Basel Committee on Banking Supervision

Working Paper 45

Lessons on supervisory effectiveness – a literature review

by Anton Badev, Laura Baztán Gutiérrez, Samuel Da Rocha Lopes, Klaus Duellmann, Yushi Endo, Daniel Foos, Laura Hierro Rosello, Spyros Palligkinis, Rita Redondo Oliveira, Naoto Tanaka, Farin Vaghefi and Thomas Vieten

July 2025

BIS

The views expressed in this Working Paper are those of their authors and do not necessarily represent the official views of the Basel Committee, its member institutions or the BIS.

This publication is available on the BIS website (www.bis.org/bcbs/).

Grey underlined text in this publication shows where hyperlinks are available in the electronic version.

ISSN 92-9131-870-1 (online)

ISBN 978-92-9259-864-8 (online)

Contents

Lessons on supervisory effectiveness – a literature review

Anton Badev (Board of Governors of the Federal Reserve System), Laura Baztán Gutiérrez (European Central Bank), Samuel Da Rocha Lopes (European Banking Authority), Klaus Duellmann (European Central Bank), Yushi Endo (Bank of Japan), Daniel Foos (Deutsche Bundesbank), Laura Hierro Rosello (Bank of Spain), Spyros Palligkinis (European Central Bank), Rita Redondo Oliveira (European Central Bank), Naoto Tanaka (Bank of Japan), Farin Vaghefi (Board of Governors of the Federal Reserve System) and Thomas Vieten (Deutsche Bundesbank)[1]

Key messages – executive summary

This literature review aims to support the work of the Basel Committee on Banking Supervision by providing insights from academic and policy work (including policy notes and speeches). It also draws on lessons from observed bank failures and supervisory practices. It provides key messages on *supervisory effectiveness,* which is defined – drawing from Principles 1 and 8 of the BCBS (2024) Basel Core Principles (BCPs) – as promoting the safety and soundness of banks and the banking system by promptly assessing prudential risks, identifying material shortcomings within banks, and using the supervisory toolkit and powers appropriately to ensure that banks remediate shortcomings in a timely manner.

The key messages below are ordered along the building blocks of the "house of effectiveness" (see Section 2, Figure 1). This literature review starts at the bottom of the house with the enablers of and impediments to effective supervision and then discusses the three interdependent pillars of (i) risk identification and assessment, (ii) remediation and enforcement, and (iii) collaboration and transparency. Supervisory culture and risk management conclude, spanning the roof over the three pillars and completing the "house".

Enablers of and impediments to effective supervision

Supervisors operate under various external conditions that can act either as enablers or impediments to their effectiveness. One example of a key element for effective supervision is **institutional arrangements** with a clear primary mandate focused on the safety and soundness of the banking system, clear roles and responsibilities, independence and a sufficient set of powers (BCP 1–3). In addition, sufficient resources are needed to ensure the availability of skilled and well-trained supervisory resources, and transparency rules for the supervisor have also been found to be important.

Well-designed internal and legal processes, high-quality institutions and a sound crisis intervention framework support supervisory effectiveness. A credible institutional resolution framework with a bail-in instrument and effective deposit insurance can foster effective supervision both in "normal" and in crisis times, as it alleviates the concerns of supervisory forbearance by providing a credible option of market exit through orderly resolution. Effective supervision can be a safeguard to mitigate the moral hazard problem that accompanies, as an unintended consequence, financial stability-enhancing government safety nets or deposit insurance systems.

New opportunities are offered by leveraging **advanced technologies and applying them to supervision (suptech)**, created by the increased availability and granularity of data and new infrastructure such as cloud computing and application programming interfaces (APIs). The use of suptech could

[1] The work stream was led by Klaus Duellmann. Comments by other members of the Research Group as well as from other Basel Committee groups are gratefully acknowledged.

improve, for example, analytical capabilities for surveillance functions and support forward-looking, judgment-based supervision. Given the claimed efficiency and effectiveness gains, discussions are increasing within the policy space about embedding new technologies into supervisory processes, though this is not without challenges, for example the protection of confidential information in an artificial intelligence engine.

Effectiveness gains from the application of suptech could be achieved either by freeing resources for other, more relevant tasks (efficiency gains) or by delivering, through transformative changes, higher quality supervision, for example, new insights that were not obtainable before. The current literature, however, predominantly provides examples of *efficiency* gains rather than *effectiveness* gains from suptech, warranting further research in the area. Furthermore, by increasing supervisory efficiency by taking over compliance checks or providing data-analysis-based signals for supervisory follow-up activities, suptech could facilitate a cultural shift from compliance-based to risk-based supervision.

Risk identification and assessment

Supervisory authorities use a combination of different tools to regularly review and assess the safety and soundness of banks and the stability of the banking system, including on-site inspections, supervisory stress tests, horizontal reviews and benchmarking analyses, and early warning tools. The availability of quality data and drawing lessons from analyses of past bank failures are also prerequisites for a sound risk assessment. Certain risk assessment activities, in particular on-site inspections and supervisory stress tests, can directly contribute not only to the *assessment* but also to the *remediation* of shortcomings by banks.

On-site inspections, for example, have been found to promote more conservative bank risk management, evidenced in empirical studies by more prudent provisioning practices following inspections. Empirical work confirms that supervisory ratings that are derived during on-site inspections have predictive power for financial stress. Furthermore, recent work on the sentiment of on-site inspection reports suggests that their informational content goes beyond and complements what is captured by the accompanying supervisory ratings. More generally, robust and relatively intrusive on-site supervision has been observed in countries that proved more resilient in the Great Financial Crisis.

Other empirical analyses have found that **supervisory stress tests** lower risk levels for banks when banks reduce lending to riskier borrowers. The public disclosure of stress test results can increase market discipline and improve financial stability. Stress tests have been successfully applied as a regular supervisory exercise in normal times (e.g. US Comprehensive Capital Analysis and Review or the biannual EU-wide stress tests) and even more successfully as a crisis management tool to rebuild trust in supervisory institutions (e.g. US Supervisory Capital Assessment Program) in times of turmoil.

Some studies have identified unintended consequences of supervisory stress tests, for example, if banks price expected higher capital charges into loan rates and lending (in particular to more risky borrowers) shifts from stress-tested to "non-stress-tested" banks, but it is generally acknowledged that such effects are outweighed by the benefits. In the case of bank-led stress tests, applying stronger supervisory scrutiny during the stress test could lead thereafter to a higher reduction in risk. The deployment of adequate personnel and technical resources have been identified as important catalysts for the success of a stress test.

Horizontal reviews and benchmarking provide a cross-sectoral perspective of risks, enable a deeper review of certain topics and promote consistency in the exercise of expert judgment, which is also very important, for example, for business model analysis. Horizontal reviews that focus on a specific issue across banks are increasingly used for a proactive, forward-looking supervisory approach. The outcome of peer benchmarking, for example, allows supervisors to identify outlier banks. Supervisors have a broad, cross-industry perspective and through benchmarks can provide useful insights in the dialogue with supervised institutions that are expected to lead to overall improvements in the industry.

Quality data aggregation and reporting are also key to enhance the effectiveness of supervision. The degree of data accuracy, integrity, completeness, timeliness and adaptability conditions data's usefulness for sound bank governance and risk management, as well as for effective supervision.

The **analysis of past bank failures** can provide valuable lessons for effective risk identification and assessment in the future. Previous bank failures suggest that supervisors need to ensure that sufficient attention is placed on weaknesses in banks' business models, risk governance and management arrangements, as risks are in many cases harder to deal with when already on the banks' balance sheets. More concretely, being attentive to risks faced by banks with rapid growth and at the same time concentrated business models, for example, is a message that emerged from the 2023 US bank failures.

Early warning tools (e.g. indicators, models or systems) provide supervisors with insights about the health of a financial institution. Some studies indicate that technological advances in recent years, for example the use of machine learning, have improved the predictive power of the tools. It has been argued that an expanded use of market data in bank supervision is valuable because it complements information gathered by examiners, even if market signals are not superior to supervisory assessments. The model outcomes can provide a "second opinion" and also support decision-making on priorities. Important aspects for their use in practice are explainability, complementing quantitative results with qualitative insights and ensuring trust in the approach, for example by allowing for thorough testing.

Remediation and enforcement

Authorities have at their disposal different tools to ensure that banks remediate issues and comply with prudential requirements and expectations. These tools differ in the objectives they address and in their frequency of use, which also depend on the supervisory authority and the powers that it has been granted. Besides (i) capital constraints and (ii) enforcement and sanction actions, early intervention regimes and individual accountability regimes can also promote remediation or even prevent the emergence of a shortcoming.

Capital constraints applied through Pillar 2 capital requirements have been found to increase the level of capital in a bank and reduce its risk level because banks try to preserve capital buffers. Capital requirements, however, have not always been found to be the most effective tool in reducing bank risk relative to other measures. Limiting the dividend payouts of undercapitalised banks can be an effective tool to strengthen banks' capital levels and sustain lending to financially constrained enterprises, assuming due consideration has been given to unintended side effects, for example obscuring the signalling effect of the dividend amount to the markets.

Sanctions and enforcement actions promote a more truthful classification of credit quality, reduce bank risk, discourage irresponsible lending and generate a deterrent effect on other (non-sanctioned) banks. Timing is key to ensure that the roots of financial distress are tackled early, in particular in the case of risk management and control issues. Sanctions have been found to contribute to financial stability and market discipline, with increasing effects as severity scales up. At the same time, it has been argued that these tools require substantial supervisory and legal resources to deploy.

Early intervention regimes prompt banks to address their weaknesses in a timely manner. These regimes are more efficient if they are discretionary, flexible, forward-looking, proactive, pre-emptive, backed by benchmarking and organisational infrastructure, and accompanied by formal intervention regimes. Timing is of the essence in early intervention; actions taken well before actual breaches of the thresholds are considered particularly effective.

Recently introduced **individual accountability regimes for bank managers** in some jurisdictions have also proved capable of enhancing supervisory effectiveness, mainly tied to improvements in risk culture and better governance outcomes, especially when paired with financial (dis)incentives for the relevant individuals. The effectiveness of these individual accountability regimes relies greatly on robust supervision and the credible threat of enforcement and action against senior bank executives. Clear guidance for banks and supervisors is key when implementing individual accountability regimes. It is crucial that appropriate incentives for accountability are established in a quantifiable manner, ideally with links to financial outcomes for the relevant individuals, to make consequences tangible for them.

Collaboration and transparency

Information sharing is an important element of cooperation across supervisory authorities and also promotes market discipline. This pillar of effectiveness therefore needs to consider both the interaction between supervisory authorities and their interactions with the public, including market players. In addition, both normal times and crisis episodes need to be taken into account.

Lessons from previous crisis episodes and empirical work suggest that cross-border arrangements in banking supervision are effective and lead to stronger financial institutions worldwide. Notwithstanding the obvious advantages of **cross-border cooperation**, it also needs to be recognised that cooperation in the form of a centralisation of decision-making can carry economic costs, especially when supervisors have different preferences and institutional structures.

Maintaining cross-border supervisory cooperation is key in both normal and crisis times, especially to ensure full oversight of complex international banking groups. The related legal frameworks that provide the basis for cross-border cooperation need to be enhanced.

Cross-border cooperation in one field, for example banking supervision, also needs to take into account and can also benefit from decisions and cooperation in other fields, for example regulatory minimum capital standards or resolution policies in order to avoid unintended adverse effects on bank stability.

Cooperation is considered particularly beneficial in the context of technical innovations (e.g. in artificial intelligence) that contribute to the increasing interconnectedness of financial networks across the globe and to the elevated need to guard against malfeasance. Another example of an area benefitting from cooperation are data collections.

Transparency of both supervisors and banks towards their stakeholders promotes effective supervision. Furthermore, increased transparency by the supervisor can strengthen **market discipline,** which in turn offers a complement to supervision (and regulation) in promoting bank stability, an effect that was confirmed by several empirical studies.

While transparency can promote market discipline in normal times, transparent public communication can also be effectively used to (re)build trust in times of financial crisis.

Transparency is an effective communication tool of supervisors towards the public. Also important for their effectiveness is a communication strategy that promotes a constructive working relationship with the supervised institutions while preserving supervisory independence.

Supervisory culture and strategy

The discourse surrounding **supervisory culture** is intimately linked to the growing adoption of the principle of risk-based supervision. Drawing on the definition of “risk culture” for banks in BCP (2024), "supervisory culture” can be similarly defined as referring to the collective values, beliefs, attitudes and behaviours that shape the way supervisory authorities and their staff conduct their oversight of the banking sector. Therefore, risk culture influences the decisions of management and employees during their day-to-day supervisory activities.

Going beyond lessons from previous episodes of bank failures, the amount of academic research on *supervisory* culture is limited, in particular when compared with work on governance and risk culture for *banks*. Overall, the literature offers more evidence of observed shortcomings in supervisory culture as contributing factors to bank failures and more proposals for improvements than positive worked-out examples of successfully applying supervisory culture concepts.

Some existing evidence suggests that supervisory cultures oriented to collective outcomes (the overall stability of the banking sector and avoidance of social costs) and uncertainty avoidance (i.e. a culture prone to clearly defined regulations) reduce banks' risk levels. Following a systematic approach with a preference for transparency is beneficial for banks. Another lesson that emerges from the literature concerns supervisors' need for an independent view to complement and challenge the perspectives of banks' management and third parties (auditors or rating agencies).

Risk governance for banks has been defined as "the framework through which the board and management establish the firm's strategy, articulate and monitor adherence to risk appetite and risk limits, and identify, measure, and manage risks" (FSB, 2013a). A common understanding of the relationship between "risk culture" and "risk governance" in the context of supervision is missing. It is recognised that supervisory culture affects the organisational design and practices (including quality assurance) that can also be regarded as elements of a governance framework.

Culture and governance build the framework on which **supervisory risk management** operates. Therefore, the trend towards risk-based supervision holds important implications for supervisory risk management and has led to the inclusion of new horizontal peer analyses and supervisory stress tests in the supervisory toolbox. Policy publications highlight the importance of sound organisational practices (including quality assurance), while the efficient and agile allocation of qualified resources also matters.

"Revolving door" policies have given rise to concerns about **supervisory capture**, i.e. that banks influence supervisors to the extent that they act more in the interest of the supervised institutions than in the public interest. Empirical work on this concern has provided mixed results. On the one hand, bank risk has been found to significantly decrease while measures of risk management activity increased after hiring a top executive with regulatory experience. On the other hand, there is some evidence that in certain cases supervisors may have become too "familiar" with their banks, affecting their judgment. Enhanced transparency of regulatory decisions has proved effective as one means to reduce the risk of regulatory capture.

With a widespread shift towards a risk-based supervision approach, which intentionally brings about more leeway for supervisory judgment, the necessary toolbox for its implementation has expanded (for example through supervisory stress tests), prioritisation has become more important, and new ways are needed to ensure supervisory consistency. Policy publications describe how these principles have been implemented in practice. Examples are the combination of top-down priorities and bottom-up assessments and the emergence of supervisory risk tolerance (or appetite) frameworks that have been used, for example, to link supervisory activities to supervisory priorities.

The **Three Lines Model** (3LM), which was last reviewed in 2020, has been widely adopted in the financial industry as an effective risk management framework. Despite its widespread use, risk management failures are still relatively frequent and have been attributed inter alia to shortcomings of the 3LM and its implementation, for example non-collaborative behaviour, ambiguity in the roles of the board and its committees and little external validation of controls. To overcome these issues and to ensure an effective implementation of the 3LM, certain structural, cultural and leadership aspects of an organisation have been highlighted as needing sufficient attention. For example, the tone from the top, business risk appetite, performance management and compensation structures need to be aligned with the company strategies. The model can be further strengthened by incorporating the principles[2] of quality management, risk management and the total quality approach.

Two different purposes for **measuring effectiveness** can be distinguished by the respective stakeholders and measurement approach: (i) to ensure accountability to the public and the government

[2] See ISO 9000, 9004, ISO 31000.

or legislative bodies, and (ii) to infer the level of effectiveness of specific supervisory activities and to allocate resources accordingly to enhance the effectiveness of future activities.

Assessing the effectiveness of both purposes is a challenging task, in particular because the causal link between the supervisory activity and the corresponding impact on the bank is often weakened by factors that are beyond the control of the supervisor, for example when changes in the economic environment affect the outcome.

Contribution analysis has been put forward as a workable methodology to assess effectiveness, especially in cases where experimental designs are not feasible and factors outside the control of supervisors may be causing the observed outcomes. Important elements of this approach can be (i) translating the objectives into SMART (specific, measurable, achievable, relevant and time-bound) criteria; (ii) developing a plausible theory of change and contribution story; (iii) constructing a portfolio of performance indicators; and (iv) using alternative research designs, for example case studies.

Areas of future research

From the literature review, at least the following six areas have emerged as benefitting from future research efforts: (i) benefits and risks of suptech tools to enhance supervisory effectiveness; (ii) the contribution of supervisory activities (on-site inspections, stress tests and horizontal reviews) to supervisory effectiveness; (iii) the performance of early warning tools; (iv) intersectoral assessments of benefits from cross-border cooperation; (v) supervisory governance and culture, including supervisory risk appetite and incentives; and (vi) methodologies to assess supervisory effectiveness.

1. Introduction

The need to increase supervisory effectiveness emerged as one out of many lessons from the Great Financial Crisis (GFC) in 2007–2008.[3] Since then, this lesson has run like a common thread through ex-post evaluations of bank failures and financial turmoil periods up to the more recent turbulences in March 2023. Balan et al. (2025) conclude that since banks' "qualitative weaknesses" (flawed risk management and business models) were root causes of bank failures, quantitative regulatory requirements need to be complemented by timely qualitative supervisory measures within the "supervisory process". While progress on risk monitoring, stress testing and business model analysis (which are elements of the supervisory process) has been acknowledged, impediments to effective supervision persist, limiting the will and ability of supervisors to act (Viñals et al., 2010; Adrian et al., 2023). Unsurprisingly, the need for (more) effective supervision also emerges as an important message from the BCBS "Report on the 2023 banking turmoil" (BCBS, 2023).

This literature review aims to support the work of the Committee by using insights from academic work. Economists traditionally have paid much less attention to bank supervision than to regulation (Hirtle and Kovner, 2022) and many relevant ideas and analyses were not published in academic journals but rather shared in working papers, speeches, policy papers, etc. Therefore, the literature survey covers not only published academic papers but also a wider pool of sources with the consequence that not all findings in this survey are scientifically validated. However, they may reflect observed trends or outcomes of policy discussions.

While banking supervision has existed in many countries since the financial crises in the 1930s, questions about its *effectiveness* have received more attention only recently. The ***GFC was a turning point after which*** the quality of supervision emerged as a material concern (Sijbrand and Rijsbergen, 2013) and ***supervisory effectiveness received increased attention***. This was reflected in several academic and policy papers that explored the role of supervision in the run-up to the GFC and synthesised key lessons learnt for banking supervision (for example, Viñals et al., 2010 or Zamorski, 2015). It was recognised that not all types of risks can be mitigated by better regulation, and supervisors need to step in and mitigate problems that do not violate the legal framework but still pose risks (Sijbrand and Rijsbergen, 2013).

Banks have also failed after the GFC, and although these failures were not comparable with the GFC in their impact on the financial system and economy, the question of whether supervisors are sufficiently effective after the implementation of wide-ranging reforms remains. After some critical financial market turbulences had root causes outside the banking sector (sovereign debt crisis in Europe in 2009–2020, Covid-19 pandemic in 2020), the failures of several mid-size US banks as well as Credit Suisse in 2023 became a reminder that ***notwithstanding the huge progress achieved in supervision and regulation after the GFC, bank failures on a scale that could pose a systemic threat to the banking system can still occur***. Although these turbulences were brought under control, in part through extraordinary measures taken in close collaboration with the relevant public sector authorities and central banks, the challenge remains: how can supervision become sufficiently effective, not to prevent any bank failure, but to prevent bank failures that can put the financial system at risk?

New developments in the conduct of supervision both from a technological and a cultural perspective are another reason why a literature survey on the topic is timely. Important technological advancements, such as machine learning (ML) and artificial intelligence (AI), appear to have the potential to improve the effectiveness of supervision. Supervisory culture has become part of the conversation on effective supervision more recently and is gaining recognition as an important element (Carretta et al., 2015).

[3] After the GFC, the IMF, for example, argued that anchoring financial stability required ensuring better resourced and more independent, intrusive and conclusive supervision (Adrian et al., 2023).

In order to support the work of the BCBS in the most efficient way, this literature review is targeted rather than comprehensive. Section 2 outlines a framework for thinking about supervisory effectiveness while acknowledging that important aspects are already covered by the Basel Core Principles (BCPs). Since the main focus of this literature review is on the *implementation* of the BCPs' principles for effective banking supervision, the literature that refers only to the content of the BCPs and not their implementation is touched on only briefly.

The literature review is structured as follows. Section 2 defines supervisory effectiveness and illustrates the concept as a ***"house of effectiveness"*** with different components or building blocks. Section 3 describes the enablers of and impediments to supervisory effectiveness which build the foundation of the house. Three different supervisory tools constitute the "pillars" of the house and are described in Section 4. These tools comprise risk identification and assessment in Section 4.1, remediation and enforcement in Section 4.2 and collaboration and transparency in Section 4.3.

The "roof" of the house is described in Section 5, which covers supervisory culture and risk management. After introducing the concept of risk-based supervision in Section 5.1, Section 5.2 is concerned with elements of a risk culture for supervision, Section 5.3 discusses the risk of supervisory capture, Section 5.4 introduces the Three Lines Model as a basis of risk management for supervisors and Section 5.5 concludes with a discussion of both challenges and potential ideas for the assessment of supervisory effectiveness. Section 6 concludes with a list of six thematic areas that have emerged from this literature review as avenues for further research. Supervision may benefit from new insights in those areas. The work on improving supervisory effectiveness has always been heavily influenced by lessons learnt from bank failures. Therefore, two separate boxes summarising lessons from bank failures in the European Union and the United States are included.

2. Supervisory effectiveness: a conceptual framework and definitions

2.1 A definition of supervisory effectiveness

Effective supervision promotes the safety and soundness of banks and the banking system by promptly assessing prudential risks, identifying material shortcomings within banks, and using the supervisory toolkit and powers appropriately to ensure that banks remediate shortcomings in a timely manner.

This definition of supervisory effectiveness captures several aspects that have been put forward by the literature, but it is also closing a gap since no widely accepted or used definition of effectiveness could be identified in the literature. It refers to the safety and soundness of banks and also the banking *system* as the ultimate objective. This broader scope, rather than focusing only on the safety of individual banks, is based on BCP 1. The definition also draws from BCP 8 which mentions forward-looking risk assessment, the need to address risks and frameworks for early intervention. "Safety and soundness" does not imply a zero failure rate. It has been argued that financial institutions should be allowed to fail but this should happen "in an orderly fashion" with losses incurred by investors in order to provide them with the right incentives (Johnston, 2021, p. 12).

The assessment of risks and the identification of shortcomings in supervised institutions are two initial steps that must be carried out consecutively in order to be able to remediate the shortcomings identified in a third step. Without remediation being carried out by the supervised entity, supervision cannot be effective; success on all three steps is needed. The definition also clarifies that the supervised institutions, *not* the supervisor, are responsible for a timely remediation of identified shortcomings.

The emphasis on remedying banks' shortcomings aligns closely with a lesson from the Great Financial Crisis, as highlighted by Palmer and Cerrutti (2009). They suggest that a results-oriented supervisory approach, which seeks to address weaknesses before they escalate into significant issues, is crucial for effective supervision.

It is challenging to assess how a concrete supervisory measure contributes directly to the safety of the banking system, so the above definition of supervisory effectiveness is practical because of its focus on banks' remediation of identified shortcomings. Shortcomings can be understood in this context in different ways, for example, referring to deficiencies in the risk management of the bank but also to shortfalls in compliance with current regulations. The means to ensure their remediation can likewise range from promoting sound practices to institution-specific enforcement and sanction measures. Effectiveness defined in this way, focused on the remediation of identified shortcomings, also has the characteristics of a SMART (Specific, Measurable, Attainable, Relevant and Time-bound) objective, as promulgated in Hilbers et al. (2013). The definition is also compatible with the BCBS "Report on the impact and accountability of banking supervision" (BCBS, 2015a) that puts forward clarity about supervisory objectives, impact evaluation and accountability to key stakeholders as elements of an ongoing monitoring of supervisory effectiveness.

