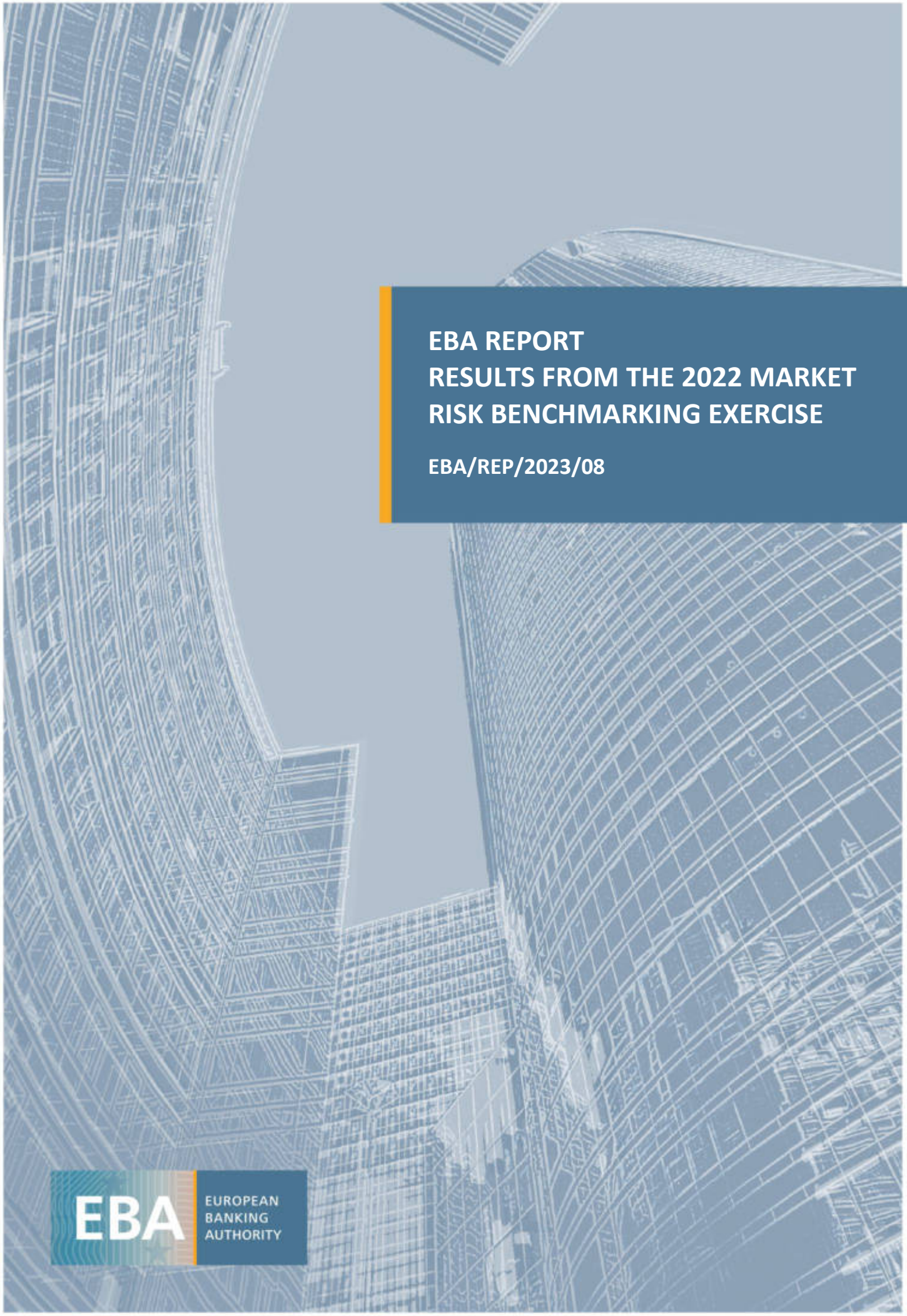

EBA REPORT
RESULTS FROM THE 2022 MARKET RISK BENCHMARKING EXERCISE

EBA/REP/2023/08

EBA EUROPEAN BANKING AUTHORITY

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Abbreviations

APR	all price risk
CA	competent authority
CDS	credit default swap
CO	commodities
CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
CS	credit spread
CS01	credit spread value of 1 basis point changes
CTP	correlation trading portfolio
CV	coefficient of variation
EBA	European Banking Authority
EQ	equity
ES	expected shortfall
EU	European Union
FRTB	fundamental review of the trading book
FX	foreign exchange
HPE	hypothetical portfolio exercise
HS	historical simulation
IMV	initial market valuation
IQD	interquartile dispersion
IR	interest rates
IRC	incremental risk charge
IT	information technology
ITS	implementing technical standards
LGD	loss given default
MC	Monte Carlo
MR	market risk
MRWA	market-risk-weighted asset
OFR	Own Funds Requirements
P&L	profit and loss
PD	probability of default
Q&A	question and answer
RTS	regulatory technical standards
RWA	risk-weighted asset
sVaR	stressed value at risk
SBM	Sensitivities Based Method
VaR	value at risk

1. Executive summary

1. This report presents the results of the 2022 supervisory benchmarking exercise pursuant to Article 78 of the Capital Requirements Directive (CRD) and the related regulatory and implementing technical standards (RTS and ITS) that define the scope, procedures and portfolios for benchmarking internal models for market risk (MR).

2. The report summarises the conclusions drawn from a hypothetical portfolio exercise (HPE) conducted by the EBA during 2021/22. The primary objective of the exercise is to assess the level of variability observed in risk-weighted assets (RWA) for market risk produced by banks' internal models.

3. The exercise was performed on a sample of 41 European banks from 13 jurisdictions. The relevant institutions submitted data for 81 instruments recombined into 62 market portfolios across all major asset classes, i.e., equity (EQ), interest rates (IR), foreign exchange (FX), commodities (CO) and credit spreads (CS), as well as two correlation trading instruments recombined into four portfolios (CTPs), for a total of 66 benchmark portfolios. Thus, the exercise covers the entire population of EU banks with internal models for MR at the highest level of consolidation.

4. The analytical part of the exercise delivered by the EBA, as summarised in this report, provided to the competent authorities (CAs) a list of outliers to be examined in detail. The banks with the most significant number of outliers were also considered for interviews to discuss the assumptions behind banks' models that produced the outliers. Nonetheless, in the 2022 exercise, no interviews with banks were carried out by CAs, which preferred to address the issues reported bilaterally. The issues detected in the benchmarking exercise were considered and addressed, where possible, by banks and CAs. Moreover, CAs and the EBA collected feedback on how to improve forthcoming benchmarking exercises.

5. Finally, taking into consideration the results of the benchmarking exercise, CAs were asked to provide the EBA with responses to a questionnaire on the actions they plan to take with regard to each participating bank's internal model.

1.1 Main findings of the benchmarking analysis

6. The report measures variability in terms of the interquartile dispersion (IQD)[1] and the coefficient of variation (CV)[2] observed within each benchmark portfolio. The IQD is more robust than the CV when the sample is drawn from an unknown, fat-tailed distribution. As far as the market-risk-weighted asset (MRWA) variability is concerned, the IQD metric suggests a level of dispersion for all the risk measures provided by banks that need to be monitored.

7. The primary considerations are that the 2022 results show a small reduction in the dispersion of the initial market valuation (IMV) versus the 2021 exercise with regard to the FX asset class; see, for instance, Table 1. CS remained fairly stable versus the 2021 dispersion. Nonetheless, the IR average IQD remain high (16% vs 19% in 2021). The reason for this is that two IR instruments (36 and 38) present an IMV that is and close to zero and show high relative dispersion. This has the unwelcome effect of exacerbating minor absolute differences in the IMV submission in absolute terms, which turns into a very high percentage difference captured by the IQD metrics. Aside from the high IQD for these two instruments, there is no evidence of a significant misunderstanding of these instruments' features. Excluding them, the average IQD of the IR asset class is 2%, which is in line with the submissions for the previous exercises. EQ shows very high IQD (21%) which is driven by an error in the instruction that compromised the IMVs of some futures in this asset class. Error on the futures aside, the IQDs are similar to the previous exercise. Furthermore, the CO asset class sees a significant jump in the IQD in the 2022 exercise. This is due to only two instruments (48 and 49), but since the whole set of CO instruments is very limited, as well as the total number of submissions, minor differences in the IMVs tend to impact the average IQD of this asset class substantially.

8. Based on this year's submission of IMVs, we can conclude that the quality of the data did not decrease. The quality of the data is of paramount importance for the benchmarking exercise, and the banks should pay great attention when submitting these data. Some types of errors persist and are sometimes trivial, such as the wrong unit being reported. In order to increase the data quality substantially, the EBA notes that several rounds of iteration with submitters will be required, which is not possible within the short time frame of the exercise. Keep improving the specification of the details for the instruments is also a possibility that the EBA is always exploring. In general, the valuation used therefore is robust, albeit with the significant effort needed to be expanded on data quality.

9. The majority of the significant dispersions have been examined and justified by the banks and CAs. A minority of the outlier observations remain unexplained and are expected to be part of

[1] IQD is defined as the absolute value of the ratio of the interquartile range (Q3 – Q1) divided by the sum of the quartiles (Q3 + Q1). The higher the IQD is, the higher the dispersion in the data.

[2] CV is computed as the ratio of the standard deviation to the mean.

the ongoing activities of supervisors, who are expected to monitor and investigate the situation (see Section 1.2 and Chapter 6 of this report).

10. From a risk factor perspective, FX and CO portfolios exhibit a lower level of dispersion than the IR, EQ and credit spread asset classes. Except for IMV, in general, variability is lower than in the previous exercise. This is likely to be due to a decrease in market volatility, which impacted the level of the risk measures, decreasing the dispersion (see Table 4: Interquartile dispersion for IMV, risk metrics and SBM OFR by risk factor).

11. Regarding the single risk measures, across all asset classes except for CS the overall variability for value at risk (VaR) is lower than the observed variability for stressed VaR (sVaR) (21% and 28% respectively, compared with 27% and 31% in 2021 and with 18% and 29% in 2020).[3] More complex measures such as the incremental risk charge (IRC) show a higher level of dispersion (45%, compared with 43% in 2021, and 49% in 2020). We would point out that a direct comparison of the IQD dispersion between 2020, 2021 and 2022 IQDs is possible because the structures of the exercises and the instruments of which they were composed are basically the same.

12. As for the past exercise, to deepen the analysis of VaR and further investigate the variability drivers, different VaR metrics were computed and compared with the banks' reported VaR, in particular:

- an alternative estimation of VaR, called profit and loss (P&L) VaR, computed by the EBA using the 1-year daily P&L series submitted by banks using a historical simulation (HS) approach; and

- a comparable VaR, called HS VaR, which corresponds to the regulatory VaR reported by those banks that use an HS approach (only).

13. When comparing the variability between the regulatory VaR and these alternative risk measures, a decrease in the IQD when considering a more homogeneous sample is confirmed (i.e., HS banks only). In fact, for all the risk types, the dispersion observed for the P&L VaR tends to be lower but is still not negligible. This finding suggests that the modelling approach is not the only driver of the observed VaR variability. Other drivers, such as risks not captured in the model or the choice of absolute versus relative returns, offer further explanations for the results' variability (see Table 4: Interquartile dispersion for IMV, risk metrics and SBM OFR by risk factor).

14. Even so, within the subset of banks using an HS approach, modelling choices (see Table 6: Coefficient of variation for regulatory VaR (controlling for HS) by modelling choice) seem to make a noticeable difference. Modelling configurations produce mixed results depending on the different asset classes. In terms of conservativeness, the calibration of more than one-year

[3] These values are derived as a simple average of the IQD across all non-correlation trading portfolios.

lookback seems to produce more conservative results (see Table 7: Average regulatory VaR by modelling choice). These observations differ from the findings of the 2020 and 2021 exercises, which were run across the same portfolios (at least for 2021). Overall, it is clear that this analysis is extremely sensitive to the different portfolios used to produce the statistic and to the low number of subjects available, and to the passage of time from one exercise to another, different model setting impact differently the dispersion; so, this report will refrain from trying to generalise the results and define a 'less dispersed' and 'more conservative' configuration of modelling choices.

15. As mentioned above, the dispersion in sVaR figures is generally higher than the dispersion observed for regulatory VaR (see Table 21 and Table 22). The stressed period used was the one applied by the bank for capital purposes, so it was not harmonised in the sample. Different choices for the stressed period are permitted by the Capital Requirements Regulation (CRR), and these choices are considered and questioned as part of the regulatory approval process. While allowing banks to use their own individual stress periods reduces the comparability of the sVaR results across the sample, doing so facilitates the estimation of implied capital needs from the HPE. Nonetheless, banks in the exercise are asked to report the stressed period applied. As a result, the EBA drew up a subset of homogeneous time windows applied and ran the benchmark for this subsample. It appears clear that when a homogeneous stress window is applied, the sVaR figures tend to be less dispersed (see Table 41: Stress VaR statistics (2008-2009 stress period only)).

16. In addition to carrying out these analyses, the EBA conducted a comparison across banks of the ratio between sVaR and VaR for each of the hypothetical portfolios included in the benchmarking exercise (see Table 5: sVaR–VaR ratio by range (number of banks as a percentage of the total)). The ratio generally varies significantly between the portfolios, especially for instruments subject to credit spread risk (from 0.63 to 11.92). However, on average the ratio comes in at around 2.28 (see Table 25: sVaR/VaR statistics).

17. As expected, for the larger banks with significant trading activities the benchmarking portfolios are generally relevant to their actual trading book. For smaller banks, this is less the case, and this is why the EBA included simpler and more plain vanilla instruments starting from the 2019 exercise. The challenge remains to design a benchmarking exercise that can fit banks that have a specialised business model. Overall, the portfolios are, however, reflective of the risk factors experienced by most banks. In the 2022 exercise, the EBA despite noticing a decrease in the VaR dispersion, reports that in many cases (30 over 59 single portfolios) the IQD remain above 20%, especially for the CS asset class (see Table 21: VaR statistics). The aggregate portfolios also feature notably low levels of IQDs.

