferable to another, a merger may facilitate internal knowledge sharing. By expanding the scale over which innovations can be applied, this may raise the returns to R&D, increase incentives to innovate, and in some cases lower prices and expand output even absent conventional production synergies.[462] The paper also distinguishes this mechanism from other R&D complementarities that are normally assessed under an efficiency defence (e.g. R&D complementarities from combining research assets, personnel, or capabilities).

8.28 More generally, Denicolò and Polo contend that some models used to support the innovation theory of harm in fact show only that mergers with adverse static effects may also reduce innovation. On that view, a conventional static assessment based on prices, output, and consumer welfare may already capture the relevant dynamic incentives, rather than implying any separate presumption against mergers in innovative markets.

8.29 Overall, Denicolò and Polo reject the general position that horizontal mergers are generally harmful to innovation, and advocate an open-minded and fact-specific assessment of both the positive and negative effects of a merger on innovation.

8.30 **Régibeau and Rockett (2019)** set out a framework for assessing merger effects on innovation based on (i) impacts in product, technology, and innovation markets, and (ii) whether innovation is 'directed' towards identifiable product markets or 'undirected'.

8.31 On **product market competition**, they argue that directed innovation concerns largely mirror ordinary horizontal overlap: a merger may weaken incentives to innovate because the merged firm internalises sales lost by the other party when one product is improved through innovation. Accordingly, remedies addressing static overlap (e.g. divestitures) may also address much of the related innovation concern.

8.32 They also emphasise that innovation may generate a number of efficiencies that may justify a more lenient treatment of innovation-intensive mergers compared to purely static transactions, including (i) knowledge diffusion within the merged entity, (ii) internalisation of involuntary spillovers (i.e. improved appropriability where licensing markets are imperfect), (iii) better coordination of R&D and reduced duplication, (iv) stronger incentives for sequential innovation by reducing hold-up, bargaining frictions, and under-reward of upstream innovators, and (v) greater legal certainty through fewer patent disputes, infringement risks, royalty uncertainty, and litigation costs between the merging parties.

8.33 On **technology market competition** (licensing and IP transactions), they argue that merger issues resemble standard competition analysis: mergers between substitute technologies may raise licensing prices, while mergers combining

[461] This argument is based on the formal model of Denicolò and Polo (2018), discussed in more detail in para. 3.26.
[462] This argument is based on the formal model of Denicolò and Polo (2021), discussed in more detail in para. 3.44.

complementary technologies may reduce double marginalisation and lower access costs.

8.34 Finally, in the case of **innovation market competition**, firms may be competing to discover commercially valuable knowledge before products exist (which is best characterised as an instance of 'undirected research'). Harm may arise where firms overlap in technological capabilities and first-mover advantages are significant (e.g. patents, standards, switching costs, network effects). In such cases, a merger may reduce race-to-invent incentives (as in patent race settings), and may require a specific innovation remedy (the divestment of IPRs, research teams, research facilities, or other essential inputs into the R&D process). The authors also describe potential vertical foreclosure concerns in innovation markets, where one of the merging parties has significant market power in the supply of some inputs, and there is overlap between the parties in innovation markets.

8.35 The key conclusion of the analysis is that one needs to distinguish between innovation effects that are grounded in (potential) product market overlaps and those that are not. Even though the first type of effect might require some divestment in innovation markets, this type is similar to traditional static efficiency concerns and can be handled by remedies that reduce downstream overlap. By contrast, one can build reasonable theories of harm that operate entirely within innovation markets, and may require specific innovation remedies. Régibeau and Rockett (2019) (as further expanded in **Régibeau and Rockett (2022)**) describe a possible 'policy algorithm' to implement their suggested approach.

8.36 In his book *The Antitrust Paradigm: Restoring a Competitive Economy*, **Baker (2019)** argues that stronger and modernised competition enforcement is needed to restore innovation, growth, and fair markets in the US economy. Chapter 8 of the book contains a discussion of the threats to innovation from lessened competition. Baker describes that mergers of actual or potential rivals can lessen innovation competition and reduce future product market competition both through a **unilateral effects theory**—by allowing the merged firm to internalise future product-market competition—and through an **exclusionary theory**—by deterring new product development by non-merging rivals (e.g. through foreclosure). He argues that courts and enforcers should adopt the following two presumptions: first, that mergers of innovation rivals will harm competition when only a handful of firms participate in an innovation market (reflecting the unilateral effects theory); and second, that innovation competition would be harmed when a dominant firm in an innovative sector acquires a rival with capabilities for developing next-generation products (even if the firms do not presently compete).

8.37 On how competition policy—including merger control—should protect innovation, **Federico, Scott Morton, and Shapiro (2020)** focus on the relevance of preserving rivalry for future sales and preventing incumbents from neutralising disruptive threats. To characterise the impact of a merger on innovation, they distinguish between the internalisation of 'business-stealing' effects (which tends to reduce innovation incentives, by analogy to unilateral price effects), and innovation synergies (including the internalisation of knowledge spillovers, voluntary technology transfers post-merger, and R&D synergies). With respect to the first channel, the authors also discuss the interaction between unilateral effects on prices and on innovation, suggesting that the combined impact of these two effects is likely to harm consumers (based on recent academic work).

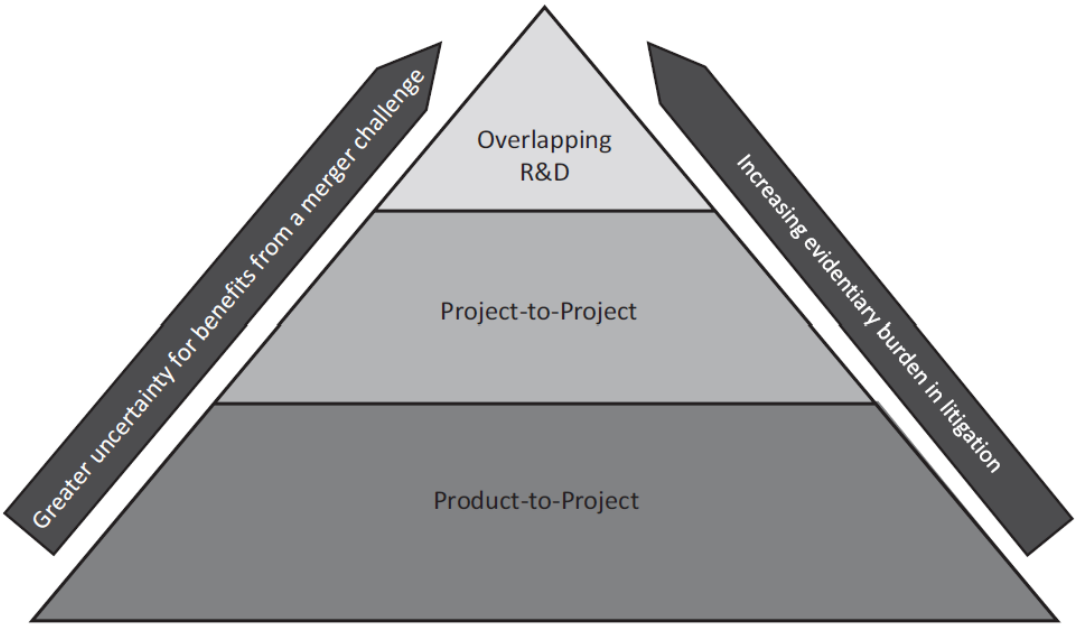
8.38 The authors also distinguish three main settings for innovation harm: (i) product-to-pipeline or pipeline-to-pipeline mergers, where future competing products are already identifiable; (ii) mergers between firms with overlapping innovation capabilities, even without specific product overlaps; and (iii) acquisitions of nascent competitors by dominant incumbents (with specific case studies for each). They

suggest that competition authorities should address the presence of uncertainty in the R&D process by considering the impact of a merger on expected consumer welfare, de facto adopting an error cost framework.

8.39 **Gilbert (2020)**, in his book *Innovation Matters: Competition Policy for the High-Technology Economy*, argues that competition policy should shift from focusing mainly on prices to protecting innovation incentives, especially in high-tech markets where future competition and new ideas matter more than short-term price effects. In Chapter 5 of his book, Gilbert specifically discusses merger policy for innovation, examining how mergers and acquisitions—particularly involving potential competitors in high-technology markets—can reduce incentives to invest in R&D, lessen future competition, and therefore warrant closer antitrust scrutiny.[463] Focusing specifically on horizontal mergers, Gilbert sets out how prior innovation-centric merger cases involving alleged unilateral effects for innovation fall into three general, non-exclusive classifications: (i) **product-to-project mergers** involving an incumbent product and a pipeline or development project that may become a future competing product, (ii) **project-to-project mergers** involving two pipeline or development projects aimed at future competing products, and (iii) **overlapping R&D mergers** involving the combination of firms conducting parallel or closely related R&D efforts where competition occurs in innovation capabilities rather than existing products. Gilbert presents these categories as an enforcement pyramid: product-to-project cases sit at the base, where the evidentiary burden is relatively lower; project-to-project cases occupy the middle; and overlapping R&D cases sit at the top, where uncertainty and the burden of proving harm are greatest. This is shown in Figure 8.1. The slices of the pyramid indicate the relative number of US cases in which alleged innovation harms were central.

[463] Other chapters relevant to the material covered in this Study include in particular Chapter 3 on Arrow versus Schumpeter, Chapter 4 on dynamics, cumulative innovation, and organisation theories, and Chapter 6 on the empirical evidence on competition and innovation. As these chapters are mostly based on literature that we already review elsewhere in our synopsis, we do not cover these chapters here.

Figure 8.1 Enforcement pyramid for mergers with potential innovation harm



Note: This presents the enforcement pyramid for mergers with potential harm to innovation as set out by Gilbert (2020). This considers specifically horizontal mergers.
Source: Gilbert (2020), Figure 5.5.

8.40 Gilbert also discusses what he considers makes a 'good' innovation merger case. This involves (i) a highly concentrated relevant R&D market, (ii) significantly increased replacement effects, (iii) innovations that relate to new products for which appropriation is high, (iv) low intra-firm technological spillovers, (v) an expectation of large future price effects, (vi) merging parties that are likely innovators in the near term, (vii) no strong innovation incentives independent of competition, (viii) acquisitions that are not necessary to incentivise innovation (i.e. innovation-for-buyout).

8.41 **Valletti (2025)** clarifies the scope and implications of the 'innovation theory of harm', by reference to recent academic work. He sets out that the innovation theory of harm should be understood as a benchmark framework for policy analysis, rather than a claim that all mergers harm innovation. In his formulation, the relevant economic setting to test the innovation theory of harm should have the following features:

- there should be competition in innovation and in final product markets,
- there should be no efficiencies or synergies,
- there should be no positive spillovers between firms, and
- the ultimate effect for policy is to look at the impact on consumer surplus.

8.42 Valletti concludes that, when properly framed, the core proposition of the innovation theory of harm remains valid. Specifically, he argues that, absent spillovers and synergies, horizontal mergers are likely to harm consumers.

8.43 Looking specifically at the role of efficiencies in horizontal merger control, **Padilla (2026)** advances several propositions and recommendations for reform. Specifically, he advances the following six propositions: (i) based on corporate finance evidence, many mergers do generate efficiencies, (ii) innovation effects are ambiguous but there are useful **separating conditions** that serve to distinguish between innovation-increasing and innovation-decreasing mergers, (iii) mergers

are an exit mechanism that can facilitate efficient reallocation of capital (e.g. by eliminating so-called 'zombie firms'), (iv) acquisitions of small innovative companies ('startups') can strengthen rivalry ex ante (i.e. through innovation-for-buyout incentives), (v) mergers among laggards can foster competition, and (vi) resilience is a consumer-welfare dimension when interpreted as continuity of supply and service quality.