Since ensuring the remediation of shortcomings is a core part of the definition of supervisory effectiveness, an assessment of supervisory effectiveness inevitably needs to be outcome-oriented. The definition of effectiveness above implies that it is not sufficient to consider *only* the "output" of supervision, i.e. if the planned supervisory activities have been completed as planned. Instead, assessments also need to consider if the remedial action by the bank has successfully rectified the identified shortcoming (or if something already went wrong in the preceding *identification* of the underlying risks and the banks' shortcomings). The challenges with an outcome-oriented assessment approach and some conceptual ideas from the literature on how it can be operationalised are discussed in Section 5.5.

The term "supervisory effectiveness" is often used in the literature without a clear definition. A notable exception is Hilbers et al. (2013), who define effectiveness by the degree to which supervisory practice contributes to the realisation of a (primary) societal objective (sound and stable institutions) and compliance objectives. The effectiveness definition at the beginning of this section (promoting the safety and soundness of banks and the banking system) corresponds to the societal objective. The compliance objectives correspond to supervisors ensuring that banks comply with legal and regulatory requirements as well as address any shortcomings that need to be remediated. This definition also emphasises *realisation*, namely by highlighting that banks must remediate the identified shortcomings.

2.2 Scope of the literature review

Supervision vs. regulation

Although they are different concepts, the terms supervision and regulation are sometimes used interchangeably in the academic literature. Therefore, it is important to distinguish them upfront. Palmer and Cerrutti (2009, p. 3) put forward the following definitions: "'Regulation' consists of setting the framework of laws, regulations, rules, and best practice guidelines within which financial actors must operate. 'Supervision' consists of monitoring the behaviour of the financial actors and intervening when needed to ensure they are acting in ways that are consistent with the letter and spirit of the regulatory framework." Quite similarly, "supervision" has been defined more recently as being about promoting safe and sound practices and behaviours whereas "regulation" is about adopting and enforcing rules (Hsu, 2024). While economists have extensively analysed the regulation of banks, supervision has received much less attention (Hirtle and Kovner, 2022). This was partly a consequence of understanding the supervisory task in the past as ensuring compliance with regulation (Mishkin, 2001). With the later shift towards risk-based supervision, supervision has become a potential complement or in certain cases even a substitute for regulation (Hirtle and Kovner, 2022). The literature survey is concerned only with the effectiveness of *supervision* and does <u>*not*</u> consider the effectiveness of *regulation*.

Effectiveness vs. efficiency of supervision

This literature survey is primarily concerned with *effectiveness* of supervision, not *efficiency*. Both concepts need to be clearly distinguished. Efficiency in banking supervision refers to cost-effectiveness (i.e. achieving objectives with minimal resources) while effectiveness focuses on achieving supervisory objectives (and ultimately ensuring financial stability). It should be stressed that given limited resources, both concepts are (in some ways) linked and cannot be (fully) separated in practice. If a supervisor allocates "too many resources" in an area that only marginally contributes to the overarching objective of safety and soundness of the banking system, this implies that due to existing budget restrictions, less resources are available for more relevant and immediate topics, ultimately reducing the overall achievable contribution to the safety and soundness of banks and, therefore, not only the efficiency but also the effectiveness of supervision. In other words, a clear separation between effectiveness and efficiency is desirable but it would be misleading to conclude that both concepts can be equally well separated in supervisory practice.

This literature review covers resource-related aspects only where they are relevant to supervisory effectiveness. It does not aim, however, to explore the notion of efficiency for a few reasons. First, effectiveness can be seen as a prerequisite for efficiency, and so it may be worthwhile to cover it first. Second, the literature on efficiency is scarcer than the literature on effectiveness because empirical work on efficiency requires information on supervisory resources and their allocation which the academic world has limited access to.

Supervision and crisis intervention frameworks

One of the lessons that emerged from the GFC was that it is important for crisis prevention, crisis management, and crisis resolution tools to be handled in a consistent regulatory framework (de Larosière et al., 2009). This literature review focuses on supervision, including the supervisory reaction function in a crisis, i.e. not only in "normal times". The resolution phase, when often other authorities take over from the supervisor, is deliberately out of scope of this review.

Nevertheless, it is acknowledged that the existence of a sound framework for resolution can support more effective supervision. The same argument can be made for the existence of a sound deposit insurance framework. Therefore, both concepts are briefly mentioned in Section 3 as enablers of supervisory effectiveness and are not discussed in detail.

Supervisory architecture and supervisory governance

Masciandaro et al. (2011) distinguish between supervisory architecture and supervisory governance as two dimensions of supervision. "Architecture" refers to the degree of supervisory consolidation (or unification) and of central bank involvement in supervision. Since architecture refers to the institutional setting, it is beyond the decision-making power of a supervisory authority, and so it is not discussed in this literature review. "Governance" captures instead supervisory independence and accountability (see Section 3.1), and it is also discussed in the context of supervisory culture and risk management in Section 5.2.

Real effects of supervision

The impact of supervision on bank lending is a topic that received significant attention in academic research in the 1990s and has been followed up by a strand of empirical literature (see Hirtle and Kovner (2022) and further references there). While more stringent supervision has been found to be accompanied by directionally lower lending growth, no consensus has emerged from these papers about the size and materiality of this impact. Examining empirical evidence of supervision's impact on banks, Hirtle and Kovner (2022) conclude that while some papers find that more intense supervision reduces credit supply, others have observed that supervision reduces risks without a significant reduction in lending volumes, for example if banks reallocate credit to more healthy borrowers. Passalacqua et al. (2021), for example, observed that bank inspections of mutual banks in Italy could mitigate "zombie lending" and also generate positive spillovers for healthy banks.

This review touches upon the impact of supervision on credit growth to the extent that new lending is a manifestation of banks' risk taking, but the broader impact of strict supervision on real activity is outside our scope.

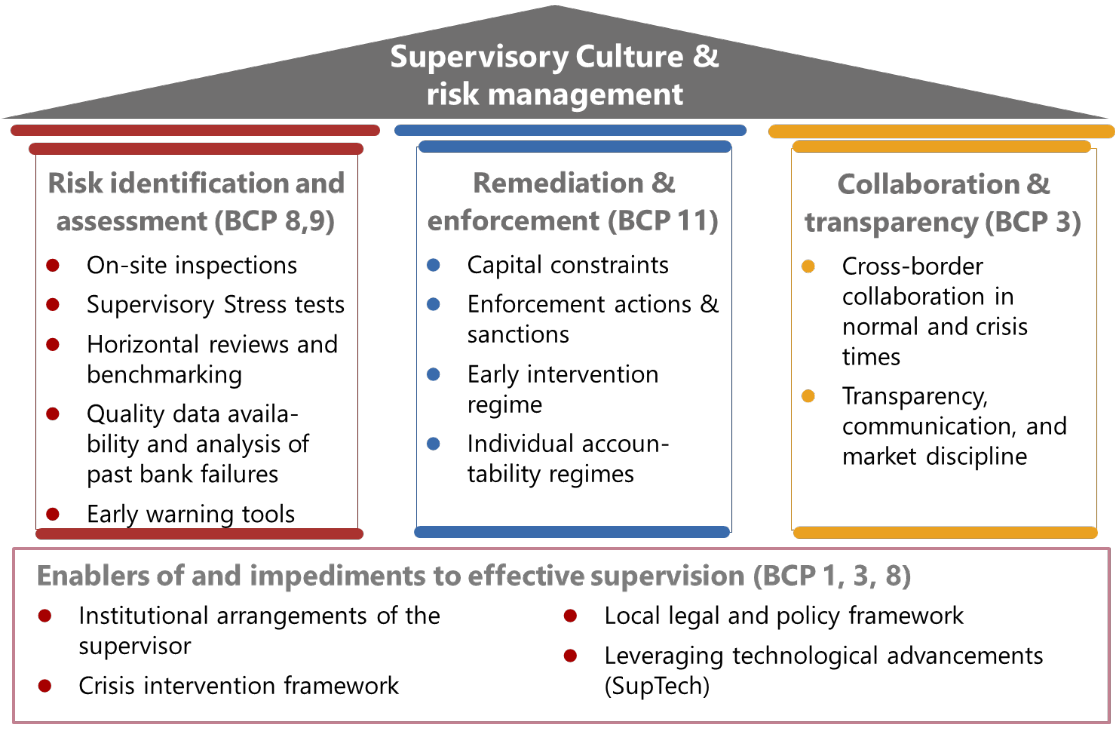
Literature on effectiveness of supervision of non-bank financial intermediaries

Important topics in this literature are also relevant in the supervision of non-bank financial intermediaries. The literature on securities regulation, for example, shares some common themes with the literature we survey. Researchers have explored the benefits of cross-border cooperation between securities regulators for increased enforcement and increased liquidity (Silvers, 2020), as well as for domestic and foreign portfolio investment (Lang et al., 2020; Silvers, 2021). The importance of transparency has also been stressed in the United States (Duro et al., 2019; Hutton et al., 2022) and Europe (Christensen et al., 2016). Exploring to what extent this literature on the supervision of other financial intermediaries could provide lessons for the effectiveness of banking supervision is left for future research.

2.3 Building blocks of the "house of supervisory effectiveness"

Recognising that effectiveness permeates a wide range of supervisory activities, this Section provides a structural framework of the important elements or building blocks of supervisory effectiveness, illustrated as a "house of supervisory effectiveness" (see Figure 1).

Building blocks of a "house of supervisory effectiveness" Figure 1



The "foundation" of the house builds on the surrounding conditions or the external environment. They can support or impede effective supervision. Supportive elements can be *necessary* but on their own they cannot be also *sufficient* conditions for supervisory effectiveness. Institutional arrangements and legal constraints (Balan et al., 2025), a credible crisis intervention framework and also technological advancements offering advanced digital solutions are elements outside the realm of supervision that can enable and enhance the effectiveness of supervision.

The three "pillars" of the house are *risk identification and assessment*, *remediation and enforcement*, and *collaboration and communication* with other authorities and the public. The three pillars do not stand in isolation but depend on and support each other. A correct and timely risk identification and assessment of a bank's shortcomings, for example, can be considered a prerequisite for ensuring a successful remediation, linking the first pillar with the second. Public communication through targeted disclosure measures can impact bank behaviour and complement or even substitute enforcement actions, linking the third and the second pillar.

The "roof" of the house consists of the overarching supervisory culture and risk management. Culture in banking refers to ethical behaviours and governance frameworks, while strategy involves planning and decision-making processes (Walter and Narring, 2020). Both are crucial for sustainable banking practices and are also relevant for supervisors themselves. The need to strengthen supervisory culture was a lesson learnt from the GFC (de Larosière et al., 2009). Other lessons learnt from the GFC highlight the importance of sound supervisory risk management including on-site inspections at reasonable intervals and in sufficient depth, instead of pure reliance on off-site surveillance (Zamorski, 2015). The lessons from the GFC illustrate how supervisory culture and risk management are integral parts of supervisory effectiveness. They are assigned to the "roof" of the house of effectiveness because the three underling pillars are all shaped by and critically depend on the overarching culture and strategy. Embedding on-site inspections or an escalation ladder approach[4] within a broader supervisory strategy are examples linking the strategy with the first and second pillar respectively. Collaboration with other stakeholders and public transparency are obviously dependent on the supervisory culture, linking this concept with the third pillar of the house.

While ongoing supervision is not explicitly mentioned within the house of effectiveness it plays a key role in all three pillars: risk identification and assessment work supports ongoing supervision while some activities, for example stress tests, are often conducted with its direct involvement. Ongoing supervision also plays an important (and maybe even a steering) role in remediation and enforcement activities, acting as point of contact for the supervised institution but also through cross-border collaboration, for example through "supervisory colleges" for internationally active banks.

The remainder of the paper elaborates on findings from the (academic and policy-oriented) literature. It is structured along the framework of the house of efficiency, starting from the foundation or base and concluding with the roof.

3. Enablers of and impediments to effective supervision

Supervisors operate under various exogenously given conditions, including institutional arrangements, the local legal and policy framework, and the crisis intervention framework. These factors, even if not directly designed by the supervisors, can act either as enablers of or impediments to supervisory effectiveness.

In addition, the emergence of technological trends and advancements such as suptech and Regulatory Technology (regtech) tools are automatising supervisory work and appear to have the potential to significantly enhance effectiveness in the future, although their impact depends heavily on supervisors' proficiency and capacity to leverage them optimally. This Section examines each of these elements comprehensively, explaining the conditions that underpin the foundation of the "house of effectiveness".

4 An escalation ladder sets out a time-bound remediation path for identified shortcomings in banks (Buch, 2024).

3.1 Institutional arrangements of the supervisor

A clear mandate focused on the safety and soundness of the banking system and financial stability is central for effective supervision (BCP 1).[5] Should the supervisory mandate include other goals that might potentially conflict with the safety and soundness of the banking system, clarity regarding the primacy of safety and soundness is important (Adrian et al., 2023). Doumpos et al. (2015) show that the unification of supervisory powers within a single regulator can also work as an enabler of effectiveness.

The supervisor's independence is key for effective supervision and needs to go hand in hand with their accountability (BCP 1, 3). Many papers find that the independence of the supervisor is important (Fiechter and Zamorski, 2016; Quintyn et al., 2007). Legal protections that come with independence can allow supervisors to fulfil their tasks more effectively (Adrian et al., 2023). Masciandaro et al. (2011) argue that in practice, de facto independence seems to be at least as important as de jure independence. In an empirical study on the GFC they observe that several countries with strong (de jure) independence and accountability arrangements were more severely hit by the crisis, while others with relatively weaker arrangements on paper emerged relatively unscathed from the crisis. They put forward Canada as an example of a country where (only) de facto independence had been high and their supervisory tradition strong, which contributed to their escaping from the crisis.

Quintyn et al. (2007) point out that independence can shield supervisors from undue political or industry interference. At the same time, supervisors should be held accountable (Davis and Obasi, 2009). Kirakul et al. (2021) take stock of accountability regimes for banking supervisors in selected jurisdictions and recommend setting a clear objective that supervisors can report on, publishing statements accompanied by a range of qualitative and quantitative indicators and having independent oversight bodies to assess the supervisor's performance. Elderson (2023) mentions that subjecting supervisory processes to review by *external* experts is important and could help keep supervisors accountable as well.[6]

Half-hearted attempts to increase supervisory independence through ill-designed accountability mechanisms or attempts to establish political control through budgetary measures can undermine a supervisor's credibility. Rather, supervisory independence and a well-designed accountability framework should be complementary in order to best support soundness of the financial system (Quintyn et al., 2007; Adrian et al., 2023).

3.2 Local legal and policy framework

Well-designed internal and legal processes and high-quality institutions support supervisory effectiveness. Boudriga et al. (2009) use data from 59 countries over the period 2002 to 2006 to show that an effective way to reduce (credit) risk is through enhancing the legal system, strengthening institutions, and increasing transparency and democracy, rather than focusing on regulatory and supervisory issues. Bermpei et al. (2018) support these results by showing that political stability and control of corruption strengthen the positive effect of certain supervisory activities on stability. Dordevic et al. (2021) highlight other institutional features that can support effective supervision: clear mandates, transparency and accountability, sufficiency of powers, skills and resources.

3.3 Crisis intervention framework

A crisis intervention framework encompasses resolution and deposit insurance as key components. ***In crisis times, a credible resolution framework is an important enabler for effective supervision*** (BCP 1,

[5] BCP refers to the Basel Core Principles for effective banking supervision, see BCBS (2024).

[6] See Dahlgren et al. (2023), ECA (2023) and EC (2023) for examples of such reviews.

8) as it alleviates the concerns of supervisory forbearance by providing the credible option of market exit through orderly resolution.

What makes up a credible or effective resolution framework is described by the International Monetary Fund and the World Bank (2009), that list requirements for an effective framework that include a legal mandate, autonomy, coordination, and confidentiality and accountability. Bolzico et al. (2007) develop guidelines for effective bank resolution in Latin America. Garcia (2009) argues that having a sufficient framework in place is one thing, but it is key that supervisors are actually willing to take corrective actions and resolve failed banks, independent of a bank's size and importance. Bail-ins are an effective part of the framework. Benczur et al. (2017) find evidence for the effectiveness of increased capitalisation and bail-ins in reducing public finance costs during crisis times in an empirical analysis of EU banks.

Deposit insurance and banking supervision are complementary and can support each other from a micro and a macro perspective.

From a micro perspective, a deposit insurance scheme can support supervision of a specific bank through the existence of a well-designed safety net in case the bank fails. In other words, the absence of a safety net could limit the room for manoeuvre for supervisory action when a situation becomes critical for a bank and in this way negatively impact the effectiveness of supervisory measures. This link is an indirect one and less obvious compared with other enablers discussed above since a deposit insurance scheme would always be activated only ***after***, i.e. when the supervised institution has already failed. According to Armour (2015), for the resolution of large complex financial institutions to be credible, an effective resolution mechanism must be thought of as an integral part of the ongoing oversight of financial institutions by regulators, and not simply as a tool kept for troubled times.

From a macro perspective, the existence of a deposit insurance scheme can increase the confidence in the financial system as a whole. Anginer et al. (2019) analyse the latest update of the World Bank's Bank Regulation and Supervision survey and point out that deposit insurance can be a way to promote stability in crisis periods by ensuring depositor confidence and preventing bank runs. Again this link is also an indirect one as it facilitates supervisory responses when an institution enters a critical situation by lowering the risk that a single failure spreads to other institutions which would pose new supervisory challenges.

The following two examples use the recent periods with elevated numbers of bank failures, to consider how the design of deposit insurance schemes affects banks' safety and facilitates effective supervision:

- Silicon Valley Bank (SVB): Heider et al. (2023) argue that a run on SVB's assets could have been avoided altogether by recognising that the post-GFC developments of Total Loss Absorbing Capital requirements and resolution regimes created a new class of debt holders who are investing in banks with the clear understanding that they will be bailed-in in the event of a bank failure. This change allows for providing deposit insurance to all demand deposits, thus reducing the likelihood of contagion-based runs from uninsured depositors without sacrificing market discipline because now such discipline is provided by the debt holders who will be credibly bailed-in. Their reasoned insights suggest a minimum and also a maximum for a banks' loss absorption capacity or bail in which can have implications beyond the US context.
- Great Financial Crisis (GFC): Cucic et al. (2024) find that a reduction in the deposit insurance limit for Danish banks following the GFC prompted retail depositors to withdraw uninsured deposits and reallocate them to other banks to maintain insurance coverage. This disproportionately benefited the banks most affected by the GFC, as they raised interest rates to attract funding inflows. The reallocation of deposits had real consequences as banks with a higher share of wholesale funding lend disproportionally to less profitable and less productive firms, which exhibited higher default rates ex post. The authors quantify the resulting decrease in aggregate productivity and output and show the continued accumulation of elevated credit risk on exposed banks' portfolios may contribute to future financial fragility.

Besides these two links that explain how a deposit insurance scheme can function as an enabler of effective supervision both in a micro dimension and a macro dimension, there is a third link that operates in the opposite direction. Effective supervision can act as an important safeguard to mitigate the moral hazard problem created by the existence of deposit guarantee schemes (Demirgüç-Kunt et al., 2015). The moral hazard problem of deposit insurance has been shown to lead to an increase in systemic risk (Calomiris and Jaremski, 2016) as well as a reduction in depositors' incentives to monitor banks (Demirgüç-Kunt and Huizinga, 2004; Ioannidou and Penas, 2010), but supervision could help guard against this complacency. Anginer et al. (2019) discuss the relationship between supervision and deposit insurance and find that good bank supervision can alleviate the unintended consequences of deposit insurance on bank systemic risk during good times. Their work suggests that fostering the appropriate incentive framework is very important for ensuring systemic stability.

3.4 Leveraging technological advancements (suptech)

There are new opportunities offered by suptech[7] and regtech, created by the increased availability and granularity of data and new infrastructure such as cloud computing and application programming interfaces (APIs) (FSB, 2020). suptech and regtech tools could have important benefits for supervisory effectiveness. For authorities, the use of suptech could improve oversight, surveillance and analytical capabilities, and generate real-time indicators of risk to support forward-looking, judgment-based supervision and policymaking. For regulated institutions, the use of regtech could improve compliance outcomes, enhance risk management capabilities and generate new insights for improved decision-making. For both authorities and regulated institutions, the efficiency and effectiveness gains and possible improvement in quality arising from automation of previously manual processes should be considered.

Given these important benefits, there are increased policy discussions about embedding new technologies into supervisory processes, though this is not without challenges, for example the protection of confidential information in an AI engine. Beerman et al. (2021) survey how the Covid-19 pandemic accelerated suptech initiatives in 20 countries. They find that 71 tools were developed. Many used natural language processing methods and qualitative data to support risk identification, some used quantitative data to identify vulnerable banks, and others used combinations of the two to enhance peer comparisons and automate processes.

A different skillset including data science skills is required for supervisors to fully reap the benefits of suptech tools. In Beerman et al. (2021), the surveyed authorities flagged challenges in training supervisors to use these advanced tools, which the authors consider a prerequisite for their wider adoption. Indeed, limited data science skills are cited by several of the surveyed authorities in that paper as the reason why certain tools are not more widely deployed. Some address it by designing user-friendly interfaces accessible to staff without data science expertise. In general, authorities were found to be building up capacity in this topic by providing training (e.g., one authority rolled out a multi-week AI/ML training that can be done remotely) to their existing staff and hiring new staff with relevant backgrounds.

In some instances, suptech is shown to free up time from data analysis, allowing supervisors to instead focus on other parts of the supervisory processes. Degryse et al. (2025) look into the effects of

[7] Suptech (supervisory technology) refers to the use of advanced technologies by authorities to enhance their supervisory capabilities and monitor the banking system more effectively – examples include artificial intelligence-based risk assessment tools that can analyse large datasets of bank data and identify potential issues for supervisors to look into, and natural language processing tools that can analyse large volumes of text (such as reports provided by banks) and extract relevant summaries for supervisors. regtech (regulatory technology), on the other hand, involves the use of technology by financial institutions and other entities to comply with regulatory requirements more efficiently and reduce the cost and complexity of compliance – examples include regulatory reporting automation for banks that facilitate the preparation and submission of regulatory reports reducing the need for manual inputs, and know your customer solutions to streamline such processes and carry out automatic compliance checks on new customers. This note does not cover regtech in detail since the emphasis is on the effectiveness of supervision.

suptech on bank behaviour by analysing data from suptech applications in Brazil. They show that this technology can generate automatic alerts to be reviewed by supervisors, after which they can decide whether and what type of supervisory intervention is needed. When supervisory actions are launched, there is a reduction in bank risk taking. The fact that the first alert from analysis of banks' financial statements is given by a machine instead of a human being does not play a major role in how effective supervisory actions might be. The authors find that what matters most is the supervisory scrutiny channel, i.e. the careful examination and oversight that supervisors apply to the operations and practices of banks, that follows the alert.

It has been claimed that suptech can facilitate a cultural shift from compliance-based to risk-based supervision. This argument by Boeddu et al. (2018) is based on three case studies (US, Lithuania, Brazil) of suptech used by market conduct supervisory authorities. These cases are specific to the context of financial consumer protection, but the conclusions can be extrapolated to banking supervision more generally. The paper argues that while suptech solutions can provide new data or analytical tools to inform a risk assessment, professional judgment is critical to validate and, in some cases, modify the outcome of that assessment. Having suptech carry out the compliance-check component of the risk assessments first can free up supervisory resources to carry out the judgment component afterwards, allowing those resources to focus more on risk-based supervision instead.

Suptech has already been found to promote supervisory efficiency. Prenio (2024) shows that suptech has improved supervisory efficiency, based on the analysis of 32 survey responses and eight interviews with various authorities. Moreover, the author shows that many of the tools that have become critical to supervision are used to support existing processes, indicating that suptech has not really resulted in new approaches but has made existing approaches more efficient.