18. Regarding the IRC, the average variability (as measured by the average IQD for this category of portfolios) is higher than that observed for all other metrics considered in the report (45%). This high variability is slightly higher than in the previous exercise – the IQD was 43% on average in the 2021 exercise (see Table 13: IRC statistics and cluster analysis). The understanding of the IRC dispersion was further analysed by disaggregating various modelling choices (see Table 14, Table

43, Table 44, Table 45 and Table 46). While the number of risk factors applied seems to make a difference in terms of dispersions, while applying market conventions to the source of LGD seems not to change the dispersion of the IRC substantially. These results are not consistent with what was observed in the previous exercises, so it looks like even for the IRC, the modelling choices have an effect on the dispersion, but the effect cannot be generalised, and it looks very time-dependent.

19. Regarding the APR, the statistics for this risk measure are no longer reported, because after Brexit the number of the reporting entities for this metric is no longer sufficient to guarantee the anonymity of the statistics computed.

20. An additional metric considered as part of the analysis was the diversification benefits observed for VaR, sVaR and IRC in the aggregated portfolios (see Table 16: Diversification benefit statistics). As expected, there is evidence that larger aggregated portfolios exhibited greater diversification benefits than smaller ones. In general, the level of dispersion observed in diversification benefits tends to be lower than that in the corresponding metrics at the level of the individual portfolios.

21. As in the previous exercise, an assessment was also carried out on the variability of the empirical estimates of the expected shortfall (ES) at a 97.5% confidence level. The results indicate that the dispersion in this metric across risk factors is similar to that found for VaR and P&L VaR (see Table 24).

Dispersion in the capital outcome

22. Alongside the variability analysis, the EBA also conducted the usual assessment regarding possible underestimations of capital requirements (see Table 17: Interquartile dispersion for capital proxy). As the analysis is based on hypothetical portfolios and the capital requirements were defined using a proxy, the results should be interpreted as approximations of potential capital underestimations. The proxy for the implied capital requirements was defined as the sum of VaR and sVaR across all portfolios. For purposes of comparison, the proxy was computed three times. In one case, the VaR and sVaR figures were multiplied by the banks' total multiplication factor and, in the other, by the regulatory minimum of three only, i.e., ignoring the banks' individual addend(s) set by the CAs. Finally, a subset of banks applying the same stress period was also considered for capital dispersion. This metric enables a comparison of banks and an assessment of their variability in this regard.

23. The average variability across the sample as measured by the IQD is significant (around 20%), especially for the most complex portfolios in the credit spread asset class. This dispersion very slightly decreases when considering a more homogenous capital proxy (20% applying three as the multiplier, and 14% for banks with the same stress period). Moreover, an analysis of the capital proxy pattern across the HPE's trades suggests that the ranges of capital value dispersion are broadly consistent, irrespective of whether the banks' actual multiplication factors are used or not.

Additional analysis of Risk measures

24. As introduced in the previous exercises, the EBA extended the analysis to other drivers of variation (see Section 5.2.5), such as the size of the bank, the business model of the bank, the level of approval granted by the CAs and the already mentioned stressed period applied in the sVaR calibration. The size and business model analyses were further analysed as in the 2020 and 2021 reports.

25. In a nutshell, based on this additional analysis we can conclude that the size (in terms of RWA for market risk) of the bank has an impact on the figures, since medium-sized banks tend to produce slightly more dispersed results than larger banks (see Table 8: Asset class comparison for VaR in terms of banks' size). Smaller banks' statistics are affected by the low number of submissions, i.e., CO is not even reported. Consistently, when considering the size in terms of the trading book (as a ratio of total assets), the bigger a bank is in terms of its trading book, the (slightly) smaller the dispersion (on average).

26. The discrimination based on the business model did not deliver strong conclusions. As in past exercises, the EBA applied the internal classification of banks as a discriminant, under which many of them are classified as cross-border universal banks (see Table 9: Asset class comparison for VaR within the same business model (cross-border universal bank)). Applying this definition of the business model, a smaller decrease in the IQD was identified due to a more homogenous sample. The business model analysis was further extended by considering the 'Level 3' assets and liabilities in the bank's books as a proxy for a more sophisticated business model linked to more exotic products (see Table 34, Table 35 and Table 36). This further specification did not prove conclusive since the dispersion did not change substantially depending on the 'Level 3' assets and liabilities ratio in the bank's trading book.

27. The subsample analysis based on the level of approval delivered interesting results. A priori, it was expected that having banks with different levels of approval would have increased the dispersion of the results of the risk measures. In line with this assumption, the IQD results seem to fluctuate among the subsamples of different approval levels. This is because more homogeneous subsamples tend to produce smaller dispersions, but this positive effect is counterbalanced by the smaller number of firms in the sample. Basically, the benchmark provided and the 25th and 75th quantiles of the distribution tend to be less dispersed with respect to the whole set of banks. This implies that the different level of approval does indeed have an impact on the dispersion of the benchmarking results (see Table 10: Asset class comparison for VaR in terms of level of approval).

28. Finally, as already mentioned above, and in line with previous findings, sVaR figures are far less dispersed when the benchmark is computed for a homogeneous subsample of firms that applied a similar time period for the stress window used for calibrating the sVaR (see Table 11: Asset class comparison for sVaR in terms of the time window applied).

29. As introduced in the 2020 Report, PV statistics are reported (see Table 42). The PVs reported generally have low IQDs, and they were useful in distinguishing true outliers and outliers due to mispricing of the portfolios.

SBM OFR analysis

30. The 2022 benchmarking exercise see the intro of the SBM sensitivities and OFR data collection. Even if precious for assessing and understanding differences at a very granular level, sensitivities data are very fragmented and too complicated to be represented at the moment. Therefore, this Report focus on the analysis of the SBM Own Funds Requirements (OFR).

31. Overall, the OFR data submitted by the banks was quite complete and close to the Risk Measures data submission. The dispersion of the SBM OFR, as expected is generally lower than the dispersion for the standard Risk Measures (VaR and SVaR), as shown in Table 4. On the one hand, this is reassuring result, since standardised measures are supposed to be the same for all, and so a low IQD is expected. On the other side, there are portfolios where the IDQ is higher for the SBM measures with respect to the VaR measures (see Figure 20).

32. Finally, the level of detail in the SBM OFR submission, allow the supervisors to clearly define which are the asset class and risk class component of the OFR (see Figure 21 and Figure 22), and this allows to identify area of potential problem in the application of the standardised methodology.

1.2 CAs' assessments based on supervisory benchmarks

33. CAs shared the outcomes of their assessments at the bank level with the EBA (see Figure 16: CAs' own assessments of the levels of MR own funds requirements). The CAs' assessments confirmed the existence of some areas that require follow-up actions on the part of specific institutions whose internal models were flagged as outliers in this benchmarking exercise.

34. Overall, CAs' assessment of the over- and underestimation of RWA was encouraging in the sense that CAs were aware of and able to explain the causes of most deviations. Although the majority of the issues were identified and actions put in place in order to reduce the unwanted variability of the RWA, the effectiveness of these actions can be evaluated only by CAs via constant monitoring of the benchmarking results.

35. The CAs are expected to pay close attention to the minority of cases in which the over- and underestimations were unexplained, to closely monitor these institutions and to put in place additional efforts to reduce these cognitional gaps in future exercises.

1.3 2023 exercise and future expected changes

36. The 2019 exercise represented a significant change from the 2016-2018 exercises in terms of the simplification of the portfolios. This simplification had a positive effect in obtaining less

dispersed results than with the previous portfolios. Furthermore, it improved the significant data quality issues relating to some portfolios while focusing on the model risk elements.

37. In the 2020 exercise, the data submitted further improved in quality thanks to the clarification of the legal text description of some instruments, and also to the further practice that the banks have gained in conducting the present exercise. This had a positive effect in terms of dispersion in the data provided. Improvements in terms of less dispersed results have also stemmed from the change in the methodology to detect outliers for the risk measures.

38. In the 2021 exercise, the data quality of the submissions was acceptable. That said, the variabilities of the risk measures (VaR, PL VaR and ES) were substantially higher than in the previous year. This seems to be linked to the increased volatility of the markets in 2021 due to the Covid outbreak, as captured by the market model, which generally provided higher figures for the risk measures. These higher figures, in absolute terms, seem to exacerbate the differences in modelling outputs, producing higher IQD metrics. As a result, this higher dispersion does not seem to be the outcome of a decrease in the quality of the market model.

39. For the 2022 exercise, the set of instruments is mainly similar to the previous exercise, so the EBA reports a similar level in terms of the data quality of the submissions, aside from the mistake in the EQ instruction. The analysis that the EBA ran for the 2022 exercise is the first in which banks report sensitivities and OFR figures relating to the sensitivities-based method of the alternative standardised approach (ASA) introduced with the FRTB. The SBM submission was overall of good quality, especially considering the tendency to improve with time. Nonetheless, there is an expectation that additional interesting insights can be provided to competent authorities from the analysis of these additional data.

40. For the 2023 exercise, in order to keep the exercise informative, the data collection was extended to allow the collection of new instruments and portfolios, in particular as regards the instruments and portfolios that have lately been applied by the industry. These new instruments are also accompanied by a rationalisation of the references of the instruments in Annex V. For the rest, the exercise will not change substantially, so the EBA will focus on the analysis of the SBM data submitted.

41. For 2024, at the moment of the draft of the report, the EBA is proposing to extend the SBM data collection to the other ASA components (DRC and RRAO), to have a complete picture of the standardised approach.

42. On a medium-term horizon, the EBA will consider reshaping the instruments and the portfolios in the exercise in a way that still keeps the instruments simple to ensure clarity regarding the instruments. This is because the different interpretations of the instruments have been a significant source of variability. Nonetheless, further enrichment of the variety of the instruments monitored could be beneficial. In addition, and very importantly, extension of the scope of the BM exercise to the banks that do not have IMA approval, but apply the ASA, and the fundamental review of the trading book (FRTB) are understood to be of particular

significance for the market risk benchmarking exercise. In the future, the exercise will require a major redesign to take into consideration the specific features of the FRTB.

2. Introduction and legal background

43. European legislators have acknowledged the need to ensure consistency in the calculation of RWA for equivalent portfolios, and the CRR and CRD include a number of mandates for the EBA to deliver technical standards, guidelines and reports with the aim of reducing uncertainty and differences in the calculation of capital requirements.

44. In this regard, Article 78 of the CRD requires the EBA to produce a benchmarking study on both credit and market risk to assist CAs in the assessment of internal models. The study should highlight potential divergences among banks or areas in which internal approaches might have the potential to underestimate their own funds requirements that are not attributable to differences in the underlying risk profiles. CAs are required to share this evidence within colleges of supervisors as appropriate and take appropriate corrective actions to overcome these drawbacks when deemed necessary. Directive (EU) 2019/878[4] of the European Parliament and of the Council of 20 May 2019 amending Capital Requirements Directive IV (CRD V) has not changed this mandate.

45. The EBA has devoted significant effort to the analysis of the consistency of outcomes in RWA, to understand the causes of possible inconsistencies and to inform the regulatory repair process. The EBA's ongoing work on benchmarking, supervisory consistency and transparency is fundamental to restoring trust in internal models and the ways in which banks calculate asset risks.

46. The use of internal models gives banks the opportunity to model their risks according to their business models and the risks faced by the bank itself. The introduction of a benchmarking exercise does not change this objective; rather, it helps to identify the non-risk-based variability drivers observed across institutions.

47. This MR benchmarking exercise is an MRWA variability assessment performed over a large sample of banks (40 banks at the highest level of consolidation across 13 jurisdictions within the EU). The banks participating in this exercise are those that have been granted permission to calculate their own funds requirements using internal models for one or more of the following risk categories:

    a) general risk of equity instruments;

    b) specific risk of equity instruments;

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0878&from=EN

c) general risk of debt instruments;

d) specific risk of debt instruments;

e) foreign exchange risk;

f) commodities risk; and

g) correlation trading.

48. Pursuant to Article 362 of the CRR, the general risk of debt instruments should refer to interest rate risk. Similarly, the general risk of equity instruments refers to the change in the value of indices.

49. Banks that have approval only for the general risk of equity or debt instruments (in accordance with Article 363 of the CRR) may use a different definition of general risk (e.g., by including credit spread risk in the interest rate general risk) if they are able to demonstrate that this leads to higher RWA. Separate permission is required for each risk category. Many banks do not have permission for internal models for all risk categories, so the number of contributions for each hypothetical portfolio in this exercise varies across the sample.

50. Banks that have permission to use the internal model for calculating MR own funds requirements for one or more – but not all – of the risk categories in accordance with Article 363(1) of the CRR ('partial use') exclude certain risks or positions from the scope of the internal model approval. In this case, the own funds requirements for the risk categories outside the scope of the internal model are calculated according to the standardised approach.

51. In addition, as set out in Article 369(1)(c) of the CRR, banks should conduct validation exercises on hypothetical portfolios to test that the model is able to account for particular structural features. These portfolios should not be limited to the portfolios defined in this exercise; however, this exercise is a useful starting point for banks to meet this legislative requirement.

52. The assessed MR results, when provided and where applicable, are VaR, sVaR, IRC and APR figures for specific and aggregated trades. Moreover, a preliminary assessment of IMV was performed, primarily to ensure that the participating banks make uniform assumptions when entering the hypothetical trades.

53. In addition to these submissions, banks using an HS approach for VaR were requested to provide one year of P&L data for each of the individual and aggregated portfolios modelled. The objective of collecting this additional information was to employ the data vector to perform alternative calculations for VaR using, where possible, a consistent 1-year lookback period and controlling, as far as possible, for the different options that banks can apply within regulation.

54. Regulation (EU) 2019/876[5] of the European Parliament and of the Council of 20 May 2019 amending the Capital Requirements Regulation as regards the leverage ratio, the net stable funding ratio, requirements for own funds and eligible liabilities, counterparty credit risk, market risk, exposures to central counterparties, exposures to collective investment undertakings, large exposures, reporting and disclosure requirements (CRR II) will have a significant impact on the market risk benchmarking exercise once it is fully implemented. However, for the time being the CRR framework will be applied for the purpose of the benchmark exercise in accordance with Article 78 of the CRD.

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0876&from=EN

3. Main features of the 2022 market risk benchmarking exercise

55. Based on the EBA benchmarking ITS, the MR benchmarking exercise is carried out by following three main steps. First, the EBA defines the hypothetical instruments and portfolios, which are the same for all banks, in order to achieve a homogeneous and comparable outcome across the sample. Second, banks are asked to submit the data accordingly. Third, and finally, the EBA processes and analyses the data, providing feedback to CAs. During the process, the EBA supports CAs' work by providing benchmarking tools to assess banks' results and detect anomalies in their submissions.