8.44 Padilla explains the agency's scepticism towards mergers and their effects on innovation with reference to canonical models that have a focus on static competition, market power as a driver of consolidation, and administrable, structural, or quasi-structural presumption (where efficiencies are merely an add-on that does not get equal attention).[464]

8.45 On mergers and innovation, Padilla argues for a need to move beyond presumptions like 'mergers harm innovation' or even 'mergers harm consumer welfare'. For example, in response to the proposition by Valletti (2025) that absent spillovers and synergies, horizontal mergers between incumbents are likely to be bad for consumers, Padilla argues that this should be understood only as a benchmark presumption within a restricted canonical unilateral-effects model. For example, outcomes may differ where mergers redirect innovation across projects, create complementarities, or affect multi-product portfolios, potentially making consumers better off. Instead of relying on presumptions, Padilla advocates structuring inquiries around separating conditions, i.e. case-specific factors that distinguish innovation-increasing from innovation-decreasing mergers.[465]

8.46 Padilla concludes on a proposal that follows the following five steps. First, identify the dominant merger 'type' and candidate channels—where Padilla identifies the following types of cases: static unilateral effects cases, dynamic capabilities or innovation cases, exit or reallocation cases, ecosystem or startup exit cases, laggard merger cases, and resilience cases. Second, apply the standard harm screen but make the counterfactual explicit and realistic. Third, for each candidate efficiency channel, require a 'mechanism plus evidence' package—i.e. articulate why the merger changes incentives or constraints and provide supporting evidence. Fourth, separate 'standards of proof' by efficiency type, while keeping a high bar. Fifth, decide when remedies are really justified based on credibility of the mechanism, or whether it risks drifting the authority into sector regulation.

8.47 **Peitz (2026)** considers how the revision of the EU Horizontal and Non-Horizontal Merger Guidelines should address innovation harms and efficiencies in an integrated framework. He argues that mergers can harm innovation through three principal channels: (i) the **elimination of independent research paths**, where parallel R&D efforts or competing technological trajectories are combined; (ii) **restricting rivals' access to key inputs**, such as data, talent, IP, research infrastructure, or customer access that rivals require to innovate (which can be understood as a form of input foreclosure affecting innovation competition); and (iii) **weakening incentives to adopt and diffuse new technologies**, where weaker post-merger

[464] On this point Padilla (2026) notes: 'If the baseline story is market power and the efficiency story is an add-on, then it is predictable that the policy culture becomes sceptical of efficiencies. It is not ideological bias, but the result of an epistemological constraint: the models are simply not built to 'see' certain dynamic and systemic mechanisms well.' (p. 8).

[465] More specifically, he concludes on the following set of potential separating conditions (pp 49–50): are the merging parties close in the innovation space? Are outsiders able to replace the innovation rivalry lost through the merger? Do the parties argue R&D efficiencies or an 'innovation sharing' defence? Do the parties argue duplication or portfolio redirection efficiencies? Does the merger raise killer acquisition or reverse killer acquisition concerns? Can you really 'divest innovation' (related to whether remedies are possible)?

competitive pressure slows deployment even if invention itself is unchanged.[466] Against this, Peitz emphasises that mergers may also generate innovation efficiencies by combining complementary tangible and intangible assets, including technological capabilities, engineering know-how, regulatory expertise, manufacturing scale, and distribution networks; and by generating efficiencies in the process of R&D. However, he stresses that innovation efficiencies should be recognised only where the merger creates capabilities that facilitate innovation, the merged firm has incentives to pursue those innovations, and the claimed efficiencies are merger-specific. On the acquisitions of small innovative companies ('startups'), Peitz rejects both systematically permissive and systematically sceptical approaches. Instead, he advocates distinguishing acquisitions that accelerate scaling and commercialisation from those that (i) remove future challengers and neutralise disruptive threats or (ii) concentrate scarce innovation inputs in dominant firms and deprive other firms of assets or capabilities they need to innovate.

8.48 Some recent policy contributions have considered specifically the concerns around non-horizontal acquisitions and the acquisition of small innovative companies—referred to as startups. **Shapiro (2025)** examines how the 2023 US Merger Guidelines deal with cross-market acquisitions—i.e. transactions in which a firm with a strong position in one market acquires a firm in another, related market. His principal concern is that the Guidelines are too ambiguous and unbalanced: they are too ambiguous on what constitutes a dominant position and what exclusionary conduct would be treated as exclusionary; and too unbalanced by underrecognising the inherent efficiencies that can come with cross-market acquisitions (e.g. economies of scale and scope, faster entry, diffusion of capabilities, 'Cournot' complementarities[467], and stronger challenges to incumbents in target markets), and the historical benefits that have come from conglomeration in the US. Shapiro also argues that the Guidelines risk reviving older conglomerate-merger doctrines that focused excessively on harm to rivals rather than harm to consumers. By contrast, he notes that the EU's non-horizontal merger framework more explicitly balances potential foreclosure concerns against efficiencies and consumer benefits.

8.49 Overall, Shapiro concludes that enforcement should be grounded in demonstrated likely harm to customers, not merely the prospect that a successful entrant may disadvantage rivals, and that overly sceptical treatment of cross-market acquisitions could deter procompetitive expansion into new or concentrated markets.

8.50 Looking specifically at merger policy in the context of startup acquisitions, **Teh and Wang (2026)** note that startup acquisitions differ from more traditional mergers in three important ways: (i) they often involve significant asymmetry in market power and capabilities between the acquiring and target firm, (ii) the focus tends to be on innovation by smaller startup firms rather than by the acquirer, and (iii) many of the target firms are not direct competitors to the incumbents, although they may reflect nascent or potential competition.

8.51 Teh and Wang make a distinction—based on the literature—between post-acquisition innovation concerns and pre-acquisition innovation concerns. **Post-**

[466] This third mechanism actually covers two distinct theories of harm, although both are related to diffusion and can stem from cannibalisation: one concerns reduced incentives to adopt superior technologies, while the other concerns weaker incentives for merging firms to license innovations to other firms.

[467] Cournot complementarities refer to the incentive created when complementary products are under common ownership, such that the firm internalises joint profits and may have stronger incentives to lower prices or improve quality to also increase demand for the other product. This is the same logic as the elimination of double marginalisation in vertical mergers.

acquisition innovation concerns refer to how an acquisition, once approved, affects subsequent innovation activity—most notably whether the acquirer continues, develops, shelves, or terminates the target's R&D project. Here, they argue that concerns around so-called killer acquisitions should be applied cautiously. In their view, the classic Arrow replacement effect—which predicts weaker incumbent incentives to innovate than entrants—does not automatically extend to product innovation, multi-product settings, or cases where incumbents possess superior resources, lower costs, or higher probabilities of successful commercialisation. They therefore contend that acquisitions motivated primarily by shutting down future competition are a possibility rather than a general rule.

8.52 **Pre-acquisition innovation concerns** refer to how anticipated merger policy and expected acquisition opportunities influence startups' innovation choices before any transaction is proposed, including whether to enter, how much to invest in R&D, and whether to pursue disruptive substitute products or complementary innovations. Here, Teh and Wang emphasise that merger policy shapes startup incentives ex ante because many startups innovate with acquisition as a principal exit strategy. Depending on expected approval rates and acquisition premia, a more permissive policy may steer startups either towards more disruptive substitute products or towards complementary innovations that increase strategic value to incumbents. They conclude that welfare-maximising merger control should balance short-run competition losses against long-run effects on innovation direction and entry incentives (i.e. pre-acquisition innovation incentives).

8.3 Further policy contributions

8.53 Several recent policy reports discuss dynamic effects in merger control. This includes for example several reports and studies on digital markets and digital mergers, a recent study by the European Commission on the state of competition in Europe, and a recent study commissioned by the GSMA with support from Connect Europe in the context of the European Commission's review of its merger guidelines.

8.54 Two prominent 'digital markets reports' from 2019 include the Crémer, de Montjoye, and Schweitzer (2019) for the European Commission and Coyle, Fletcher, Furman, Marsden, and McAuley (2019) for the UK government.

8.55 **Crémer, de Montjoye, and Schweitzer (2019)**, in their report for the European Commission, argued that merger control should be tightened for digital markets, in part because incumbents can entrench dominance by acquiring nascent rivals before they mature into effective competitors. They focused especially on acquisitions by dominant platforms of startups with low turnover but rapidly growing user bases, valuable data assets, or strong future competitive potential—transactions that conventional turnover thresholds may miss. They argued that the existing significant impediment to effective competition (SIEC) test remained applicable to these concerns but required updated theories of harm, e.g. authorities should assess whether the acquirer benefits from network effects or data-driven barriers to entry, whether the target is a real or potential competitive constraint, whether the deal raises entry barriers or strengthens ecosystem lock-in, and whether efficiencies are merger-specific. This implied more intensive scrutiny of 'killer acquisition'-type strategies in digital ecosystems.

8.56 **Coyle, Fletcher, Furman, Marsden, and McAuley (2019)**, in a report for the UK government, argued that merger policy in digital markets required a 'reset' because existing enforcement had been too permissive towards acquisitions by major platforms. The report noted that the largest technology firms had made hundreds of acquisitions with virtually no prohibitions, suggesting risks of under-enforcement rather than false positives. It urged authorities to scrutinise mergers more

frequently and more firmly, with particular attention to losses of potential competition, reduced innovation, and the strategic value of data or nascent technologies. The review rejected a blanket ban on digital mergers, but recommended more forward-looking analysis, recognising that harms in dynamic markets may arise in the future rather than immediately. Most notably, it proposed a legislative shift to a **balance of harms** standard, allowing authorities to weigh the scale as well as the likelihood of future competitive harm. It also recommended mandatory notification of acquisitions by firms with 'strategic market status'.

8.57 Separately, **Lear (2019)**, in a study prepared for the UK Competition and Markets Authority (CMA), conducts an ex post assessment of selected digital mergers—including Facebook/Instagram, Google/Waze, Priceline/Kayak, and Amazon/The Book Depository—and argues that traditional merger assessment tools may systematically understate competitive risks in digital markets. The report emphasises that network effects, data advantages, multi-sided business models, and competition for the market can make potential and nascent competitors particularly important constraints on dominant platforms. Lear argues that competition authorities had often focused excessively on current overlaps and short-term evidence, while underweighting theories of harm relating to future competition, ecosystem expansion, and the strategic value of data and user attention. The study further suggests that high levels of uncertainty surrounding the future evolution of young digital firms should not automatically militate against intervention, because the costs of false negatives may be especially significant in markets prone to tipping and entrenched dominance. In this context, Lear recommends a more forward-looking and risk-tolerant approach to merger control in digital markets (i.e. being more willing to intervene, despite uncertainty about future competitive harm), including greater scrutiny of acquisitions of nascent firms, broader consideration of monetisation strategies and multi-sided effects, and a willingness to assess longer-term counterfactuals when evaluating potential competition and innovation harms.