More research and experimentation are needed to investigate the potential impacts of suptech on supervisory effectiveness, including how it can facilitate a shift in supervisory culture. There is a gap in suptech research, with most of the existing literature focusing on efficiency gains. In theory, an argument can be made that freeing up supervisory resources provides supervisors with more time to dedicate to in-depth assessments and other steps of the supervisory process (e.g. remediation and escalation of longstanding issues) which can enhance effectiveness; however, this link is not covered in the literature. In general, more research is needed on the relationship between supervisory effectiveness and suptech.

4. Effectiveness of supervisory tools

4.1 Risk identification and assessment

Supervisory authorities use a combination of different tools to regularly review and assess in a forward-looking manner the safety and soundness of banks and the stability of the banking system, including on-site inspections, supervisory stress tests, and a combination of horizontal reviews and benchmarking, as well as on-going supervision which is performed on a continuous basis (BCP 8 and 9).

Both on-site inspections and stress tests can serve, however, not only as risk assessment tools but also as effective remediation tools for supervisors. This is the case if an on-site inspection is completed with clearly communicated, binding expectations for the bank and deadlines for remediation. Another example is binding thresholds for capital ratios in stress tests with a clear deadline for increasing the capital level if they are breached. These examples illustrate why both tools could alternatively be discussed under the second pillar of effectiveness, namely remediation and enforcement. Nevertheless, the tools discussed here fall under the first pillar of risk identification and assessment because conceptually they are used to assess risks and vulnerabilities at the stress-tested institutions, despite the fact that we acknowledge that both tools can also contribute to the remediation of shortcomings.

The different tools are discussed below as complementary tools and not from the perspective of which tool performs best. Their complementary nature is also recognised in the literature; for example, Cole and Gunther (1998) suggest off-site analysis is a complement to on-site inspections.

Data quality is an essential precondition for sound risk assessment by banks and supervisors. Moreover, early warning tools are considered key to gain insights about the health of supervised entities and identify issues promptly enough to be able to address problems before becoming acute.

On-site inspections

Based on the rationale that banks are opaque financial institutions and that supervisors need to acquire private information to become well informed about bank conditions, Berger and Davies (1998) have empirically confirmed that bank exams do indeed result in significant information acquisition. This outcome confirms that on-site inspections can achieve their purpose of contributing to the safety and soundness assessment of banks. But they can also support supervisory effectiveness beyond that.

The literature finds that on-site inspections promote more conservative bank risk management. Delis and Staikouras (2011) study bank-level data from 17 countries around the world for the period 1998–2008. They find that on-site inspections are related to decreased bank risk, as measured by z-scores, non-performing loan (NPL) ratios and the share of risky assets. The relationships they estimate are U-shaped, indicating that on-site inspections are more likely to decrease bank risk if they are relatively frequent.[8] The results imply an important role for on-site inspections, over and above bank fundamentals and the prevailing macroeconomic environment. Bonfim et al. (2023) analyse loan-level data collected around inspections that were conducted at the eight largest banks of Portugal in the context of a financial assistance program that the Portuguese government signed in May 2011 with the International Monetary Fund, the European Commission and the ECB. They find that inspected banks became less likely to refinance zombie (negative equity) firms, as the related costs become substantial. They further find that their results on the rationing of credit to zombie firms were confined to the inspected portfolios, implying that the analysed inspections, which were conducted during a crisis episode, had no broader disciplinary effect. Passalacqua et al. (2021) analyse bank- and loan-level data from Italian mutual banks and find that following on-site inspections, banks are more likely to reclassify loans as non-performing and are more likely to increase loan loss provisions. Lending also decreases, but this is driven exclusively by the reduction of loan extensions towards impaired firms, which are less likely to gain access to new credit and receive lower amounts when they do. Moreover, inspections are linked to changes in bank governance and operations, as board members are more likely to leave after an inspection and inspected banks also strengthen their monitoring efforts by increasing staff in supervision and control units. Finally, the authors find that banks tend to increase their equity as well. Ivanov and Wang (2024) analyse the impact of examinations related to syndicated loans extended by US banks and find that following supervisory rating downgrades of loans, banks reduce their commitments and intensify their internal monitoring of those loans.

The literature finds evidence on the predictive power of supervisory ratings that are derived during on-site inspections. Only some older papers argue that the informational content of such ratings decays over a relatively short period of time. In a recent working paper, Gaul and Jones (2021) study CAMELS ratings, which are assigned to US banks after on-site audits, between 1984 and 2020.[9] They find that the composite rating and the individual rating for management have significant predictive power for future bank performance and risk measures (ROA, NPL, stock returns, stock return volatilities, market-to-book ratios), while the composite rating has significant forecasting power for future bank failures. Moreover, they find that CAMELS ratings appear to contain more information for riskier and poorly

8 Rezende and Wu (2014) find that more frequent examinations increase profitability by decreasing loan losses and delinquencies.

9 CAMELS is a composite rating that consists of ratings that cover Capital adequacy (C), Assets (A), Management (M), Liquidity (L), Earnings (E) and Sensitivity to market risk (S).

performing banks. Mayes and Stremmel (2014) also study if CAMELS ratings can predict financial distress. Their analysis suggests that capital adequacy, asset quality (especially non-performing loans), liquidity and earnings have appreciable associations with financial distress, whereas the other two components (management and sensitivity to market risk) have less pronounced effects. Turning to older contributions, Cole and Gunther (1998) found that the informational content of inspections decays fast and call for complementary off-site analysis. Berger et al. (2000) found that supervisory ratings have explanatory power, but they may get "stale" as time passes since the last on-site inspection, as they are much more accurate when derived from an on-site inspection during the past quarter. DeYoung et al. (2001) find that exam ratings lead bank bond yields. Moreover, they find that unexpectedly poor exam ratings lead to tightened yields, as markets anticipate increased supervisory oversight, while the opposite holds for unexpectedly good ratings.[10]

Recent work on the sentiment of on-site inspection reports suggests that their informational content goes beyond and complements what is captured by the supervisory ratings that accompany them. Cowhey et al. (2022) conduct textual analysis of about 5,500 small to medium-sized commercial bank examination reports from 2004 to 2016 in the US. They construct sentiment indicators that capture the tone of the examination reports with respect to five components of the CAMELS supervisory rating (sensitivity to market risk is excluded). They find that negative sentiment in asset quality and earnings is related to future problem loans and problems with profitability, respectively. Also, the sentiment indicator that covers the capital adequacy section of the exams is associated with future capital ratios for weak banks.

Palmer and Cerrutti (2009) describe some countries that were better able to withstand the GFC and using case studies, identify a common trait: robust and relatively intrusive on-site supervision.

Supervisory stress tests

The term "supervisory stress test" refers in the following to a stress test conducted by a supervisory authority and that is referred to as "micro stress test" by Borio et al. (2013) in order to differentiate it from a "macro stress test". "Micro stress tests" are designed to stress individual institutions while "macro stress tests" are designed to stress the financial system as a whole or groups of financial institutions.[11]

Hirtle and Lehnert (2015) recall that bank stress tests had become a credible means of assessing the health of banking systems and communicating it to the public, both in the US financial crisis (in 2009) and at the peak of the European sovereign debt crisis (in 2010 and 2011). Afterwards, supervisory authorities have moved to make stress testing a central part of their supervisory regimes. Prominent examples include the US' Dodd-Frank Act and the associated Capital Plan Rule, the EU-wide stress tests coordinated by the European Banking Authority every second year and the Bank of England's Risk Assessment Model for Systemic Institutions.

The vast majority of empirical analyses have found that supervisory stress tests lower risk levels for banks. Acharya et al. (2018) find that US bank stress tests reduced the supply of credit, particularly to relatively risky borrowers, based on loan-level data from DealScan. This especially holds true for the safer banks where these results are concentrated. The authors look at the Supervisory Capital Assessment Program (SCAP) of 2009 and the Comprehensive Capital Analysis and Review (CCAR) in 2011, 2012 and 2013. They also observe that the later stress tests have mixed results, suggesting that stress tests may be losing some effectiveness over time. Luu and Vo (2021) confirm the reduction in overall risk of stress-tested banks. The authors use quarterly data from 2003Q1 to 2016Q4 on a sample of 130 large US

10 Gopalan and Granja (2024) analyse the evolution of CAMELS scores around the 2022 US monetary policy tightening. They find that supervisors downgraded L and S scores but did so only after the tightening cycle had started, while unrealised losses of held-to-maturity portfolios were only accounted for after the March 2023 turmoil. The paper highlights the importance of timely supervisory intervention.

11 The latter are also sometimes called "system focus stress tests" because they aim at identifying common vulnerabilities across institutions (Jones and Hilbers, 2004).

bank holding companies. They find that banks participating in the stress test hold safer asset portfolios. However, the authors also find that the overall risk reduction might mainly be driven by reduction in the holdings of low-risk assets rather than risky assets. Moreover, banks tend to reduce on-balance sheet exposures rather than off-balance sheet exposures. Therefore, to assess the effectiveness of stress tests, it is not only important to look at the overall picture but also at channels that lead to the reduction in risk. Acharya et al. (2014) compare regulatory stress tests in the European Union and the United States to a benchmark methodology that relies only on public data ("V-lab stress test"). They find that stress tests can be more effective when also using total assets to define capital adequacy. Konietschke et al. (2022) perform an empirical analysis based on centralised European stress tests of 2016 and 2018 with a total of 93 and 87 banks, respectively, and quarterly supervisory information on approximately 1,000 banks (stress-tested and non-tested). They show that banks participating in the stress test tend to be safer as they reduce their credit risk by reallocating credit away from riskier borrowers. This, however, also makes them less profitable. Lubberink (2022) comes to a different conclusion from the studies mentioned above. He considers the effects of the EBA stress tests in 2016 and 2018 and finds that banks that performed poorly in the stress tests struggled to strengthen their capital headroom. He concludes that the policy of using stress test results to motivate banks to increase capital may not always be effective.

The public disclosure of (bank-specific) stress test results can increase market discipline and improve financial stability. Hirtle and Lehnert (2015) argue that a commitment to publish the results of supervisory stress tests and to tie certain actions to firms' quantitative stress test results can increase the credibility of the regulatory regime and improve communication with market participants. Goldstein and Sapra (2019) conclude that the disclosure of stress test results is beneficial because it promotes financial stability and may enhance market discipline by incentivising a more prudent risk-taking behaviour in banks. They also recognise, however, that stress test disclosures may also exacerbate bank-specific inefficiencies, which need to be addressed. For example, disclosure may adversely impact the ability of financial institutions to trade claims to achieve insurance and risk sharing which could be addressed by disclosing only partial or pooled information. Konietschke et al. (2022) analyse the effect of the publication of European stress test results. The authors show that a publication improves market discipline and financial stability through more robust capital ratios of included banks. Stress test publication also reduces systemic risk, as shown by Sahin et al. (2020) based on an analysis of the impact of banking stress tests in the US. Woo et al. (2014) argue that effective disclosure of stress test results can reduce systemic risk due to an increase in market discipline. They show that enabling factors include clear communication on the purpose and limitations of the test. Their results are based on observations during the EU 2012 stress test and the US CCAR in 2011. Schuermann (2014) argues that disclosure of stress test results and framework after the GFC was successful in re-establishing the market's trust in troubled banks, but also that in "normal times", the same level of transparency might not be required. Kohn and Liang (2019) find that the public disclosure of the Federal Reserve's qualitative review of internal processes has major influence on sharpening banks' risk management and capital planning. Clear and timely communication should be ensured to avoid misinterpretations or market speculation about the results (BCBS, 2018). A stocktake among supervisory authorities by the BCBS (2017) shows divergent views regarding the disclosure of stress test results. Most authorities support publishing high-level methodology, scenario features and aggregate results; however, they disagree on whether to publish individual bank results.

Stress tests have successfully been applied as a regular supervisory exercise in normal times (e.g. US CCAR or the biannual EU-wide stress tests) but even more successfully as a crisis management tool to rebuild trust in supervisory institutions (e.g. US SCAP) in times of turmoil. Borio et al. (2013) argue that "macro stress tests" are ill suited as early warning devices but they can be effective as crisis management and resolution tools.[12] The empirical work by Fernandes et al. (2020) on market reactions after US SCAP and CCAR stress tests indicates that "micro stress tests" provide important information and reduce information asymmetries in both situations but especially at times of turmoil. They

[12] One argument why macro stress tests are ill-suited as early warning tools is the "paradox of financial instability", i.e. that a financial system looks strongest (in terms of credit growth and asset prices) when it is most vulnerable.

also find that the market reaction is not limited to the tested banks only, affecting as well banks that are not subject to the tests.

Stress tests may have unintended consequences, for example, if lending to more risky borrowers shifts from stress-tested to "non-stress tested" banks under lower supervisory scrutiny, ***but it is generally acknowledged that these are outweighed by the benefits***. Covas (2018) finds that US stress tests constrained the availability of small business loans secured by non-farm non-residential properties, which accounts for approximately half of small business loans on banks' books. With reference to the regular bank-led EU-wide stress tests, Quagliariello (2019) discusses challenges but also ways to remediate, for example through methodological constraints and a credible quality assurance of banks' projections, that the participating banks treat such exercises as a 'beauty contest' in which the purpose of the stress test is circumvented by window dressing. Calem et al. (2020) analyse the effect of the US CCAR stress test in 2011 on the supply of mortgage loans. They find that the share of jumbo mortgage originations of stress-tested banks decreased, and even more so for banks with worse capital positions. Subsequent stress tests did not have any similar significant additional effects; banks that had been stress tested in 2011 may have adjusted their loan supply and raised capital buffers targets based on the stress test results. Cortés et al. (2020) consider a sample of US banks that were subject to supervisory stress tests from 2012–2016. Based on public data they find that the stress tests do not reduce the aggregate credit supply and work as intended. Banks more affected by stress tests, however, would price the implied increase in capital requirements (concentrated around more risky borrowers) into loan rates in markets where they have local knowledge and exit markets where they do not. Smaller, non-stress tested banks seem to fill the gap which may explain why the aggregate credit supply was less affected but the move of more risky borrowers to banks that are less scrutinised in the sense that they are not subject to the same supervisory stress tests could be seen as an unintended consequence. Shapiro (2023) show in a theoretical model that supervisors recognise and use their influence in designing the methodology and the stress scenario; they may conduct softer stress tests to encourage lending or tougher stress tests to reduce risk-taking. Therefore, supervisors can leverage the degrees of freedom in the methodology and stress scenario in order to reign in unintended effects of their stress tests. Bräuning and Fillat (2024) observe that large banks subject to US' Dodd-Frank Act based stress testing rebalance their portfolios making them more similarly diversified, leading to higher concentration in the aggregate banking system and increasing systemic risk contributions. In other words, they find a trade-off between two effects and perspectives: a *desirable* effect from a *micro*prudential perspective in that stress tests lead to individually better capitalised banks with more diversified portfolios. At the same time, there is also an *undesirable* effect from a *macro*prudential perspective because the banks' portfolios through the same portfolio rebalancing also become more similar and more concentrated in the aggregate.

In the case of bank-led stress tests, applying stronger supervisory scrutiny during the exercise could lead thereafter to a larger reduction in risk, although certain drawbacks may emerge. Kok et al. (2023) analyse a set of confidential supervisory data related to the 2016 EU-wide stress test. They conclude that credit risk for banks subject to the stress test subsequently decreases and this effect intensifies with increased supervisory scrutiny when a bank has a strong risk management culture. Supervisory scrutiny is measured by the quantity, potential impact and duration of interactions between banks and supervisors during the stress test. Neither higher capital charges nor more transparency and related market discipline accompanying the stress test have a similar disciplining effect. These findings are based on the design of a single stress test and so it is unclear if these conclusions hold for other stress tests.

Besides the level of scrutiny during the stress test*,* ***the deployment of adequate personnel and technical resources have emerged as additional important catalysts for a successful stress test.*** The BCBS (2017) stocktake uncovered that obtaining adequate resources is a main challenge to perform successful supervisory stress tests. This includes skilled staff and technical equipment. Moreover, an adequate planning and quality assurance process are key success factors.

Horizontal reviews and benchmarking

Horizontal reviews are part of ongoing supervision and can involve "desk work", but they can also be beneficial to help explore potential vulnerabilities of supervised institutions. One example is (peer) benchmarking where banks are compared or ranked based on certain quantitative indicators, for example the level of non-performing exposures in a specific portfolio.

Horizontal reviews and benchmarks provide a cross-sectoral perspective of risks, enable a deeper review of certain topics and promote consistency in the exercise of expert-judgment. Horizontal reviews, which focus on a specific issue across banks instead of focusing on a specific bank, are increasingly used to provide a more proactive and forward-looking approach, capturing both current and emerging risks. They allow supervisors to obtain a cross-sectoral perspective on the selected topics or risks and to conduct more granular work on issues that are outside the scope of standard, periodic reporting requirements (FSB, 2015). Regular benchmarking exercises, horizontal reviews and identification of outlier banks are useful supervisory tools to promote a proactive supervisory approach and enhance firms' understanding of supervisory expectations and standards. They can help supervisors to be more assertive, exercise judgment-based supervision in a consistent way and reduce the likelihood that banks challenge supervisors on fairness in the supervisory approach (Adrian et al., 2023).

In the EU, several examples of horizontal reviews and benchmarking exercises have been developed and published. For instance, banks' internal approaches used for the calculation of the capital requirements for credit and market risk are subject to an annual assessment by supervisory authorities, including benchmarks that help identify any material differences in RWA outcomes (EBA, 2015; EBA, 2024). The application of benchmarking exercises (together with common validation standards, and harmonised definitions and processes) have been put forward by the EBA as an effective means by which to ensure the consistency of internal models. Resti (2016) argues that such exercises should be promoted on a global scale. A study of the internal ratings-based approach and the risk weights of EU banks based on stress test benchmarking data revealed significant evidence of a relationship between RWA density and internal ratings-based approach utilisation, and portfolio composition, bank size and market risk measures (Montes et al., 2018). More recently, the ECB has reported on its targeted review of the digitalisation strategies of 21 significant institutions, which aims to provide banks with supervisors' views and benchmarks on the topic (ECB, 2024c). The ECB has further upgraded its IT infrastructure to provide supervisors with, among other things, more tools on benchmarking. Also, in its assessment of effective risk data aggregation and risk reporting, the ECB conducted a horizontal, thematic review of related on-site inspections, which revealed shortcomings in the effectiveness of data governance frameworks (ECB, 2024b).

In the United States, multiple benchmarks for operational loss projections were proposed and industry distribution relative to these benchmarks were documented. The proposed benchmarks link bank holding companies' loss projections with both financial characteristics and metrics of historical loss experience. These benchmarks capture different measures of exposure and together provide a comprehensive view of the reasonability of model outcomes (Curti et al., 2020).

Exploring the contributions of all three types of supervisory activities discussed so far (on-site inspections, stress tests and horizontal reviews) to supervisory effectiveness and how they can be used in a complementary manner to increase efficiency, are important areas for further research. Although some work already exists on the impact of certain supervisory activities (for example, on-site inspections or stress tests), further work appears warranted for two reasons. First, the ways in which these activities are implemented is heterogenous and varies by country. Even within a country, implementation can change dynamically over time, for example, driven by experiences gained during previous implementations. The lessons learnt might change as implementation changes. Nevertheless, heterogenous implementation can provide researchers with a set of case studies to examine how varied implementation of supervisory activities impacts their effectiveness. While there is some literature on stress tests, there is a lack of research on horizontal reviews and benchmarking.

Quality data availability and analysis of past bank failures

Quality data aggregation and reporting are also key to enhance the effectiveness of supervision. The ability to manage and aggregate risk-related data effectively is a prerequisite for sound decision-making and strong risk governance (McCaul, 2024). This is relevant for banks and also for supervisors, who benefit from the enhancement of risk data aggregation and reporting to be used in banks' risk management as well as in supervision. Gutierrez Girault and Hwang (2010) find that public credit registers contain granular credit information which enables the implementation of advanced techniques to measure banks' credit risk exposure. Implementing these techniques can ensure that provisioning and capital requirements are properly imposed to cover expected and unexpected losses. It also contributes to micro- and macroprudential surveillance in processes such as the validation of banks' internal rating systems or the performance of stress tests. More broadly, the degree of accuracy, integrity, completeness, timeliness and adaptability of data determines their usefulness for a sound governance and risk management in banks, as well as for effective supervision. While there is evidence of the economic benefits of more accurate data, losses caused by poor data quality are often unquantified or underestimated, and the need of improvement often involves a large investment and complex large-scale remediation projects.

The analysis of bank failures provides valuable lessons for the effectiveness of supervisors' risk identification, including the need to assess banks' business models and their governance and risk management functions. A supervisory lesson emerging from past failure, for example the case of SVB (see Box A), is to be more attentive to the risks faced by firms with rapid growth and concentrated business models. Complex and unstable business models are a key risk that supervisors have sometimes failed to identify and led to bank failures, and banks that fail to review their business model may face substantial risks. Examples of the latter case were the German Landesbanken, which were not sufficiently prepared for the change of their business model once state guarantees ended (Senkarcin, 2015). Another key lesson for supervisors that emerged from the GFC and resurfaced again in the bank failures on both sides of the Atlantic in March 2023 is to pay attention to governance and risk management weaknesses (G30, 2012; Gontarek, 2016; G30, 2024).

Potential benefits of early warning tools

The use of early warning tools (e.g. indicators, models or systems) can provide supervisors with insights about the health of a financial institution, ideally with enough lead time so that adequate measures can be taken to mitigate the consequences of distress and potentially avert failure. It can be argued that quantitative early warning tools increase supervisory effectiveness because they are typically readily available and can serve as an alternative view or "second opinion". They could also be used for taking decisions on which areas should be prioritised in the conduct of supervision. Therefore, early warning tools could still be valuable even if line supervision in general will have a more comprehensive view of a bank's profile because of its access to more granular and confidential information. Their usefulness for increasing supervisory effectiveness requires in any case an understanding of their performance, especially with regards to their application and use in supervisory activities.

The literature on early warning systems contains examples from applications in financial markets, among several other fields, and points to tools and models that have the potential to be useful for supervisors. The work in Citterio (2024) provides a thorough survey of early warning tools in the context of bank distress and failure based on empirical studies published after 2000. Citterio (2024) addresses the development of an early warning model along four dimensions, viz.,

(1) Statistical modelling

(2) AI/ML approaches

(3) Ensemble methods, which combine homogenous models (algorithms)

(4) Hybrid methods, which combine heterogenous models (algorithms)

Comparison of these various approaches may not be straightforward as in standard model comparison exercises since the definition of financial distress (and bank failure) could vary. The review reveals an increasing use of AI techniques, despite the persistent predominance of traditional statistical models. The integration of new technologies and big data were poised to significantly enhance a model's predictive capacity. At the same time the authors acknowledge that AI models were still far from offering completely "explainable"[13] results.[14] In this regard, statistical approaches offer a clear advantage as it is more straightforward for a user of a statistical model to understand *which* variables are important, and typically there is a mapping to policy strategies – in this case, to better understand the correlates of financial distress.

An early warning model, judiciously constructed, can provide a supervisor with key insights to monitor for distress signals in financial institutions. Conceptually, the development of such a model should ideally include both quantitative and qualitative elements and should be devised in a way that is of practical use to a supervisor. Adequate statistical models can reveal useful insights about distress in banks – an important feature for supervisors – but their predictive abilities are not as strong as ML algorithms though these lack explainability, thus rendering them limited for policymakers. In the United States, the CAMELS ratings are often leveraged as inputs to early warning models, although, as discussed, these ratings get mixed reviews in the literature. An example of recent work in statistical early warning systems, Oet et al. (2013) use microprudential and macroprudential data sets to augment early warning modelling, showing the benefit of both public and private data sources. The data in this analysis comes from funding, credit, equity and foreign exchange markets, and the authors construct a statistical model incorporating structural aspects of the financial system as well as feedback information from the institution.

Petropoulos et al. (2020) provide a study using ML methods to forecast bank distress in the euro area. Their research shows the predictive benefits of ML techniques, especially the Random Forest approach, and they make comparisons to other statistical techniques. The ML approach they use appears to have strong classification (predictive) accuracy in terms of labelling distressed banks, so this feature is undoubtedly of value to supervisors.