3.1 Definition of the market risk hypothetical portfolios

56. The MR portfolios have been defined as hypothetical portfolios composed of both non-CTPs and CTPs, as set out in Annex V of the benchmarking ITS. The exercise includes 81 instruments recombined into 65 portfolios (59 individual and 6 aggregated), capitalised under the VaR, sVaR and IRC models, comprising mainly plain vanilla and some complex financial products in all major asset classes: EQ (18 instruments and 10 individual portfolios), IR (20 instruments and 17 individual portfolios), FX (9 instruments and five individual portfolios), CO (four instruments and three individual portfolios) and CS (28 instruments and 21 individual portfolios). The EBA also designed aggregated portfolios, obtained by combining individual ones, to take into account diversification effects. Each aggregated portfolio has a particular composition: the first (portfolio 60) encompasses all asset classes; the second (portfolio 61) is made up of only EQ portfolios; the third (portfolio 62) is made up of only IR portfolios; the fourth (portfolio 63) is made up of only FX portfolios; the fifth (portfolio 64) is made up of only CO portfolios; and the sixth (portfolio 65) is made up of only CS portfolios.

57. In addition, the set of portfolios includes two instruments and four portfolios (three individual and one aggregated) used for correlation trading activities, capitalised under the VaR, sVaR and APR models. These portfolios contain positions in index tranches referencing the iTraxx Europe index on-the-run series. The portfolios are constructed by hedging each index tranche with the iTraxx Europe index on-the-run 5-year series to achieve a zero-credit spread value of 1 basis point (CS01) as at the initial valuation date (spread hedged). No further re-hedging is required.

58. A more detailed explanation of the portfolios can be found in the benchmarking ITS on the EBA website.[6]

3.2 Data collection process

59. The data for the supervisory benchmarking exercise were submitted by banks to their respective CAs using the supervisory reporting infrastructure. Banks submitted the specified templates provided in the ITS, where applicable.

3.2.1 IMV

60. The reference date for IMV was 23 September 2021, 5.30 p.m. CET. Banks entered all positions on 16 September 2021 ('reset or booking date'), and, once positions had been entered, each instrument aged for the duration of the exercise. Furthermore, banks did not take any action to manage the instruments in any way during the entire exercise period.

61. The IMV figure to be reported by the banks for each hypothetical instrument was defined as the mark to market of the instrument on the booking date plus the profit and loss from the booking until the valuation date and time. Therefore, it was the mark to market of the instrument on 23 September 2021, 5:30 p.m. CET.

3.2.2 Risk measures

62. Pursuant to the common instructions provided, banks were required to calculate the risks of the positions without taking into account the funding costs associated with the portfolios (i.e., no assumptions were admitted with regard to the means of funding the portfolios). Moreover, banks were required to exclude, as far as possible, counterparty credit risk when valuing the risks of the portfolios.

63. Banks were required to calculate the regulatory 10-day 99% VaR on a daily basis. sVaR and IRC could be calculated on a weekly basis. In such cases, sVaR and IRC had to be based on end-of-day prices for each Friday in the time window of the exercise. For the four CTPs (54-56 and 66), APR was also requested.

64. For each portfolio, banks were asked to provide results in the base currency, as indicated in Annex V of the benchmarking ITS. The choice of base currency for each trade was made to avoid polluting results with cross-dependencies on risk factors.

[6] https://eba.europa.eu/regulation-and-policy/supervisory-benchmarking-exercises/its-package-for-2022-benchmarking-exercise. Please also refer to Commission Implementing Regulation EU 2016/2070 of 14 September 2016 and Commission Implementing Regulation 2019/439 of 15 February 2019, laying down ITS in accordance with Article 78(2) of Directive 2013/36/EU (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1562830373986&uri=CELEX:32019R0439).

65. All collected data underwent a preliminary analysis to spot possible misinterpretations of the common instructions set out in the ITS/RTS on benchmarking and outliers, as defined hereafter.

3.3 Participating banks

66. A total of 41 banks representing 13 EU countries participated in the exercise (see Table 18 in the annex). All EU banks with MR internal models approved by CAs were asked to submit data at all levels where own funds requirements are calculated. The EBA collected the results only at the highest level of consolidation.

67. CAs are in charge of conducting similar benchmarking investigations for results at a 'solo' level within their own jurisdictions for eligible banks.

3.4 Data quality issues

68. The data collection process aims to ensure the reliability and validity of the data obtained. In this regard, it is obvious that an unwanted driver of variability (which would pollute the results) could be misunderstandings vis-à-vis the portfolios and the specific instruments included in them.

69. IMV results reached the EBA in November/December 2021, after which the EBA carried out a preliminary IMV analysis and provided CAs with a tool to help them spot likely anomalies or misunderstandings regarding the interpretation of each portfolio. This was done to enhance the quality of all risk measures so that they would be provided in accordance with a correct interpretation of the portfolios. This step was conducted before the computation of the risk measures by the banks. Where the price of an instrument fell outside a certain range,[7] more investigation had to be undertaken by the CA, which could – if necessary – ask the banks in its jurisdiction for a repricing and subsequent resubmission. The same process was carried out for the risk measure submission.

70. The issue experienced in the previous exercises linked to the aggregated portfolio figures no longer seems to be a major issue. It is worth noting that some banks reported the IMVs and risk measures for the aggregated portfolios without including all the relevant components.[8] The reason was that the 2018 (and previous) ITS required banks to report the value of aggregated portfolios even if not all individual portfolios are modelled for the benchmarking exercise. As a result, the submissions were not comparable with those valued in full. This issue was addressed in the 2019 exercise, and since then banks have reported the results for the aggregated

[7] The range means the interval between the first and third quartiles. These quartiles were considered and subsequently updated when resubmissions were received.

[8] Some banks reported values for aggregated portfolios, taking into account only those components for which they had permission to use an internal model. This is clearly not a data quality issue, and it is correct that banks report results only where they have permission to do so for regulatory purposes.

portfolios only if the results of all components have been submitted.[9] The structure of the 2019-2020 exercise, i.e. a plurality of instruments that are recombined into a plurality of individual portfolios, which are themselves the components of the aggregated portfolios, produced a similar error, i.e. the absence of some instrument components within some of the individual portfolios. Nonetheless, banks should not provide any (aggregated or individual) portfolios where any instrument is missing in order not to distort the risk measures analysis. This specification was further clarified in the ITS 2022, so the possibility that some individual portfolios could have been submitted even when some specific instruments were missing cannot be ruled out. On the other hand, the data submission seems compatible with the correct interpretation of the rule, at least for the majority of submitters.

71. It should be recalled that the 2022 exercise is the first exercise where EBA is collection information concerning the sensitivities linked to the SBM and the OFR linked to the SBM from the banks participating in the benchmarking exercise. The complete representation of the sensitivities collected is not possible at the moment due to the very granular nature of the data collected. Nonetheless, some issues were detected, mainly linked to the volatility reported (inconsistent representation). All in all, the quality of the submitted sensitivities was more acceptable, especially considering this is the first exercise where the data is collected.

72. In the data analysis, it was clear that a major errors in the reporting of some Equity instruments were present; this was done because a mistake in the 2022 instruments on this asset class, concerning the notional of the instruments. A complete list of the errors in the submitted data is beyond the scope of this report, but the most common and easily avoided mistakes worth mentioning are as follows:

- Equity asset class: use of the wrong notional in the equity positions. This has generated very high dispersion for instruments 3, 5, 7 and 8; also, the future on Nikkei was wrongly represented. In the 2023 Annex, the instruction was corrected, reporting now the exact amount of share (or point of index) that the option or the future should report. This should enhance the quality of the submission of this asset class substantially.

- Interest rates: good results were obtained, especially where the international securities identification number was available. Minor errors were identified, such as wrong bookings (i.e., long position instead of short, or vice versa). But this was detected in a minority of the submissions. For instruments with very low IMVs, generally the swaps, a generally higher IQD (e.g., instruments 19, 21 and 36) was reported, but no systemic issue was detected. The Cross-currency Swap (now included on IR instruments), on the other side, present a very high IQD (256%) partially driven by the low IMVs, but also to an inconsistent booking practice of this instrument.

[9] Annex 5, Market risk 2021 BM, Section 1 (Common instructions), letter (ee)

- FX: the amendment of the previous instruction enhance the quality of the at submission for this asset class, which show now generally low IQD.

- Cmd: high IQD for instruments 48 and 49. This is driven mostly by the low value of the IMVs of these instruments.

- Credit spread: very good results in terms of CV and IQD, with very sporadic mistakes entailing possible wrong bookings, and no long position instead of a short, or vice versa.

73. Although these mistakes were detected thanks to the EBA data analysis and corrected by resubmission/cleansing of the data from the banks, unnoticed errors in data submissions could still be present in the dataset analysed, and this can potentially drive and pollute the results.

74. Data quality for the 2022 exercise has been fairly good, except for equity instruments. Ensuring data quality is a fundamental step for the benchmarking exercise. However, reporting errors might still occur in future exercises, and the process will allow both regulators and participating banks to learn from it.

4. Market risk benchmarking framework

75. The benchmarking exercise aims to assess the variability in banks' MR models and to identify the drivers that account for it. Variability in banks' models can come from three types of drivers.

76. First, variability can stem from banks' modelling choices that are explicitly envisaged in the regulation. For example, when modelling VaR institutions can choose to use a lookback period longer than the minimum (i.e., the previous year), use a weighting scheme for the data series, calculate the 10-day VaR directly or, alternatively, obtain a 1-day VaR and rescale it using the square root of time approximation. Likewise, when modelling IRC, banks can choose from several sources of the probability of default (PD) and have a certain degree of freedom when choosing the transition matrices applied, or when deciding on the liquidity horizon applied to a particular instrument. It should be highlighted that all of these possibilities are, in principle, acceptable under the current regulatory framework (the CRR), provided that they have been agreed on with the CA during the approval process. Therefore, given the wide range of approaches that each institution using internal models can choose to implement, some degree of variability is expected.

77. Second, there are other modelling choices that are not explicitly envisaged in the regulations, which may cause variability. Examples include differences in simulation engines; differences in pricing model assumptions; the modelling of returns, volatility, correlations and other indirect parameter estimates; additional risk factors considered in the models; different approaches to P&L computation and attribution; and a stochastic framework for the simulated shocks.

78. Finally, another source of potential variability originates from supervisory practices. In particular, the use of regulatory add-ons in the form of both VaR and sVaR multipliers and additional capital charges (e.g. to encompass risk not in VaR issues, any information technology (IT) and organisational weaknesses, independent pricing valuations or detected flaws) and, quite significantly, the application of limits to the diversification benefits applied by banks (i.e. not allowing a single calculation at consolidated level and, instead, requesting an aggregation of the capital results at sub-consolidated and/or subsidiary levels) are likely to increase the observed variability in capital. In most cases, these supervisory actions have been established to address known flaws or model limitations, or to add an additional layer of prudence. Therefore, they typically result in higher capital requirements than would otherwise be the case. However, they can also increase the variation in market own funds requirements between banks, particularly across jurisdictions. Although the effects on capital levels of these supervisory actions can be substantial, a benchmarking portfolio exercise is not suitable for assessing some of these supervisory actions. In particular, any constraints on diversification benefits and direct capital add-ons cannot be properly assessed, since these effects are entirely portfolio-dependent. To assess these effects, it would be necessary to use a much more realistic (hypothetical) portfolio,

comprising thousands of instruments and including partial model approval. Nevertheless, some supervisory actions can be assessed and the effects of regulatory add-ons on the VaR and sVaR multipliers will be analysed as part of this assessment.

79. Possible additional drivers of variation include:

- misunderstandings regarding the positions or risk factors involved that could not be resolved during the preliminary assessment (see Section 3.2);
- non-uniform market conventions and practices adopted in the hypothetical portfolio booking;
- incompletely implemented models (e.g., because a pricing module is being tested, or an additional risk factor is being taken into consideration);
- missing risk factors not incorporated into the model;
- differences in calibration or data series used in the modelling simulation;
- additional risk factors incorporated into the model;
- alternative model assumptions applied; and
- differences attributable to the methodology used (i.e. Monte Carlo (MC) versus HS or parametric).

4.1 Outlier analysis

80. After the data quality assurance process, the EBA performed an 'extreme value' analysis with the aim of excluding from the computation of the benchmarks those values for which the IMV and risk measures (RMs: VaR, SVaR, P&L VaR and ES) were found to lie outside a certain tolerance range due to misinterpretation of the trade or mistyping of bookings by the banks.

81. The presence of clear outliers in the data used to assess variability is deemed inappropriate, since these data points are likely to weigh heavily on the results, distorting the actual level of variability observed.

82. Extreme IMVs and RMs are defined as values outside the range of two truncated standard deviations[10] from the median. Since some results exhibited empirical distributions that had fatter tails than expected, outliers were defined as values differing by twice the truncated standard deviation or more from the median.

[10] The truncated standard deviation is computed by excluding the values below the 5th and above the 95th percentile of the data series.

83. If a bank's IMV or RM are found to be an extreme value for a particular instrument, then this observation is removed from the computation of the final benchmark statistics. The empirical evidence indicates that excluding the RMs based solely on IMV submissions, as in the previous exercise, implied that some extreme RM submissions are wrongly reflected in the benchmarking computation, while some good observations are removed. Changing this methodology did not influence the benchmarking data point, i.e., the median result. In addition, the overall dispersion of the portfolio was only marginally affected (slightly improved). The significant enhancement is in the communication to the CAs of the significant outliers to be examined with the bank. This approach, which was first adopted for the 2020 market risk benchmarking exercise, increased the overall quality of the benchmark data, providing more consistency for the benchmarks of these metrics.

84. The dispersion across the contributions is summarised by the IQD coefficient, which is more robust than the coefficient of variation (CV) for data derived from fat-tailed distributions. The higher the IQD, the more dispersed the data. IQD is defined as:

$$IQD = abs[(Q_{75th} - Q_{25th})/(Q_{75th} + Q_{25th})],$$

where Q_{75th} and Q_{25th} denote the 75th and 25th percentiles, respectively.