8.58 **Fumagalli, Jullien, Lefouili, and Polo (2026)** examine the economic characteristics of digital mergers and argue that traditional merger-control frameworks often struggle to capture the competitive dynamics of platform markets.[468] The authors emphasise that digital markets are shaped by network effects, economies of scale, data advantages, ecosystem complementarities, switching costs, and multi-sided interactions that may generate tipping dynamics and durable market power. The paper emphasises the distinction between competition in the market and competition for the market, arguing that digital mergers may affect not only existing competition, but also future contestability, innovation, and entry dynamics. Particular attention is given to acquisitions of nascent competitors, ecosystem expansion, data-driven foreclosure, vertical integration, and self-preferencing strategies capable of entrenching dominant platforms. At the same time, the authors stress that digital mergers are not presumptively anticompetitive and may generate efficiencies, innovation synergies, interoperability gains, and consumer benefits through ecosystem integration. The paper therefore advocates a case-specific and economically grounded approach to merger assessment that places greater weight on dynamic competition, multi-sided platform economics, data and innovation effects, and the institutional challenges associated with reviewing digital mergers.

8.59 **European Commission (2024)**, in its study titled *Protecting competition in a changing world: Evidence on the evolution of competition in the EU during the past*

[468] An early version of this paper was a chapter in a policy report by the Bocconi Institute for European Policy Making.

25 years, provides a broad empirical assessment of how competition in the EU has evolved over the last 25 years and why this matters for prices, productivity, competitiveness, and growth. In addition to rising concentration, markups, and profits across a wide range of EU sectors, the report also finds that business dynamism (reflected in entry and exit rates, market share volatility, and persistence of market leadership) has declined and the productivity and innovation gap between leaders and followers has widened. The report associates these dynamic effects with weaker fluctuations in market shares, slower diffusion of innovation, and reduced competitive pressures on incumbents. It attributes these developments principally to structural 'winner takes most' dynamics linked to proprietary IT, data, and other intangibles, globalisation, and, to a lesser extent, M&A activity. The report emphasises that these dynamics can be both benign and adverse: they may initially reflect efficient firms gaining share through innovation and lower costs, but may subsequently raise barriers to entry, reduce diffusion of innovation and productivity gains, and increase opportunities for exclusionary conduct.

8.60 The report concludes that EU competition enforcement—including merger control—remains an important tool for preserving effective competition in the face of these structural trends. It finds that EU merger and antitrust interventions have occurred most frequently in sectors identified as presenting high competition risks, suggesting that enforcement has broadly tracked areas where competitive conditions are more fragile. The report also notes that acquisitions by industry leaders have likely contributed to rising markups and concentration, although the estimated contribution is limited and does not explain the overall weakening of competition. More generally, it presents merger control as part of a broader competition policy response that can help prevent structural advantages from becoming entrenched market power, while recognising that the main drivers of declining competition appear to be long-term structural changes rather than a weakening of EU enforcement.

8.61 More recently, **BRG (2026)**—in a report commissioned by the global mobile industry trade association GSMA and with support from European telecom network operators' association Connect Europe—advances a framework for assessing horizontal mergers under the EUMR. The report argues that existing merger control remains overly anchored in static indicators such as prices, market shares, and near-term certainty, which may overstate harms and understate dynamic benefits in sectors characterised by high investment intensity, rapid technological change or long payback periods. The report identifies four perceived shortcomings in current horizontal merger control practice:

- **short-term bias and risk aversion**, which discounts uncertain future gains;
- **de facto presumption of harm**, rooted in a static, price-focused perspective that is not supported by the broader economic literature;
- **asymmetric standards**, in which anticompetitive effects are assessed within the core SIEC analysis under a 'more-likely-than-not' standard while procompetitive effects are assessed under stricter standards within the efficiencies framework; and
- **sequencing in review**, which treats entry, buyer power, and efficiencies mainly as offsets to an already-formed theory of harm, rather than shaping the assessment from the start.

8.62 On that basis, the report contends that conventional frameworks may deter welfare-enhancing mergers that could strengthen capabilities, accelerate innovation, or improve long-run consumer outcomes.

8.63 To address these concerns, the BRG report proposes a unified and more explicitly dynamic SIEC framework in which authorities assess both positive and negative

strategic effects within the core competitive analysis. The report distinguishes **strategic effects**—changes in firms' behaviour or incentives across dimensions such as price, quality, entry, innovation, and investment—from **efficiencies**, understood as merger-induced changes in underlying costs, financing conditions, productivity, or organisational capabilities that then generate indirect strategic effects. It recommends a two-step approach:

- First, identify the **dimensions of competition** most relevant to consumer welfare in the case at hand;
- Second, formulate and test dimension-specific **theories of competitive effects**, while integrating substantiated **efficiencies** iteratively rather than as a separate balancing exercise.

9 Guidelines on dynamic merger effects and related principles

9.1 In this Chapter we review the framework for the assessment of dynamic effects from horizontal and non-horizontal mergers, set out in the current merger guidelines of the EC (2004 and 2008), the UK (2021), and the US (2023) as well as of the recommendations for the assessment of such effects provided by the ICN (2025) and the OECD (2025). We also consider the insights that may be drawn from the EC guidelines on horizontal cooperation agreements (2023), specifically in R&D, and the US guidelines on IP licensing (2017). Finally, we briefly describe the conceptual framework for market definition in cases where significant R&D is involved and relevant metrics to measure concentration as set out in the EC Market Definition Notice (2024).

9.1 European Commission's Horizontal Merger Guidelines (2004)

9.2 The 2004 Horizontal Merger Guidelines from the European Commission (EC Horizontal Merger Guidelines) recognise the relevance of dynamic merger effects in several places—particularly when it comes to innovation as a parameter of competition, the role of potential competition, the risk that the merger hinders expansion by rivals, and potential dynamic efficiencies. These are discussed in turn below.[469]

9.1.1 Innovation as a parameter of competition

9.3 The EC Horizontal Merger Guidelines identify innovation among the benefits to consumers brought about by effective competition and recognise the potential for mergers that significantly increase market power to diminish innovation.[470]

9.4 When discussing whether a merger may eliminate an important competitive force, the EC Horizontal Merger Guidelines point out that in markets where innovation is an important parameter of competition, mergers may *increase* firms' ability and incentive to bring new innovations to the market.[471] At the same time, the guidelines also note that competition can be significantly reduced by a merger between two important innovators (e.g. firms with competing pipeline products).

9.1.2 Potential competition

9.5 The EC Horizontal Merger Guidelines envisage two ways through which a merger with a potential competitor may harm competition: the potential competitor may already significantly constrain incumbents via the threat of entry (if entry does not entail significant sunk costs), or the potential competitor would constrain incumbents in the market after entry (if the potential competitor is very likely to incur the necessary sunk costs). Based on this framework, the guidelines identify two basic conditions for a merger with a potential competitor to be a concern: first, the potential competitor must already exert a significant constraining influence or there must be a significant likelihood that it would grow into an effective competitive

[469] The EC Horizontal Merger Guidelines also discuss various dynamic aspects relevant for merger control, e.g. dynamic counterfactuals (including a forward-looking assessment of market shares and failing firm defence) and countervailing entry, expansion, or repositioning. However, these are not the focus of the Study and are not discussed further.
[470] European Commission (2004), 'Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings', 5 February, 2004/C 31/03, para. 8.
[471] EC Horizontal Merger Guidelines, para. 38.

force; and second, there must not be a sufficient number of other potential competitors, which could maintain sufficient competitive pressure after the merger.[472]

9.6 Similarly, the guidelines describe how competition can be harmed by a merger with a recent entrant which is likely to become a significant competitive force in the future and constrain the other firms in a concentrated market.[473]

9.1.3 Hinder expansion by rivals

9.7 The EC Horizontal Merger Guidelines also discuss how a merger may give the merged firm the ability and incentive to make the expansion of smaller firms and potential competitors more difficult, or otherwise restrict the ability of rival firms to compete.[474] The guidelines identify various mechanisms through which entry or expansion by rivals may be made more costly or difficult, for example where the merged entity controls (or has influence over) the supply of inputs or distribution channels, or it controls patents or other types of IP (e.g. brands), or it can worsen interoperability between different infrastructures or platforms for its rivals.

9.1.4 Dynamic efficiencies

9.8 On efficiencies, the EC Horizontal Merger Guidelines note upfront that corporate reorganisations in the form of mergers may enhance dynamic competition and increase the competitiveness of an industry.[475]

9.9 In the discussion of the general framework for efficiencies (including the well-established three-limb test), the EC Horizontal Merger Guidelines note that consumers may benefit not only from lower prices (typically as a result of lower variable costs), but also from new or improved products or services, for instance stemming from efficiency gains in the sphere of R&D and innovation.[476] They also note that efficiencies need to be timely and, where reasonably possible, they need to be quantified.[477] These considerations are particularly pertinent to dynamic efficiencies, as these may take longer to materialise than static ones, and may be harder to quantify.

9.2 European Commission's Non-Horizontal Merger Guidelines (2008)

9.10 As in the 2004 EC Horizontal Merger Guidelines, the 2008 Non-Horizontal Merger Guidelines from the European Commission recognise innovation as a potential parameter of competition and a reduction in innovation as a potential adverse effect of mergers.[478]

9.11 The EC Non-Horizontal Merger Guidelines note that mergers may entail both horizontal and non-horizontal effects. In particular, non-horizontal mergers may give rise to a direct loss of competition between the merging parties where one of

[472] EC Horizontal Merger Guidelines, paras 58–60.
[473] EC Horizontal Merger Guidelines, para. 37.
[474] EC Horizontal Merger Guidelines, para. 36.
[475] EC Horizontal Merger Guidelines, para. 76.
[476] EC Horizontal Merger Guidelines, para. 81.
[477] EC Horizontal Merger Guidelines, paras 83 and 86.
[478] European Commission (2008), 'Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings', 2008/C 265/07, 18 October, para. 10.

the merging firms is a potential competitor in the relevant market where the other merging firm operates.[479]

9.2.1 Dynamic foreclosure

9.12 The EC Non-Horizontal Merger Guidelines recognise that non-horizontal mergers are less likely to significantly reduce competition than horizontal mergers to the extent that they do not entail a direct loss of competition between the merging parties. At the same time, non-horizontal mergers may give rise to foreclosure concerns, including dynamic foreclosure effects. These effects are assessed through an 'Ability-Incentive-Effects' framework.