The two studies above point to the strengths of early warning models based on a statistical approach as well as those based on AI/ML algorithms. In addition to strengths, both approaches also have limitations, so, as Citterio (2014) suggests, future studies might combine approaches (using ensemble or hybrid methods) to augment the capabilities of early warning systems.

The 2023 regional banking crisis in the United States provides an opportunity to consider how early warning models are used, particularly by supervisors. Following the crisis, Vice-Chair for Supervision of the Federal Reserve Board, Michael Barr, stated supervisors were slow to act considering the weaker CAMELS ratings of SVB (see FRB, 2023). His letter states that SVB's Board of Directors did not optimally manage their risks, particularly given the rate at which SVB grew. The letter suggests that even if early warning models provided signals of impending distress at the bank, supervisors were slow to act, sometimes in response to statutory guidelines that made it challenging for supervisors to escalate issues where they arose.

Adrian et al. (2023) offer some practical observations about early warning models noting that the early warning toolkit should encompass "supervisory business models". One potential consideration alluded to in this work is how early warning toolkits can be part of the **suptech** architecture leveraging other digital tools (or platforms) in supervision. Exposure of a bank to social media conversation can amplify classical bank run risks (Cookson et al., 2023). The authors claim to be first to provide direct

[13] A model can be considered as "explainable" when "it is possible to generate explanations that allow humans to understand how a result is reached or on what grounds the result is based" (EBA, 2020b, p. 35).

[14] The improvements that AI/ML algorithms offer in terms of prediction should come as no surprise since they effectively overfit – i.e. the underlying "model" is in no way parsimonious, which is typically what is desired within a statistical framework.

evidence of a social transmission channel via social media for bank runs. Their empirical tests show that banks with a large preexisting exposure to social media performed much worse during the recent SVB bank run. This effect is more pronounced in the presence of other risk drivers, in particular large mark-to-market losses and a large percentage of uninsured deposits. The outcome of this study may also motivate further research how social media can be used for an early-warning tool. In the study the authors indeed observe that negative returns emerge after periods of intense Twitter conversation, but this effect only emerges after the run on SVB had begun.

Some key takeaways for policymakers to consider about the practical use of early warning models include, among other things:

- **Explainability:** The use of an early warning system should provide practical, usable insights to a supervisor, particularly since the benefit of an early warning tool is to provide enough lead time for the supervisor to act.
- **Quantitative-Qualitative:** A robust early warning tool should not only include quantitative insights. An early warning tool should be adaptive not only to numerate signals, but also non-numerate (more qualitative) signals in efforts to support prudent supervision.
- **Trust:** Early warning tools need to convey trust, otherwise supervisors will only rely on their subjective knowledge of the bank. Therefore, early warning models should be constructed so that supervisors can test such tools, uncovering their limitations so that appropriate steps can be taken in these instances. The key point is early warning models should be developed so that supervisors can rely upon them with confidence and make better decisions by leveraging them to enhance supervisory effectiveness.

Box A

United States case study: Lessons learnt from the 2023 regional bank crisis

Anton Badev and Farin Vaghefi

From March through May of 2023, the United States experienced a regional banking crisis in which Silicon Valley Bank (SVB), Signature Bank (SBNY), and First Republic Bank (FRC) failed. While among the largest 32 banks at the end of 2022, these three banks together held 2% of total assets and deposits in the banking system at the end of 2022, prior to their failure (FFIEC, 2025). The crisis did not reflect systemic stress on the banking system as a whole. Persistent poor risk management practices (FRB, 2023) and highly specialised business models led to the failure (Kelly and Rose, 2025), despite Federal Reserve and FDIC supervisory actions (FRB, 2023; FDIC, 2023a; FDIC, 2023b).

This Box synthesises public studies of these failures conducted by the banks' respective supervisors (the Board of Governors of the Federal Reserve (FRB, 2023, commonly known as the "Barr review"), the Federal Deposit Insurance Corporation (FDIC, 2023a) as well as reports by the Government Accountability Office (GAO, 2023), the Basel Committee on Banking Supervision (BCBS, 2023) and the Financial Stability Board (FSB, 2023) and academic research to highlight the root causes of the bank failures in order to provide insights for effective bank supervision.

Why did these institutions fail?

The failures were largely attributed to poor risk management, unstable business models and changes in the macro-economic environment when the prolonged period of low interest rates ended (FRB, 2023; Kelly and Rose, 2025). Federal Reserve supervisors had identified poor interest rate risk management practices at SVB since 2020 (FRB, 2023). SVB's weaknesses were correctly identified and presented to SVB's management and board in the form of safety and soundness supervisory warnings (the bank had 31 open matters requiring attention and matters requiring immediate attention at the time of its failure); however, the bank did not fix the issues mentioned (FRB, 2023). In addition, these three banks exhibited inadequate liquidity management practices in the face of high levels of uninsured deposits (Eberly et al., 2024) and both SVB and Signature were unprepared to use the Federal Reserve's discount window (FDIC, 2023b; FSB, 2023).

All three of the stressed banks had unstable business models that were heavily concentrated. SVB focused on startups and the venture capital industry while SBNY specialised in lending to cryptocurrency and decentralised finance firms, which exposed it to the turmoil of the "crypto winter" in late 2022 and 2023 (G30, 2024; FDIC, 2023b). First Republic had a narrow asset portfolio and focused on serving high net worth individuals (G30, 2024; FDIC, 2023a). These concentrations made them vulnerable to turbulence in the venture capital and crypto sectors (Kelly and Rose, 2025).

What was the role of the supervisors?

According to the post-crisis reviews of supervisory actions, there are a few areas where supervisors could have been more effective ahead of this crisis. In the years leading up to the failures, supervisors had a narrow focus on measures of profitability, capital adequacy and liquidity positions (G30, 2024). Regulatory ratios were mostly satisfied, which potentially distracted supervisors from more concerning trends: undiversified business models, very high asset growth, falling equity valuations and high certificate of deposit spreads in the periods before failure (G30, 2024). While supervisors identified interest rate risks at SVB and FRC, they only started downgrading banks once the Federal Reserve began raising interest rates (Gopalan and Granja, 2024). Supervisors (FDIC, 2023a; FRB, 2023) have suggested that adopting a more forward-looking perspective that entertains potential negative outcomes of weak risk management practices and business model risk could be an avenue for improved supervisory effectiveness. That being said, rather than eliminating the risk of bank failures, the goal of supervision is to promote sensible risk management and minimise any harm should a bank fail (FDIC, 2023b; Bowman, 2025).

In the case of SVB, the FRB's report suggests that their supervisory approach was slow to evolve with SVB's growing size and increased complexity. After the US banking agencies finalised their 2019 tailoring rule, firms with assets under $100 billion, including SVB, were no longer subject to enhanced prudential standards. However, effective supervision of SVB would have required allocating more resources, a quicker return to onsite examination and more training in supervising large, complex institutions (FRB, 2023).

In the aftermath, researchers and regulators identified a number of directions for supervisory practices to evolve, suggesting that supervisors should focus more on bank business models and institutional depositors (Kelly and Rose, 2025; BCBS, 2023), recognise the speed of bank runs in a digital age (FSB, 2023; Cookson et al. 2023), and continue to assess a bank's governance and risk management (BCBS, 2023).

4.2 Remediation and enforcement

Authorities act at an early stage to address shortcomings in banks and have at their disposal different tools to ensure that banks remediate issues through corrective actions and comply with prudential requirements and expectations (BCP 11). These tools differ in the objectives they address and in their frequency of use which also depends on the supervisory authority and the powers that it has been granted. In the following, we consider capital constraints and afterwards enforcement and sanctions, which are two consecutive steps on the "escalation ladder". Besides these tools that typically address already identified specific shortcomings in supervised institutions, early intervention regimes and individual accountability regimes are also considered and can promote remediation from a different angle.

Capital constraints (Pillar 2 and payouts)

Increases in Pillar 2 capital requirements translate into higher bank capital ratios, as banks try to preserve their capital buffers through a variety of strategies. Supervisors update their bank-specific Pillar 2 capital requirements on a regular basis, with the intention to incentivise banks to subsequently increase their regulatory capital and maintain relatively stable capital buffers.[15] De-Ramon et al. (2022) analyse bank-level data from the UK and find that higher capital requirements result in roughly equally higher capital ratios, even in cases where the requirements were not binding in a regulatory sense. This is

[15] Banks build buffers above their overall capital requirements. These include a wide range of micro- and macroprudential requirements, making identification challenging.

in line with the idea that banks try to maintain their capital buffers. They further find that banks achieve this increase through a combination of all the possible channels they have at their disposal, namely by raising capital, shrinking the size of their assets and decreasing the riskiness (and therefore the risk-weighted assets) of their portfolio. Post-GFC, however, UK banks responded to increases in Pillar 2 requirements predominantly by increasing regulatory capital. De Jonghe et al. (2020) analyse the relationship between Pillar 2 requirements for Belgian banks and the riskiness of their loans. They find evidence of de-risking, as banks decrease their extension of credit to risky firms more than they do towards their safer peers.[16] In such studies, adequate measurement is of key importance. Delis and Staikouras (2011) find that stringency of capital requirements is not significantly related to bank riskiness. This message, however, does not rely on capital requirements data, but rather on a capital stringency index that is constructed from banks' responses to a qualitative survey conducted by Barth et al. (2001). Despite their merits, such indices introduce measurement error to the estimations.[17]

Limiting dividend payouts of undercapitalised banks can be an effective tool to strengthen banks' capital, assuming due consideration has been given to unintended side effects, for example obscuring the signalling effect of the dividend amount to the markets**.** BCBS (2020) finds that retained earnings are the primary means of strengthening a bank's equity base. However, in an empirical analysis with data for 271 advanced economy banks in 30 jurisdictions, Gambacorta et al. (2020) point out that banks demonstrate a greater propensity to pay dividends when their price-to-book ratio is low even when dividend payouts weaken their resilience. Abreu and Gulamhussen (2013) examine dividend payouts of 462 US bank holding companies before and during the 2007–2009 financial crisis. They find that applying regulatory pressure to restrict dividends without actively limiting them is ineffective in non-crisis times due to the presence of the signalling and agency hypothesis.

Paying dividends can help banks to address information asymmetries vis-à-vis shareholders and signal future profitability or mitigate agency costs. In a panel data approach for two samples of listed and unlisted European banks in the period 2005 to 2019, Belloni et al. (2023) find evidence that European banks adjust their dividend payments to signal profitability, mitigate agency costs, and in response to supervisory or regulatory constraints. While banks seem not to systematically account for future expectations of economic conditions or their own profitability in their dividend payout decisions and while the introduction of the maximum distributable amount (MDA) limit did not appear to have a significant impact on dividend payouts, simulations in the paper suggest that authorities' recommendations to withhold dividend distributions during the pandemic had an important role in retaining capital in the banking sector. Also, applying more regulatory pressure to avert dividend payouts by undercapitalised banks is successful in crisis times (Abreu and Gulamhussen, 2013). Dautovic et al. (2023) find that during the Covid-19 pandemic, dividend restrictions were an effective policy in supporting financially constrained firms. The positive effects on lending were larger for small and medium enterprises and for firms operating in Covid-19 vulnerable sectors without a significant increase in lending to riskier borrowers and to "zombie" firms. D'Utekem (2021), however, observed unintended side effects of dividend restrictions imposed on US banks

[16] A separate strand of the literature studies the impact of the 2011 European Banking Authority's capital exercise, whereby a subset of large euro area banks was asked to increase their Core Tier 1 capital ratio to 9% (Mésonnier and Monks, 2015). Using this episode as a quasi-natural experiment, Gropp et al. (2019) find that treated banks increased their capital ratios by reducing their risk-weighted assets, and their credit to corporate and retail customers, but not by increasing their equity. Mayordomo et al. (2021) analysed the data of the representative Spanish bank and its subsidiaries and found that it increased the use of personal guarantees and, to a lesser extent, of collateral to decrease the riskiness of it loans. The results were stronger for subsidiaries with lower capital ratios. Degryse et al. (2021) find similar results on collateralisation for banks based in Portugal.

[17] The index of capital stringency is determined by adding 1 if the answer is yes to questions 1–6 and 0 otherwise, while the opposite occurs in the case of questions 7 and 8 (i.e., yes = 0, no = 1). (1) Is the minimum required capital asset ratio risk-weighted in line with Basel guidelines? (2) Does the ratio vary with market risk? (3–5) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realised in accounting books? (b) unrealised losses in securities portfolios? (c) unrealised foreign exchange losses? (6) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (7) Can the initial or subsequent injections of capital be done with assets other than cash or government securities? (8) Can initial disbursement of capital be done with borrowed funds?

during the GFC in the sense that dividend restrictions made dividend policies less effective at inducing monitoring by institutional shareholders. This is indeed a drawback because he also found that (even during market turbulences) stable dividend policies were effective in attracting institutional shareholders and incentivise them to monitor the bank and ensure that it is well-managed, see also Allen et al. (2000).

Enforcement actions and sanctions

Sanctions and enforcement actions are found to promote a more truthful classification of credit quality, reduce bank risk, limit lending and generate a deterrent effect on other (non-sanctioned) banks. Timing is key to an early tackling of the roots of financial distress, especially in the case of risk management and control issues. Caiazza et al. (2018) explore data on Italian banks between 2005 and 2013 to investigate the effects of sanctions in banking. They find that credit risk-related sanctions lead banks to be more truthful when classifying credit quality, off-load non-performing loans to clean their balance sheets and exhibit reduced willingness to lend. At the same time, sanctions have spillover effects from sanctioned banks to similar non-sanctioned banks, which exhibit similar changes in behaviour despite not facing sanctions themselves. This finding highlights the importance of public disclosure of enforcement actions in reducing risk-taking behaviour across the banking system. Delis et al. (2016) explore the effect of sanctions on bank capital, risk and performance. They employ data on all US banks for the period 2000–2010, analysing variables in a time window of four quarters prior and after the sanctioning event. A distinction is made between sanctions where the underlying reason lies at the core of bank safety and soundness (e.g. capital or liquidity impairment) and those where it does not. For the former, sanctions do not improve the risk profile of the involved banks, possibly because they come too late and affect bank fundamentals. The work suggests that the focus of sanctions should be placed on the timely uncovering of internal control and risk management deficiencies, to allow for the early tackling of potential serious problems at inception. The relevance of risk governance and control is also reflected in the work of Ke et al. (2024) which, based on data on Chinese commercial banks during the period 2009–2019, concludes that regulatory penalties significantly reduce bank risk-taking, with a more pronounced effect on banks with better corporate governance and stronger market discipline. Klomp and de Haan (2015) show that the effectiveness of supervisory measures depends on the organisational structure of banks. They analyse data for 1,238 banks located in developing and emerging countries and find evidence that measures such as business restrictions work well to reduce the risk of foreign-owned banks, while others such as liquidity restrictions work better for unlisted and commercial banks.

Sanctions are found to contribute to financial stability and market discipline, with increasing effects as their severity scales up. From a systemic risk perspective, Berger et al. (2022) find that enforcement actions are associated with enhanced financial stability by reducing banks' leverage and portfolio risk, based on analysis of a dataset of formal actions and financial information of US banks between 1989 and 2016. They find a greater effect of more severe actions, against banks and during financial crises (compared with smaller actions, against individual bank managers and in normal times, respectively). Pereira et al. (2019) investigate shareholders and depositors' reactions to public enforcement actions in the US banking sector between 2004 and 2015. The market's reaction varies based on the severity of the enforcement action; markets react negatively following severe enforcement actions (e.g. cease and desist orders), while weak reactions are observed following less severe enforcement actions (e.g. civil money penalties and formal agreements). Depositors' reaction varies based on the type of sanction and the type of deposit considered. Demand depositors penalise sanctioned banks following cease and desist order announcements, while they react positively to formal agreement announcements because these are perceived as a corrective mechanism.

Early intervention regimes

Early supervisory intervention regimes prompt banks to address their weaknesses in a timely manner. These are more efficient if they are flexible, forward-looking, proactive, pre-emptive, backed by organisational infrastructure and accompanied by formal intervention regimes (Svoronos, 2018; BCBS, 2018). Svoronos' analysis of early intervention regimes in six jurisdictions[18] finds that discretionary measures are often considered the most efficient way to encourage bank managers to promptly remediate deficiencies, and because of their discreet nature (they are not subject to market disclosure), they are likely to have a minimal impact on the bank's stability. Formal intervention regimes may prove effective as a backstop when certain measures beyond the supervisor's regular powers are required (e.g. replacement of bank's management). Flexibility is also needed, to allow for tailor-made solutions which adapt to the specificities of each bank. Moreover, the triggers for intervention should be calibrated to facilitate timely action by supervisors. The use of composite indicators, including capital-based metrics and supervisory ratings, balances the trade-offs between different indicators (simple, consistent, transparent vs. forward-looking).

Timing is of the essence in early intervention; actions taken well before actual breaches of the thresholds are considered particularly effective. A distinction can be established between early supervisory intervention frameworks, where there is clear predominance of pre-emptive supervisory actions before actual breaches are triggered, and prompt corrective action (known as PCA), where more prescriptive and formal actions are imposed when thresholds are breached (BCBS, 2018). These more formal frameworks generally intend to make supervisory intervention more timely and less discretionary by limiting supervisory forbearance. However, Peek and Rosengren (1997) find that formal actions frequently occur in the early intervention phase, well before thresholds are breached, and they include more comprehensive restrictions than PCA provisions. Moreover, it is noted a high value of actions driven by more frequent examinations in the early intervention phase.

Granting more powers to supervisory bodies to remove bank managers and to change banks' organisational setup reduces excessive risk-taking and appears to be more effective than monetary penalties. Shehzad and De Haan (2015) explore the impact of different types of bank supervisory powers on bank risk-taking. They analyse more than 8,000 banks from high-income OECD countries between 2007 and 2011, considering the impaired loans to gross loans ratio as a proxy for bank risk-taking. Overall results indicate that the powers of bank supervisors to change the organisational structure of banks reduce the moral hazard problem and are more effective than powers to issue monetary penalties. In the case of large banks, no effects are found on risk-taking and other instruments are needed. A stocktake by Oliveira et al. (2023) shows that while most authorities have some form of power to remove bank managers, not all require prior regulatory approval for appointments or reappointments of those individuals or can only impose such requirements after a bank is in a troubled condition. An example of a jurisdiction with relatively advanced powers in this area is the Single Supervisory Mechanism (SSM), where fit and proper assessments are carried out for relevant roles to check the suitability of the appointees, and the supervisor also has the possibility to remove people from their roles at any point in time by launching a fit and proper re-assessment.

Individual accountability regimes

Individual accountability regimes for senior managers in banks have emerged only recently as a tool to foster supervisory effectiveness. Such regimes include the UK's Senior Managers and Certification Regime (SM&CR) implemented in 2016, Australia's Banking Executive Accountability Regime (BEAR) adopted in 2018 (and replaced by the Financial Accountability Regime in 2024) and Singapore's 2021 Individual Accountability and Conduct Guidelines. The Financial Conduct Authority (FCA), Prudential Regulation Authority (PRA) and the Financial Services Culture Board have reviewed the SM&CR using interviews, surveys and examinations of its application and have found that the regime ensures bank managers take greater responsibility for their actions (Bank of England, 2023). Similar conclusions have been drawn for other regimes around the world (Oliveira et al., 2023). The review of the SM&CR also finds it works better when it is integrated alongside firms' internal approaches to staff, culture and incentives (including remuneration). The analysis of fitness and propriety is considered a key mechanism for

[18] European Union, India, Japan, Peru, the Philippines and the United States.

improving behaviours and outcomes. Firms' due diligence and high regulatory standards are essential. Diversity and inclusion, as well as managers who rise to meet new and emerging risks are also important (Bank of England, 2023).

Individual accountability regimes have been found to be accompanied by complementary mechanisms that also support individual accountability. Examples are regulatory expectations about banks' internal conduct rules, remuneration guidance, restrictions on insurance cover for financial penalties and requirements for firms to have whistleblower policies in place (Oliveira et al., 2023).

The effectiveness of these individual accountability regimes relies on robust supervision and (to a great extent) the credible threat of enforcement and action against senior bank executives (Oliveira et al., 2023). This was one of the main conclusions from a stocktake of individual accountability arrangements in six jurisdictions with a combination of survey data, follow-up interviews with selected authorities and a review of relevant publications. The work argues that regulatory requirements that target accountability must also be underpinned by direct enforcement powers against individuals and require practical supervisory guidance to be effective (Oliveira et al., 2023). Similarly, Ryder et al. (2023) argues that the FCA should more frequently use its enforcement powers to sanction senior managers to ensure that the SM&CR effectively achieves its core objectives. A credible deterrent strategy is therefore key, and this requires certainty, celerity and severity, i.e. a solid prospect of enforcement action, a rapid enforcement response and a significant penalty attached to noncompliance.

Clear guidance for both banks and supervisors is key when implementing individual accountability regimes. More guidance is required for supervisors to determine whether individuals did everything in their power to fulfil their responsibilities (i.e. whether all "reasonable steps" that could be expected to take place were actually carried out to prevent material breaches and other issues), and the level of culpability of senior executives (Oliveira et al., 2023). The concept of "reasonable steps" allows the circumstances of the case to be taken into account when assessing whether an individual has fallen short in carrying out their responsibilities and should therefore be held accountable. This facilitates appropriately nuanced assessments but also requires supervisory judgment that may not be straightforward. It also entails a risk that the standards are not transparent to covered individuals.

It is crucial that appropriate incentives for accountability are established in a quantifiable manner, ideally with links to financial outcomes for the relevant individuals, to make the consequences tangible for them. Andrea Enria stated in a speech that true transformation in bank culture must come from within and that real progress lies beyond the direct reach of supervisors and regulators. That being said, remuneration (e.g. bonus caps, malus and clawback provisions) is a key element of individual accountability regimes that can have a major impact on behaviour (Enria, 2019). By crystallising accountability in a measurable way, remuneration structures have the power to drive behaviour changes, aligning individual actions with broader organisational goals. This approach is not just theoretical; it has been observed in real-world applications. For instance, the Australian Royal Banking Commission (ARBC) found that poor remuneration and incentive programs had contributed to poor customer and market outcomes. Incentive systems are also one of three pillars of Hong Kong's bank culture reform. Similarly, the United Kingdom and the European Union require larger financial services firms to put in place malus and claw back provisions (Baker McKenzie, 2019). Additionally, disincentives can be established via the possibility for imposition of fines and similar tools. Such provisions ensure that rewards are not only aligned with short-term performance but also subject to adjustment based on longer-term accountability and risk considerations (Oliveira et al., 2023).

4.3 Collaboration and transparency

Laws, regulations and other arrangements provide a framework for cooperation and collaboration with relevant domestic authorities and foreign supervisors (BCP 3). Information sharing is an important element of cooperation across supervisory authorities and also for promoting market discipline when applied towards the public. This pillar of effectiveness therefore needs to consider both the interaction between supervisory authorities and interactions between supervisory authorities and the public, including market participants. Besides the communication among supervisors and communication towards the public, a third area of application is the communication towards the supervised institutions and their interest groups.

Cross-border collaboration in normal and crisis times

The onset of international cooperation in banking supervision (under the umbrella of the BCBS) is arguably the case of Herstatt Bank, a mid-sized bank which failed due to a foreign exchange crisis in the 1970s, following the end of Bretton Woods (BCBS, 2004; Mourlon-Druol, 2015). Due to the increasing connectedness of the global financial network, this bank failure demonstrated a need for more formal collaboration between advanced economies. More recent evidence of cross-border cooperation arose out of the GFC, which had notable impacts around the world and required authorities to cooperate. For example, the lessons learnt from the GFC led to the creation of the Financial Stability Board (FSB) and in Europe the SSM.