85. Another metric used in the variability studies is the CV, which is defined as the ratio between the standard deviation[11] and the mean (in absolute values):

$$CV = abs[StD/Mean].$$

86. The analysis reports both metrics because they jointly allow detection of the highest peaks of variability.

[11] The standard deviation was considered in order to gain a sense of the entire variability and a harmonised approach across the HPE. Obviously, a truncated standard deviation may appear more consistent for some highly dispersed trades.

Table 1: IMV statistics and extreme values

EU Statistics for IMV by instrument

		Main statistics								Percentiles			
	Instr. ID	Min	Max	Ave.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	25th	50th	75th	IQD
Equity	1	4,080,000	10,750,000	2,165,579	10,959,637	190,105,215	719	145%	21	4,050,500	4,081,399	4,085,399	0%
	2	461,750	465,450	461,095	142	199	6	0%	20	465,100	461,100	465,126	0%
	3	-1,501,161	-448,096	-2,114,561	2,039,824	2,044,982	8,643	85%	25	-1,479,125	-461,211	-448,585	52%
	4	-1,574,888	-802,152	-1,572,022	191,535	242,975	14,100	12%	19	-1,634,231	-1,599,240	-1,599,246	1%
	5	-15,179,750	-18,240	-5,527,551	8,059,908	5,135,511	38,891	95%	25	-18,257,851	-1,540,064	-1,833,212	82%
	6	-184,510	-127,751	-180,245	1,535	53,893	491	1%	24	-181,257	-180,501	-150,502	0%
	7	-1,062,391	-101,858	-540,141	427,316	475,490	3,443	85%	25	-1,039,401	-102,231	-103,543	82%
	8	-1,147,500	-108,273	-160,079	516,305	515,245	4,751	91%	22	-1,113,618	-115,027	-111,161	82%
	9	40,549	48,716	44,563	1,855	2,005	729	4%	25	43,745	44,768	45,278	2%
	10	-55,181	-48,810	-52,162	1,452	2,130	854	3%	24	-53,314	-52,216	-51,587	2%
	11	15,328	19,621	17,451	1,208	1,540	743	7%	23	16,646	17,332	18,205	5%
	12	19,529	23,650	21,584	943	1,020	719	4%	23	20,813	21,519	22,209	3%
	13	31,514	36,722	34,519	1,196	1,240	506	4%	24	34,124	34,265	35,263	2%
	14	-29,014	-22,941	-25,240	1,521	1,249	925	6%	25	-26,622	-25,901	-24,814	-4%
	15	1,164	2,193	1,383	198	252	107	11%	22	1,658	1,791	1,900	6%
	16	2,913	3,622	3,215	240	285	111	8%	23	3,035	3,150	3,312	5%
	17	-2,524,000,000	-1,418,923,237	-1,572,161,980	612,974,041	720,765,509	10,310,321	34%	21	-2,657,601,590	-1,491,014,113	-1,450,413,520	28%
	18	1,012,192	1,053,152	1,001,950	11,313	12,757	7,908	1%	19	1,023,640	1,002,211	1,040,800	1%
Interest Rate	19	25,401	15,575	21,570	2,729	5,580	1,901	15%	55	25,565	21,826	19,814	9%
	20	66,601	48,000	54,265	5,665	20,297	1,550	7%	55	55,950	54,240	52,740	5%
	21	44,191	27,605	37,531	4,669	5,215	3,358	13%	57	40,959	37,750	35,511	10%
	22	21,410	14,572	17,704	1,706	1,857	902	10%	55	19,061	17,780	16,158	8%
	23	1,005,795	1,150,740	1,095,524	46,010	54,045	55,057	4%	14	1,055,560	1,080,245	1,124,946	5%
	24	1,250,045	1,225,152	1,272,277	10,259	15,040	620	1%	22	1,261,015	1,281,564	1,282,261	0%
	25	1,486,015	1,480,268	1,482,026	1,048	5,456	202	0%	55	1,482,264	1,481,561	1,481,752	0%
	26	1,507,147	1,510,244	1,505,484	852	24,752	409	0%	26	1,507,947	1,505,140	1,509,154	0%
	27	1,065,084	1,066,110	1,065,881	260	1,125	151	0%	52	1,065,500	1,065,571	1,065,804	0%
	28	1,157,815	1,159,859	1,158,560	568	878	257	0%	55	1,158,272	1,158,517	1,159,081	0%
	29	1,151,287	1,149,504	1,150,565	715	594	105	0%	52	1,151,110	1,149,080	1,149,852	0%
	30	1,505,617	1,506,170	1,506,472	1,755	11,446	759	0%	54	1,509,255	1,507,826	1,507,720	0%
	31	1,350,077	1,354,565	1,352,477	829	1,615	756	0%	55	1,351,757	1,352,410	1,353,550	0%
	32	1,156,710	1,163,658	1,160,071	1,161	2,587	555	0%	55	1,160,752	1,160,051	1,161,514	0%
	33	1,081,416	1,072,660	1,077,280	1,626	2,777	850	0%	55	1,078,254	1,077,585	1,076,802	0%
	34	1,075,000	1,085,425	1,072,405	2,401	5,345	770	0%	25	1,076,915	1,080,102	1,080,755	0%
	35	1,146,500	1,151,155	1,156,195	5,616	7,267	968	0%	24	1,157,148	1,156,025	1,150,257	0%
	36	5,765	45,000	31,055	10,065	10,450	7,801	32%	50	24,051	30,055	40,019	25%
	37	17,015	29,028	26,545	2,867	3,411	2,052	12%	57	21,554	25,411	25,020	7%
	38	56,276	40,124	7,488	23,906	27,695	16,451	319%	51	21,832	14,262	9,554	256%
FX	39	-21,811	-8,501	-15,435	3,400	7,492	2,895	19%	32	-21,450	-17,555	-16,050	14%
	40	82,327	115,290	101,180	6,952	14,289	4,361	7%	31	97,106	100,909	105,645	4%
	41	850,121	852,108	851,549	401	781	287	0%	30	851,259	851,667	851,739	0%
	42	16,526	20,589	18,559	1,121	1,875	611	6%	30	18,018	18,650	19,305	3%
	43	1,051,477	1,082,509	1,072,521	7,309	39,416	3,913	1%	32	1,069,744	1,072,504	1,077,340	0%
	44	-290,015	-217,602	-251,074	8,949	59,122	1,874	4%	31	-252,341	-250,117	-248,708	1%
	45	-44,519	-31,797	-35,325	2,246	3,381	859	6%	31	-39,000	-35,355	-37,071	2%
	46	925,290	952,150	939,339	7,908	11,185	3,628	1%	31	935,316	935,592	943,820	0%
	47	-1,015,399	-986,151	-1,006,971	7,171	14,015	3,058	1%	30	-1,011,262	-1,007,711	-1,006,658	0%
Commodities	48	52,702	7,807	17,258	11,300	17,555	6,561	65%	12	25,018	15,046	9,050	44%
	49	17,000	55,176	16,580	15,562	15,595	7,252	82%	12	9,517	17,056	24,016	44%
	50	195,295	229,460	260,440	25,002	55,007	9,654	10%	11	252,528	261,072	275,708	4%
	51	174,782	120,566	146,026	15,960	16,157	5,005	10%	11	148,472	145,026	156,424	4%
Credit Spread	52	-37,560	-36,651	-37,440	345	545	177	1%	19	-37,697	-37,512	-37,340	0%
	53	-14,159	-13,025	-13,531	343	559	81	3%	19	-13,613	-13,429	-13,330	1%
	54	35,565	36,360	35,951	208	242	115	1%	19	35,756	35,999	36,085	0%
	55	-4,240	-2,919	-3,594	273	1,012	91	7%	17	-3,801	-3,747	-3,621	2%
	56	45,114	49,252	45,273	920	2,065	300	2%	17	45,816	45,591	46,402	1%
	57	-47,287	-46,015	-46,544	291	367	144	1%	18	-46,727	-46,549	-46,538	0%
	58	21,021	22,050	21,581	228	348	139	1%	20	21,342	21,561	21,773	1%
	59	-21,505	-21,239	-21,564	138	361	106	1%	20	-21,626	-21,514	-21,443	1%
	60	27,387	28,073	27,381	172	223	53	1%	19	27,612	27,568	27,857	0%
	61	-21,227	-22,997	-21,090	53	81	40	0%	20	-23,128	-21,081	-23,014	0%
	62	24,717	25,057	24,899	59	110	54	0%	20	24,853	24,917	24,951	0%
	63	24,152	24,757	24,361	133	211	57	1%	19	24,217	24,350	24,436	0%
	64	35,029	36,105	35,271	319	442	53	1%	18	35,801	35,530	35,956	0%
	65	42,301	44,432	43,301	355	564	121	1%	21	43,092	43,134	43,456	0%
	66	-37,361	-36,670	-37,107	106	223	58	0%	20	-37,201	-37,082	-37,025	0%
	67	-21,002	-20,459	-20,285	141	165	58	1%	20	-20,825	-20,741	-20,724	0%
	68	1,085,750	1,111,320	1,107,230	6,932	13,581	558	1%	18	1,106,715	1,109,585	1,110,609	0%
	69	125,329	152,695	139,469	4,854	7,102	758	4%	18	139,011	139,757	140,548	1%
	70	1,090,389	1,106,277	1,103,505	1,826	4,109	510	0%	23	1,103,322	1,104,251	1,104,737	0%
	71	1,105,100	1,112,220	1,111,195	708	1,452	267	0%	24	1,110,613	1,111,475	1,111,625	0%
	72	-1,058,427	-1,056,150	-1,057,002	474	4,129	127	0%	22	-1,057,148	-1,057,001	-1,056,812	0%
	73	1,125,524	1,130,812	1,130,020	639	4,403	145	0%	21	1,129,936	1,130,210	1,130,320	0%
	74	1,580,316	1,627,515	1,619,599	7,812	27,569	1,812	1%	25	1,620,813	1,622,535	1,623,628	0%
	75	-109,541	-97,450	-101,026	2,858	3,477	1,714	3%	18	-101,851	-102,909	-101,239	2%
	76	1,065,900	1,074,492	1,070,061	2,102	14,436	1,251	0%	24	1,058,736	1,069,531	1,071,815	0%
	77	-140,151	-130,819	-135,099	2,938	3,295	2,521	2%	19	-137,658	-134,435	-132,626	2%
	78	1,221,515	1,236,836	1,230,165	3,231	27,505	1,958	0%	25	1,228,240	1,225,169	1,232,790	0%
	79	-179,542	-152,771	-160,545	8,134	8,758	5,109	5%	19	-170,726	-161,281	-158,519	5%
CTP	80								5				
	81								2				

[1] STDev trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

Table 2: Average IMVs' interquartile dispersion by asset class

Average Interquartile dispersion by asset class

	Interquartile range 2022 exercise	*Interquartile range 2021 exercise*	*Interquartile range 2020 exercise*	*Interquartile range 2019 exercise*	*Interquartile range 2018 exercise*
Equity	21%	2%	1%	2%	2%
IR	16%	19%	2%	3%	8%
FX	3%	4%	16%	15%	6%
Commodity	24%	4%	10%	6%	8%
Credit spreads	1%	1%	1%	3%	6%
CTP			5%	8%	103%

87. Table 1 and Table 2 depict the results at the level of both each individual instrument and each risk type. As shown, the highest dispersion at the level of the individual instruments is detected for IR instrument 38 (5 years IRS) (IQD 256%). This high dispersion is due to the 'low value' (close to zero) of the instruments. In terms of its construction the IQD is a ratio of two absolute measures (difference of the 25th and 75th quantiles, divided by the sum of the two). Therefore, a difference of a few hundred euros in the IMV generates very high IQD statistics, which is the case for some derivative instruments that exhibit an IMV of close to zero at inception, since they are entered at market rates. The same differences in the case of instruments that are much more valuable generate IQDs close to zero. Moreover, it appears that the variety of market practices concerning this instrument is so that make it particularly difficult to describe precisely and so it becomes complicated for banks to book it consistently

88. Besides the 5-year IRS Instrument 37, IR instruments 36 show an IQD above 25%. The perception with regard to these submissions, besides the minor presence of trivial errors such as inverted bookings (long instead of short), is that minimal changes in the parameter cause a significant change in the IMVs. This exacerbates the issue described for instrument 38, which is linked to the low absolute value of the instruments. This tends to inflate the IQD index of these instruments. Excluding these instruments gives us an average IQD for the IR asset class of 2%, which can be interpreted as an extremely low dispersion.

89. The Cmd instruments 48 and 49 also show high IQDs (44%). This is likely due to the low IMVs value, which exacerbate the IQDs, since the instruments are not changed with respect the previous exercise, so such worsening of the IMVs submission would not be explained otherwise.

90. EQ instrument 3, 5, 7 and 8 presents IQDs barely above 50%. These high IDQs are due to an error in the instructions that caused a wrong booking of these instruments. The error was corrected and for the next exercise it is expected that the IQD of this asset class would return to normal standard.

91. Overall, the IQD by asset class for the instruments of the 2022 exercise is comparable to the past exercises for the FX and CS asset classes. The worsening of the other asset class is driven

by specific instruments (e.g., instrument 38) or by a mistake in the ITS instruction (EQ instruments – futures). This means that an adjustment to the 2022 instructions was needed, and for the future exercise there is the expectation that of obtaining a generally low IQD of the instruments in the exercise.

92. Comparing the 2022 instruments with the 2021 instruments purely on the basis of the IQD, once the instruments with values of close to zero that skew the average by asset class have been excluded, as well as the issue linked to the futures description, it would appear that the quality of the data remain stable.

93. From an aggregated risk-type perspective, EQ, IR and CO instruments show the highest dispersion, with values much higher with the 2021 exercise. The FX and CS asset classes are substantially equal with respect to the previous exercise.

94. CTP IMVs are no longer reported since the observations obtained are too few to provide meaningful statistics.

95. A cluster analysis (see Figure 1, Figure 2, Figure 24 and Table 3) was performed to strengthen and deepen the aforementioned descriptive insights. It shows the dispersion of the IMVs by instrument and helps in identifying clusters in the instruments' pricing that could explain the scattering of IMVs for some trades. The results of this analysis suggest that the clusters are observable for EQ instruments 1, 3-5, 7-8 and 17, for IR instrument 38, and for CO instruments 48 and 49. These clustered distributions for EQ are linked to the wrong instructions for futures, while the rest seems to be more closely linked to the extremely low value of the instruments rather than to a misinterpretation of the instruments; this is also confirmed by an analysis of the dispersion of the risk measures relating to these portfolios.