9.13 In setting out the framework to assess foreclosure, the guidelines indicate that the effects on competition can be both static, e.g. where foreclosure raises the costs of rivals to the merged entity, making them less competitive, and dynamic, e.g. where foreclosure raises entry barriers for potential competitors deterring them from entering. This may be the case, for example, if as a result of foreclosure potential competitors would need to enter at different levels of the supply chain or in related markets to compete effectively (so-called multi-level entry).[480]

9.14 In the case of input or customer foreclosure, the concern around higher entry barriers is considered particularly relevant in industries that are opening up, or are expected to open up, to competition (e.g. regulated industries such as telecoms, postal, rail).[481] Similarly, in the case of foreclosure effects due to tying or bundling, foreclosure concerns are considered particularly relevant in industries with economies of scale or network externalities.[482]

9.15 On customer foreclosure, the EC Non-Horizontal Merger Guidelines recognise that a customer foreclosure strategy, by reducing the revenue streams of upstream rivals, may reduce their ability and incentive to invest in cost reduction, R&D, and product quality, thus limiting their ability to compete in the long run and possibly even causing their exit.[483]

9.16 In addition to foreclosure concerns, the EC Non-Horizontal Merger Guidelines also point out the risk that a vertical merger may allow the merged entity to gain access to commercially sensitive information regarding upstream or downstream competitors, putting these competitors at a competitive disadvantage, and discouraging them from entering or expanding.[484]

9.2.2 Dynamic benefits

9.17 The EC Non-Horizontal Merger Guidelines recognise the substantial scope for efficiencies in non-horizontal mergers and set out a number of mechanisms through which such efficiencies may arise.[485]

9.18 As regards dynamic efficiencies, the EC Non-Horizontal Merger Guidelines note how the integration of complementary activities may lead to greater efforts to increase

[479] EC Non-Horizontal Merger Guidelines, paras 7 and 12.
[480] EC Non-Horizontal Merger Guidelines, paras 49, 64, 75, 101 and 112.
[481] EC Non-Horizontal Merger Guidelines, paras 49 and 75, last sentence.
[482] EC Non-Horizontal Merger Guidelines, paras 101 and 112.
[483] EC Non-Horizontal Merger Guidelines, para. 65.
[484] EC Non-Horizontal Merger Guidelines, para. 78.
[485] Efficiencies must meet the same cumulative criteria set out in the EC Horizontal Merger Guidelines, para. 53.

sales at one level—e.g. through improved services or stepping up innovation—by internalising the positive externality of these efforts on the other level.[486]

9.19 Additionally, the EC Non-Horizontal Merger Guidelines point out that non-horizontal integration may allow better coordination between firms (in terms of product design, process organisation, and sales),[487] and may align investment incentives.[488] For example, the guidelines note that a vertical merger may enhance upstream investment incentives in vertical relationships, by avoiding freeriding concerns by competing downstream providers. The guidelines note further that many of the efficiencies applicable to vertical mergers may also apply to conglomerate mergers involving complementary products.[489]

9.3 CMA's Merger Assessment Guidelines (2021)

9.20 The CMA revised its Merger Assessment Guidelines in 2021 to bring them up to date with current best practice, building on recommendations made by the Furman and Lear reports in 2019.[490] The 2021 guidelines note that mergers can harm the process of rivalry between firms, undermining their incentives not only to cut prices but also to improve non-price aspects of their offerings. The range of non-price aspects of competition is wide and includes the introduction of new and better products, with innovation considered to be central to some merger cases.[491]

9.21 The CMA Merger Guidelines contain a number of references to dynamic issues throughout the various sections. In what follows, the focus is on the most salient aspects involving dynamic effects, namely those related to the elimination of future and dynamic competition (Section 5), those potentially arising in non-horizontal mergers (Section 7), and those resulting from procompetitive efficiencies (Section 8).[492]

9.3.1 Horizontal dynamic harm: loss of future and dynamic competition

9.22 Section 5 concerns unilateral effects arising from the loss of 'potential competition', defined as competitive interactions involving at least one firm that has the potential to enter or expand in competition with other firms.[493] The guidelines identify two ways through which mergers can affect potential competition, namely through a loss of future competition and through a loss of dynamic competition.[494]

9.23 A loss of future competition refers to the elimination of competition between the merger firms at a future point after the potential entrant(s) would have entered or expanded. The assessment of such theory of harm focuses on whether either merging firm would have entered or expanded absent the merger,[495] on a 'more

[486] EC Non-Horizontal Merger Guidelines, para. 13.
[487] EC Non-Horizontal Merger Guidelines, para. 14.
[488] EC Non-Horizontal Merger Guidelines, para. 57.
[489] EC Non-Horizontal Merger Guidelines, paras 116–118.
[490] Coyle, Fletcher, Furman, Marsden, and McAuley (2019); Lear (2019).
[491] CMA (2021), 'Merger Assessment Guidelines', 18 March, paras 2.2 and 2.5.
[492] The CMA is currently reviewing its approach to the assessment of rivalry-enhancing efficiencies in mergers—see CMA (2026), 'Reviewing our approach to assessing merger efficiencies', accessed 21 July 2026.
[493] CMA Merger Guidelines, para. 5.1.
[494] CMA Merger Guidelines, paras 5.2–5.4. To note that the same framework set out in section 5 in relation to potential entrants may apply to horizontal mergers involving existing competitors who have the potential to expand significantly, CMA Merger Guidelines, para. 5.5.
[495] This is typically considered as part of the counterfactual analysis, CMA Merger Guidelines, paras 5.9 and 3.17.

likely than not' basis, and whether the loss of future competition as a result of the merger would lead to a substantial lessening of competition (SLC) considering the remaining constraints from existing and potential rivals.[496] The guidelines set out a sliding scale principle, whereby the impact of a potential entrant on competition is expected to be more significant the fewer the existing (and potential) competitive constraints, and note that the acquisition of a potential entrant by a firm with a strong market position may be concerning even if that potential entrant is expected to be small.[497]

9.24 A loss of dynamic competition refers to the weakening of the 'ongoing' incentives of the merger firms to continue with efforts or investments towards entry or expansion and/or towards mitigating the threat of rival entry or expansion (including where the specific future product overlaps may not yet be identified).[498] This theory of harm represents the more novel aspect of the 2021 CMA guidelines, with the CMA setting out the framework and relevant evidence for the assessment at length.

9.25 The guidelines refer to a wide range of 'efforts or investments', including product development, innovation, or strategies that enhance competitiveness (e.g. introducing new features, disruptive business models, or sacrificing short-run margins to build scale or reputation),[499] with the reference to 'efforts' indicating that plans can be at a very early stage when investments have not been made yet. The guidelines are clear that the reduction in incentives can have an impact in the present (rather than solely from a future point in time).[500] In particular, the guidelines emphasise that even if there is uncertainty about the outcome of the dynamic competitive process, such process can increase the likelihood of new innovations or products being made available and therefore has present economic value.[501] As such, the elimination of dynamic competition can lead to an SLC even where entry or expansion is not 'more likely than not', and may ultimately be unsuccessful (for example when the impact of entry/expansion on other firms' profits is expected to be significant).[502] Finally, the guidelines indicate that evidence of an incumbent's direct response to the threat of entry/expansion is not a necessary condition for competitive harm, and that the CMA can consider evidence on its incentives.

9.3.2 Non-horizontal dynamic harm

9.26 In relation to non-horizontal mergers, the CMA Merger Guidelines include some elements that are relevant to dynamic effects.

9.27 First, the guidelines note that (input, customer, and conglomerate) foreclosure strategies can affect not only current rivals but also potential ones, in particular through raising barriers to entry for potential entrants, with negative impacts on customers potentially taking time to materialise.[503] As regards conglomerate effects in particular, the guidelines highlight that such concerns may be particularly pronounced in nascent and digital markets, where new customers can be easily diverted, scaling is critical, competitors may be more easily marginalised, and future

[496] CMA Merger Guidelines, paras 5.7–5.16. The guidelines note that the competitive assessment in this case is similar to the assessment of horizontal unilateral effects when the merger firms are existing competitors.
[497] CMA Merger Guidelines, para. 5.15.
[498] CMA Merger Guidelines, paras 5.18 and 5.21.
[499] CMA Merger Guidelines, para. 5.17.
[500] CMA Merger Guidelines, para. 5.3.
[501] CMA Merger Guidelines, para. 5.20.
[502] CMA Merger Guidelines, para. 5.23.
[503] CMA Merger Guidelines, paras 7.2, 7.20, 7.29, and 7.36.

benefits of controlling these markets can be especially large. Given that in these markets the anticompetitive effects may not emerge in full until after the market has reached maturity, the guidelines note that the CMA's assessment may focus on their impact on the structure of the market and competition over the longer term.

9.28 Second, regarding the potential concern that the merged entity may gain access to commercially sensitive information of its rivals, the guidelines note that this can include rivals' innovation plans, with the effect of allowing the merged entity to compete less aggressively and deterring rivals from innovating.[504]

9.29 Finally, the guidelines recognise that non-horizontal mergers can give rise to potential and dynamic competition issues if the merger firms may have launched competing products in the absence of the merger, noting that the fact that they are active in closely related markets may mean they have an enhanced ability and incentive to expand in this way.[505]

9.3.3 Dynamic efficiencies

9.30 The CMA Merger Guidelines distinguish between two types of efficiencies: rivalry-enhancing efficiencies and relevant customer benefits.[506]

9.31 Rivalry-enhancing efficiencies are those that change the incentives of the merging firms making them stronger competitors, thus potentially offsetting the anticompetitive effects of the merger and preventing an SLC from arising.[507] While marginal or variable cost reductions are generally seen as more likely to translate into price reductions or short-term quality improvements, the guidelines note that some fixed cost savings or other efficiencies may enhance the ability of firms to innovate or invest in entry or expansion.[508] Non-cost efficiencies, such as increased innovation from combining complementary R&D assets or reducing incremental innovation costs, are acknowledged too.[509] Finally, the CMA Merger Guidelines note that efficiencies will be assessed within the same timeframe adopted by the CMA in the rest of its analysis, but also that efficiencies must be likely to be realised.[510]

9.32 Relevant customer benefits are those accruing to UK direct and indirect customers of the merged entity and future customers, but not necessarily within the same relevant market where the SLC is found. Unlike rivalry-enhancing efficiencies, these benefits do not prevent an SLC but may outweigh it and its adverse effects.[511] This suggests, though not explicitly discussed, that out-of-market innovation benefits can be considered.[512] The guidelines note that relevant customer benefits are taken into account either as an exception to the duty to refer a merger for Phase two or when assessing alternative remedy options.[513]

9.33 The CMA is currently reviewing its approach to assessing rivalry-enhancing efficiencies in merger cases, with revised guidance expected to be published later

[504] CMA Merger Guidelines, para. 7.3.
[505] CMA Merger Guidelines, para. 7.5.
[506] CMA Merger Guidelines, para. 8.3.
[507] Rivalry-enhancing efficiencies may be considered subsequently or together with the anticompetitive effects of the merger and must meet four criteria: (i) enhance rivalry in the relevant market, (ii) be timely, likely, and sufficient, (iii) be merger-specific, and (iv) benefit UK customers, CMA Merger Guidelines, paras 8.4 and 8.8.
[508] CMA Merger Guidelines, para. 8.10.
[509] CMA Merger Guidelines, para. 8.11.
[510] CMA Merger Guidelines, paras 8.12–8.13.
[511] CMA Merger Guidelines, paras 8.4–8.5.
[512] See also CMA Merger Guidelines, para. 8.23.
[513] CMA Merger Guidelines, paras 8.24–8.27.

in 2026.[514] Based on the published draft revised guidance, the framework to assess efficiencies would remain the same, but with greater emphasis and detail on how the assessment of dynamic efficiencies is carried out. Consistent with the approach to assess the loss of dynamic competition between the merging parties, the assessment of dynamic efficiencies is expected to focus on whether the merger will enhance the ability or incentive of firms to innovate, invest, and undertake R&D that benefits customers, taking into account the responses of rivals to the merged entity. The CMA clarifies that the same evidentiary standards apply to the assessment of procompetitive and anticompetitive dynamic effects, and that the relevant timeframes to assess the timeliness of dynamic efficiencies may extend to several years depending on the market-specific context and the investment or innovation cycle, where appropriate discounting will be applied. Finally, the CMA acknowledges in its draft revised guidance on efficiencies that in rare circumstances a theory of harm can arise where short-term benefits to customers may lead to long-term harm as a result of creating an 'unassailable advantage' for the merged entity, causing rivals to exit the market and/or inhibiting their growth.

9.4 US Merger Guidelines (2023)

9.34 The 2023 US Merger Guidelines (US Merger Guidelines) note at the outset, much like the EC and CMA guidelines, that competition is a process of rivalry that incentivises firms to offer a number of benefits to consumers (including innovation), and that mergers may inhibit this competitive process, depriving the public of these benefits.[515]

9.35 The US Merger Guidelines consist of eleven separate guidelines, followed by sections on potential rebuttal evidence—including failing firm, countervailing entry and expansion, and efficiencies—and on analytical, economic, and evidentiary tools. Dynamic anticompetitive effects are addressed to varying degrees in four guidelines (2, 4, 5, and 6),[516] which we discuss in what follows (distinguishing between horizontal and non-horizontal effects). We also discuss at the end of the Section the treatment of efficiencies and of market definition in cases involving harm to innovation.