Acharya (2003) argues that international coordination on regulatory minimum capital requirements can have detrimental effects for stability if it is done without also coordinating on other dimensions of the regulatory framework, for example resolution policies. He also suggests that the results of his paper can carry over to the link between the effectiveness of bank supervision or enforcement and capital requirements. In other words, ***cross-border cooperation in one field, for example banking supervision, also needs to consider the cooperation in other fields, for example minimum capital standards or resolution policies in order to avoid unintended adverse effects on bank stability.***

With this caveat in mind, it has emerged as a lesson from the GFC (Box B) and also been empirically supported (Beck et al., 2023) that ***cross-border arrangements in banking supervision are effective and lead to stronger financial institutions worldwide.*** A mapping from international collaboration in banking supervision to supervisory effectiveness is, however, not always straightforward.

Irrespective of the obvious advantages of cross-border cooperation, there are also indications that cooperation in the form of a centralisation of decision-making carries economic can carry economic costs, especially when supervisors have different preferences and institutional structures. This would imply that cooperation is not always desirable, despite being effective in reducing bank risk. This conjecture is supported by an empirical study (Beck et al., 2023) that examine whether actual cooperation agreements were consistent with measures of economic benefits and costs. The work is based on hand-collected agreements by 93 countries from 1995 to 2013, i.e. the sample does not cover developments in the last decade. In this study cooperation arrangements are more effective[19] when activated for "smaller" banks than when activated for very large multinational banks.[20] The effectiveness is higher when both home and host are more stringent and have access to quality information.

Notwithstanding these results pointing to limits of economically desirable collaboration, the benefits of international cooperation are nowadays well recognised by supervisors. Remarks by former US Comptroller of the Currency, Thomas J. Curry, highlight the importance of collaboration across borders, particularly considering risks apart from financial ones – e.g. geopolitical risks, terrorism and money-laundering, among others (Curry, 2016). Additionally, as digitalisation proliferates, the safety of financial institutions can be strengthened by cross-border supervisory alliances.

Fiechter and Zamorski (2016) stress that a constructive working relationship between the supervisor and other regulatory authorities (such as central banks, other bank regulatory authorities,

[19] Effective supervision is defined here by increasing bank stability that is in turn assessed by a z-score and by a Marginal Expected Shortfall measure (Acharya et al., 2012).

[20] The threshold to distinguish "very large" from "smaller banks" used in the empirical study was 93 million USD total assets.

market conduct regulators, deposit insurance agencies, resolution authorities and ministries of finance) favours effective supervision.

In addition to "normal" times, crisis episodes also need to be considered, when the risks arising from incomplete information about supervised institutions are most critical and the trust in the stability of banks or the banking sector as a whole may need to be rebuilt. ***Maintaining cross-border supervisory cooperation is key in both normal and crisis times, especially to ensure full oversight of complex international groups.*** Externalities arise from national supervision of cross-border banks as supervisory cooperation is essential for reaping the benefits of closer financial integration while managing its risks to stability. Beck (2016) notes that the increases in the banking sectors' concentration and in cross-border flows in the years leading up to the GFC was not matched by the necessary regulatory adjustments. D'Hulster (2011) and Alford (2010) point out that for supervisory cross-border arrangements (such as supervisory colleges) to function effectively, there is a need for an international regime on resolution and burden-sharing to minimise incentive conflicts. It is also key to ensure an effective exchange of information and successful common actions for supervision, while avoiding negative cross-border spillovers as de Vincenzo et al. (2010) point out in their discussion.

Hernández de Cos (2024), in a keynote speech in his role as Chair of the BCBS, stressed cross-border arrangements when reflecting on the past 50 years and how international cooperation safeguards global financial stability by "…strengthening the regulation, supervision and practices of banks worldwide". Additionally, he emphasises the relevance of global cooperation in banking supervision given the challenges of the future posed by technological innovations such as those driven by AI and ML. Although international collaboration is essential, the idiosyncrasies of banking supervision for a given jurisdiction should be recognised as there are limitations to the benefits a country might gain from international cooperation in banking supervision as argued in Beck et al. (2023).

An important consideration for policymakers is how legal frameworks need to be enhanced to support cross-border arrangements in banking supervision. In the case of Dexia, Whitbeck (2013) shows the firm's complicated legal structure made it difficult for national regulators to figure out who exactly had authority over the bank. Since 2001, it was agreed that the Belgian authority would oversee Dexia's activities, though the French authority agreed to be in close cooperation and supervise only the French entity of the Group.

Khan (2017) studies the IMF's Central Bank Legislation Database and argues that these data can enhance cooperation between central banks. Similarly, data collection (and potential data-sharing agreements) can facilitate cooperation between supervisors. However, data-sharing agreements pose their own challenges for cooperation among different jurisdictions, particularly those with stringent privacy laws.

In a recent speech, BIS General Manager Carstens (2024) noted that cooperation mechanisms provide a "common language and signalling device for market participants" and this also proves beneficial to supervisors when prompt regulatory actions are needed. Moreover, Carstens' remarks dovetail with Curry's regarding digitalisation and the risks its entails (e.g. liquidity risks posed by rapid withdrawal of deposits), thus providing more impetus for strong cross-border cooperation. Financial networks across the globe are becoming more connected due to the advent of new technology (e.g. in the AI/ML space), so from this perspective, cross-border collaboration is indispensable for guarding against malfeasance in global financial networks.

Transparency, communication and market discipline

Market discipline offers a complement to supervision (and regulation) in promoting bank stability. The effectiveness of market discipline was discussed in the 1990s, well in advance of the GFC. In his review of the literature, Flannery (1998) finds that the market is able to promptly price in new information about banks, evidenced in equity prices, CD rates, and bank debenture rates. Retail depositors are generally found to behave rationally when banks encounter solvency problems. The paper argues that public oversight of the banking system could be improved if supervisors are more transparent and share more regulatory information with market analysts.

A later empirical study confirms the effectiveness of market discipline in the banking sector (Nier and Baumann, 2006) by considering 729 individual banks from 32 different countries over the years 1993 to 2000. They find that larger uninsured liabilities and more disclosure results in larger capital buffers, all else equal, while this effect is reduced when banks enjoy a high degree of government support.

The role of transparency and how it can be made more impactful is also discussed among supervisors. Charles Plosser, former President of the Federal Reserve Bank of Philadelphia, argued in remarks at a 2014 conference on "Enhancing Prudential Standards in Financial Regulations" to avoid rules and regulations as a substitute for market discipline. He states that "creating incentives for markets to monitor and price risk-taking by financial institutions, rather than have markets simply assume that regulators have monitored the risk for them, is a desirable outcome". If these market-monitoring tools are made transparent to the public, supervision efforts can be further enhanced. In fact, Plosser also notes that "the argument for greater use of market data in bank supervision is not that market signals are always superior to supervisory assessments, but that market data can complement information gathered by examiners". While his speech also discusses specific instruments that can be leveraged to use market discipline to enhance supervision, an important point (and challenge) is the combination of transparent, trustworthy, useful market information and examination efforts. Indeed, he states that "there is still much to learn about how best to combine market data with examiner data to improve supervisory assessments of risk in the financial system, and additional research in this area could prove highly useful" (Plosser, 2014).

Transparency by disseminating information to the public, including market participants, is a tool that can be used not only by supervisors but also by banks. Multiple studies suggest that ***supervisory and bank transparency towards their stakeholders both promote effective supervision.*** Arnone et al. (2007), for example, examine a database of 116 countries that underwent IMF and World Bank missions from 1999 to 2004 and find a positive correlation between transparency of the supervisor and effectiveness as measured by BCP compliance. Tadesse (2006) analyses transparency requirements for banks in a cross-sectional study of banking systems across 49 countries in the 1990s. This study finds that banking crises are less likely in countries with regulatory regimes that require extensive bank disclosure and stringent auditing, potentially suggesting that transparency from banks enables more effective supervision.

Enriques and Hertig (2011) go one step further than evaluating the impact of transparency by identifying six key areas where certain supervisory authorities could, through more transparency, increase the efficacy of supervisory interventions and reduce the risk of regulatory capture[21]: the appointment process, business planning, periodic reporting, interactions with banks' interest groups and, with due qualifications, decision-making and enforcement actions.

A targeted increase of transparency has been used by supervisory authorities on various occasions to reduce information asymmetries and ultimately support bank stability. Prominent examples are public disclosures of the outcome of supervisory stress tests that have been found to increase market discipline (see Section 4.1 for references and further details). As another example, the EBA developed and published data templates to reduce information asymmetries between potential buyers and sellers of non-performing loans (NPLs). It thereby contributed to the development of a functioning secondary market in the EU, increasing transparency by specifying detailed information required from banks on their credit exposures in the banking book (EBA, 2017).

Garrido et al. (2019) and EBA (2020a) studied the use of banking data in assessing and designing insolvency frameworks and proposes the use of insolvency cases and the number and type of insolvency proceedings with the aim of monitoring economic trends, resolution of non-performing loans, disclosing

[21] See also Section 5.3 on supervisory capture.

(based on loan-level data), the rate of credit recovery and time to recovery by banks and European Union countries.

While transparency can promote market discipline in "normal times", transparent public communication can also be effectively used to (re-)build trust in times of financial crisis. Specifically, with respect to orderly resolution of failed banks, communication is essential. As an example, Federal Reserve Board Chair Powell's speech on the 2023 regional banking crisis assured the public that taxpayers' funds would not be used with respect to the failure of SVB (among other banks) when making depositors whole (Powell, 2023). Yet another example of transparent communication channels (in both a domestic and international sense) is making the operations of banking institutions more transparent (e.g., the publication of annual stress-test results by the Federal Reserve System). As noted in a consultative document by the Basel Committee on Pillar 3 (see BCBS, 2001), earlier research analyses the costs and benefits of adequate public communication, concluding that effective public communication has benefits for the health of banking institutions as well as investors and depositors. Transparency reinforces financial stability and supports the efficient operation of capital markets, thus maintaining a sound framework for market discipline. Indeed, it can be argued that preserving market discipline enhances trust (from the public) in banking institutions, thereby fostering a financial eco-system conducive to robust economic growth.

Supervisory authorities can use transparency as a communication tool to the public. Another relationship that merits a communication strategy is the one between supervisors and the supervised institutions, including their interest groups. This has been recognised by supervisors: Gully (2023) stresses that open, frank and direct communication with stakeholders is key because "effective supervision depends on strong relationships". Fiechter and Zamorski (2016) claim that a constructive working relationship between supervisors and the banking industry favours effective supervision. Allen et al. (2017) discuss transparency in the context of technical innovations, more specifically algorithmic trading and cloud computing. They argue that the global financial regulatory framework has become antiquated and obsolete in the face of rapid technological advances that drastically reduced costs to intermediation but have not correspondingly increased or distributed the benefits of greater immediacy. The study proposes a set of cyber-centric regulatory principles that promote transparency, enable the creation of additional risk safeguards, and encourage the implementation of risk management processes and workflows that allow human knowledge to complement the computational abilities of machines, especially as the use of machines in trading has become so widespread.

Box B

European Union case study: Reflecting on the 2008 Great Financial Crisis and its impact on the EU supervisory architecture[22]

Ana Rita Redondo Oliveira

The 2007–2008 Great Financial Crisis (GFC) was a pivotal moment in global economic history, being the most disruptive crisis since 1929. It exposed significant weaknesses in the global financial system and sparked widespread debate on the effectiveness of the financial sector's regulation and supervision. In the European Union (EU), the report prepared by the *High-Level Group on Financial Supervision in the EU* chaired by Jacques de Larosière (de Larosière et al., 2009, also known as the Larosière report), published in February 2009 as a direct response to the GFC, played a crucial role at the time, highlighting the deficiencies in the EU's regulatory frameworks and the need for stronger coordination among national supervisory bodies. Even if most of that report's recommendations are now obsolete, as the landscape for the EU's banking supervision has evolved considerably, there are important lessons on effectiveness which are worth highlighting for the purpose of this case study.

[22] The following reflections are based on the de Larosière (2009) report.

What triggered the GFC?

The crisis, triggered by the collapse of the subprime mortgage market in the United States, quickly spread across the globe and into the EU, revealing systemic vulnerabilities throughout the financial system. Its main driver was the preceding long period of ample liquidity and low interest rates which led to rapid credit expansion, under the illusion of permanent and high levels of macroeconomic growth. On top, for the US, the failure of government sponsored entities like Fannie Mae and Freddie Mac and strong political pressure to promote home ownership for low-income households aggravated the situation. These imbalances were further heightened by investors turning to increasingly complex financial products in their search for higher yields, which made it harder to assess the underlying risk, while generating a dramatic expansion of leverage within the financial system as a whole.

Failures in risk assessment and management were aggravated by missing checks and balances on the corporate governance side. Several management bodies and senior managers of banks neither understood nor were they aware of the true exposure of the institutions they managed or the complex financial products they were dealing with. Inadequate limits on remuneration and incentive schemes, coupled with shareholders' pressure to deliver higher share prices, contributed to further risk taking by rewarding short-term growth above long-term sustainability.

Inadequate regulatory frameworks, coupled with a lack of transparency in important segments of financial markets, severe underestimation of risks by key players and conflicts of interest (e.g. for the credit rating agencies due to their issuer-pay business model), posed important challenges for supervisory oversight bodies to identify risks at a sufficiently early stage. For the EU in particular, the lack of a coordinated EU-level crisis management framework made it even harder for supervisors to react. This underscored the critical need for better regulation to be developed, coupled with more robust, proactive banking supervision to safeguard the EU's financial stability going forward.

What was the role of the EU supervisors?

Even if the EU's banking supervisors were not the primary cause behind the GFC, the Larosière report highlighted a few areas in which the crisis prevention role of EU supervision was not fit for purpose and needed to be enhanced (these are listed below). The report called for the establishment of a new European supervisory architecture, leading to the creation of the European Systemic Risk Board (ESRB) and three European Supervisory Authorities (EBA, ESMA and EIOPA). Indirectly, the new coordinated architecture laid the conceptual groundwork for the Banking Union and the later establishment of the Single Supervisory Mechanism (SSM) in 2014 to improve the effectiveness of banking supervision.

- Risk assessment: There was at the time no formal mechanism to oversee macroprudential risks and translate them into action, with the report highlighting a need for such a framework. This has since been tackled by the establishment of the European Systemic Risk Board (ESRB) in 2010 as a direct consequence of the Larosière report – this is the EU level body responsible for the macroprudential oversight of the EU financial system and the prevention and mitigation of systemic risk. More generally, the concept of translating risks into action is also incorporated into the SSM processes via the annual risk and priorities setting exercise, which jointly with considerations on how much risk supervisors are willing to tolerate from banks under the risk tolerance framework, drives the supervisory strategic planning for the following cycle.
- Collaboration:
  - For banks present in several countries, extensive reliance was and continues to be placed on the judgments and decisions of the home supervisor. With that in mind, there was at the time a need for processes and practices that allow the host authorities to challenge the decisions of the home supervisor when these are seen as inadequate, and vice-versa for the home supervisor to challenge the host (e.g. via peer review arrangements, with binding mediation mechanisms to handle cross-border supervisory disagreements).
  - Linked with this, the report flagged the need for more open and transparent discussions between supervisors at an early stage of the crisis, paired with sufficient flows of information to foster candid discussions.
- Remediation: At the time, and this remains partially applicable, the powers granted to national supervisors across EU member states were rather heterogenous, especially regarding enforcement actions for banks breaching their duties – with the report suggesting their harmonisation to ensure a more levelled playing field where all authorities have sufficient powers to take effective and enforceable actions. There were also

difficulties for supervisors to take urgent action where needed, due to the difficulties in implementing common decisions, and the lack of appropriate legal powers.

- Culture and strategy: the report highlights the need for a strong European supervisory culture making recommendations on how this can be achieved from the human resource perspective by, for example, facilitating exchanges of personnel between national supervisory authorities, and ensuring all authorities develop an attractive personnel and training policy. These types of initiatives have since been developed as part of the SSM culture.

The lessons learnt since the GFC highlight the need for: (i) proactive early detection of issues by the supervisor by having procedures to look more deeply into certain aspects even when the financial situation of the banks is still positive; (ii) early and timely intervention to address the issues detected, without reluctance or fear of repercussions; (iii) enhanced inter-agency coordination, with feedback loops between authorities, especially for those supervising large and complex banking groups with international presence to minimise blind spots; and (iv) improved transparency in interactions between supervisory authorities, to ensure they can be sufficiently intrusive and forward-looking in their work and able to challenge banks' management on key topics. These lessons have been instrumental in shaping the reforms that followed the GFC both in the EU/SSM context and beyond.

5. Supervisory culture and risk management

The discourse surrounding supervisory culture is intimately linked to the growing adoption of the principle of risk-based supervision. After briefly sketching out the emergence of risk-based supervision, the focus shifts to the relationship between culture and governance, and how culture interacts with organisational design and organisational practices, touching also on the need for qualified resources. Afterwards, two specific culture-related topics are considered in more detail, namely potential pitfalls in relations with supervised institutions that could lead to supervisory capture and the Three Lines Model as a supervisory risk management tool.

Acknowledging – to the best of our knowledge – an existing gap in the literature regarding evaluations of concrete approaches that operationalise the assessment of supervisory effectiveness, the section concludes with a discussion of the challenges that generally exist for such an assessment and – heavily drawing on Hilbers et al. (2013) – some reflections that could benefit future thinking about how effectiveness can be assessed.

5.1 Risk-based supervision, culture, and governance

From the 1970s to today, the global banking sector has gone through a number of systemic crises (Laeven and Valencia, 2020) with different root causes. Though excessive risk taking and/or inadequate risk management by bank managers lies at the core of these episodes, weaknesses in regulation and supervision frameworks have also been cited as contributing factors (Pedro et al., 2023). In this context, supervisory approaches have progressively evolved from "compliance-based" to "risk-based" (Viñals et al., 2010, de Larosière et al., 2009). This shift towards ***risk-based supervision*** had already started well before the GFC; deregulation and technological developments in the 1970s and 1980s are cited as key developments that assisted banks in expanding beyond traditional activities (deposit-taking and provisioning of credit) and towards various sources of market risk (Viñals et al., 2010). Risk-based approaches, which focus limited supervisory resources on the risks that are assessed as the greatest and which the supervisor has the best chances of mitigating, were deemed more appropriate to deal with the new environment. Palmer and Cerrutti (2009) mention risk-based supervision beside robust on-site supervision and a results-oriented supervisory style as essential elements for effective supervision.

The concept of risk-based supervision is also supported by the insight – from the GFC but also from recent bank failures on both sides of the Atlantic in March 2023 – that supervisors need to assess banks' business models and also their governance and risk management functions. Conyon et al. (2011) identified governance shortcomings in companies from many countries that contributed to the GFC. They conclude that corporate governance mechanisms external to and within financial institutions failed to avoid and adequately cope with the crisis as it unfolded. Fahlenbrach et al. (2012) conclude from the empirical observation that the financial performance of a firm in one crisis can predict its performance in a later one, that the persistence in risk culture (and the business model) of a financial firm affects its sensitivity to a crisis situation. Besides a new oversight approach for governance in banks, supervisors should also monitor more closely firms with rapid growth and concentrated business models, as the case of SVB illustrates (see Box A).

Inspired by the definition of risk culture for banks in BCBS (2014), ***supervisory culture*** can be similarly defined as referring to the collective values, beliefs, attitudes and behaviours that shape the way supervisory authorities and their staff conduct their oversight of the banking sector. It encompasses the norms and practices that guide how supervisors interact with each other, with the banks they oversee and with the broader financial system. Similar to corporate culture (Gorton et al., 2022), supervisory culture is a mental construct, which reflects a complex set of observable behaviours of supervisors.

Going beyond lessons learnt from previous crisis episodes, there is a quite limited amount of academic research available on supervisory governance and risk culture compared to work on banks' governance and culture, arguably partly due to confidentiality constraints. A notable exception is Carretta et al. (2015) who assess supervisory culture by breaking it down into different dimensions. Their taxonomy distinguishes between a supervisor's orientation towards flexibility in applying the rules, considerations of systemic implications and social costs, and appetite for confrontation, transparency and forbearance. They measure supervisory culture by analysing the text of supervisory publications from 15 euro area countries and from 1999 to 2011. Based on this text, they create indices that follow their taxonomy of cultural dimensions and they relate the indices afterwards to the z-score of euro area banks. They find that supervisory cultures oriented to collective outcomes (the overall stability of the banking system, avoidance of social costs for stakeholders) and uncertainty avoidance (i.e. a culture prone to clearly define regulations, answer clarification questions, and frequently write and update detailed single book rules) reduce banks' risk levels, measured by increases of the banks' distance to default. Supervision cultures based on inflexible supervision instead decrease the banks' distance to default. In other words, their analysis confirms that supervisory culture has a bearing on how effective supervision is in achieving its ultimate objective to promote the safety and soundness of the supervised institutions.

Supervisors need an ***independent view (from third parties)*** to complement and challenge the perspectives of the banks' management and third parties. They need to manage the extent to which they rely on external providers and on bank management and control functions for formulating their view on banks' risks. Excessive reliance on external auditors and rating agencies could lead to a false sense of security among supervisors (Admati and Hellwig, 2024).

A common understanding of the relationship between "risk culture" and ***"risk governance"*** in the context of supervision is missing both in the literature and in practice. The FSB put forward the following definition, albeit directed at banks: "*risk governance is defined as the framework through which the board and management establish the firm's strategy, articulate and monitor adherence to risk appetite and risk limits, and identify, measure and manage risks*" (FSB, 2013a). A clarification of the relationship between supervisory culture and governance is difficult to find. One exception has been the ECB's Guide on Governance and Risk Culture that was published for consultation in July 2024. In this guide, risk culture is considered as the link between governance and behavioural and cultural patterns. In other words, culture is the overarching element, i.e. sits one level above the concept of governance. Culture has alternatively been seen as on the same level as governance and intertwined with governance. Gontarek (2016) considers instead risk appetite statements, the establishment of a risk committee and culture as features of a governance framework, implying that culture sits one level below governance. While no consensus seems to exist on if culture and governance should be defined as one being part of the other, this question is less important in the context of this literature review which focuses on both of their contributions to enhancing supervisory effectiveness.

5.2 Interaction with organisational design, organisational practices and risk management

Supervisory culture also affects ***organisational design and organisational practices*** (including quality assurance). Sijbrand and Rijsbergen (2013) argue that even adequately managing the supervisory process is not yet a guarantee for the quality of the desired outcome. The reason was a rapidly changing economic environment in which no single process can control risks that are evolving in parallel. A "problem-solving strategy" with "tailor-made solutions" could, however, better address specific risks (Sparrow, 2000). Dahlgren et al. (2023) flag the importance of improving the link between various supervisory activities (regular assessments, on-site inspections, thematic reviews, etc.), while BCBS (2015b) stress the relevance of having structured control and quality assurance processes in place.[23] Authorities that value the balance between risk-based strategies and supervisory consistency may introduce a second line of defence to their organisational structure. In Europe, the SSM for example introduced a second line of defence as part of an internal reorganisation in 2020.

Adrian et al. (2023) analyse 10 years of the IMF's FSAP findings and argue that sound organisational practices should deal with reported impediments relating to hesitant supervisors and delayed supervisory actions that are in turn due to several reasons: (a) preference to have moral suasion or informal warnings first; (b) fear of the length of a fully-fledged due process, burden of proof and the associated legal risks; (c) the political pressure and inadequate policy support; and (d) absence of an adequate impact assessment. Turning to cultural issues, one lesson from previous bank failures that was recently confirmed by the March 2023 turmoil is the important role of the "will to act" by the supervisor (see Box A). This aspect is becoming even more important considering that a more risk-based supervision concept also increases the role of judgment and discretion in taking supervisory decisions.

Culture and governance build the framework within which the ***supervisory risk management*** operates. Therefore, the trend towards risk-based supervision holds important implications for a supervisory risk management and the associated strategy. With the implementation of a risk-based supervision concept, the toolbox for its implementation also expanded, including new horizontal peer analyses or stress tests for example.[24]

FSB (2015) clarifies that greater supervisory intensity does not necessarily translate to more effective supervision. Supervision is effective instead when supervisors proactively influence the behaviour of financial institutions in key areas (such as governance, risk appetite, risk and financial management and, where appropriate, strategy).

In addition, given limited availability of supervisory resources, prioritisation has become more important, as did the need to ensure supervisory consistency in a context of risk-based, tailor-made priorities decided at the level of supervised entities.