Table 3: IMV cluster analysis – number of banks by range

2022 IMV cluster analysis by instrument: number of banks by range

(X = ratio with the median)

100 Range containing more than 10% of the total sample for that particular portfolio

	Instr. ID	500% < X	300% < X ≤500%	200% < X ≤150%	150% < X ≤100%	100% < X ≤50%	50% ≤ X <0	0 < X ≤ -100%	-100% > X ≥ -200%	Num obs.
Equity	1	12			3	16				31
	2				10	21				31
	3	13				15				28
	4				13	5	10			28
	5	12			4	14	1			30
	6				11	12	4			27
	7	13				15				28
	8	13				15				28
	9				13	14				27
	10				14	13				27
	11	1			12	12				25
	12	1			11	13				25
	13				14	13				27
	14				14	13				27
	15	1			11	13				25
	16				12	13				25
	17		1	11	1	14			1	28
	18				10	11				21
Interest Rate	19		1		20	19		1		41
	20	1	1		16	18			2	38
	21	1			19	20	1			41
	22				21	19		1		41
	23				7	8				15
	24				16	17				33
	25				20	19				39
	26				16	16				32
	27				20	19				39
	28				20	19				39
	29				20	19				39
	30				20	19				39
	31				19	18				37
	32				19	19				38
	33				17	19				36
	34				12	13	1			26
	35				13	14		1		28
	36				21	14	5	1		41
	37				21	19		1		41
	38	2	4	2	8	5		5	5	31
FX	39				17	13	1	3		34
	40	1			16	16	2			35
	41				17	17				34
	42				17	17				34
	43				17	17				34
	44				17	15	2			34
	45			2	15	17				34
	46				16	18				34
	47				17	17				34
Commodities	48			2	5	2	1	1	2	13
	49			2	5	2	1	1	2	13
	50				6	6				12
	51				6	6				12
Credit Spread	52				11	11				22
	53				11	11				22
	54				11	11				22
	55		1		8	9				18
	56				9	9				18
	57				11	11				22
	58				11	12				23
	59				11	12				23
	60				11	12				23
	61				11	12				23
	62				11	12				23
	63				11	12				23
	64				10	11				21
	65				11	12				23
	66				11	12				23
	67				11	12				23
	68				10	11				21
	69				10	10				20
	70				13	14				27
	71				13	13	1			27
	72				13	14				27
	73				13	14				27
	74				12	15				27
	75				11	11				22
	76				13	14				27
	77				11	10	1			22
	78				13	14				27
	79				11	11				22
CVA	80									0
	81									0

96. In particular, as shown in Table 3 and Figure 2:

- Instrument 3, 5, 7, 8 and 17 (EQ) are the high IQD instruments, and this is due to the error in the instruction (amended in the 2023 instructions); for the rest there are generally very few extreme outlier observations, which do not represent a substantial problem for the CAs.
- Instruments 38 (IR): this the only extreme outliers with an IQD above 50%.
- Instruments 39 (FX): the only outlier with a relatively high IQD (above 10%).
- Instruments (CO): instruments 48 and 49 are high IQD instruments with some significant outliers.
- Instrument 67 (CS): No significant outliers.

97. Some of these extreme outlier banks were classified as a high priority for the CAs (see also Chapter 6), so they were followed with greater attention during the exercise in order to specifically define the reason for the extreme result.

98. CTPs are no longer reported in the cluster analysis because of the scarcity of contributions.

99. Despite many recommendations, some minor misalignments in the IMV have been detected due to the reporting of the 'clean price' (i.e., the price of a trade excluding the accrued interest) instead of the 'dirty price' (i.e., the price of a trade including any interest), which is what was intended for the mark to market valuation. This has been detected especially in the bond price, as in instruments 24-35. This problem was more frequent in the past, but it is evident that not all the banks follow the instructions in this regard. On the other hand, this mistake does not significantly prejudice the provision of the risk measures.

100. In addition, the EBA recommends that banks make better use of the Q&A tool by submitting questions before the start of the exercise to avoid misinterpretations in the future. Banks are kindly invited to provide, using the Q&A tool, their best practice and market standard conventions when further specifications of the hypothetical trades are needed.

101. Evidence from a large majority of the banks is that IMV comes from front office systems. This is acknowledged as the best practice for alignment with real market-trading activities.

102. Figure 1 and Figure 2 report the clusters found in the IMV results for a sample of low IQD instruments (0% IQD or close to zero) and high IQD (the highest in the asset class) instruments. All the instruments' IMV distributions are available in the annex in Figure 24.

Figure 1: IMV scatter plots – low-IQD instruments

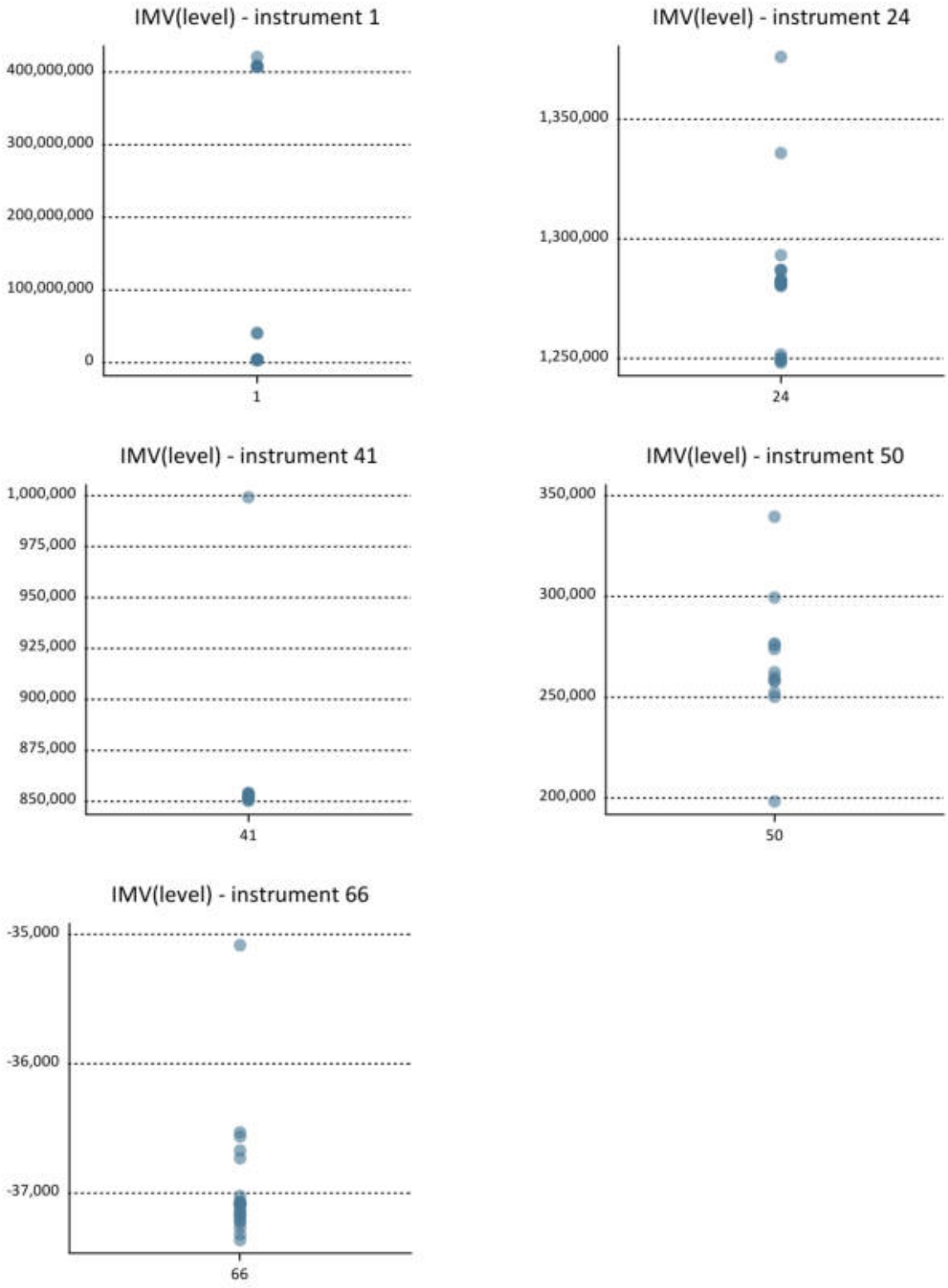
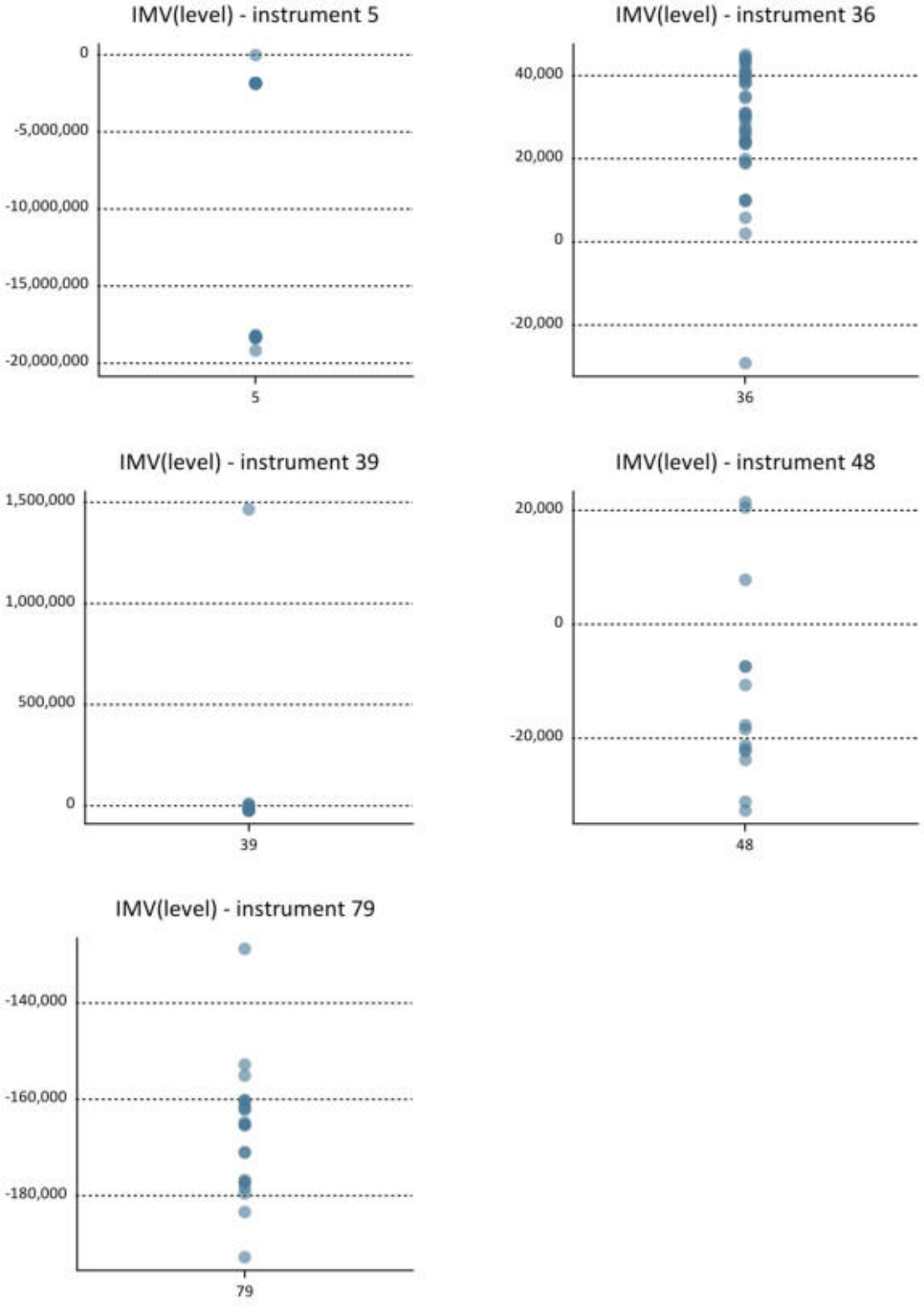


Figure 2: IMV scatter plots – high-IQD instruments



103. The 'concentration index' as per the percentage of values between 50% and 150% of the median value in Table 3 shows that, overall, 93% of the observations lie between those ranges.

104. This result is higher, because of the mistake in the future instruction, but consistent with that reported following last year's MR benchmarking exercise, demonstrating once again that the simplification of the instruments resulted in a decrease in the number of outliers.

105. Given the EBA's experience of past benchmarking exercises, values lying in this range might be considered acceptable on the basis of fine-tuning as successive benchmarking exercises are run. Nevertheless, the aim will be to increase this IMV empirical range coverage in subsequent exercises.

106. For many hypothetical instruments, the IMV variability is explained by the divergence in terms of both fixings and market practice assumptions by the participating banks. Therefore, the interpretation of the deals and market practices substantially explains the observed variability.

4.2 Risk and stressed measures assessment

107. For VaR and sVaR, variability was assessed by using the banks' reported VaR and sVaR over a 2-week period (from 17 January 2022 to 28 January 2022). Banks submitted weekly or daily observations, depending on their models, and the final risk measures by portfolio were obtained by averaging the observations over the 2 weeks.

108. In the sample, 12 out of 41 banks calculated weekly sVaR measures. The remaining two thirds of the participating banks computed daily sVaR measures.

109. In addition, a P&L VaR measure produced by the EBA using the P&L data provided by banks via an HS approach was analysed. The relevant banks delivered a yearly 1-day P&L vector for each of the individual and aggregated portfolios modelled. These were used to compute the P&L VaR.

110. The additional P&L information for non-APR portfolios allowed the EBA to compute the alternative measure for VaR previously defined, and to check the variability of the results across banks by calculating VaR using a 1-year lookback period.

111. Additional checks were carried out for the available P&L vectors, such as the 1-day P&L versus the 10-day P&L (either overlapped or not), where applicable. Furthermore, the time series with the wrong time window were dropped. P&L vectors provided by banks with no HS model were also dropped. A final consistency check across the HS banks entailed computing the ratio between P&L VaR and the regulatory VaR provided, which can be expected to be close to 1.[12]

[12] It should be noted that this expectation depends on the lookback period for VaR.