9.4.1 Horizontal dynamic effects

9.36 *Guideline 2* of the US Merger Guidelines concerns mergers which eliminate substantial *existing* competition between firms, where competition to win customers may involve non-price dimensions including new or improved products, features, and services. The guideline notes that this includes R&D competition and that the elimination of such competition can cause harm even if the products or services are not yet commercially available.[517] The later section on analytical, economic, and evidentiary tools expands on innovation and product variety competition,[518] setting out the mechanism through which innovation incentives are internalised post-

[514] The revised guidance is intended to replace the text currently in paras 8.2 to 8.27 of the CMA Merger Guidelines—see CMA (2026), 'Draft revised guidance on our approach to assessing merger efficiencies', accessed 21 July 2026. A consultation document was published at the same time, summarising the key changes proposed in the draft revised guidance: CMA (2026), 'Draft revised merger efficiencies guidance: Consultation document', June.
[515] US DOJ & FTC (2023), 'Merger Guidelines', 18 December, p. 1.
[516] The other guidelines, not covered here, relate to current concentration levels (Guideline 1), coordinated effects (Guideline 3), trend towards consolidation (Guideline 7), serial acquisitions (Guideline 8), multi-sided platforms (Guideline 9), mergers involving competing buyers (Guideline 10), and partial ownership or minority interests (Guideline 11).
[517] US Merger Guidelines, pp 6–8, Section 2.2.
[518] US Merger Guidelines, p. 39, Section 4.2.E.

merger. In particular, the guidelines note that a merged firm may have reduced incentives to continue or start development of new products that would have competed with the other merging party, as post-merger such products would 'cannibalise' the sales of the other merging party. The guidelines also state that the impact on incentives to innovate is expected to be greater when the merger involves two of a small number of firms with innovation capabilities in a specific area.

9.37 Guidelines 4 and 6 of the US Merger Guidelines concern mergers which can substantially lessen competition by eliminating a *potential entrant*. Guideline 4 distinguishes between the elimination of actual and perceived potential competition in a concentrated market,[519] while Guideline 6 addresses, among other theories of harm, the elimination of a nascent competitive threat by a dominant firm.[520]

9.38 Under *Guideline 4*, a merger eliminates *actual potential competition* where one or both merging firms would have entered or expanded in a concentrated market (including in markets that do not yet have commercial products[521]) and, as such, a merger prevents new or increased competition, and the associated procompetitive effects, from arising in the *future*.[522] To assess this theory of harm, the agencies examine two factors: (i) whether one or both merging firms had a *reasonable probability* of entering absent the merger, taking into account their capabilities and incentives, and (ii) whether such entry would lead to significant procompetitive effects, including deconcentration of the market. Guideline 4 notes that new entry can yield a variety of procompetitive effects, including increased investment and innovation, and that if there is a reasonable probability of entry in a highly concentrated market the benefits from entry can be expected to be competitively significant.

9.39 The elimination of *perceived potential competition* refers instead to a merger where a merging firm is perceived as a potential entrant and likely exerts *current* competitive pressure on existing rivals, for example prompting them to invest or improve their products. The merger can therefore substantially lessen competition by eliminating or reducing this competitive pressure.[523] Guideline 4 notes that this theory of harm requires evidence that market participants could reasonably consider a firm to be a potential entrant (e.g. based on the evidence of the potential entrant's capabilities of entering or exerting competitive pressure), and evidence of likely influence on existing rivals (e.g. based on evidence of their competitive response to the threat of entry).

9.40 In relation to both theories of harm, Guideline 4 sets out a sliding scale principle, noting that the more concentrated the market, the greater the magnitude of harm to competition from any lost potential entry. Accordingly, for mergers involving potential entrants, the higher the market concentration, the lower the probability of entry that gives rise to concern. The guideline also indicates that potential entry in a concentrated market does not need to meet the same standard of timeliness, likelihood, and sufficiency as entry as a rebuttal, noting in particular that the loss

[519] US Merger Guidelines, p. 10, Section 2.4. To note that the two theories of harm can coexist.
[520] US Merger Guidelines, p. 20, Subsection 2.6.A.
[521] US Merger Guidelines, footnote 23.
[522] US Merger Guidelines, pp 11–12, Subsection 2.4.A. This theory of harm is akin to the loss of future competition in the UK Merger Guidelines, although these guidelines require entry to be 'more likely than not' for the theory of harm to hold.
[523] US Merger Guidelines, pp 12–13, Subsection 2.4.B. This theory of harm is akin to the loss of dynamic competition in the UK Merger Guidelines.

of an even 'attenuated' source of competition may substantially lessen competition in such markets.[524]

9.41 *Guideline 6*, which covers mergers leading to the entrenchment of a dominant firm's market position or its extension into adjacent markets, highlights that one of the key mechanisms for entrenchment is the elimination of a nascent competitive threat.[525] In the context of a dominant firm, Guideline 6 notes that nascent competitors can pose a threat even if their product or service, albeit similar, does not substantially constrain that of the dominant firm at the time of the merger, and that in certain circumstances (for example in the presence of network effects or switching costs) nascent competitors may initially avoid directly entering the dominant firm's market, and instead serve a narrow customer segment, offer only partially overlapping services, or target overlapping customers with distinct products. The acquisition of nascent competitors can be defensive, i.e. reinforcing entry barriers, or offensive, i.e. preventing the competitor from gaining enough customers to overcome such barriers.

9.4.2 Non-horizontal dynamic effects

9.42 In relation to non-horizontal mergers, *Guideline 5* of the US Merger Guidelines covers input, customer, and conglomerate foreclosure (whereby the merged entity may limit access to products, services, or routes to market that rivals rely on to compete and that are competitively significant to those rivals).[526] Particularly relevant to dynamic effects are the considerations around foreclosure of potential rivals. A merged entity limiting access to products, services, or routes to market may deter potential rivals from entering, especially when entry would require them to invest both in the relevant market and in substitutes for the product whose access has been limited (referred to as 'multi-level entry'). Guideline 5 also notes that the threat of facing limited access alone can deter potential rivals from investing to enter a market.[527] This guideline emphasises that this may occur even if the merged firm does not deliberately seek to weaken rivals and regardless of the firm's incentives to limit access, effectively broadening foreclosure concerns beyond the traditional Ability & Incentive framework.

9.43 In relation to the new or increased visibility into rivals' competitively sensitive information by the merged entity, Guideline 5 notes that this can include product improvements, innovations, or entry plans, and can undermine rivals' ability or incentives to compete aggressively.[528]

9.44 As noted above, *Guideline 6* addresses the entrenchment of a dominant firm's market position and includes mechanisms of entrenchment that may arise in non-horizontal mergers. In particular, it notes that a merger may create or enhance barriers to entry or expansion that limit the capabilities or competitive incentives of rivals to enter or expand. This may occur for example by increasing customers' switching costs (e.g. through a degradation of interoperability with rivals' products), by interfering with the use of competitive alternatives, or by depriving rivals of scale economies or network effects (e.g. through the acquisition of an important customer acquisition channel). The guideline emphasises that such effects may arise even if the nature of future entry or the identity of future entrants are uncertain.[529] The guideline also notes that, with entrenchment effects, a merger may lead to long-

[524] US Merger Guidelines, p. 12, Subsection 2.4.C.
[525] US Merger Guidelines, pp 18–21, Subsection 2.6.A.
[526] US Merger Guidelines, pp 13–17, Subsection 2.5.A.
[527] US Merger Guidelines, pp 17–18, Subsection 2.5.C.
[528] US Merger Guidelines, p. 17, Subsection 2.5.B.
[529] US Merger Guidelines, pp 18–21, Subsection 2.6.A.

term harm to competition even if it may provide some short-term benefits, and that the merged entity may be willing to sacrifice short-term profits to increase its profits from dominance in the longer term.

9.4.3 Dynamic efficiencies

9.45 The US Merger Guidelines contain a discussion on procompetitive efficiencies (as part of potential rebuttal evidence showing that a merger does not reduce competition).[530] This discussion does not specifically focus on dynamic efficiencies. This is in contrast with the 2010 US Horizontal Merger Guidelines which recognised that efficiencies may arise in R&D activity and lead to new or improved products, even if they do not immediately and directly affect price.[531]

9.46 The US Merger Guidelines make it clear that benefits outside the relevant market will not be credited if they do not prevent a lessening of competition in the relevant market.[532] Out-of-market innovation benefits are therefore presumably disregarded.

9.4.4 Market definition considerations

9.47 The US Merger Guidelines include a brief subsection on market definition in cases involving harm to innovation.[533] They note that markets may be defined around products that could result from the innovation, if successful, even if these products do not yet exist, aligning with the concept of pipeline products in the EC Market Definition Notice (discussed below) and the CMA Merger Guidelines.[534] The guidelines also state that the FTC and DOJ may define different relevant markets when assessing innovation compared with other dimensions of competition, consistent with the approach in the EC Market Definition Notice (see below).

9.5 ICN Recommended Practice for Merger Analysis

9.48 The 2025 ICN Recommended Practices for Merger Analysis[535] were developed by the International Competition Network (ICN) to promote convergence among competition authorities in how they carry out the substantive merger assessment through non-binding international best practices. We focus below on guidance on the assessment of dynamic merger effects.

9.5.1 Harm to innovation and other dynamic harm

9.49 The Recommended Practices place a significant focus on innovation as a parameter of competition and recognise that mergers can negatively impact the level of

[530] US Merger Guidelines, pp 32–33, Section 3.3.
[531] In the discussion of innovation efficiencies, the 2010 guidelines also noted that the Agencies would consider the ability of the merged firm to appropriate a greater fraction of the benefits resulting from its innovations (e.g. by reference to licensing and IP conditions). While such dynamic efficiencies were recognised in principle, the 2010 guidelines emphasised that they may be difficult to verify and may result from anticompetitive reductions in innovative activities, and as such may not be admissible. See US DOJ and FTC Horizontal Merger Assessment Guidelines (2010), Section 10, pp 29–31.
[532] US Merger Guidelines, p. 32.
[533] US Merger Guidelines, p. 48.
[534] CMA Merger Guidelines, para. 5.21.
[535] International Competition Network (2025), 'ICN Recommended Practices for Merger Analysis', May.

innovation in a market in several ways, through both horizontal and non-horizontal effects.[536]

9.50 In relation to horizontal mergers, the Recommended Practices articulate a number of theories of harm relating to innovation: the elimination of existing competition in innovation between the merging firms;[537] the removal of a nascent or potential competitive threat, where the incentives to innovate of both the incumbent firm and the disruptor firm can be undermined by the merger;[538] the elimination of an important competitive force, where for example a recent entrant has a particularly aggressive innovation strategy which would prompt a reaction by other firms, or a promising pipeline of products;[539] or the elimination of a potential entrant, whether actual or perceived, in particular where entry depends on successful innovation or product development.[540]

9.51 The Recommended Practices state that the loss of innovation competition may relate to products already in the market or pipeline products, either at an advanced stage of development (such that it is possible to identify the specific product market within which they will compete once launched) or at an early stage of development. In the case of pipeline products, such loss may arise from the discontinuation, delay, or redirection of one or both of the overlapping pipeline products.[541]

9.52 It is also noted that the loss of innovation competition may refer to early R&D efforts related to technologies or products which are undefined or several years away from reaching the market. In this case, a merger may lead to a reduction in R&D efforts in the same 'innovation space' as well as a reduction in the R&D capabilities to innovate and invest in innovation spaces in the longer term, through a reduction of the resources devoted to R&D.[542]