Eisenbach et al. (2017) present the Federal Reserve's supervisory strategy by describing how day-to-day supervision is conducted; priorities are identified, supervisory plans are implemented and available resources are allocated efficiently. The risk-based (or "risk-focused") nature of the approach implies that supervisors seek to identify banks' most relevant risks and assess their ability to identify, measure, monitor and control them.

In parallel, supervisory authorities increasingly formulate explicit ***risk appetite statements*** (RASs), which acknowledge the risks that are inherent in their activities, describe what the authorities' risk

[23] See Section 5.5 for further details.

[24] See Section 4.1 for further details on the use of supervisory stress tests.

appetite levels are and what processes they have in place to manage their risks. Andrade (2021) presents the results of a related survey of central banks around the globe conducted by the International Operational Risk Working Group. They find that RASs are a relatively recent development, with roughly half of the surveyed authorities answering that they had no RAS before 2016. In terms of transparency, half of the respondents do not publish RASs on their website, while an additional 31% only publish a high-level summary. Respondents highlight the benefits of transparency and of commitment that RASs provide, but also flag the risk of miscommunication and of potential constraints that they represent.[25]

A supervisory strategy links top-down steering with the specific situation of a supervised institution. It builds on top-down priorities that need to be cascaded down to the supervised bank level and consider the specific risk profile of the bank. In the SSM, such a concept has been implemented through the way in which supervisory priorities are set. The supervisory priorities are reflected in the ECB's Banking Supervision department's medium-term strategy and are set by its Supervisory Board on an annual basis. They rely on a comprehensive assessment of the main risks and vulnerabilities of the banking system (ECB, 2024a). The increased need for risk-based prioritisation has led the SSM to apply an explicit supervisory risk tolerance (or appetite) framework when linking supervisory activities to strategic priorities (Enria, 2023).[26]

The SSM's risk tolerance framework provides tools and processes to supervisors for combining strategic priorities with bottom-up relevance assessments for each supervised bank (ECB, 2024c). This ensures that idiosyncratic issues of banks, which may affect multiple risk areas, are adequately considered. One application of the risk tolerance framework is the structuring of regular bank evaluations following a multi-year approach, involving a core assessment conducted every year and a set of modular assessments that are evaluated over a multi-year timeframe. This gives supervisors flexibility in prioritising and allocating resources, as they are empowered to decide on the order and frequency of the various modular assessments.

Some studies point to the challenge of employing ***adequate and sufficiently qualified resources*** for effective supervision. Dordevic et al. (2021) perform a textual analysis of the IMF FSAP assessment reports and find that the lack of sufficiently skilled supervisors is an issue that hinders effective supervision. Davis and Obasi (2009) use World Bank data of 64 countries evenly divided geographically and in stages of development in the period 1995 to 2003. They confirm the importance of qualified supervisory staff for banks' sustainable stability. Finally, the development of suptech tools promises to provide some technological solutions to resource constraints.[27] Crisanto et al. (2022) highlight the importance of sound capacity development strategies for an effective supervision.

"Allocation policy", i.e. how and how long the same supervisor is assigned to a single institution, can also affect supervisory effectiveness. If examiners are assigned to the same institution for many years, they may simply assume an institution's controls are adequate as they cannot frame how this institution performs compared to its peers (Zamorski, 2015). Eisenbach et al. (2022) argue that supervisory resources in the Federal Reserve System could be allocated more efficiently, both geographically and towards riskier banks, while FRB (2023) discusses shortcomings in the resources allocated to the supervision of SVB (see also Box A).

5.3 Supervisory capture

The concept of what is commonly called "regulatory capture" was introduced by Stigler (1971) without reference to the banking sector. Regulatory capture refers to the process through which special interests

[25] FSB (2013b) and Central Bank of Ireland (2014) discuss risk appetite frameworks in the context of commercial banks.

[26] This development followed the recent, high-level assessment of the SSM's Supervisory Review and Evaluation Process (SREP) by Dahlgren et al. (2023).

[27] See Section 3.4 for further details on the prospects of technological advancements in this context.

affect state interventions (dal Bó, 2006) and in the case of banks, that banks influence the regulators to the extent that regulators act more in the interest of the regulated industry than in the public interest.

Lambert (2018) finds evidence for a sample of US commercial and savings banks that aggregate risk increases for "lobbying" banks. These banks expanded more aggressively in the year before the GFC, and they show a lower performance. The prevention of supervisory capture is, therefore, an important objective of a sound supervisory culture and governance framework and has gained increased attention after the GFC (Igan and Lambert, 2019).

A prominent example of supervisory capture concerns the "revolving door" phenomenon that involves a tendency of regulators to favour the industry if they themselves have an industry background or when they expect rewards in the form of future industry employment (dal Bó, 2006). ***Revolving doors*** at supervisory authorities raise the important empirical question of whether the primary motivation for firms employing former regulators is their expertise or their "lobbying potential" (dal Bó, 2006).

Empirical results on if "revolving doors" can contribute to supervisory capture are rather mixed. Shive and Forster (2017) analyse financial firms' approach to risk taking after hiring a top executive with regulatory experience. They find that market- and balance sheet-based risk measures decrease significantly and that measures of risk management activity increase, especially for hires from prudential supervisors who directly monitor financial firm risk. The evidence is in line with the idea that certain firms tend to hire ex-employees of their regulators when they perceive a need to reduce risk.

Notwithstanding these observed positive effects of "revolving doors", there is also some evidence that supervisors can get overly familiar with their banks, in the sense that their judgment is affected. Lucca et al. (2014) analyse net worker flows between the private sector and the regulatory sector and find that workers tend to move towards the private sector in good times and more towards the regulatory side in bad times. This countercyclical behaviour is more in line with the idea of transfer of skills and reacting to job uncertainty than to any "quid-pro-quo" behaviour at the aggregate level.

Supervisory forbearance that was encouraged by career concerns in a revolving door job market has been found to have contributed to the US Savings and Loans crisis in the 1980s (Kane, 1992). Igan and Lambert (2019) argue that enhanced transparency of regulatory decisions could help reduce the risk of regulatory capture through lobbying.

Adrian et al. (2023) report that some countries value the opportunity to hire supervisors with banking experience, while other jurisdictions highlight potential conflicts of interest in this case. Lim et al. (2019) examine the issue of regulatory capture caused by bank directors holding public service positions in the Federal Reserve. They find that this might reduce supervisory effectiveness, as connected banks are linked to decreases in the sensitivity of bank leverage to risk and to the extraction of larger public subsidies by shifting risk to the financial safety net.

In summary, while a constructive relationship between supervisors and supervised institutions can favour effective supervision (Fiechter and Zamorski, 2016), the existing analytical work and experiences with past bank failures suggest that the right balance needs to be struck to prevent excessive trust in banks' managers and their internal control functions, which could ultimately hinder supervisors' ability to identify and assess the risks (e.g. for HBOS plc, the PRA and FCA stated they had a better relationship with this bank than with its peers, see FCA and PRA, 2015).

5.4 Supervisory risk management – The Three Lines Model

Robust risk management frameworks for *banks* are discussed more often in the literature than for supervisors, notwithstanding that their relevance also extends to supervision. Existing work on the risk culture of banks can help to overcome gaps in the literature regarding corresponding concepts for supervisors although any read-across requires caution, given that banks are profit-oriented organisations in contrast to supervisory authorities.

It has been argued that by having a strong framework in place, supervisors can manage and mitigate risks while striving to achieve their goals. In this respect, the ***Three Lines (of Defence) model (3LM)*** has been widely adopted in the financial sector industry. It has been promoted by the financial services industry including regulators and industry organisations as a "best practice" for coordinating risk management within an organisation (Turner, 2021). BCBS (2015b) mentions that risk governance frameworks "should include well-defined organisational responsibilities for risk management, typically referred to as the three lines of defence".

The Institute of Internal Auditors (IIA) formalised the Three Lines of Defence model in 2013.[28] The model aims to promote risk ownership and a stronger risk management culture whilst eliminating inefficiencies, gaps and overlaps that can arise in the management of risk and compliance by multiple functions. For this purpose, essential roles and duties would need to be clearly defined and articulated. Following Turner (2021), in general, the "first line of defence owns and manages the risks, the second line of defence includes functions that oversee the risks, and the third line of defence provides independent assurance".

Despite good intentions and its widespread use, scandals related to risk management are relatively frequent, prompting questions on what has gone wrong. According to Turner (2021), criticisms of the 3LM include: an excessive focus on defence rather than value creation to support the business; non-collaborative, adversarial "us vs. them" relationships; divergence in its implementation, especially in the relationship between the first and second lines of defence; ambiguity in the roles of the board and its committees; lack of integration and barrier creation; lack of confidence in it; false sense of security; workload. Diffusing responsibilities and little external validation of controls are also often criticised (Davies and Zhivitskaya, 2018).

To overcome these issues and to ensure an effective implementation of the 3LM, Turner (2021) highlights certain structural, cultural, and leadership aspects of an organisation that need sufficient attention. An effective 3LM would need to be well defined, articulated and understood by all employees, as well as effectively implemented and continuously monitored. It needs to be underpinned by a strong and robust corporate culture that encourages constructive challenge by combining an independent and collaborative approach, promotes ethical decision-making, sets the appropriate incentives, and fosters openness and transparency. It is key that the tone from the top, business risk appetite, performance management and compensation structures are aligned with the company strategies. Tett (2016) uses several examples from the GFC to explain how organisations, including financial authorities, struggle to work efficiently, improve leadership and management, eliminate silo mentality and communicate more effectively. Similarly, Davies and Zhivitskaya (2018) propose a number of principles that can be considered to promote the effectiveness of the model, including providing clarity in the definition of what the lines are defending against (e.g. against breaches of the risk appetite of the organisation), the borders and relationships, especially between the first and second line (e.g. partnership vs. policy and policing vs. offence and defence[29]), and the risks under coverage. Also, it is key to set the right remuneration incentives. It is also important that the board supports the risk function by ensuring it is well resourced, has access to business decisions, and that the Chief Risk Officer (CRO) is genuinely independent. Moreover, the usefulness of providing some external independent assurance for risk committees is highlighted. Finally, further review and guidance by regulators could contribute to a more effective implementation of the 3LM in banks and better oversight by the boards.

[28] The 3LM concept has been around for longer though. It was already referred to in FSA (2003) in a policy statement on operational risk systems and controls.

[29] Sweeting (2011) outlines three distinct styles of risk management interaction within the 3LM: (1) The "offence and defence" model, where the first and second lines are in opposition. The first line is solely profit-driven, without any risk management duties. Sweeting (2011) considers unlikely that regulators would find this model acceptable. (2) The "partnership model", where business units and risk management collaborate to maximise returns while maintaining an acceptable level of risk. (3) The "policy and policing" model, where the risk management function sets policies and monitors compliance, acting more as an oversight function.

The former 3LM was reviewed by the IIA in 2020.[30] They adopt a principles-based approach which emphasises the collaboration and communication across the lines to collectively pursue the achievement of business objectives (Turner, 2021). It has been renamed as *The Three Lines Model* to lessen the connotation of defence. It calls for a more flexible and integrated approach. It also recognises the role of the governing body in overseeing the organisation's risk management and control framework and its accountability to stakeholders for ensuring that appropriate structures and processes are in place for effective governance. Also, the importance of the role of the middle management is highlighted, affecting the way in which top management's expectations are translated into front-line employee behaviour.

It has been argued that the model can be strengthened by incorporating the principles[31] of quality management, risk management and the total quality approach (Luburic, 2017). Luburic assesses the synergies and complementarities of the different risk management standards with the model, applied to the operational risk management of central banks. The application of the principles generates a new way of thinking regarding governance which produces new behaviours and an enriched business, quality, and risk culture. One important conclusion is that most effective results are achieved when the role of the "process owner" and "risk owner" are merged into one person or team, leading to a higher involvement to more actively deal with risks.

5.5 Challenges and conceptual ideas to assess supervisory effectiveness

Rigorously assessing supervisory effectiveness has increased in importance with the shift towards risk-based supervision that was accompanied by an increased role of judgment in supervisory decision-making. BCBS (2015a) puts forward clarity about supervisory objectives, impact evaluation and accountability to key stakeholders as elements of an ongoing monitoring of supervisory effectiveness.

Despite the visible changes in supervisory culture and a growing sophistication of supervisory strategies in recent years, as well as the interest in improving further on that front, the academic evidence about the direct impact of supervisory culture and top-down strategies on the effectiveness of banking supervision is much scarcer than in other areas that we have examined. This also contrasts with a growing empirical literature assessing the impact of supervision on banks (Hirtle et al., 2020).

Two different purposes for measuring effectiveness differ in their respective stakeholders and measurement approach (Sijbrand and Rijsbergen, 2013). One purpose is to measure progress because of the accountability of a supervisor to the public and the government or to legislative bodies. For this purpose, which typically involves public disclosure, there exist two challenges: first, the legal question of whether supervisors are allowed to report an outcome of their intervention given their statutory duty of confidentiality. Second, whether supervisory disclosure could ex post adversely impact public confidence in the affected institution. For this purpose, measures of the ultimate objective of supervision, namely the safety and soundness of the banks are appropriate. Supervisors in practice apply a broad portfolio of indicators to assess the effectiveness of prudential supervision in this context. Examples of indicators are supervisory rating systems, the outcome of external or international peer reviews or the outcome of stakeholder surveys (BCBS, 2015a).

A different purpose characterised by a more internal focus is for the supervisor to reallocate resources internally and learn how the effectiveness of future supervisory activities can be enhanced. In this case, the measurement approach needs to be more granular since the impact of a single supervisory activity is less likely to be captured by an indicator of the overall bank risk.

While the importance of assessing supervisory effectiveness is evident, this assessment remains a challenging task. The reasons are explained in the following. The causal link between the supervisory

30 With a later update in 2024 to reflect the new Global Internal Audit Standards glossary.

31 See ISO 9000, 9004, ISO 31000.

activity and the impact on the bank plays a critical role in any effectiveness assessment because it is often weakened by factors that are beyond the control of the supervisor:

- A first example of such a factor is the continuous evolution of the financial and economic environment in which the bank operates, which may either facilitate or impede the remediation of the observed deficiencies and the impact of which may be similarly difficult to isolate and quantify. If the objective is, for example, to reduce the NPL volume, economic growth will affect the success of remediation actions because of the impact of economic growth on asset quality.
- A common approach to control for exogenous factors is counterfactual analysis. However, it is not straightforward to apply in this context (Hilbers et al., 2013). The reason is that it is often difficult or not possible to cleanly separate the treatment group from the control group. Even if a supervisor applies a specific measure only to a subset of banks, other institutions become aware and may also change their behaviour accordingly in order to avoid receiving the same treatment in the future.
- Another challenge for the assessment of effective supervision is the time lag between the identification and the remediation of an identified shortcoming that is also bank-specific; addressing the underlying deficiency may compete with other identified shortcomings that need to be urgently addressed, leading to competition for the required resources in the bank. In addition, the remediation may have short-term effects such as higher costs or higher provisions that have a negative impact on profitability or other regulatory ratios whereas in the long term, positive effects emerge.
- A move towards risk-based supervision also increases the role of supervisory judgment that is needed to tailor the supervisory work to the risk profile of a specific bank. This makes it more difficult to assess a supervisory response since it limits the usefulness of peer group analyses, benchmarking or assessments of how a specific methodology is applied. An outcome-based (rather than output-based) assessment of effectiveness may therefore be more promising.
- It stands to reason that a manager, in the spirit of Goodhart's law, could behave strategically and the value of an *ex ante* defined quantitative outcome measure may (partially) lose its information value if his or her success is assessed only by this measure. In other words, if the quantitative outcome measure is the main criterion of success, the manager would be incentivised to focus narrowly on optimising its value even if this is done in ways that are no longer supportive to the associated original objective. In addition, supervisors may also behave strategically, and wrong incentives could lead to biased outcomes in particular if the indicators used to assess his or her own effectiveness depend on supervisory judgment.

The challenges mentioned above notwithstanding, assessing the effectiveness of financial supervision is vital for meeting accountability obligations and enhancing supervisory practices. Hilbers et al. (2013) build on Mayne (2001), who proposes "contribution analysis" which is a methodology to assess the extent to which a policy has been effective, especially in cases where experimental designs are not available and factors outside the control of supervisors may be causing the observed outcomes. Hilbers et al. (2013) offer four key suggestions (or "lessons") for convincingly measuring supervision effects:

i. Firstly, supervisors should define specific objectives and measure them at a micro level, translating their goals into SMART criteria (specific, measurable, attainable, relevant and time-bound) to facilitate effective measurement. By reducing abstraction and focusing on concrete supervisory actions and measurable bank-level outcomes (e.g., on-site inspections and bank governance structure, respectively), supervisors can establish more plausible causal links than if they try to assess the extent to which they contribute to the broader and less quantifiable goal of financial stability.

ii. Secondly, developing a plausible theory of change and contribution story is essential. This involves creating a logical framework that outlines how supervisors expect to achieve their desired outcomes by mobilising resources and generating output in terms of actions or interventions. The theory needs to also include alternative explanations for the observed outcomes. Tools like results chains or logic charts are part of contribution analysis, which helps supervisors construct credible narratives linking their actions to observed results, differentiating their impact from that of alternative factors.

iii. Thirdly, constructing a portfolio of performance indicators is recommended over relying on a single metric. A varied set of indicators provides a comprehensive evaluation of effectiveness and efficiency, incorporating diverse perspectives, reducing sensitivity to outliers, and providing what Mayne (2001) calls "multiple lines of evidence". Hilbers et al. (2013) categorise indicators into "hard" (quantitative) and "soft" (qualitative) types, and differentiate among those suitable for strategic, tactical and operational analysis. Hard indicators, such as market-based data like credit ratings and solvency ratios, provide objective and verifiable data. Soft indicators, including public confidence surveys and compliance assessments, focus on qualitative aspects. Both types of indicators have their merits, with hard indicators offering objectivity and ease of monitoring, while soft indicators capture qualitative, forward-looking supervision aspects. Together, they provide a comprehensive framework for evaluating financial supervision effectiveness.[32] Hilbers et al. (2013) further suggest that indicators should cover the various aspects of the contribution story (input, output and outcome) so that effectiveness can be confirmed or, if not, the breaking point of a failed action is identified.

iv. Lastly, Hilbers et al. (2013) argue that the use of alternative research designs, including qualitative analyses like case studies, can enhance the plausibility of causal relationships. This suggestion generalises a common practice among empirical academic studies: most publications rely on multiple econometric specifications and conduct a range of robustness checks to alleviate the risks posed by model uncertainty and sample selection.

Although the conceptual ideas above can provide useful guidance how effectiveness can be assessed in a rigorous manner, the questions which role expert judgment should play and which indicators or metrics should be used are still underexplored in the academic literature and merit further research.

6. Suggestions of areas of future research on supervisory effectiveness

Without claiming to be complete, the list below comprises six areas that appear as promising for further research to enhance our understanding of supervisory effectiveness. These areas were selected because the respective existing literature is scarce or fragmentary considering the policy importance of the area.

1. ***Benefits and risks of suptech tools to enhance supervisory effectiveness***, in particular how they can strengthen supervisory effectiveness going beyond freeing resources by making existing tasks more efficient. Research would be beneficial of course also on the challenges or risks posed by the use of suptech that could adversely impact effectiveness and how they can be mitigated. Another relevant question, for example, is how suptech can promote effectiveness by facilitating a cultural shift towards risk-based supervision.

2. ***Contribution of supervisory activities (on-site inspections, stress tests, horizontal reviews) to supervisory effectiveness.*** Although more work exists on the impact of certain supervisory activities (for example, on-site inspections or stress tests) than in other research areas in this list, further work appears warranted considering the dynamic change in the way these activities have been applied over time and across regions and also that existing analyses are more concentrated on certain tools (for example, stress tests) but scarcely available for others, for example for horizontal reviews and benchmarking.

[32] We would argue that the use of a portfolio of indicators is also a pragmatic way to alleviate concerns related to the potential issue of strategic behaviour highlighted above.

3. ***Performance of early warning tools*****:** Rigorous comparisons of existing early warning tools are scarce, in particular, regarding the emergence of advanced technologies like AI and also how market data-based tools should be most efficiently used alongside and to complement examiner data and information. This field of research could also benefit from new developments, both in terms of applied advanced technologies but also in considering new, emerging risk factors. The research conducted on the role of the exposure to social media in the case of the SVB failure can serve as a relevant example going into this direction (Cookson et al., 2023).

4. ***Intersectoral assessments of benefits from cross-border cooperation***: Cross-border cooperation is not restricted to the banking sector but has also been explored, for example for securities regulators with respect to increased enforcement and increased liquidity. It stands to reason that a relevant research question is about the read-across from other sectors and which lessons carry over to bank supervision.

5. ***Supervisory governance and culture, including supervisory risk appetite and incentives*****:** While the importance of governance and culture in supervised institutions is a well-understood lesson from past bank failures, their application in supervisory authorities appears limited and has not entered the realm of academic research. Issues with supervisory incentives can play a role when supervisors are motivated in their decision-making by concerns that distract them from taking the optimal decision regarding the safety and soundness of the banking sector as the only ultimate objective in mind. The question if a revolving door policy can cause supervisory capture is a case in point even if in this regard the limited existing literature found little evidence for concern regarding this aspect (see Section 5 and also Hirtle and Kovner, 2022).

6. ***Methodologies to assess supervisory effectiveness***: While there is some literature on supervisory accountability towards the public, virtually no literature has been found that explores the measurement of effectiveness from a supervisory perspective, in particular on the granular level of effectiveness of specific supervisory activities.

References

Abreu, J. F. and Gulamhussen, M. G. (2013). 'Dividend payouts: Evidence from US bank holding companies in the context of the financial crisis', *Journal of Corporate Finance*, 22, pp. 54–65. doi: 10.1016/j.jcorpfin.2013.04.001.

Acharya, V. V., Berger, A. N. and Roman, R. A. (2018). 'Lending implications of US bank stress tests: Costs or benefits?', *Journal of Financial Intermediation*, 34, pp. 58–90. doi: 10.1016/j.jfi.2018.01.004.

Acharya, V. (2003). 'Is the international convergence of capital adequacy regulation desirable?' *Journal of Finance*, 58(6), pp. 2745–2781. doi: 10.1046/j.1540-6261.2003.00621.x.

Acharya, V., Engle, R. and Richardson, M. (2012). 'Capital shortfall: A new approach to ranking and regulating systemic risks', *American Economic Review*, 102(3), pp. 59–64. doi: 10.1257/aer.102.3.59.

Acharya, V., Engle, R. and Pierret, D. (2014). 'Testing macroprudential stress tests: The risk of regulatory risk weights', *Journal of Monetary Economics*, 65, pp. 36–53. doi: 10.1016/j.jmoneco.2014.04.014.

Admati, A. and Hellwig, M. (2024). The bankers' new clothes: What's wrong with banking and what to do about it. Princeton: Princeton University Press.

Adrian, T., Moretti, M., Carvalho, A., Chon, H. K., Seal, K., Melo, F. and Surti, J. (2023). *Good supervision: Lessons from the field*. IMF working paper no. 2023/81. Available at: ideas.repec.org/p/imf/imfwpa/2023-181.html.

Alford, D. (2010). *Supervisory colleges: The global financial crisis and improving international supervisory coordination*. Emory International Law Review, 24, pp. 57–82. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=1545291.

Allen, F., Bernardo, A. E. and Welch, I. (2000). A theory of dividends based on tax clienteles. *Journal of Finance*, Vol. 55, No. 6 (Dec., 2000), pp. 2499–2536.

Allen, F., Carletti, E., Gray, J. and Gulati, M. (eds.) (2017). The changing geography of finance and regulation in Europe. ISBN: 978-92-9084-545-4. Florence: European University Institute; London: Brevan Howard Centre at Imperial College; Milan: Baffi Carefin, Bocconi University. Florence School of Banking & Finance (FBF). Available at: hdl.handle.net/1814/47745.

Andrade, G. (2021). *A risk appetite framework in central banking – some thoughts*. Presentation given on 18 March 2021. Available at: www.bportugal.pt/sites/default/files/anexos/documentos-relacionados/a_risk_appetite_framework_in_central_banking.pdf.