112. Clearly, the P&L VaR assessment is possible only for banks applying an HS approach, and with at least 185 days of results submitted. Accordingly, banks applying an MC or parametric approach, or another approach other than HS, cannot be subject to this assessment, and have been dropped from the sample (see also Section 3.4, 'Data quality issues').

113. The P&L VaR was computed as the absolute value of the empirical first percentile of the P&L vector rescaled to 10 days by applying the square root of time approximation, without applying any data-weighting scheme:[13]

$$VaR_{99\%}^{10day} = \sqrt{10} * VaR_{99\%}^{1day}$$

114. The P&L vector is used to assess the degree of P&L correlation across banks, as well as the level of volatility shown in each bank's vector. This analysis should provide useful insights into the degree of market consensus on the relevant risk factors in terms of both market dynamics and volatility levels. Obviously, this analysis, like most of those discussed here, relies on sufficient data points and portfolios being modelled by banks to ensure robustness and consistency.

115. The IRC analysis cannot be deepened in this way for VaR because of the higher level of confidence (99.9%) and longer capital horizon (1 year) applied in these metrics. Nevertheless, a variability analysis was performed. In the paragraph concerning IRC, particular emphasis is reserved for missing, zero or unrealistically low results, which suggest that key underlying risk factors are not efficiently captured by the IRC internal model.

116. In the sample, 13 out of 23 banks computed weekly IRC measures.

117. It is apparent that more complex risk measures, such as IRC, are computed at a less frequent pace (i.e., a weekly basis instead of a daily basis).

118. For APR, only a small number of contributions were submitted because of the scarcity of approved internal models on CTPs and because most institutions consider the CTP business to be declining significantly as a result of the recent financial crisis. Therefore, the sample is quite limited.

119. The ES, as an alternative risk metric to VaR, has been estimated from the daily P&L series by averaging the P&L observations below the 2.5th percentile converted by the square root of time approximation and taking the absolute value:

[13] Some banks apply data weightings at a risk factor level and these will be present in the P&L vectors. This is an implicit source of variability that cannot be controlled.

$$ES_{97.5\%}^{10day} = \sqrt{10} * ES_{97.5\%}^{1day} = \sqrt{10}\ \frac{1}{n}\ \sum_{i=1}^{n} P\&L_{t_i}$$

where *n* = number of days describing the 2.5th quantile rounded to the highest decimal.

120. For the aggregated portfolios, diversification effects were checked with regard to the VaR, sVaR and IRC metrics, regardless of whether they were provided or estimated.

121. For the most inclusive portfolios – i.e., the aggregate portfolios – the implied capital charges were also computed, and their variability analysed. Where possible, the idiosyncratic factors that drive variability and the impact of regulatory add-ons (e.g., multipliers) were analysed.

122. It is worth noting that, although the effects on capital levels of these supervisory actions can be substantial, an HPE is not suitable for assessing such differences. This is especially the case for diversification benefits since these effects are entirely portfolio-dependent. More on this is included in the following subsection entitled 'Limitations'.

123. Finally, to make the analysis more comprehensive, CAs were asked to complete a questionnaire about the takeaways from this benchmarking analysis and the actions they plan to take to overcome potential weaknesses in the banks' MR models (see Section 6 of this report). Thanks to the interview process, the EBA had the opportunity to discuss directly some issues raised by CAs when challenging the models in the ongoing assessment process.

4.2.1 Limitations

124. The design of the benchmarking portfolio exercise described in the ITS aims to ensure the quality of the data used in the report to be produced by the EBA and, more importantly, to identify the banks and portfolios that need specific attention on the part of the responsible CAs. Nevertheless, any conclusions regarding the total levels of capital derived from the hypothetical data should be treated with due caution. The hypothetical portfolios are very different from real portfolios in terms of size and structure. What is more, the data cannot reflect all the actions taken by supervisors.

125. From a methodological perspective, the sVaR metric variability observed could originate either from differences in modelling or from the different data periods used for sVaR computation. Further variability stems from banks' different stress periods because there is no common benchmarking stress period. To allow more specific analysis of this aspect, since the 2019-2020 benchmarking exercise more information about the stressed VaR time window has been requested from banks by expanding the relative template envisaged in Annex VI of the benchmarking ITS (in this regard, see subsection 5.2.5.d, 'Common stress period considered' below).

126. Another limitation that was tackled in this exercise is that of producing a segregated analysis for institutions with partial model approval (e.g., general risk only) in order to split the result for portfolios with specific risk to filter the additional unwarranted dispersion of VaR figures. The benchmark analysis was run by splitting banks with full approval for equity and IR

from those with partial approval to filter out the variability of the risk measure introduced by the partially approved banks.

127. Banks with partial model approval provided insights into how they approached the benchmarking exercise. It has been found that the differences reported by the banks in respect of the EBA's benchmark measure are almost entirely explained by considering the internal measure of risk, which is not approved for capital purposes but is more complete in terms of risk factor coverage.

128. In summary, the reporting of partial use approval results should be continued for the purpose of the exercise. However, it should be considered within the specific sample in order to assess any bias these partial use approval results could introduce into the results for the rest of the sample observed.

5. Overview of the results obtained

5.1 Analysis of VaR and sVaR metrics

129. The dataset used to perform the assessment of risk measures for the 2022 exercise was determined on the basis of the actual dispersion of the risk measures analysed. The outcome of the IMV extreme value analysis was used as an early indication of the potential problems to be reported to banks by their CAs. As explained in Section 4.1, banks' data were taken into account only for portfolios for which the RM is between the benchmark (50th percentile) +/- two times the truncated standard deviation in the portfolio analysed. The rest was classified as an outlier. As shown in Figure 33, we can see that this methodology, contrary to what was used until the 2019 exercise, does not exclude RMs that are clearly consistent with the benchmark.

130. To check if submissions (by portfolio) were at least approximately symmetrically distributed around the mean and/or the median, the EBA checked for any significant differences between the mean and median values for the truncated sample. Table 20 in the annex reports the banks' VaR results in relation to the median, aggregated into six buckets, to enable the detection of unexpected clusters.

131. As Table 20 and Table 21 clearly show, the variability of the VaR (above 20% in IQD) remained substantially high and comparable to the previous year, where only FX portfolios asset class report some decrease in the IQDs. The analysis also identifies substantial clusters for portfolios 1-4 and 7 (EQ), portfolio 24 (IR), portfolio 33 (CO), and_36-37, 40-41, 43, 45, 52-53 (credit spread). After the spikes in the volatilities of the 2020-2021, in the 2021-2022 period the volatility in the market seems to be back to pre-Covid period (just slightly higher). This is reflected by lower levels of VaR. Nonetheless, the IQDs remain substantially high. At least for EQ portfolio this high IDQs should be caused by the errors in booking of the future products. Nonetheless, IQDs for FX and CS portfolio are substantially lower.

132. As in the previous exercise, the VaR values for CTPs (portfolios 54 to 56) are not reported because of insufficient numbers of these data submission to guarantee the significance of the statistics provided and the anonymity of the submissions.

133. The cluster analysis presented above is superior to a simple outlier analysis that flags submissions more than a designated number of standard deviations from the mean, as this method cannot easily be used for clustered or strongly asymmetric portfolios.

Interquartile dispersion

134. Figure 3 and Table 4 summarise the variability of the results, measured via the IQD and coefficient of variation, for the IMV as well as all three VaR measures (i.e. VaR, VaR for HS banks only and VaR calculated from the 1-year P&L series submitted by HS banks). IQD and CV for IMV,

PV, VaR and stress VaR, divided by risk factors, are reported at the bottom of Figure 3. Table 4 also includes the VaR results for MC simulation banks and the expected shortfall.

135. In terms of risks across different assets classes, the IQDs for VaR for EQ asset class is increased; while they are close to 20% for the IR and CO portfolios, they are lower than EQ and CS risk types. The asset class with the lower level of IQD is FX, with just 11%. The asset class with the highest IQD remain the CS (28%; it was 37% in 2021). Overall, the IQD is lower than in the 2021 exercise, where there was an average dispersion of the VaR of 25%, whereas this decrease to 21% in the 2022 exercise (it was 17% before Covid pandemic in 2020). This decrease in the IQD of the VaR is likely to have stemmed from a decrease in the volatility in the market in 2022.

136. As expected, the IQD for sVaR is higher than for VaR (see the bottom panels of Figure 3), with an average IQD of 28% (29% in 2021 and 25% in 2020). The CS asset class features a higher dispersion once again (35%; in 2020 and in 2021 it was 34%), but the IQD ratios for IR is also above 30%. Higher sVaR dispersion is likely to be due to the differences between banks in their choice of the 1-year stress period used, which is chosen based on each participating bank's actual portfolio. It might therefore be the case that the sVaR is not calculated with respect to the 1-year period that maximises VaR for the given hypothetical portfolio.

Figure 3: Interquartile dispersion and coefficient of variation for IMV and risk metrics by portfolio

Table 4: Interquartile dispersion for IMV, risk metrics and SBM OFR by risk factor

Average Interquartile dispersion by risk factor

	IMV	VaR (all sample)	SVaR	P&L VaR	VaR HS banks	VaR MC banks	Exp shortfall	OFR SBM
Equity	21%	25%	28%	24%	24%	9%	22%	17%
IR	16%	21%	33%	18%	17%	13%	17%	11%
FX	3%	11%	26%	12%	10%	10%	9%	2%
Commodity	24%	18%	18%	14%	13%	0%	25%	26%
Credit spr.	1%	28%	35%	27%	24%	17%	26%	22%

137. Table 4 confirms that when a homogeneous subset of banks is considered (i.e., HS or MC banks), the VaR results show less dispersion than the total sample (average 18% vs. 21%). With regard to the P&L VaR, it is evident that the dispersion (19% on average) is slightly higher with respect to both HS VaR and all-sample VaR for all the asset classes. This is not consistent with the assumption that fewer differences in the methodology would imply less dispersion among the risk measures. Further investigations on the P&L VaR shall be run in the future in order to clarify this inconsistency.

138. When comparing variability for HS VaR and MC VaR, also this year's result tells us that the MC VaR values are less dispersed than those of the HS VaR, as it was in the past exercise. Nonetheless, the analysis needs to take account of the fact that the sample of MC banks is quite small compared with that of HS banks (i.e., 7 MC banks versus 28 HS banks). As far as parametric banks are concerned, a similar analysis is not informative as the total number of parametric banks is very small (i.e., three banks in the sample – the remaining three apply a combination of methods).

139. The ratio between sVaR and VaR was also analysed across the sample (see Table 25 in the annex). Some banks have ratios below 1 for many portfolios, while other banks have extremely high ratios for some portfolios. While it is generally expected that the sVaR is greater than the VaR, the clear disparity between these values is usually a natural indication that something is wrong with the data submitted, and the EBA and CAs have to pay attention to these observations.

140. Table 5 shows the distribution of the sVaR–VaR ratio classified into three buckets (i.e., below 1, between 1 and 3, and above 3) for each portfolio. It is worth noting that a significant number of portfolios for EQ, and IR have a significant proportion of ratios below 1.

Table 5: sVaR–VaR ratio by range (number of banks as a percentage of the total)

Distribution of sVaR / Var ratio over portfolios

(K = ratio with the median)

	Port. ID	K > 3	1 < K < 3	K < 1
Equity	1	11.1%	81.5%	7.4%
	2	32.0%	68.0%	0.0%
	3	0.0%	82.6%	17.4%
	4	4.3%	78.3%	17.4%
	5	17.4%	65.2%	17.4%
	6	0.0%	62.5%	37.5%
	7	25.0%	62.5%	12.5%
	8	0.0%	68.2%	31.8%
	9	9.1%	81.8%	9.1%
	10	33.3%	66.7%	0.0%
Interest Rate	11	[illegible]	[illegible]	[illegible]
	12	11.0%	[illegible]	[illegible]
	13	[illegible]	[illegible]	[illegible]
	14	[illegible]	[illegible]	[illegible]
	15	[illegible]	[illegible]	[illegible]
	16	11.0%	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]
	18	[illegible]	[illegible]	[illegible]
	19	11.0%	[illegible]	[illegible]
	20	[illegible]	[illegible]	[illegible]
	21	11.0%	[illegible]	[illegible]
	22	[illegible]	[illegible]	[illegible]
	23	11.0%	[illegible]	[illegible]
	24	[illegible]	[illegible]	[illegible]
	25	[illegible]	[illegible]	[illegible]
	26	[illegible]	[illegible]	[illegible]
	27	[illegible]	[illegible]	[illegible]
FX	28	10.3%	79.3%	10.3%
	29	21.4%	78.6%	0.0%
	30	10.7%	89.3%	0.0%
	31	35.7%	64.3%	0.0%
	32	42.9%	57.1%	0.0%
Commodities	33	[illegible]	[illegible]	[illegible]
	34	[illegible]	[illegible]	[illegible]
	35	[illegible]	[illegible]	[illegible]
Credit Spread	36	38.9%	55.6%	5.6%
	37	42.9%	50.0%	7.1%
	38	35.3%	64.7%	0.0%
	39	40.0%	46.7%	13.3%
	40	66.7%	22.2%	11.1%
	41	44.4%	50.0%	5.6%
	42	17.6%	58.8%	23.5%
	43	40.0%	45.0%	15.0%
	44	35.0%	55.0%	10.0%
	45	50.0%	44.4%	5.6%
	46	35.3%	58.8%	5.9%
	47	55.6%	33.3%	11.1%
	48	37.5%	62.5%	0.0%
	49	44.4%	44.4%	11.1%
	50	10.5%	78.9%	10.5%
	51	20.0%	80.0%	0.0%
	52	13.3%	66.7%	20.0%
	53	6.3%	87.5%	6.3%
	54	0.0%	100.0%	0.0%
	55	29.4%	70.6%	0.0%
	56	15.0%	75.0%	10.0%
CVA	57	11.0%	11.0%	0.0%
	58	11.0%	11.0%	0.0%
	59	11.0%	11.0%	0.0%
All-Within-ETP	60	18.2%	72.7%	9.1%
Equity Cumulative	61	11.8%	64.7%	23.5%
IR Cumulative	62	7.7%	88.5%	3.8%
FX Cumulative	63	46.4%	50.0%	3.6%
Commodity Cumulative	64	22.2%	66.7%	11.1%
CS Cumulative	65	7.4%	85.2%	7.4%
CVA Cumulative	66	37.5%	58.0%	3.4%

5.2 A closer look at the VaR and sVaR results

141. Figure 4 and Figure 5 give an overview of the VaR and sVaR results for portfolios 1 to 59, i.e. they do not include the aggregated portfolios, where fewer observations were available for the reasons explained above (see Section 3.4).