9.53 In relation to non-horizontal mergers, the Recommended Practices emphasise that the assessment of foreclosure concerns should not be limited to static price effects through rising rivals' costs, and should also include dynamic effects on rivals' ability to compete in the longer term by investing and innovating (for example where rivals face a degradation in interoperability or delayed access to product features or developments, or where they are prevented from achieving an efficient scale).[543]

9.54 The Recommended Practices also note that non-horizontal mergers may raise dynamic concerns (including over innovation) which are ultimately horizontal in nature. This could be the case where a non-horizontal merger eliminates potential competition from the acquirer or the target or innovation competition, or where it deters entry for example by increasing barriers to entry or blocking entry points in adjacent markets. Such concerns are particularly relevant in dynamic or highly

[536] The focus in the following discussion is on unilateral theories of harm. However, the Recommended Practices note that a merger may lead to coordinated effects involving innovation, where firms for example coordinate on delaying the introduction of new products or technologies, or on reducing efforts on innovation or investment. While in highly innovative and dynamic markets coordination may be more difficult to achieve than in more stable and predictable markets, it is noted that coordination on these dimensions may still exist in the presence of high barriers to entry. Recommended Practices, pp 29 and 31.
[537] ICN Recommended Practices, pp 16 and 22.
[538] ICN Recommended Practices, p. 18. The theory of harm is described as the creation of a monopoly or the creation, strengthening or entrenchment of a dominant position.
[539] ICN Recommended Practices, p. 20.
[540] ICN Recommended Practices, p. 21.
[541] ICN Recommended Practices, pp 21–22.
[542] ICN Recommended Practices, pp 22–23.
[543] ICN Recommended Practices, pp 38–39.

innovative markets, in nascent markets, and/or in markets characterised by strong network effects.[544]

9.5.2 Dynamic efficiencies

9.55 As regards dynamic efficiencies, the Recommended Practices recognise the potential for a merger to bring long-term benefits in terms of increased innovation leading to new or improved products. This may stem from higher R&D investment or new combinations of know-how, experience, or technologies.[545]

9.56 However, the Recommended Practices caution that, where long-run anticompetitive effects are significant, transaction-specific short-term efficiencies are unlikely to outweigh long-term competitive harm.[546] The Recommended Practices also reiterate that the further into the future efficiencies are expected to materialise, the more uncertain and difficult it becomes to predict their countervailing effect.[547]

9.6 OECD Recommendation on Merger Review

9.57 The 2025 Recommendation of the Council on Merger Review (Recommendation)[548] set out key principles which should underpin merger assessment, some of which are directly relevant to the assessment of dynamic merger effects.

9.58 In particular, the Recommendation notes that merger analysis should:

- consider effects on innovation and dynamic competition, including the risk of reduced incentives to innovate;[549]
- take into account both actual competition and potential competition from one of the merging firms into the market of the other;[550]
- assess the impact of mergers on the capabilities or incentives of the merging parties or competitors;[551]
- acknowledge the degree of uncertainty involved in each transaction, while noting that uncertainty does not by itself reduce the risk of competition harm.[552]

9.7 European Commission's Guidelines on Horizontal Cooperation Agreements (2023)

9.59 Though the EC Horizontal Cooperation Agreements Guidelines concern horizontal cooperation agreements rather than mergers, they provide useful concepts which can inform the assessment of dynamic merger effects on R&D and innovation competition. In particular, Chapter 2 of the EC Horizontal Cooperation Agreements Guidelines gives guidance on assessing horizontal R&D cooperation agreements

[544] ICN Recommended Practices, pp 37 and 50. The recommended practices emphasise that special attention is warranted where a non-horizontal merger involves the acquisition of a firm with a recent innovation or an important pipeline product (upstream or downstream). Such acquisitions may increase the merged entity's ability and/or incentive to foreclose rivals (particularly those developing competing pipeline projects), and/or remove a future competitive threat.
[545] ICN Recommended Practices, pp 58–59.
[546] ICN Recommended Practices, p. 38.
[547] ICN Recommended Practices, p. 60.
[548] OECD (2025), 'Recommendation of the Council on Merger Review', June.
[549] OECD (2025), para. III.2.
[550] OECD (2025), para. III.8.
[551] OECD (2025), para. III.4.
[552] OECD (2025), para. III.10.

under Article 101, by balancing the procompetitive effects of R&D cooperation against the risks to product market and innovation competition.

9.60 The EC Horizontal Cooperation Agreements Guidelines distinguish between R&D targeting improvements to existing products or technologies, and R&D, including early R&D efforts, concerning the development of new products or technologies. In the first case, the assessment should focus on price and non-price effects in the existing product/technology markets.[553] In the second case, the analysis should instead focus on the effects on innovation competition.[554] In many cases the assessment will involve both.

9.61 The EC Horizontal Cooperation Agreements Guidelines identify the following dynamic competition concerns which may arise from R&D cooperation. These may also be relevant in the context of a merger assessment.

- Reduction or slowing of innovation: cooperation can reduce incentives to innovate, lower innovation pace/quality, or delay market introduction of new products;[555]
- Elimination or reduction of alternative independent R&D poles: pooling a rival's R&D efforts can remove alternative technological paths, reducing variety and potentially locking industry into a single innovation path;[556]
- Foreclosure of third parties: exclusive exploitation rights, restrictive licensing, or refusal to license essential results can foreclose rivals and hinder follow-on innovation or entry;[557]
- Entrenchment of market power: combining R&D can amplify effects from the innovation stage into product markets and raise incumbents' market power;[558] and
- Loss of competitive R&D incentives: where parties abandon independent projects and pool efforts, savings from avoiding R&D duplication may come at the cost of reduced competitive pressure to innovate.[559]

9.62 At the same time, the EC Horizontal Cooperation Agreements Guidelines recognise that many R&D agreements bring about efficiencies by combining complementary skills and assets, which can result in improved or new products/technologies being developed and marketed more rapidly. They can also lead to a wider dissemination of knowledge, which in turn may trigger further innovation. Finally, R&D agreements may also give rise to cost reductions.[560]

9.63 Under Article 101(3), the parties to an R&D agreement can claim efficiencies which may counterbalance any competitive harm from the agreement.[561] In the specific case of innovation-related efficiencies, evidence can include R&D spending, patents, projected project timeframes, and market impact.

[553] European Commission (2023), 'Guidelines on the applicability of Art.101 of the Treaty on the Functioning of the European Union of Horizontal co-operation agreements', C(2023) 3445 final, June, para. 136.
[554] EC Horizontal Cooperation Agreements Guidelines, para. 138.
[555] EC Horizontal Cooperation Agreements Guidelines, para. 54.
[556] EC Horizontal Cooperation Agreements Guidelines, para. 168.
[557] EC Horizontal Cooperation Agreements Guidelines, paras 54 and 123(b).
[558] EC Horizontal Cooperation Agreements Guidelines, paras 145–149.
[559] EC Horizontal Cooperation Agreements Guidelines, paras 166–169.
[560] EC Horizontal Cooperation Agreements Guidelines, para. 141.
[561] EC Horizontal Cooperation Agreements Guidelines, paras 141–144.

9.8 US DOJ and FTC's IP Licensing Guidelines (2017)

9.64 As in the case of the EC Horizontal Cooperation Agreements Guidelines, the 2017 US IP Guidelines do not directly relate to mergers, but contain insights on IP agreements which are relevant for the analysis of dynamic merger effects.

9.65 At the outset, the US IP Guidelines highlight the fact that IP licensing arrangements and transactions[562] must be analysed not only for their static effects on prices and output, but also for their potential to change innovation incentives and R&D competition.

9.66 This implies that the delineation of a *technology market* may be appropriate when rights to IP are marketed separately from the products in which they are used. In such cases, technology markets consist of the licensed technology and its close substitutes—i.e. technologies or goods that are close enough substitutes to constrain the exercise of market power with respect to the licensed technology.[563]

9.67 Moreover, there are cases where IP rights may affect innovation related to identifying a commercialisable product or developing new or improved goods or processes. In these cases it may be appropriate to delineate a separate *R&D market* comprising the relevant R&D assets and their substitutes. The US IP Guidelines note that an R&D market can be defined only when the relevant R&D capabilities can be associated with specialized assets or firm characteristics (e.g. R&D facilities, pipelines, personnel, IP), and it should include those firms that have the capability and incentive to pursue closely substitutable R&D.[564]

9.68 The US IP Guidelines distinguish between IP licensing arrangements or transactions involving vertical and horizontal relationships.[565] The guidelines note that horizontal agreements may result in harm to competition if they pose a significant risk of retarding or restricting the development of new or improved goods or processes. This risk depends in part on the degree of concentration and on the presence of barriers to entry.[566] The guidelines point to the specific example of harm to competition for development of new goods and services from an arrangement that effectively merges the activities of two actual or potential competitors in R&D in a relevant field.[567]

9.69 In vertical relationships, the guidelines note that a licensing arrangement may harm competition if it anticompetitively forecloses access to, or increases competitors' costs of obtaining, important inputs, or facilitates coordination. The risk of foreclosure is related to the proportion of the markets affected by the licensing restraint, market characteristics (e.g. concentration and difficulty of entry) and the duration of the agreement.

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[562] The US IP Guidelines note that certain transfers of IP should be analysed under merger principles, in particular those set out in the 2010 Horizontal Merger Guidelines. Specifically, this is the case for an outright sale of all rights or a transfer of an exclusive license that effectively precludes others (including the licensor) from using the IP. US DOJ & FTC (2017), 'Antitrust Guidelines for the Licensing of Intellectual Property', 13 January, Section 5.7.
[563] US IP Guidelines, Subsection 3.2.2.
[564] US IP Guidelines, Subsection 3.2.3.
[565] US IP Guidelines, Section 3.3.
[566] US IP Guidelines, Section 3.3.
[567] US IP Guidelines, Section 3.1. Footnote 27 notes that a firm will be treated as a potential competitor if it is reasonably probable that the firm would have become a competitor in the absence of the licensing arrangement, and also points to relevant jurisprudence on pay-for-delay (*Actavis*) and exclusionary conduct (*Microsoft*).

9.70 The US IP Guidelines contain a discussion of antitrust 'safety zones' where IP licensing agreements would not be challenged by the Agencies. These include a market share threshold (whereby the licensor and its licensees collectively account for no more than 20% of each relevant market significantly affected by the restraint) and an alternative threshold on the number of competing firms (whereby there are four or more independently controlled entities in addition to the parties to the arrangement that possess the required assets or characteristics and the incentive to engage in R&D that is a close substitute of the R&D activities of the parties to the licensing agreement).

9.71 In terms of potential dynamic efficiencies, the US IP Guidelines note that horizontal agreements may result in integrative efficiencies, including the realization of economies of scale and the integration of complementary R&D, production, and marketing capabilities.[568] In the case of non-horizontal agreements, the guidelines note that a combination of the licensor's IP with the licensee's complementary factors of production may align their incentives to promote the development and marketing of the licensed technology, or enhance competition by substantially reducing transactions costs.[569]

9.72 The guidelines note that while the balancing of anticompetitive harms and procompetitive efficiencies is necessarily a qualitative one, greater evidence of efficiencies is required as the expected anticompetitive effects increase (sliding scale principle) and that the duration of the restraint should be compared with the period needed to achieve the efficiency.[570] The guidelines also note that efficiencies will not be credited if they can be achieved by means that are significantly less restrictive. In making this assessment, the Agencies will not engage in a search for a theoretically least restrictive alternative that is not realistic in the practical prospective business situation faced by the parties.