Anginer, D., Bertay, A. C., Cull, R., Demirgüç-Kunt, A. and Mare, D. S. (2019). *Bank regulation and supervision ten years after the global financial crisis.* World Bank Policy Research working paper 9044. Available at: documents1.worldbank.org/curated/en/685851571160819618/pdf/Bank-Regulation-and-Supervision-Ten-Years-after-the-Global-Financial-Crisis.pdf.

Armour, J. (2015). 'Making bank resolution credible', in Moloney, N., Ferran, E. and Payne, J. (eds.), *The Oxford Handbook of Financial Regulation*. doi: 10.1093/oxfordhb/9780199687206.013.18.

Arnone, M., Darbar, S. M. and Gambini, A. (2007). *Banking supervision: Quality and governance*. IMF working paper no. 2007/82. Available at: www.imf.org/en/Publications/WP/Issues/2016/12/31/Banking-Supervision-Quality-and-Governance-20611.

Baker McKenzie (2019). *Bitesize briefings: Individual accountability regimes – Driving improvements in culture*. Available at: www.bakermckenzie.com/-/media/files/insight/publications/2019/07/fsr-bitesize-article.pdf?la=en.

Balan, M., Restoy, F. and Zamil, R. (2025). Act early or pay later: therole of qualitative measures in effective supervisory frameworks. FSI Insights, No. 66. Available at: www.bis.org/fsi/publ/insights66.htm.

Bank of England (2023). *Review of the Senior Managers and Certification Regime*. Discussion Paper 1/23. Available at: www.bankofengland.co.uk/prudential-regulation/publication/2023/march/review-of-the-senior-managers-and-certification-regime.

Barth, J., Caprio, G. and Levine, R. (2001). *The regulation and supervision of banks around the world: A new database*. World Bank Policy Research Paper 2588. Available at: documents.worldbank.org/curated/en/981551468739510139/The-regulation-and-supervision-of-banks-around-the-world-a-new-database.

Basel Committee on Banking Supervision (BCBS) (2001). *Pillar 3 (Market Discipline)*. Available at: www.bis.org/publ/bcbsca10.pdf.

Basel Committee on Banking Supervision (BCBS) (2004). *Bank failures in mature economies*. Available at: www.bis.org/publ/bcbs_wp13.pdf.

Basel Committee on Banking Supervision (BCBS) (2015a). *Report on the impact and accountability of banking supervision.* Available at: www.bis.org/bcbs/publ/d326.htm.

Basel Committee on Banking Supervision (BCBS) (2015b). *Corporate governance principles for banks.* Available at: www.bis.org/bcbs/publ/d328.pdf.

Basel Committee on Banking Supervision (BCBS) (2017). *Supervisory and bank stress testing: range of practices*. Available at: www.bis.org/bcbs/publ/d427.htm.

Basel Committee on Banking Supervision (BCBS) (2018). *Frameworks for early supervisory intervention*. Available at: www.bis.org/bcbs/publ/d439.htm.

Basel Committee on Banking Supervision (BCBS) (2020). *Basel III monitoring report*. Available at: www.bis.org/bcbs/publ/d570.htm.

Basel Committee on Banking Supervision (BCBS) (2023). *Report on the 2023 banking turmoil.* Available at: www.bis.org/bcbs/publ/d555.htm.

Basel Committee on Banking Supervision (BCBS) (2024). *Core principles for effective banking supervision*. Available at: www.bis.org/publ/bcbs230.htm.

Beck, T. (2016). 'Regulatory cooperation on cross-border banking–progress and challenges after the crisis', *National Institute Economic Review,* 235(1), pp. 40–49. doi: 10.1177/002795011623500114.

Beck, T., Silva-Buston, C. and Wagner, W. (2023). 'The economics of supranational bank supervision', *Journal of Financial and Quantitative Analysis*, 58(1), pp. 324–351. doi: 10.1017/S0022109022000588.

Beerman, K., Prenio, J. and Zamil, R. (2021). *SupTech tools for prudential supervision and their use during the pandemic*. FSI Insights, No. 37. Available at: www.bis.org/fsi/publ/insights37.htm.

Belloni, M., Grodzicki, M. and Jarmuzek, M. (2023). *Why European banks adjust their dividend payouts?* ECB working paper, No. 2765. Available at: www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2765~f1fdc64a14.en.pdf?9fb82237eb57881daf6df09218b01efc.

Benczur, P., Cannas, G., Cariboni, J., Di Girolamo, F., Maccaferri, S. and Giudici, M. P. (2017). 'Evaluating the effectiveness of the new EU bank regulatory framework: A farewell to bail-out?', *Journal of Financial Stability,* 33, pp. 207–223. doi: 10.1016/j.jfs.2016.03.001.

Berger, A. N., Davies, S. M. and Flannery, M. J. (2000). 'Comparing market and supervisory assessments of bank performance: Who knows what when?', *Journal of Money, Credit and Banking*, 32(3), pp. 641–667. doi: 10.2307/2601200.

Berger, A. N., Cai, J., Roman, R. and Sedunov, J. (2022). 'Supervisory enforcement actions against banks and systemic risk', *Journal of Banking and Finance*, 140, 106222. doi: 10.1016/j.jbankfin.2021.106222.

Berger, A. and Davies, S. (1998). 'The information content of bank examinations', *Journal of Financial Services Research*, 14(2), pp. 117-144. doi: 10.1023/A:1008011312729.

Bermpei, T., Kalyvas, A. and Nguyen, T. C. (2018). 'Does institutional quality condition the effect of bank regulations and supervision on bank stability? Evidence from emerging and developing economies', *International Review of Financial Analysis*, 59, pp. 255–275. doi: 10.1016/j.irfa.2018.06.002.

Boeddu, G. L., Newbury, L. B., Kachingwe, N. L., De Souza Neves Lopes, L. and Randall, D. (2018). *From spreadsheets to SupTech: Technology solutions for market conduct supervision*. World Bank Report 127577. Available at: documents.worldbank.org/en/publication/documents-reports/documentdetail/612021529953613035/from-spreadsheets-to-suptech-technology-solutions-for-market-conduct-supervision.

Bolzico, J., Mascaro, Y. and Granata, P. (2007). *Practical guidelines for effective bank resolution*. World Bank Policy Research working paper, No. 4389. Available at: documents1.worldbank.org/curated/en/454181468269686072/pdf/wps4389.pdf.

Bonfim, D., Cerqueiro, G. Degryse, H. and Ongena, S. (2023). 'On-site inspecting zombie lending', *Management Science*, 69(5), pp. 2547–3155. doi: 10.1287/mnsc.2022.4452.

Borio, C., Drehmann, M. and Tsatsaronis, K. (2013). 'Stress testing macro stress testing: Does it live up to expectations?' *Journal of Financial Stability*, 12, pp. 2–15. doi: 10.1016/j.jfs.2013.06.001.

Boudriga, A., Boulila Taktak, N. and Jellouli, S. (2009). 'Banking supervision and nonperforming loans: A cross-country analysis', *Journal of Financial Economic Policy*, 1(4), pp. 286–318. doi: 10.1108/17576380911050043.

Bowman, M. *Testimony* [Speech transcript]. Nomination hearing before the Committee on Banking, Housing, and Urban Affairs, US Senate. Washington, D.C. 10 April 2025. Available at: www.federalreserve.gov/newsevents/testimony/bowman20250410a.htm.

Bräuning, F. and Fillat, J. L. (2024). The impact of regulatory stress tests on banks' portfolio similarity and implications for systemic risk. Journal of Money, Credit and Banking. doi: 10.1111/jmcb.13239

Buch, C. (2024). *Current challenges in supervision – new challenges for researchers* [Speech transcript]. Keynote speech at the 2024 Annual ECB Banking Supervision Research Conference. Frankfurt am Main. 11 June 2024. Available at: www.bankingsupervision.europa.eu/press/speeches/date/2024/html/ssm.sp240611~a153d00f3a.en.html.

Caiazza, S., Cotugno, M., Fiordelisi, F. and Stefanelli, V. (2018). 'The spillover effect of enforcement actions on bank risk-taking', *Journal of Banking and Finance*, 91, pp. 146–159. doi: 10.1016/j.jbankfin.2018.04.008.

Calem, P., Correa, R. and Lee, S. J. (2020). 'Prudential policies and their impact on credit in the United States', *Journal of Financial Intermediation*, 42, 100826. doi: 10.1016/j.jfi.2019.04.002.

Calomiris, C. and Jaremski, M. (2016). 'Deposit insurance: Theories and facts', *Annual Review of Financial Economics*, 8, pp. 97–120. Available at: www.jstor.org/stable/26774070.

Carretta, A., Farina, V., Fiordelisi, F., Schwizer, P. and Stentella Lopes, F.S. (2015). 'Don't stand so close to me: The role of supervisory style in banking stability', *Journal of Banking and Finance*, 52, pp. 180–188. doi: 10.1016/j.jbankfin.2014.09.015.

Carstens, A. (2024). *Strong together: the benefits of international cooperation* [Speech transcript]. Dinner speech at the joint European Banking Authority and European Central Bank international conference. Frankfurt am Main. 3 September 2024. Available at: www.bis.org/speeches/sp240903.htm.

Central Bank of Ireland (2014). *Risk appetite – a discussion paper*. Available at: www.centralbank.ie/docs/default-source/publications/discussion-papers/discussion-paper-4/risk-appetite-paper.pdf?sfvrsn=5715d81d_2.

Christensen, H. B., Hail, L. and Leuz, C. (2016). 'Capital-market effects of securities regulation: Prior conditions, implementation, and enforcement', *The Review of Financial Studies*, 29(11), pp. 2885–2924. doi: 10.1093/rfs/hhw055.

Citterio, A. (2024). 'Bank failure prediction models: Review and outlook', *Socio-Economic Planning Sciences* 92, 10818. doi: 10.1016/j.seps.2024.101818.

Cole, R. A. and Gunther, J. W. (1998). 'Predicting bank failures: A comparison of on- and off-site monitoring systems', *Journal of Financial Services Research*, 13(2), 103–117. doi: 10.1023/A:1007954718966.

Conyon, M., Judge, W. Q. and Useem, M. (2011). 'Corporate Governance and the 2008–09 Financial Crisis', *Corporate Governance: An International Review*, 19(5), pp. 399-404. doi: 10.1111/j.1467-8683.2011.00879.x.

Cookson, J. A., Fox, C., Gil-Bazo, J., Imbet, J. F. and Schiller, C. (2023). *Social media as a bank run catalyst*. SSRN working paper. Available at: www.fdic.gov/system/files/2024-07/cookson-paper.pdf.

Cortés, K.R., Demyanyk, Y., Li, L., Loutskina, E. and Strahan, P. E. (2020), 'Stress tests and small business lending', *Journal of Financial Economics*, 136(1), pp. 260–279. doi: 10.1016/j.jfineco.2019.08.008.

Covas, F. (2018). *Capital requirements in supervisory stress tests and their adverse impact on small business lending*. The Clearing House, Staff working paper 2017-2. Available at: ssrn.com/abstract=3071917.

Cowhey, M., Lee, S. J., Popeck Spiller, T. and Vojtech, C. M. (2022). *Sentiment in bank examination reports and bank outcomes*. FRB, Finance and Economics Discussion Series (FEDS) 2022-077. doi: 10.17016/feds.2022.077.

Crisanto, J. C, Prenio J., Singh M. and Yong J. (2022). *Emerging sound practices on supervisory capacity development*. FSI Insights, No. 46. Available at: www.bis.org/fsi/publ/insights46.pdf.

Cucic, D., Iyer, R., Kokas, S., Peydró, J. L. and Pica, S. (2024). *Distortive effects of deposit insurance: Administrative evidence from deposit and loan accounts*. Preliminary draft presented at the 11–12 June 2024 SSM Banking Supervision Research Conference.

Curry, T. J. (2016). *Remarks* [Speech transcript]. Speech at Annual Washington Conference of the Institute of International Bankers. Washington, DC. 7 March 2016. Available at: www.occ.treas.gov/news-issuances/speeches/2016/pub-speech-2016-25.pdf.

Curti, F., Migueis, M. and Stewart, R. (2020). 'Benchmarking operational risk stress testing models', *Journal of Operational Risk,* 15(2), pp. 27–42. doi: 10.21314/JOP.2020.239.

Dahlgren, S., Himino, R., Restoy, F. and Rogers, C. (2023). 'Assessment of the European Central Bank's Supervisory Review and Evaluation Process. Report by the expert group to the chair of the supervisory board of the ECB'. Available at: www.bankingsupervision.europa.eu/ecb/pub/pdf/annex/ssm.pr230417_annex.en.pdf.

dal Bó, E. (2006). 'Regulatory capture: A review', *Oxford Review of Economic Policy*, 22, pp. 203–225. doi: 10.1093/oxrep/grj013.

Davies, H. and Zhivitskaya, M. (2018). 'Three lines of defence: A robust organising framework, or just lines in the sand?', *Global Policy*, 9(S1), pp. 34–42. doi: 10.1111/1758-5899.12568.

Davis, E. P. and Obasi, U. (2009). *The effectiveness of banking supervision*. Brunel University Economics and Finance working paper, No. 09-27. Available at: bura.brunel.ac.uk/handle/2438/5122.

Dautovic, E., Gambacorta, L. and Reghezza, A. (2023). *Supervisory policy stimulus: evidence from the euro area dividend recommendation.* ECB working paper, No. 2796. Available at: www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2796~9d1860e15e.en.pdf.

de Larosière, J. (2009). *The high-level group on financial supervision in the EU*. Available at: ec.europa.eu/economy_finance/publications/pages/publication14527_en.pdf.

De Jonghe, O., Dewachter, H. and Ongena, S. (2020). 'Bank capital (requirements) and credit supply: Evidence from pillar 2 decisions', *Journal of Corporate Finance*, 60, 101518. doi: 10.1016/j.jcorpfin.2019.101518.

de-Ramon, S. J. A., Francis, W. B. and Harris, Q. (2022). 'Bank-specific capital requirements and capital management from 1989–2013: Further evidence from the UK', *Journal of Banking and Finance*, 138, 106189. doi: 10.1016/j.jbankfin.2021.106189.

De Vincenzo, A., Freni, M. A., Generale, A., Nicoletti Altimari, S. and Quagliariello, M. (2010). *Lessons learned from the financial crisis for financial stability and banking supervision*. Bank of Italy Occasional Paper, No. 76. Available at: www.bancaditalia.it/pubblicazioni/qef/2010-0076/QEF_76.pdf?language_id=1.

Degryse, H., Huylebroek, C. and Van Doornik, B. (2025). *The disciplining effect of banking supervision: Evidence from SupTech*. Banco Central do Brasil Working Paper No 617. Available at: www.bcb.gov.br/content/publicacoes/WorkingPaperSeries/WP617v2.pdf.

Degryse, H., Karapetyan, A. and Karmakar, S. (2021). 'To ask or not to ask? Bank capital requirements and loan collateralization', *Journal of Financial Economics*, 142(1), pp. 239–260. doi: 10.1016/j.jfineco.2021.05.017.

Delis, M. D. and Staikouras, P. K. (2011). 'Supervisory effectiveness and bank risk', *Review of Finance*, 15(3), pp. 511–543. doi: 10.1093/rof/rfq035.

Delis, M. D., Staikouras, P. K. and Tsoumas, C. (2016). 'Formal enforcement actions and bank behaviour', *Management Science* 63(4), pp. 959–987. doi: 10.1287/mnsc.2015.2343.

Demirgüç-Kunt, A. and Huizinga, H. (2004). 'Market discipline and deposit insurance', *Journal of Monetary Economics*, 51(2), pp. 375–399. doi: 10.1016/j.jmoneco.2003.04.001.

Demirgüç-Kunt, A., Kane, E. and Laeven, L. (2015). 'Deposit insurance around the world: A comprehensive analysis and database', *Journal of Financial Stability*, 20, pp. 155–183. doi: 10.1016/j.jfs.2015.08.005.

Deyoung, R., Flannery, M. J., Lang, W. W. and Sorescu, S. M. (2001). 'The information content of bank exam ratings and subordinated debt prices', *Journal of Money, Credit and Banking*, 33(4), pp. 900–925. doi: 10.2307/2673928.

D'Hulster, K. (2011). *Cross border banking supervision: incentive conflicts in supervisory information sharing between home and host supervisors.* World Bank Policy Research working paper, No. 5871. Available at: documents.worldbank.org/en/publication/documents-reports/documentdetail/172321468325263744/cross-border-banking-supervision-incentive-conflicts-in-supervisory-information-sharing-between-home-and-host-supervisors.

Dordevic, L., Ferreira, C., Kitonga, M. and Seal, K. (2021). *Strengthening bank regulation and supervision: National progress and gaps.* IMF Departmental/Policy Papers 2021/005. Available at: www.elibrary.imf.org/view/journals/087/2021/005/article-A001-en.xml.

Doumpos, M., Gaganis, C. and Pasiouras, F. (2015). 'Central bank independence, financial supervision structure and bank soundness: An empirical analysis around the crisis', *Journal of Banking and Finance*, 61 Supplement 1, pp. S69–S83. doi: 10.1016/j.jbankfin.2015.04.017.

Duro, M., Heese, J. and Ormazabal, G. (2019). 'The effect of enforcement transparency: Evidence from SEC comment-letter reviews', *Review of Accounting Studies*, 24, pp. 780–823. doi: 10.1007/s11142-019-09503-1.

d'Udekem, B. (2021). 'Agency conflicts and dividend persistence'. *Journal of Financial Services Research* 60, pp. 207–234. doi: 10.1007/s10693-021-00348-x.

Eberly, J. C., Hanson, S. G., Steinsson, J., Tarullo, D. K. and Wessel, D. (2024). *What should regulators do about the risks to mid-sized banks?* Brookings Institution Podcast on Economic Activity. Available at: www.brookings.edu/articles/what-should-regulators-do-about-the-risks-to-mid-sized-banks/.

Eisenbach, T., Haughwout, A., Hirtle, B., Kovner, A., Lucca, D. and Plosser, M. (2017). *Supervising large, complex financial institutions: What do supervisors do?* Federal Reserve Bank of New York Economic Policy Review, 23(1), pp. 57–77. Available at: www.newyorkfed.org/medialibrary/media/research/epr/2017/

EPR_2017_what-do-supervisors-do_eisenbach.pdf?sc_lang=en&hash=D58BF257024AB0570BF756FA78AE67E2.

Eisenbach, T. M., Lucca, D. O. and Townsend, R. M. (2022). 'Resource allocation in bank supervision: Trade-offs and outcomes', *Journal of Finance*, 77(3), pp. 1685–1736. doi: 10.1111/jofi.13127.

Elderson, F. (2023). *Powers, ability and willingness to act – the mainstay of effective banking supervision* [Speech transcript]. Speech. Brussels. 7 December 2023. Available at: www.bankingsupervision.europa.eu/press/speeches/date/2023/html/ssm.sp231207~10204b8b70.en.html.

Enria, A. (2019). Jus*t a few bad apples? The importance of culture and governance for good banking* [Speech transcript]. Speech at Conference of the Federation of International Banks. Dublin. 20 June 2019. Available at: www.bankingsupervision.europa.eu/press/speeches/date/2019/html/ssm.sp190620~f9149fe258.en.html.

Enria, A. (2023). *Exogenous shocks and endogenous challenges: Five years of European banking supervision (and beyond)* [Speech transcript]. Speech at the London School of Economics, Financial Markets Group. London. 30 October 2023. Available at: www.bankingsupervision.europa.eu/press/speeches/date/2023/html/ssm.sp231030~5bda5cf516.en.html.

Enriques, L. and Hertig, G. (2011). 'Improving the governance of financial supervisors', *European Business Organization Law Review*, 12(3), pp. 357-378. doi: 10.1017/S1566752911300018.

European Banking Authority (EBA) (2015). *Report on the 2015 EU-wide transparency exercise*. Available at: www.eba.europa.eu/risk-and-data-analysis/risk-analysis/eu-wide-transparency-exercise/2015-eu-wide-transparency.

European Banking Authority (EBA) (2017). *EBA publishes its standardised data templates as a step to reduce NPLs*. Available at: www.eba.europa.eu/publications-and-media/press-releases/eba-publishes-its-standardised-data-templates-step-reduce.

European Banking Authority (EBA) (2020a). *Report on the benchmarking of national loan enforcement frameworks*. EBA/Rep/2020/29. Available at: www.eba.europa.eu/publications-and-media/press-releases/eba-publishes-report-benchmarking-national-insolvency.

European Banking Authority (EBA) (2020b). *Report on big data and advanced analytics*. EBA/REP/2020/01. Available at: www.eba.europa.eu/sites/default/files/document_library/Final%20Report%20on%20Big%20Data%20and%20Advanced%20Analytics.pdf.

European Banking Authority (EBA) (2024). *Report on the 2023 credit risk benchmarking exercise – results on the analysis of the variability of own funds requirements based on the IRB approach*. EBA/REP/2024/05. Available at: www.eba.europa.eu/publications-and-media/press-releases/eba-publishes-annual-assessment-banks-internal-approaches-calculation-capital-requirements.

European Central Bank (ECB) (2024a). *ECB Banking Supervision: SSM supervisory priorities for 2024–2026*. Available at: www.bankingsupervision.europa.eu/banking/priorities/html/ssm.supervisory_priorities202312~a15d5d36ab.en.html.

European Central Bank (ECB) (2024b). *Guide on effective risk data aggregation and risk reporting*. Available at: www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.supervisory_guides240503_riskreporting.en.pdf.

European Central Bank (ECB) (2024c). *ECB annual report on supervisory activities*. Available at: www.bankingsupervision.europa.eu/press/publications/annual-report/html/ssm.ar2023~2def923d71.en.html.

European Commission (EC) (2023). Report from the Commission to the European Parliament and the Council on the Single Supervisory Mechanism established pursuant to Regulation (EU) No 1024/2013. Available at: eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0212#:~:text=The%20review%20leads%20the%20Commission,for%20economic%20and%20financial%20crises.

European Court of Auditors (ECA) (2023). *EU supervision of banks' credit risk*. Special Report 12-2023. Available at: www.eca.europa.eu/ECAPublications/SR-2023-12/SR-2023-12_EN.pdf.

Fahlenbrach, R., Prilmeier, R. and Stulz, R. M. (2012). 'This time is the same: Using bank performance in 1998 to explain bank performance during the recent financial crisis', *Journal of Finance*, 68 (6), pp. 2139-2185. doi: 10.1111/j.1540-6261.2012.01783.x.

Federal Deposit Insurance Corporation (FDIC) (2023a). *FDIC's supervision of First Republic Bank.* Available at: www.fdic.gov/sites/default/files/2024-03/pr23073a.pdf.

Federal Deposit Insurance Corporation (FDIC) (2023b). *FDIC's supervision of Signature Bank.* Available at: www.fdic.gov/sites/default/files/2024-03/pr23033a.pdf.

Federal Reserve Board (FRB) (2023). *Review of the Federal Reserve's supervision and regulation of Silicon Valley Bank.* Available at: www.federalreserve.gov/publications/files/svb-review-20230428.pdf.

Fernandes, M., Igan, D. and Pinheiro, M. (2020). 'March madness in Wall Street: (What) does the market learn from stress tests?', *Journal of Banking & Finance*, 112, 105250. doi: 10.1016/j.jbankfin.2017.11.005.

Federal Financial Institutions Examination Council (FFIEC) (2025). Reports of Condition and Income (Call Reports). Data from 2022, quarter 4.

Fiechter, J. L. and Zamorski, M. J. (2016). 'Improving the effectiveness of bank supervision', *SEACEN Financial Stability Journal,* 6, pp. 21–35. Available at: www.seacen.org/products/702002-100397-PDF.pdf.

Financial Conduct Authority (FCA) and Prudential Regulation Authority (PRA) (2015). *The failure of HBOS plc (HBOS).* Available at: www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/hbos-complete-report.pdf.

Financial Conduct Authority (FCA) (2003). *Building a framework for operational risk management: The FSA's Observations.* Available at www.handbook.fca.org.uk/archive/2003/08/PS142_2.pdf.