142. Broken down by portfolio, the figures show the average VaR and sVaR over the 10-day submission period for each bank, normalised by the median[14] of the given portfolio.[15]

143. Comparing Figure 4 and Figure 5, it looks as if the dispersion is higher for sVaR than for VaR (sVaR 28% IQD versus 21% VaR IQD on average). Differences in dispersion between VaR and sVaR seem steady but are more marked for the FX and IR portfolios, in which sVaR shows a higher level of dispersion than in the other asset classes (26% and 33%).

144. FX and CO are the asset classes with the lowest levels of dispersion for VaR (11% and 18%), as they are for sVaR (26% and 18%).

[14] The portfolio median is the median of the average VaR and sVaR over the submission period.

[15] Note that the figures are restricted to VaR–median and sVaR–median ratios below 450%.

Figure 4: VaR submissions normalised by the median of each portfolio

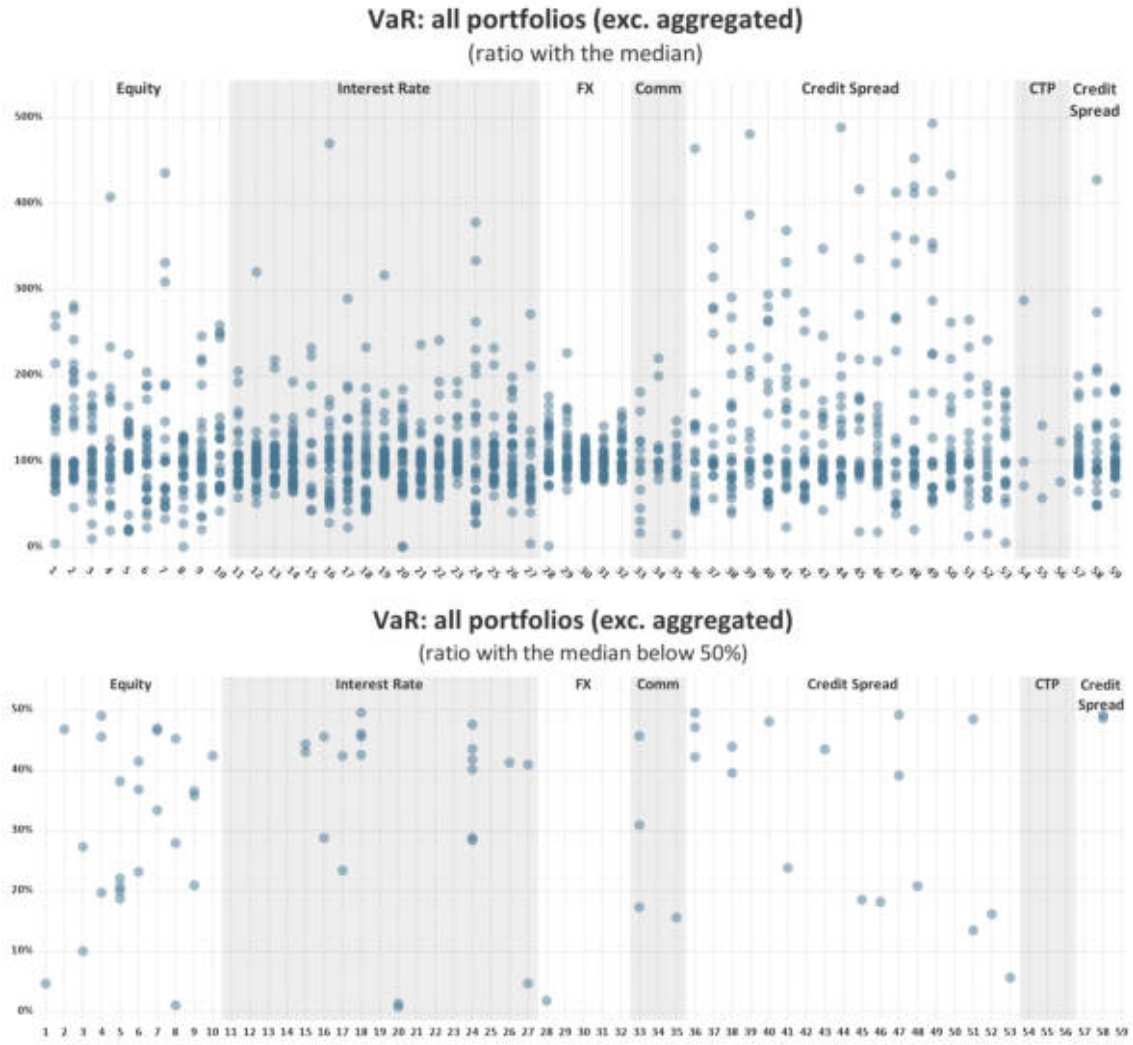
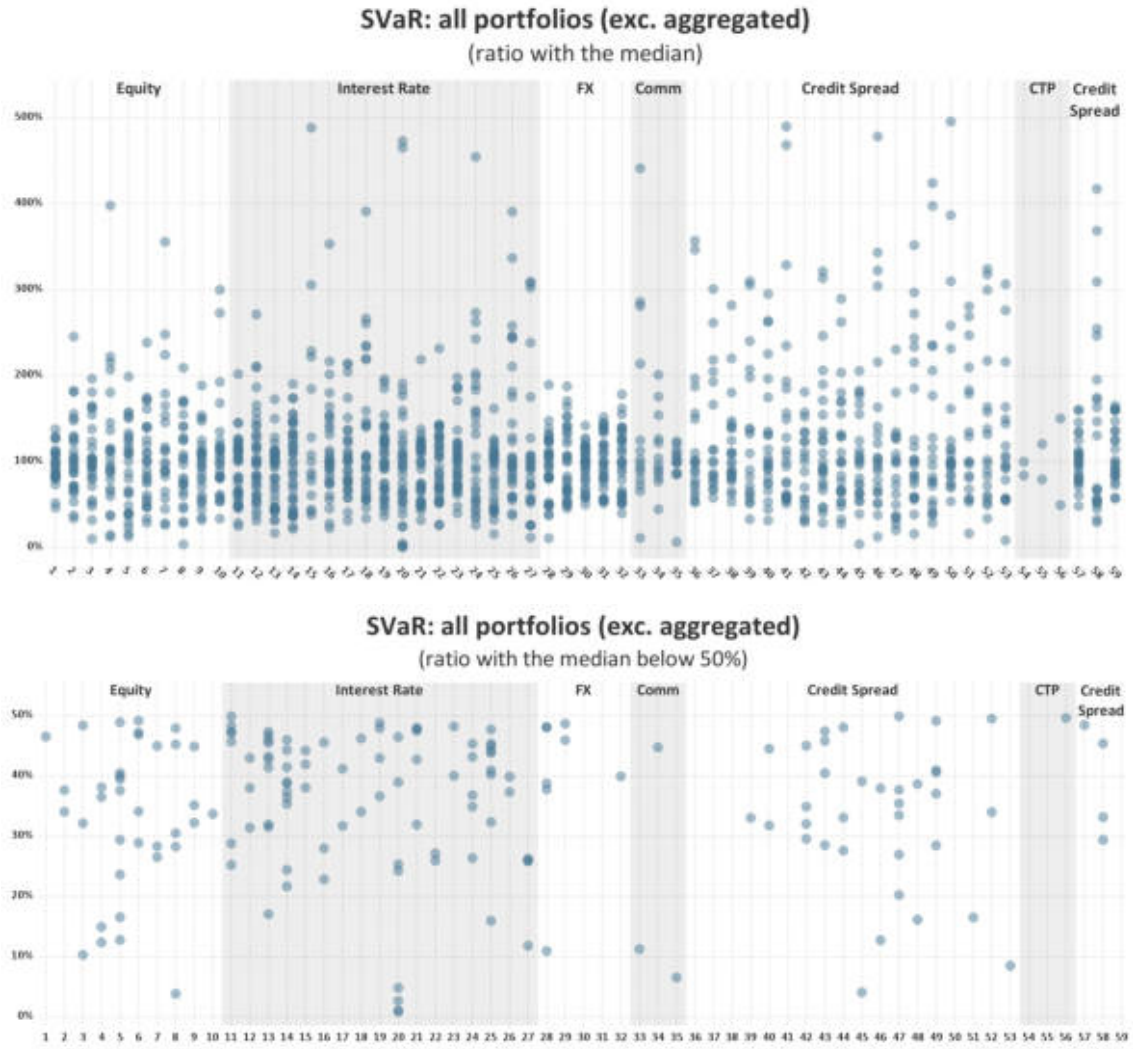


Figure 5: sVaR submissions normalised by the median of each portfolio



145. Table 21 and Table 22 in the annex report all the VaR and sVaR statistics along with EU benchmarks for all HPE portfolios.

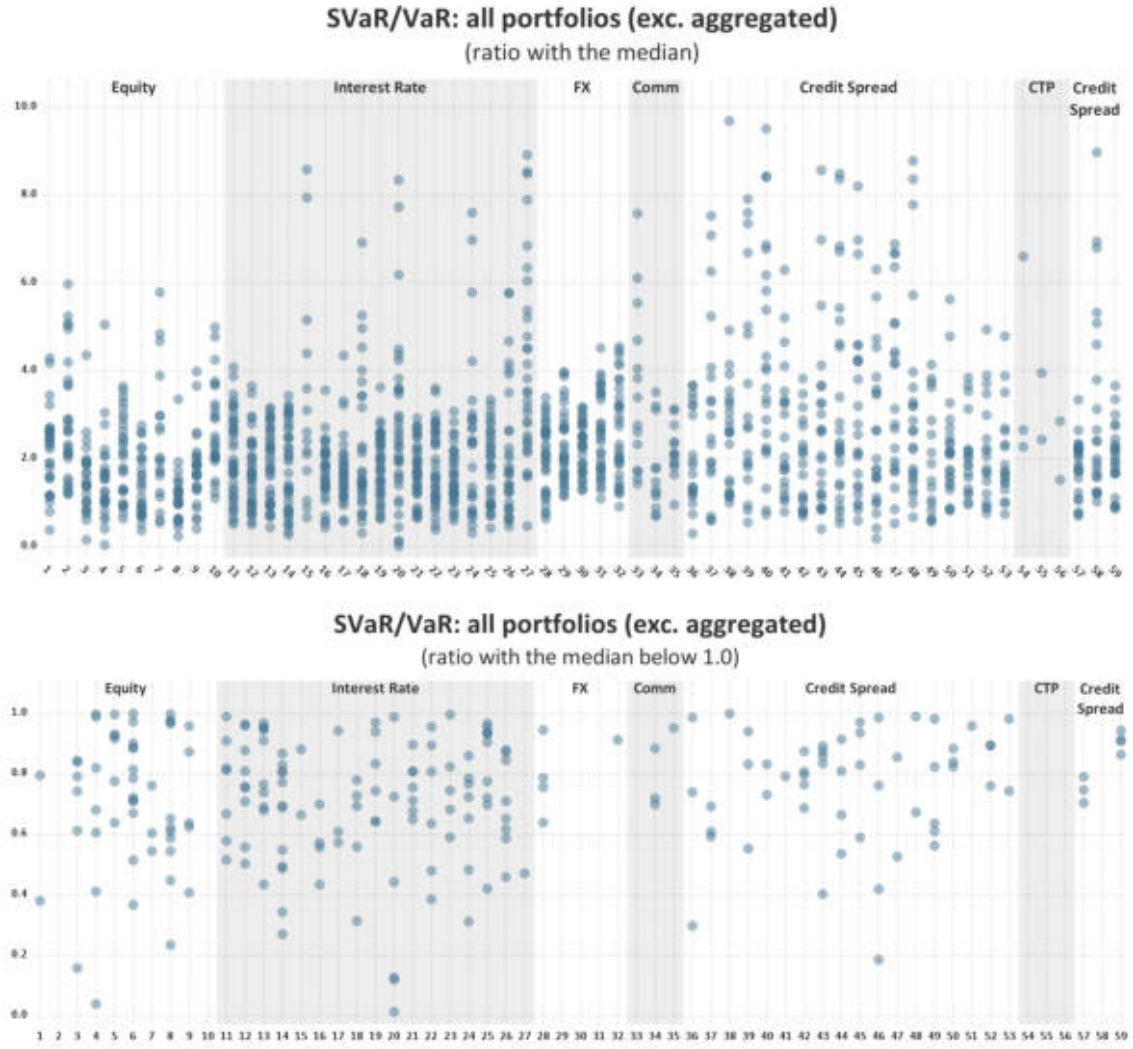
5.2.1 Comparison of sVaR and VaR ratios

146. Banks were assessed in relation to the full sample not only by their VaR and sVaR values, but also by their sVaR–VaR ratios (Table 25). In general, it should be expected that sVaR would be at least as high as VaR, as sVaR is calibrated to a 1-year period of significant stress. This is verified in 89% of cases. This was just 73 percentage in the previous exercise. It should be noted that the 2021 VaR statistics submitted in the previous exercise were substantially higher in absolute terms compared to the past (this percentage was usually above 90%) due to the Covid pandemic and the higher volatility generated in the market. The evidence tell that this ration has now return to the level pre-pandemic.

147. Figure 6 shows the ratio of the average sVaR to the average VaR for each bank. The sVaR–VaR ratio varies significantly across the portfolios. Excluding outliers, the average sVaR–VaR

ratio per portfolio varies between 0.63 and 11.92 and averages 2.31. The portfolios with the lowest levels of dispersion for the sVaR–VaR ratio (excluding outliers) are portfolios 9 (EQ), 17(IR), 30 (FX), 35 (CO) and 57 (CS).

Figure 6: sVaR–VaR ratio for the average VaR and sVaR by portfolio



148. A few banks have a high sVaR–VaR ratio for portfolios in certain asset classes only. This suggests that these asset classes dominate the banks' real trading portfolios and, for that reason, drive the calibration of the sVaR window.