9.9 European Commission's Market Definition Notice (2024)

9.73 The 2024 EC Market Definition Notice (EC Market Definition Notice) contains guidance that is relevant for the assessment of dynamic merger effects.

9.74 The EC Market Definition Notice recognises that competition may occur not only on price but also on innovation and various aspects of quality.[571] It explicitly includes innovation in its definition of market power, noting that firms with market power can profitably reduce innovation below competitive levels.[572]

9.75 The EC Market Definition Notice contains a dedicated section on market definition in cases where significant R&D is involved. It distinguishes between (i) market definition for pipeline products[573], which may fit within existing product markets[574]

[568] US IP Guidelines, Section 3.4.
[569] US IP Guidelines, Section 3.4.
[570] US IP Guidelines, Sections 3.4 and 4.2.
[571] European Commission (2024), 'Commission Notice on the definition of the relevant market for the purposes of Union competition law', 22 February, para. 15. See also para. 18(c): '[…] [the relevant effective and immediate competitive constraints] may depend on whether the concern being explored is that the merger would lead to increases in prices of existing products, or that the same merger would reduce investments in product development. […]', which references *Dow/DuPont* (2017); and para. 90.
[572] EC Market Definition Notice, footnote 14.
[573] EC Market Definition Notice, para. 91.
[574] The EC Market Definition Notice gives the examples of Novartis/GlaxoSmithKline Oncology Business (2015), which involved B-Raf serine/threonine kinase (B-Raf) inhibitors and Mitogen-activated protein kinase kinase (MEK) inhibitors under development by the parties as part of the market for targeted therapies for the treatment of advanced melanoma, in which existing products

or form new ones[575], and (ii) market definition for early–stage innovation efforts or stages of research.[576] To delineate the boundaries within which firms compete in early innovation efforts, relevant factors to consider are the nature and scope of the innovation efforts, the objectives of the different lines of research, the specialisation of the teams involved, and the outcomes of past innovation efforts. The notice relies here on the concept of 'innovation spaces', drawing on the precedent of Dow/DuPont.[577]

9.76 The EC Market Definition Notice notes that the relevant geographic market for pipeline products may be broader than the geographic market for commercialised products, reflecting the geographic dimension of the underlying R&D efforts. The notice also notes that the relevant geographic markets for early innovation efforts are often global in scope.[578]

9.77 When calculating market shares in R&D-intensive contexts, the EC Market Definition Notice explains that these may be measured using indicators such as R&D spending, patent counts, or patent citations, in addition to or instead of traditional output–based metrics.[579]

were already marketed; and General Electric/Alstom (Thermal Power Renewable Power & Grid Business) (2016), which involved a pipeline of heavy-duty gas turbines as part of the existing product market for heavy-duty gas turbines; see EC Market Definition Notice, footnote 121.

[575] The EC Market Definition Notice gives the example of AbbVie/Allergan (2020), which involves a plausible relevant market limited to IL-23 inhibitors for the treatment of ulcerative colitis and Crohn's disease, even though no IL-23 inhibitors were then marketed by any supplier; see EC Market Definition Notice, footnote 122.

[576] EC Market Definition Notice, para. 92. The EC Market Definition Notice gives the example of Dow/DuPont (2017), which involved a merger between two companies active in crop protection and which, at an industry level, had the assets and capabilities to discover and develop new products which, as a result of the R&D effort, could be brought to market.

[577] EC Market Definition Notice, footnote 125.

[578] EC Market Definition Notice, paras 91–92; see footnotes 122 and 126 for examples.

[579] EC Market Definition Notice, para. 109; see footnote 157 for examples.

ANNEXES

A1 Methodological considerations in empirical studies

A1.1 In this Chapter, we outline key methodological issues that one should pay attention to when evaluating the strength of the evidence provided in an empirical (merger) study.

A1.2 We divide these issues into six categories. We start from issues that are generic and apply to any empirical study. Thereafter we discuss issues that are of particular importance for studies employing DiD methods—this is the single most popular estimation method encountered in our review of the empirical literature. A much smaller number of papers rely on instrumental variables for the identification of merger effects; these we discuss in the third category. Studies that employ structural models take a very different approach, with pros and cons discussed in category four. A methodological approach that has thus far found limited use in merger studies is the use of calibrated general equilibrium models, but as our literature review covers a few such studies, we briefly comment on this methodology, too. We conclude with 'other points', including a brief discussion of the important differences in interpreting the results of theoretical and empirical studies.

A1.1 Generic issues

A1.3 Any empirical study has to be evaluated against two key criteria: internal and external validity.

A1.4 **Internal validity** refers to the question of whether the study at hand has been executed in such a way that its results are correct for the studied setting and can be given the intended interpretation, meaning in the case of merger studies that the results are reliable for the set of firms, markets, and countries studied, for the time period that the data covers. In evaluating internal validity one has to pay attention to both the quantity and quality of the data as well as the econometric methods that have been applied.

A1.5 **External validity** in turn revolves around the question of the extent to which the internally valid results of a given study can be applied to different settings than the one that has been studied. For example, can a study using data from the 1990s, even if internally valid, inform us as to the effect of mergers on innovation in the 2020s?

A1.6 In our evaluation of individual papers we emphasise internal validity as external validity is very context dependent.

A1.2 Difference-in-differences methods

A1.7 DiD methods in their various forms are arguably the most commonly used reduced form tools to study the causal effect of a treatment on the outcome of interest.[580] In a merger setting, the interest would be the (average) causal effect of mergers on e.g. prices, R&D investments, or innovation output such as patents.

A1.2.1 Basic setup

A1.8 The canonical DiD setup contains two groups of observation units—the **treatment group**, all the members of which receive the treatment at a given point in time, and the **control group**, none of the members of which receive the treatment—and

[580] For textbook treatments, see for example Cameron and Trivedi (2005) and Wooldridge (2010).

two time periods, one before the treatment starts, and another after the treatment has been 'administered'.

A1.9 Given its straightforward structure and applicability, DiD is widely used in social sciences in general and economics in particular. It has also found increasing use in the economics field of IO which is important for our work, including in analysis of mergers.

A1.2.2 Key conditions and assumptions

A1.10 A generic challenge with applying DiD is the so-called **parallel trends assumption**, which roughly states that the treatment group's outcome should have developed similarly to that of the control group, had the treatment not taken place. This rules out for example a situation where the innovation output of the merging firms deteriorates before the merger when compared to non-merging firms in the control group. One way to manage this challenge is to resort to a conditional DiD setting whereby the observation units (most often firms in the context of mergers) selected into the control group are 'matched' to be as similar as possible to the firms in the treatment group.

A1.11 A challenging key assumption of DiD, when applied to a setting of imperfectly competitive markets, is the **assumption of no (general) equilibrium effects**.[581] It requires that the treatment status of an observation unit can have no effect on the outcomes of other observation units. In a merger context this means that the merger between, say, firms A and B, cannot have an effect on any other merging firms nor on any non-merging firms selected into the control group. This assumption therefore excludes the possibility of including firms competing with the merging firms into the control group. Strictly speaking, inclusion of competitors into the control group invalidates the DiD setting and the causal interpretation and at the very least, changes the interpretation of the results. If rival firms are included in the control group in a DiD study of mergers, the most one can learn is the average effect of the merger on the merging parties relative to the effect of the average merger on the competing firms.

A1.12 Another challenge, revealed by a rather recent methodological literature on DiD, arises when the treatment 'hits' different observation units at different points in time. This so-called **staggered setting** is almost invariably the case in merger analysis as the only way to compile a large enough data set on mergers is to include mergers that happen in different years. The recent advances have first, demonstrated that using what used to be standard DiD methods (so-called two-way fixed effects estimators) may lead to biased estimates of the treatment effect and second, provided a number of new estimators that can handle a staggered setting and produce unbiased estimates of the average treatment effect under specific conditions.[582] As this literature is relatively new and the diffusion of new methods invariably takes time, older merger studies could not have used these modern methods.

A1.13 A final challenge, rarely taken up in the existing literature, is that while standard DiD estimators (even most of the modern ones) model the 'treatment', i.e. the participation of a firm in a merger, as a zero/one-event, any one merger usually is unlike any other merger. As an example, it is conceivable that the merger between the industry leader and the fourth largest firm has a different impact than the

[581] Also known as the Stable Unit Treatment Value Assumption (SUTVA).
[582] For a survey, see De Chaisemartin and d'Hautfœuille (2023) and Baker, Callaway, Cunningham, Goodman-Bacon, and Sant'Anna (2026).

merger between the 9th and 10th largest firms, both on the merging firms and on their competitors. Yet the standard approach is to model the effects of these example mergers the same way. While one may still interpret the estimated parameter as the average treatment effect of mergers on the outcome variable, a more fruitful way could be to allow for (observed) heterogeneity in the mergers to affect the estimated parameter. Moreover, focusing on an average treatment effect can mask substantial heterogeneity across mergers, with some transactions generating positive effects and others negative effects. This is particularly important in our context, since theoretical models predict that mergers can have either positive or negative effects on innovation depending on the setting. Thus, while one may want to update one's beliefs of the average effect of mergers based on solid empirical evidence, that should not lead to an assumption that in a specific merger, the effect is the same, or even in the same direction, as the estimated average effect.

A1.3 Instrumental variables

A1.14 A key challenge in much of social science research is the endogeneity of the key explanatory variable of interest. In a merger context this translates into e.g. a worry that the merger is affected by the same factors as the outcome of interest. In such a situation, the 'effect' of a merger on the outcome may simply reflect such an omitted factor, rather than the causal effect of the merger on the outcome. A similar challenge arises in structural models of mergers where the researcher needs to estimate the demand function: both price and quantity are affected by things the researcher does not observe, but which either increase or decrease the demand for the goods in question.

A1.15 A potential solution for such a problem is offered by so-called instrumental variables.[583] An IV is a variable that directly affects the explanatory variable in question (the merger-dummy which takes value one if the firm in question participates in a merger, and value zero otherwise; or the price variable in demand estimation), but does not directly affect the outcome of interest (e.g. number of patents). An IV thus needs to satisfy two key conditions.

- Instrument relevance: Is the instrument sufficiently strongly correlated with the endogenous explanatory variable it is an instrument for?
- Instrument exogeneity: Do the authors provide a plausible explanation for why the instrument does not directly affect the outcome variable of interest?

A1.16 Finally, in the context where the merger-dummy is 'instrumented', the authors should provide a discussion of whether the estimated treatment effects should be interpreted as local average treatment effects (LATE) i.e. the average effect for those firms whose merger status is affected by the instrument, or average treatment effects for all firms in the population (or statistical tests for this). In case of LATE, the authors should provide a further discussion of its policy relevance.

A1.4 Structural models

A1.17 In contrast to reduced form models that strive to study the causal effect of X (e.g. a merger) on Y (e.g. number of patents), structural models bring together a detailed mathematical model of an industry or market with data on the market (prices, quantities, R&D investments, innovation outcomes, etc.). The objective is to construct a 'laboratory' that captures how the market works, e.g. how customers choose what to buy, how firms choose prices and products as well as their innovative

[583] See, for example, Cameron and Trivedi (2005) and Wooldridge (2010).

efforts, and how firms choose whether or not to be on the market (entry and exit). Once such a laboratory has been built by fitting the model to the data and obtaining the relevant 'structural' parameters, the researcher can 'change the rules of the game' by e.g. asking what would happen if particular regulations were introduced or removed. In the case of merger control, the researcher could study e.g. whether a merger between firms A and B would be profitable, and whether the competition authority should allow for it if the authority e.g. uses expected consumer welfare as its criterion.