Financial Stability Board (FSB) (2013a). *Thematic review on risk governance*. Available at: www.fsb.org/2013/02/r_130212/.

Financial Stability Board (FSB) (2013b). *Principles for an effective risk appetite framework*. Available at: www.fsb.org/uploads/r_131118.pdf.

Financial Stability Board (FSB) (2015). *Thematic review on supervisory frameworks and approaches for SIBs – Peer review report*. Available at: www.fsb.org/uploads/Thematic-Review-on-Supervisory-Approaches-to-SIBs.pdf.

Financial Stability Board (FSB) (2020). *The use of supervisory and regulatory technology by authorities and regulated institutions: Market developments and financial stability implications.* Available at: www.fsb.org/uploads/P091020.pdf.

Financial Stability Board (FSB) (2023). *2023 bank failures: Preliminary lessons learnt for resolution.* Available at: www.fsb.org/uploads/P101023.pdf.

Flannery, M. J. (1998). 'Using market information in prudential bank supervision: A review of the U.S. empirical evidence', *Journal of Money, Credit and Banking*, 30(3) part 1, pp. 273–305. doi: 10.2307/2601102.

Gambacorta, L., Oliviero, T. and Shin, H. S. (2020). *Low price-to-book ratios and bank dividend payout policies*. BIS working paper, No. 907. Available at: www.bis.org/publ/work907.pdf.

Government Accountability Office (GAO) (2023). *Preliminary review of agency actions related to March 2023 bank failures.* Available at: www.gao.gov/assets/gao-23-106834.pdf.

Garcia, G. G. (2009). 'Ignoring the lessons for effective prudential supervision, failed bank resolution and depositor protection', *Journal of Financial Regulation and Compliance*, 17(3), pp. 186–209. doi: 10.1108/13581980910972205.

Garrido, J., Bergthaler, W., DeLong, C., Johnson, J., Rasekh, A., Rosha, A. and Stetsenko, N. (2019). *The use of data in assessing and designing insolvency systems*. IMF working paper, WP/19/27. Available at: www.imf.org/en/Publications/WP/Issues/2019/02/04/The-Use-of-Data-in-Assessing-and-Designing-Insolvency-Systems-46549.

Gaul, L. and Jones, J. (2021). *CAMELS ratings and their information content*. Office of the Comptroller of Currency working paper, WP-2021-01. Available at: www.occ.gov/publications-and-resources/publications/economics/working-papers-banking-perf-reg/economic-working-camels-ratings.html.

Goldstein, I. and Sapra, H. (2014). Should banks' stress test results be disclosed? an analysis of the costs and benefits. Foundations and Trends in Finance, 8(1). pp. 1–54.

Gontarek, W. (2016). 'Risk governance of financial institutions: The growing importance of risk appetite and culture', *Journal of Risk Management in Financial Institutions*, 9(2), pp. 120–129. doi: 10.69554/VAMF6201.

Gopalan, Y. and Granja, J. (2024). *How (in)effective was bank supervision during the 2022 monetary tightening?* SSRN working paper. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=4588186.

Gorton, G. B., Grennan, J. and Zentefis, A. K. (2022). 'Corporate culture', *Annual Review of Financial Economics*, 14, pp. 535–561. doi: 10.1146/annurev-financial-092321-124541.

Gropp, R. and Vesala J. (2004). 'Deposit insurance, moral hazard, and market monitoring', *Review of Finance*, 8(4), pp. 571–602. doi: 10.1093/rof/8.4.571.

Gropp, R., Mosk, T., Ongena, S. and Wix, C. (2019). 'Banks response to higher capital requirements: Evidence from a quasi-natural experiment', *Review of Financial Studies*, 32(1), pp. 266–299. doi: 10.1093/rfs/hhy052.

Group of Thirty (G30) (2012). *Toward effective governance of financial institutions*, Group of Thirty, Washington, DC. Available at: group30.org/images/uploads/publications/G30_TowardEffectiveGovernance.pdf.

Group of Thirty (G30). (2024). *Bank failures and contagion: lender of last resort, liquidity, and risk management*. Special Report. Available at: group30.org/images/uploads/publications/G30_Lessons-23-Crisis_RPT_Final.pdf.

Gully, B. (2023). *What makes an effective prudential supervisor* [Speech transcript]. Speech to C. D Howe Institute. 14 November 2023. Available at: www.osfi-bsif.gc.ca/en/news/deputy-superintendent-ben-gully-speech-c-howe-institute-what-makes-effective-prudential-supervisor.

Gutierrez Girault, M. A. and Hwang, J. C. (2010). *Public credit registries as a tool for bank regulation and supervision*. World Bank Policy Research working paper, No. 5489. Available at: documents.worldbank.org/en/publication/documents-reports/documentdetail/934021468177872103/public-credit-registries-as-a-tool-for-bank-regulation-and-supervision.

Heider, F., Krahnen, J. P., Pelizzon, L., Schlegel, J. and Tröger, T. (2023). *European lessons from Silicon Valley Bank resolution: A plea for a comprehensive demand deposit protection scheme (CDDPS).* SAFE Policy Letter No. 98, Leibniz Institute for Financial Research. Available at: safe-frankfurt.de/policy-center/policy-publications/policy-publ-detailsview/publicationname/european-lessons-from-silicon-valley-bank-resolution-a-plea-for-a-comprehensive-demand-deposit-protection-scheme-cddps.html.

Hernández de Cos, P. (2024). *Building on 50 years of global cooperation* [Speech transcript]. Keynote speech at the 23rd International Conference of Banking Supervisors. Basel. 24 April 2024. Available at: www.bis.org/speeches/sp240424.htm.

Hilbers, P., Raaijmakers, K., Rijsbergen, D. and de Vries, F. (2013). *Measuring the effects of financial sector supervision*. DNB working paper, No. 388. Available at: www.dnb.nl/media/auoba4t1/working-paper-388.pdf.

Hirtle, B. and Lehnert, A. (2015). 'Supervisory stress tests', *Annual Review of Financial Economics*, 7, pp. 339-355, doi: 10.1146/annurev-financial-111914-042040.

Hirtle, B., Kovner, A. and Plosser, M. (2020). 'The impact of supervision on bank performance', *Journal of Finance*, 75(5), pp. 2765–2808. doi: 10.1111/jofi.12964.

Hirtle, B. and Kovner, A. (2022). 'Bank supervision', *Annual Review of Financial Economics*, 14, pp. 39-56. doi: 10.1146/annurev-financial-111620-022516.

Hsu, M. (2024). *Evolving bank supervision* [Speech transcript]. Remarks before the Joint European Banking Authority and European Central Bank International Conference. Frankfurt. 3 September 2024. Available at: occ.gov/news-issuances/speeches/2024/pub-speech-2024-95.pdf.

Hutton, A., Shu, S. and Zheng, X. (2022). 'Regulatory transparency and the alignment of private and public enforcement: Evidence from the public disclosure of SEC comment letters', *Journal of Financial Economics*, 145(1), pp. 297–321. doi: 10.1016/j.jfineco.2021.07.011.

Igan, D. O. and Lambert, T. (2019). *Bank lobbying: regulatory capture and beyond*. International Monetary Fund working paper 2019/171. Available at: www.imf.org/en/Publications/WP/Issues/2019/08/09/Bank-Lobbying-Regulatory-Capture-and-Beyond-45735.

Institute of Internal Auditors (IIA) (2013). *IIA position paper: The three lines of defense in effective risk management and control*. Available at: theiia.fi/wp-content/uploads/2017/01/pp-the-three-lines-of-defense-in-effective-risk-management-and-control.pdf.

Institute of Internal Auditors (IIA) (2024). *The IIA's three lines model: An update of the three lines of defense*. Available at: www.theiia.org/globalassets/documents/resources/the-iias-three-lines-model-an-update-of-the-three-lines-of-defense-july-2020/three-lines-model-updated-english.pdf.

International Monetary Fund (IMF) and the World Bank (2009). *An overview of the legal, institutional, and regulatory framework for bank insolvency*. Available at: www.imf.org/external/np/pp/eng/2009/041709.pdf.

Ioannidou, V. P. and Penas, M. F. (2010). 'Deposit insurance and bank risk-taking: Evidence from internal loan ratings', *Journal of Financial Intermediation*, 19(1), pp. 95–115. doi: 10.1016/j.jfi.2009.01.002.

Ivanov, I. T. and Wang, J. Z. (2024). 'Bank supervision and corporate credit supply', *Management Science*, 70(5), pp. 3338–3361. doi: 10.1287/mnsc.2023.4854.

Johnston, R. B. (2023). *Integrating microprudential supervision with macroprudential policy*. Toronto Centre notes. Available at: www.torontocentre.org/videos /Integrating_Microprudential_Supervision_with_Macroprudential_Policy_FINAL.pdf.

Jones, M. T., Hilbers, P. and Slack, G. (2004). *Stress testing financial systems: What to do when the governor calls*. IMF working paper, No. 04/127. Available at: www.imf.org/external/pubs/ft/wp/2004/wp04127.pdf.

Kane, E. J. (1992). 'The savings and loan insurance mess', *Society*, 29, pp. 4–10. doi: 10.1007/BF02695291.

Ke, K., Xu, W. and He, Y. (2024). 'Do regulatory penalties reduce risk-taking of banks?', *North American Journal of Economics and Finance*, 70, 102073. doi: 10.1016/j.najef.2023.102073.

Kelly, S. and Rose, J. (2025). *Rushing to judgement and the banking crisis of 2023*. Federal Reserve Bank of Chicago Working Paper, No. 2025-04. doi: 10.21033/wp-2025-04.

Khan, A. (2017). *Central bank legal frameworks in the aftermath of the Global Financial Crisis*. IMF working paper, 2017/101. Available at: www.imf.org/en/Publications/WP/Issues/2017/05/01/Central-Bank-Legal-Frameworks-in-the-Aftermath-of-the-Global-Financial-Crisis-44858.

Kirakul, S., Yong, J. and Zamil, R. (2021). *The accountability regime of banking supervisors: with great power comes great responsibility*. FSI Briefs, No. 14. Available at: www.bis.org/fsi/fsibriefs14.htm.

Klomp, J. and De Haan, J. (2015). 'Bank regulation and financial fragility in developing countries: Does bank structure matter?', *Review of Development Finance*, 5(2), pp. 82–90. doi: 10.1016/j.rdf.2015.11.001.

Kohn, D. and Liang, N. 2019. *Understanding the effects of the US stress tests*. Prepared for the Federal Reserve System Conference: Stress testing: A discussion and review. Available at: www.brookings.edu/articles/understanding-the-effects-of-the-u-s-stress-tests/.

Konietschke, P., Ongena S. and Ponte Marques, A. (2022). *Stress tests and capital requirement disclosures: do they impact banks' lending and risk-taking decisions?*. Swiss Finance Institute Research Paper, No. 60. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=4182633.

Kok, C., Müller, C., Ongena, S. and Pancaro, C. (2023). 'The disciplining effect of supervisory scrutiny in the EU-wide stress test', *Journal of Financial Intermediation*, 53, 101015. doi: 10.1016/j.jfi.2022.101015.

Laeven, L. and Valencia, F. (2020). 'Systemic banking crises database II'. *IMF Economic Review*, 68, pp. 307–361. doi: 10.1057/s41308–020-00107–3.

Lambert, T. (2018). 'Lobbying on regulatory enforcement actions: Evidence from U.S. commercial and savings banks', *Management Science*, 65 (6), pp. 2445–2945. doi: 10.1287/mnsc.2017.2895.

Lambert, C., Noth, F. and Schüwer, U. (2017). 'How do insured deposits affect bank risk? Evidence from the 2008 Emergency Economic Stabilization Act', *Journal of Financial Intermediation,* 29, pp. 81–102. doi: 10.1016/j.jfi.2015.07.001.

Lang, M., Maffett, M., Omartian, J. D. and Silvers, R. (2020). 'Regulatory cooperation and foreign portfolio investment,' *Journal of Financial Economics*, 138(1), pp. 138–158. doi: 10.1016/j.jfineco.2020.04.016.

Lim, I., Hagendorff, J. and Armitage S. (2019). 'Is the fox guarding the henhouse? Bankers in the Federal Reserve, bank leverage and risk-shifting', *Journal of Corporate Finance* 58, pp. 478–504. doi: 10.1016/j.jcorpfin.2019.04.012.

Lubberink, M. (2022). 'Max headroom: Discretionary capital buffers and bank risk'*, International Review of Financial Analysis,* 84, 102402. doi: 10.1016/j.irfa.2022.102402.

Luburic, R. (2017). 'Strengthening the three lines of defence in terms of more efficient operational risk management in central banks', *Journal of Central Banking Theory and Practice*, 6(1), pp. 29–53. doi: 10.1515/jcbtp-2017-0003%0A.

Lucca, D., Seru, A. and Trebbi, F. (2014). 'The revolving door and worker flows in banking regulation', *Journal of Monetary Economics*, 65, pp. 17–32. doi: 10.1016/j.jmoneco.2014.05.005.

Luu, H. N. and Vo, X. V. (2021). 'The impact of supervisory stress tests on bank ex-ante risk-taking behaviour: empirical evidence from a quasi-natural experiment', *International Review of Financial Analysis*, 75, 101586. doi: 10.1016/j.irfa.2020.101586.

Masciandaro, D., Pansini, R. V. and Quityn, M. (2011). *The economic crisis: Did financial supervision matter?*. IMF working paper, 11(261). doi: 10.5089/9781463924560.001.

Mayes, D. G. and Stremmel, H. (2014). *The effectiveness of capital adequacy measures in predicting bank distress.* SUERF Study 2014/1. Available at: www.econstor.eu/handle/10419/163510.

Mayne, J. (2001). 'Addressing attribution through contribution analysis: Using performance measures sensibly', *Canadian Journal of Program Evaluation*, 16(1), pp. 1–24. doi: 10.3138/cjpe.016.001.

Mayordomo, S., Moreno, A., Ongena, S. and Rodríguez-Moreno, M. (2021). 'Bank capital requirements, loan guarantees and firm performance', *Journal of Financial Intermediation*, 45, 100825. doi: 10.1016/j.jfi.2019.05.002.

McCaul, E. (2024). 'Risk data aggregation and risk reporting: ramping up supervisory effectiveness', ECB Supervision Blog, 15 March 2024. Available at: www.bankingsupervision.europa.eu/press/blog/2024/html/ssm.blog240315~aae1a39e84.en.html.

Mésonnier, J.-S. and Monks, A. (2015). 'Did the EBA capital exercise cause a credit crunch in the Euro area?', *International Journal of Central Banking*, 11(3), pp. 75–117. Available at: www.ijcb.org/journal/ijcb15q3a2.pdf.

Mishkin, F. S. (2001). 'Prudential supervision: Why is it important and what are the issues?', in Mishkin, F. (ed.) *Prudential supervision: What works and what doesn't.* Chicago: University of Chicago Press, pp. 1–10. doi: 10.7208/chicago/9780226531939.003.0001.

Montes, C. P., Artigas, C. T., Cristófoli, M. E. and San Segundo, N. L. (2018). 'The impact of the IRB approach on the risk weights of European banks', *Journal of Financial Stability*, 36, pp. 147–166. doi: 10.1016/j.jfs.2016.11.004.

Mourlon-Druol, E. (2015). ''Trust is good, control is better': The 1974 Herstatt Bank Crisis and its implications for international regulatory reform', *Business History*, 57(2), pp. 311–334. doi: 10.1080/00076791.2014.950956.

Nier, E. and Baumann, U. (2006). 'Market discipline, disclosure and moral hazard in banking', *Journal of Financial Intermediation*, 15(3), pp. 332–361. doi: 10.1016/j.jfi.2006.03.001.

Oet, M. V., Bianco, T., Gramlich, D. and Ong, S. J. (2013). 'SAFE: An early warning system for systemic banking risk', *Journal of Banking and Finance,* 37(11), pp. 4510–4533. doi: 10.1016/j.jbankfin.2013.02.016.

Oliveira, R., Walters, R. and Zamil, R. (2023). *When the music stops - holding bank executives accountable for misconduct.* FSI Insights, No. 48. Available at: www.bis.org/fsi/publ/insights48.htm.

Palmer, J. and Cerrutti, C. (2009). *Is there a need to rethink the supervisory process?* Washington, D.C.: World Bank Group. Available at: documents.worldbank.org/curated/en/552861468054544285/Is-there-a-need-to-rethink-the-supervisory-process.

Passalacqua, A., Angelini, P., Lotti, F. and Soggia, G. (2021). *The real effects of bank supervision: evidence from on-site bank inspections.* Bank of Italy, Temi di Discussione (working paper), No. 1349. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=3705558.

Pereira Pedro, C., Ramalho, J. S. and Vidigal da Silva, J. (2023). 'How to measure banking regulation and supervision', *Research in International Business and Finance*, 66. doi: 10.1016/j.ribaf.2023.102059.

Peek, J. and Rosengren, E. S. (1997). 'Will legislated early intervention prevent the next banking crisis?', *Southern Economic Journal*, 64(1), pp. 268–280. doi: 10.2307/1061051.

Pereira, J., Malafronte, I., Sorwar, G. and Nurullah, M. (2019). 'Enforcement actions, market movement and depositors' reaction: evidence from the US banking system', *Journal of Financial Services Research*, 55, pp. 143–165. doi: 10.1007/s10693-019-00313-9.

Petropoulos, A., Siakoulis, V., Stavroulakis, E. and Vlachogiannakis, N. E. (2020). 'Predicting bank insolvencies using machine learning techniques', *International Journal of Forecasting*, 36(3), pp. 1092–1113. doi: 10.1016/j.ijforecast.2019.11.005.

Plosser, C. I. (2014). *Simplicity, transparency, and market discipline in regulatory reform* [Speech transcript]. Speech at the 2014 Conference on "Enhancing Prudential Standards in Financial Regulations. Philadelphia. 8 April 2014. Available at: www.philadelphiafed.org/-/media/frbp/assets/institutional/speeches/plosser/2014/04-08-14-frbp.pdf.

Powell, J. (2023). [Press conference transcript]. Washington, DC. 22 March 2023. Available at: www.federalreserve.gov/mediacenter/files/FOMCpresconf20230322.pdf.

Prenio, J. (2024). *Peering through the hype – assessing SupTech tools' transition from experimentation to supervision.* FSI Insights, No. 58. Available at: www.bis.org/fsi/publ/insights58.htm.

Quagliariello, M. (2019). Are stress tests beauty contests? EBA Staff Papers, 4.
dx.doi.org/10.2139/ssrn.3427389.

Quintyn, M., Ramirez, S. L. and Taylor, M. (2007). *The fear of freedom: Politicians and the independence and accountability of financial sector supervisors*. IMF working paper 2007/025. Accessed at: www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Fear-of-Freedom-Politicians-and-the-Independence-and-Accountability-of-Financial-Sector-20155.

Quintyn, M. and Taylor, M. W. (2003). *Regulatory and supervisory independence and financial stability*. IMF working paper 02/46. Available at: www.imf.org/external/pubs/ft/wp/2002/wp0246.pdf.

Resti, A. (2016). 'Bank internal ratings: Are capital floors a suitable tool to restore their credibility?', *Journal of Financial Management, Markets and Institutions,* 4(2), pp. 179–194. doi: 10.12831/85436.

Rezende, M. and Wu, J. (2014). *The effects of supervision on bank performance: Evidence from discontinuous examination frequencies*. Midwest Finance Association 2013 Annual Meeting Paper. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=2135017.

Ryder, N., Johnson, D., Bourton, S. and Hall, D. (2023). 'Review of the senior managers & certification regime', *Journal of Economic Criminology*, 2, 100029. doi: 10.1016/j.jeconc.2023.100029.

Sahin, C., de Haan, J. and Neretina, E. (2020). 'Banking stress test effects on return and risk', *Journal of Banking and Finance*, 117, 105843. doi: 10.1016/j.jbankfin.2020.105843.

Schuermann, T. (2014). 'Stress testing banks', *International Journal of Forecasting*, 30(3), pp. 717–728. doi: 10.1016/j.ijforecast.2013.10.003.

Senkarcin, M. (2015). *German Landesbanks in the post-guarantee reality*. University of Pennsylvania, Wharton School, Weiss Center working paper. Available at: wifpr.wharton.upenn.edu/wp-content/uploads/2021/07/15-14.pdf.

Shapiro, J. and Zeng, J. (2023). 'Stress testing and bank lending', *Review of Financial Studies,* 37 (4), pp. 1265–1314. doi: 10.1093/rfs/hhad086.

Shehzad, C. T. and De Haan, J. (2015). 'Supervisory powers and bank risk taking', *Journal of International Financial Markets, Institutions and Money*, 39, pp. 15–24. doi: 10.1016/j.intfin.2015.05.004.

Shive, S. A. and Forster, M. M. (2017). 'The revolving door for financial regulators', *Review of Finance*, 21(4), pp. 1445–1484. doi: 10.1093/rof/rfw035.

Silvers, R. (2020). 'Cross-border cooperation between securities regulators', *Journal of Accounting and Economics*, 69(2–3), 101301. doi: 10.1016/j.jacceco.2020.101301.

Silvers, R. (2021). 'Does regulatory cooperation help integrate equity markets?', *Journal of Financial Economics*, 142(3), pp. 1275–1300. doi: 10.1016/j.jfineco.2021.05.040.

Sijbrand, J. and Rijsbergen, D. R. (2013). 'Managing the quality of financial supervision', in Kellermann, J., de Vries, F., and de Haan, J. (eds.) *Financial Supervision in the 21st Century*. Heidelberg: Springer, pp. 17–32.

Sparrow, M. K. (2000). *The regulatory craft*. Washington DC: Brookings Institution Press. Available at: www.jstor.org/stable/10.7864/j.ctvg254fz.

Stigler, G. (1971). 'The theory of economic regulation', *Bell Journal of Economics and Management Science,* 2, pp. 3–21. doi: 10.2307/3003160.

Svoronos, J. P. (2018). *Early intervention regimes for weak banks*. FSI Insights, No. 6. Available at: www.bis.org/fsi/publ/insights6.htm.

Sweeting, P. (2011). *Financial Enterprise Risk Management*. Vol. 1. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511844133.

Tadesse, S. (2006). *Banking fragility and disclosure: International evidence*. William Davidson Institute working paper, No. 874. Available at: deepblue.lib.umich.edu/bitstream/handle/2027.42/57254/wp874?sequence=1.

Tett, G. (2016). The silo effect: The peril of expertise and the promise of breaking down barriers. London: Little, Brown. ISBN-10 9781451644746.

Turner, D. (2021). 'Three lines of defence – is it the right model?', *Journal of Financial Compliance,* 5(3), pp. 237–247. Available at: www.henrystewartpublications.com/sites/default/files/JFC5.3Threelinesofdefenseisittherightmodel.pdf.

Viñals, J., Fiechter, J., Narain, A., Elliott, J., Tower, I., Bologna, P. and Hsu, M. (2010). 'The making of good supervision: Learning to say "no".' IMF staff position note, SPN/10/08. Available at: www.imf.org/external/pubs/ft/spn/2010/spn1008.pdf.

Walter, S. and Narring, F. (2020). 'How can supervisors and banks promote a culture of strong governance and ethical behaviour?', *Journal of Risk Management in Financial Institutions*, 13(2), pp. 145–154. doi: 10.69554/RLSR2317.

Whitbeck, N. (2013). 'Dexia: Rise & fall of a banking giant', *Thesis*. HEC Paris Business School. Unpublished essay. Available at: elischolar.library.yale.edu/cgi/viewcontent.cgi?article=3491&context=ypfs-documents2.

Woo, V., Chelluboina, B. and Xoual, W. (2014). 'The effectiveness of the regulatory stress testing disclosure process', *Financial Markets, Institutions and Instruments*, 23(1), pp. 1–70. doi: 10.1111/fmii.12014.

Zamorski, J. (2015). 'Strengthening bank supervision: The need for forward-looking, intrusive supervision and a supportive supervisory culture', *SEACEN Financial Stability Journal,* 5, pp. 49–58. Available at: www.seacen.org/products/702003-100386-PDF.pdf.