A1.18 Structural models are by design involved, yet there is largely a consensus on what criteria a good structural model should satisfy.[584] In particular, a structural model should:

- allow a flexible description of the data;
- respect the details of the economic institutions;
- be sensitive to the non-experimental nature of the data.

A1.19 Building a structural model does not remove the responsibility of the researcher to think carefully about the identification of the key parameters, the potential restrictions that chosen functional forms impose on the results, and so on—all key considerations also in well done reduced-form studies.

A1.5 Calibrated general equilibrium models

A1.20 Calibrated general equilibrium models are in heavy use in economics of innovation (e.g. so-called Schumpeterian growth models[585]). A great benefit of them is that they allow the researcher to model the whole economy when the structural models discussed in Section 2.4 are most often used to model individual markets or industries (in IO). Such models allow therefore the researcher to study the effect of a given policy more widely than in the narrower context of an individual industry. The cost in the case of these models is that one cannot hope to fit the data as carefully to the institutional structure (of individual markets) as in the case of structural models.

A1.21 The empirical approach adopted in this literature is to choose 'moments' from the model,[586] which are then matched to data ('internal calibration') available to the researchers to find the right parameter values while other parameters are 'externally calibrated', i.e. taken from existing research.

A1.22 A good general equilibrium model should satisfy similar criteria as a good structural model. In addition, the reader should pay attention to which parameters are internally calibrated and which ones are externally calibrated.

A1.6 Other points

A1.23 In this Section, we discuss a few other points worth mentioning.

A1.24 Well-executed causal studies on the impact of mergers identify an average effect of the merger on the outcome of interest. One should not forget that an average can mask widely different case-specific effects. As a simple example, to arrive at an average effect of +/-5% (say, on the number of patents), one possibility is that each merger has exactly the same +/-5% effect. Another possibility is that four

[584] Reiss and Wolak (2007).
[585] See e.g. Aghion, Akcigit, and Howitt (2014).
[586] See e.g. Guthmann and Rahman (2026).

mergers out of five have an effect of +/-8% and one in five an effect of 7% **in the opposite direction**. This simple observation is of particular importance in merger control which almost always deals with an individual merger. The proper role of well-executed causal merger studies is to give the right **prior** on the likely effect of the merger, but not to serve as the **estimate of the effect** of a particular merger. The latter always requires a thorough analysis of the particular circumstances of the merger in question.

A1.25 **Empirical vs theoretical work.** It is important to emphasise a key difference between the theoretical and the empirical literature we review. A key strength of theoretical models is that the researcher can decide which effects to study. For example, a large number of theoretical papers that we review have by design excluded the possibility of both (involuntary) knowledge spillovers and (R&D) efficiencies. This has been done in order to concentrate on other mechanisms of interest. The cost of this approach is that one needs to piece together the results from different theoretical models to form a holistic understanding of what we learn. The empirical literature (this applies to non-experimental data; all the empirical studies we review use non-experimental data) captures the combination of any effects that exist in the actual data that is being analysed, and the ability of researchers to identify the exact mechanisms (e.g. the role of involuntary knowledge spillovers) may be limited.

A1.26 **Measurement of the outcome variable.** Recent research[587] has shown that a commonly used transformation of the outcome variable from y to ln(1+y) is not innocuous but can lead to serious biases in the estimated (treatment) effect. Such a transformation has been in relatively wide use in innovation studies to deal with the fact that e.g. many firms obtain no patents.

A1.27 **Confidence intervals contain information.** Often researchers do not pay attention to estimated parameters unless they are statistically significant. This is defensible when one e.g. has to summarise a large number of studies. It is, however, the case that if a well-conducted study produces a parameter that is statistically not significant, one can still learn something of substance. The so-called confidence interval tells the set of values that the parameter most likely takes—e.g. in the case of a 95% confidence interval, the true estimated parameter (e.g. the average treatment effect of mergers on the number of patents) lies within that interval with 95% probability. One can therefore be almost sure that the true parameter value is no larger than the upper bound of the confidence interval and no smaller than the lower bound of the confidence interval. In addition, in many empirical settings, particularly when sample sizes are large and there is little prior reason to believe that the true effect is exactly zero, a failure to reject the null hypothesis can be more informative than a statistically significant finding.[588] This provides an additional rationale for reporting and interpreting confidence intervals and statistically insignificant estimates, rather than dismissing them as uninformative.

[587] Chen and Roth (2024), in particular.
[588] Abadie (2020).

A2 Disclosures

A2.1 This table provides an overview of relevant disclosures of the references included in the Study. These disclosures include whether the article or study was (i) commissioned or funded by an interested party (including private or public organisations) and/or (ii) authored by someone directly affiliated with an interested party at the time of publication.

A2.2 This table includes articles cited in either Volume 1 or Volume 2 of the Study.

Table A2.1 Article disclosures

Author(s) (year)	Disclosure
Abate, Bahia, and Castells (2020)	Author(s) affiliated with mobile industry association GSMA
Aghion and Tirole (1994)	Article written with financial support from France Telecom
Aimene, Jeanjean, and Liang (2021)	Author(s) affiliated with Orange
Amelio et al. (2018)	Author(s) affiliated with European Commission at the time of publication
Argentesi, Buccirossi, Calvano, Duso, Marrazzo, and Nava (2021)	Article written following a study commissioned by the UK's Competition and Markets Authority
Arqué-Castells and Spulber (2022)	Article written with the financial support of Qualcomm
Athey and Nevo (2023)	Author(s) affiliated with the US Department of Justice and Federal Trade Commission at the time of publication
Athey, Gross, Marinescu, and Shanefelter (2024)	Author(s) affiliated with the US Department of Justice at the time of publication
Bahia and Castells (2023)	Author(s) affiliated with mobile industry association GSMA
Bello, Rabellotti, Ravanos, and Smallenbroek (2025)	Author(s) affiliated with the Joint Research Centre, European Commission
Bennato, Davies, Mariuzzo, and Ormosi (2021)	Article partially based on a report prepared by the authors for the European Commission
Bisceglia, Padilla, Perkins, and Piccolo (2024)	Article written with financial support from Vodafone
Boutin, Cestone, Fumagalli, Pica, and Serrano-Velarde (2013)	Author(s) affiliated with European Commission at the time of publication
BRG (2026)	Study prepared for the GSMA.
Brocas (2003)	Article written with financial support from the European Commission
Chugh et al. (2016)	Author(s) affiliated with the US Department of Justice
Ciriani and Jeanjean (2020)	Author(s) affiliated with Orange
Cockburn and Henderson (2001)	Article funded by four pharmaceutical companies (unnamed)
Condorelli and Padilla (2020)	Article written with financial support from Telefonica SA
Coublucq and Federico (2023)	Author(s) affiliated with European Commission at the time of publication

Coublucq, Kovo, and Valletti (2023)	Author(s) affiliated with European Commission at the time of publication
Coyle, Fletcher, Furman, Marsden, and McAuley (2019)	Study commissioned by the UK government
Crémer, de Montjoye, and Schweitzer (2019)	Study commissioned by the European Commission
Denicolò and Polo (2018)	Article written following a research project sponsored by Compass Lexecon and Baker/McKenzie
Denicolò and Polo (2019)	Article written with financial support from Compass Lexecon and Baker/McKenzie
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Doan and Mariuzzo (2026)	Author(s) affiliated with UK's Office of Communication (Ofcom)
Dubois, de Mouzon, Scott Morton, and Seabright (2015)	Article written with research support from Pfizer
Eisenmann, Parker, and van Alstyne (2011)	Article written with financial support from British Telecom, CISCO Corporation, and Microsoft
Elliott, Houngbonon, Ivaldi, and Scott (2025)	This paper has benefited from the financial support of Orange in the context of its research partnership with TSE–Partnerships
Etro (2019)	Author(s) disclose that they were involved in the Qualcomm-NXP case for third parties.
Federico (2017)	Author(s) affiliated with European Commission at the time of publication.
Federico, Langus, and Valletti (2017)	Author(s) affiliated with European Commission at the time of publication.
Federico, Langus, and Valletti (2018)	Author(s) affiliated with European Commission at the time of publication.
Federico, Scott Morton, and Shapiro (2020)	Author(s) affiliated with European Commission at the time of publication.
Frontier Economics (2015)	Author(s) affiliated with mobile industry association GSMA
Frontier Economics (2021)	Author(s) affiliated with mobile industry association GSMA
Genakos, Valletti, and Verboven (2018)	Previous version of this study was written for the Centre on Regulation in Europe (CERRE). Author(s) affiliated with DG Competition at the time of publication
Gilbert, Riis, and Riis (2018)	Article written with the financial support of the Norwegian Competition Authority
Hann, Ogneva, and Ozbas (2013)	Article written with financial support from KPMG
Haucap and Stiebale (2026)	Article based on study commissioned by the European Commission
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Houngbonon and Jeanjean (2016)	Author(s) affiliated with Orange
Houngbonon and Jeanjean (2019)	Author(s) affiliated with Orange
Informa Pharma Consulting (2020)	Study commissioned by the European Commission
Jeanjean (2021)	Author(s) affiliated with Orange

Jeanjean and Houngbonon (2017)	Author(s) affiliated with Orange
Jin, Leccese, and Wagman (2023)	Author(s) disclose that they provided consulting services to a few companies covered by this article
Jin, Leccese, and Wagman (2025)	Author(s) disclose that they provided consulting services to a few companies covered by this article
Jullien and Lefouili (2018)	Article written with financial support from Baker McKenzie and Compass Lexecon
Kühn, Lorincz, Verouden, and Wilpshaar (2012)	Author(s) affiliated with the European Commission at the time of publication
Lear (2019)	Study commissioned by the UK's Competition and Markets Authority
Lear (2024)	Study commissioned by the European Commission
Lear et al. (2024)	Study commissioned by the European Commission
Lefouili and Madio (2026)	This paper is partly based on, and supersedes, a working paper that has benefited from the financial support of Orange in the context of its research partnership with TSE–Partnerships
Martinez Cillero, Napolitano, Rentocchini, Seri, and Zaurino (2025)	Author(s) affiliated with the Joint Research Centre, European Commission
Melitz and Ottaviano (2008)	Article written with financial support from the European Commission
Motta and Peitz (2021)	One of the authors discloses that they were involved in some of the investigations discussed in the paper in their capacity as Chief Economist at DG Competition
Motta and Tarantino (2021)	One of the authors discloses that they were involved in some of the investigations discussed in the paper in their capacity as Chief Economist at DG Competition
Padilla (2026)	Author(s) disclose that they provided consulting services to a few companies covered by this article
Padilla, Klein, Reynolds, and Wickens (2024)	Article commissioned by Vodafone UK and Hutchison 3G UK Limited
Pietola, Tarantino, and Zenger (2026)	Author(s) affiliated with the European Commission
Salop and Culley (2014)	Author(s) disclose that they provided consulting services to a few companies covered by this article
Schmidt (2014)	Article written with financial support from Qualcomm
Shapiro (2010)	Author was a member of the 2010 Horizontal Merger Guidelines working group from the US Department of Justice and Federal Trade Commission
Spulber (2013)	Article written with financial support from Qualcomm
Stiebale (2025)	Article commissioned by the European Commission
Teh and Wang (2026)	This article is part of the outcome of research collaboration between the Monash Digital Lab and Amazon on 'Competition issues in the technology industry'
Valletti (2025)	Author(s) disclose that they were involved in some of the investigations discussed in the paper in their capacity as Chief Economist at DG Competition

WIK Consult (2015)	Study commissioned by UK's Office of Communication (Ofcom)

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