5.2.2 Drivers of variation

149. Based on the qualitative information provided by banks (Figure 7 to Figure 11), the most common methodological approach used by banks to model MR is HS (68%). Although the majority of banks use the same methodological approach, the dispersion of VaR remains significant because other modelling choices play a key role in producing variability of the risk

measures (e.g., differences in time scaling and/or weighting scheme choices, absolute versus relative returns for different asset classes).

Figure 7: Qualitative data: VaR methodological approaches

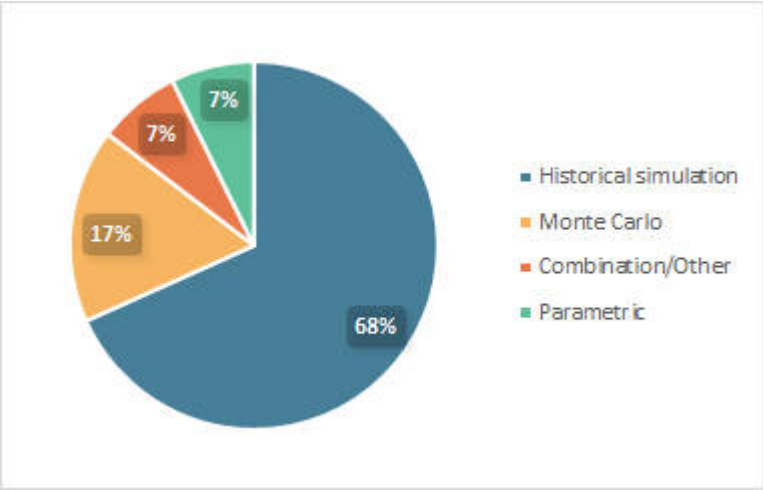
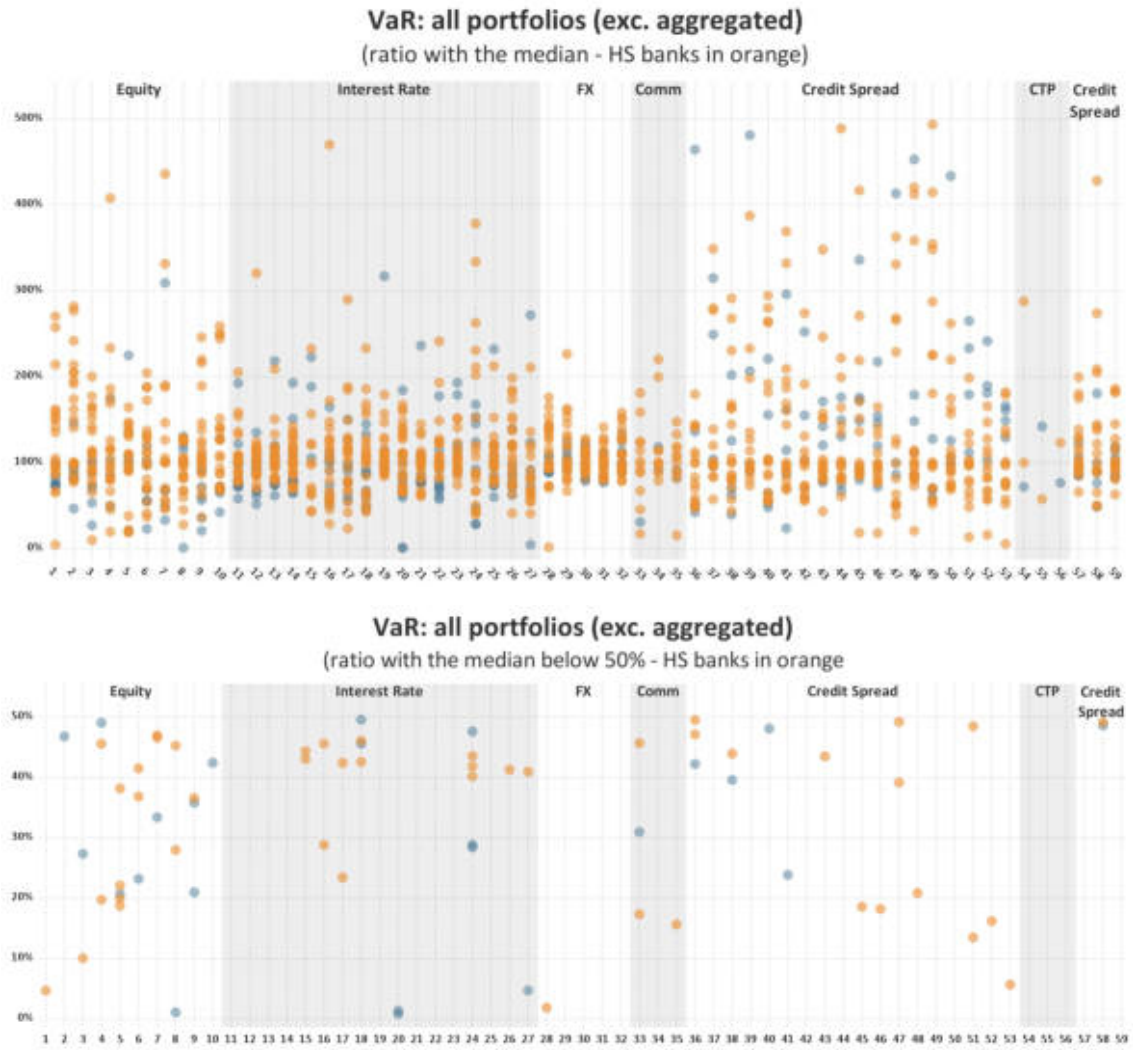
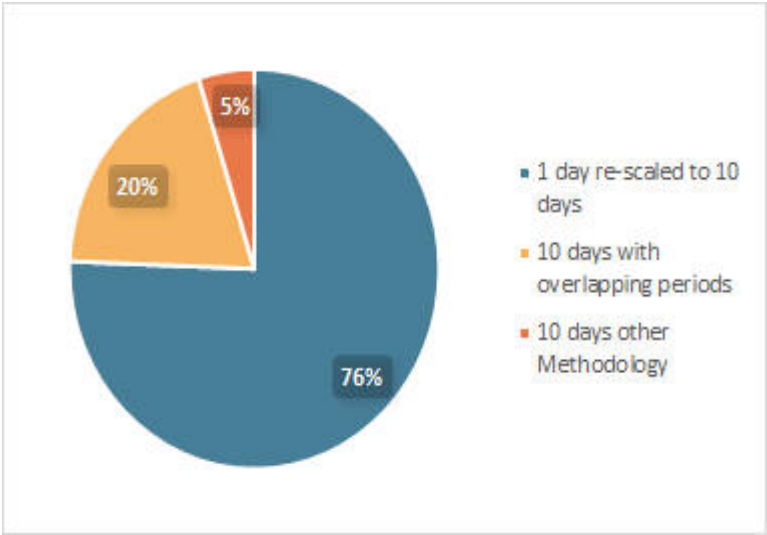


Figure 8: VaR submissions normalised by the median of each portfolio (by methodological approach)



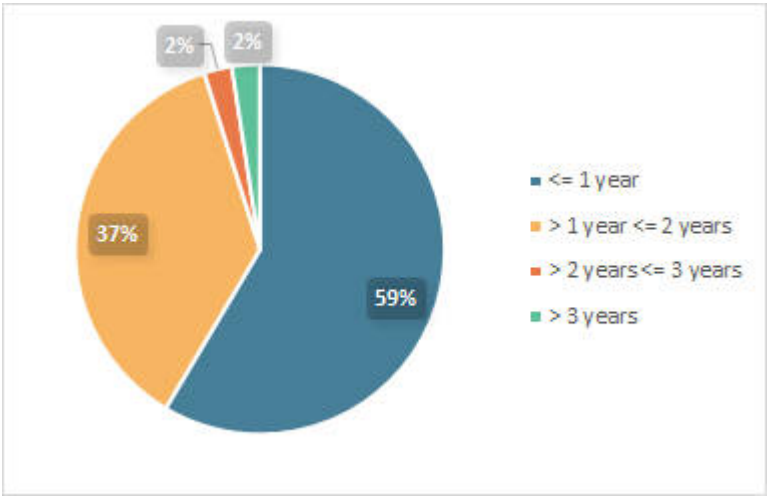
150. With regard to the regulatory 10-day VaR computation, by far the preferred method is rescaling the 1-day VaR to the 10-day VaR using the square root of time approximation.

Figure 9: Qualitative data: VaR time-scaling techniques



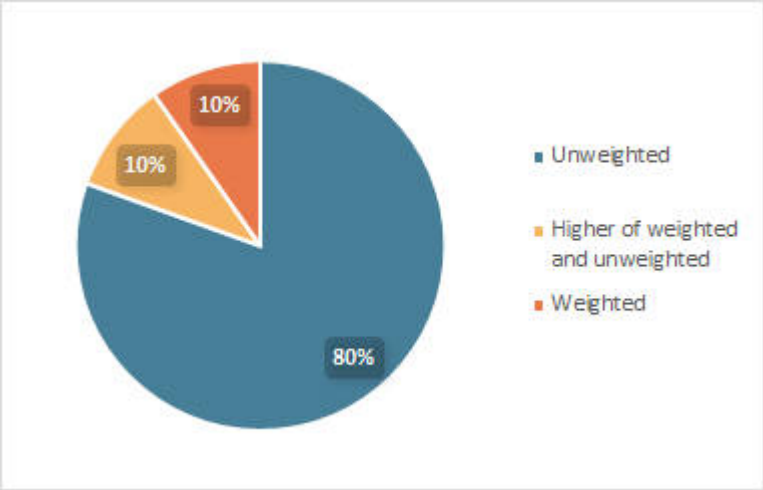
151. With regard to the historical lookback period used to calibrate banks' VaR models, 59% of the banks use the minimum period of one year and applying a period longer than 2 years is very unusual.

Figure 10: Qualitative data – length of VaR lookback period



152. As for the possible use of a data-weighting scheme, the great majority of banks' models use unweighted data in the regulatory VaR computation (80% of respondents).

Figure 11: Qualitative data – VaR weighting choices



153. Finally, with regard to supervisory actions on regulatory add-ons, 83% of the banks in the sample have a total multiplication factor greater than the minimum of 3, which includes the addend resulting from the number of over-shootings (Table 1 in Article 366 of the CRR) and any supervisory extra charge(s). The average total multiplication factor in this sample is equal to 3.73, with a maximum of 5.5. As a result, quite a number of banks either have to correct for excessive over-shootings or are subject to supervisory measures. In addition, some banks have been assigned other kinds of added penalties that encompass risk 'not in VaR' and additional charges for IRC and APR. This was apparent from the additional and related information provided by some CAs about their supervised banks, and from discussions with some banks during the interviews.

154. These responses suggest that the observed variation may be due to a number of different drivers. The EBA chooses to present the analysis using the following broad headings:

- supervisory actions;
- modelling differences; and
- other drivers of variation.

5.2.3 Supervisory actions

155. Supervisory actions can take different forms and are therefore difficult to capture fully in the analysis. However, the effects of some types of supervisory charges can be approximated. The effect of a higher VaR or sVaR multiplier imposed by a CA because of model weaknesses, for example, can be studied using the following proxy:

$$\text{Capital proxy} = m_{vaR} * VaR + m_{sVaR} * sVaR$$

where m_{VaR} and m_{sVaR} are the total regulatory multipliers given by 3 plus any add-on resulting from excessive backtesting exceptions and other prudential extra charges imposed by the regulator (where appropriate).

156. Including the multipliers in the analysis did not significantly change the results in terms of variability across the sample; that is, the positioning across the sample changed, but, on average, the extent of the dispersion did not.

157. Other supervisory measures, such as capital add-ons, cannot be easily captured. They are normally calculated at an aggregate level on the basis of the banks' actual portfolios and cannot therefore be readily computed for the hypothetical portfolios used for benchmarking. Moreover, it tends to be the case that these add-ons are intended to capture difficulties in modelling risks associated with more exotic trades not represented well in the HPE.

5.2.4 Modelling differences

158. As outlined in Chapter 4, the CRR permits banks to tailor their VaR models to their specific requirements by making different modelling choices. To test the impact of different modelling choices in a controlled manner, four portfolios were selected based on low IQD. Obviously, the average sample size in this analysis is limited.

159. The portfolios – portfolios 3, 13, 31 and 48 – cover the main asset classes (i.e., EQ, IR, FX and CS) and were chosen due to the relative low variability of the submissions received for them. Six subsets of banks were defined within (and hence controlling for) the sample of banks using historical simulation, distinguishing the following modelling choices:

- 1-day scaled versus 10-day overlapping returns[16];
- the length of the historical lookback period (1 year versus > 1 year)[17]; and
- keeping constant the 1-day and unweighted modelling choices and varying the length of the lookback period (1 year versus > 1 year).[18]

160. As shown in Table 6 and Table 7, there seems to be evidence that the modelling choices matter in terms of dispersion and the conservativeness of the VaR. For instance, for the EQ portfolio the 1-day calibration, more than 1 year and unweighted choices produce less dispersed and more conservative results.

161. For the IR portfolio the 1-day and more than 1-year calibrations produce more dispersed and more conservative results.

[16] 31 banks adopted 1-day returns, while 10 banks adopted 10-day returns.

[17] 24 banks adopted 1-year, while 17 banks adopted > 1 year.

[18] 16 banks adopted 1-day, unweighted & 1-year, while 9 banks adopted 1-day, unweighted & >1 year.

162. For the IR, FX and CS portfolios, the '1 year' calibration produces less dispersed but less conservative results.

163. Columns 5 and 6 of Table 6 and Table 7 illustrate the effect of increasing the lookback period (1-year compared to 'more than 1 year') when we keep the other factors (1-day & unweighted shocks) the same. We see the 'more than 1 year' calibration tending to produce less dispersed and more conservative results across assets classes. This result is the opposite of what observed in the previous exercise.

164. These results can be directly matched to the previous year's results because the instruments selected are the same. It is clear that these results depend on the portfolios' selection but also on the period applied for this analysis. Therefore, based on this analysis, it is difficult to support the idea that one specific model choice will lead to consistently more conservative and less dispersed risk measures, at least on a stable basis.

Table 6: Coefficient of variation for regulatory VaR (controlling for HS) by modelling choice (%)

	Coefficient of Variation for regulatory VaR (controlling for HS)					
Port.	*1-day*	*10-day*	*1y*	*>1y*	*1d, 1y, unw*	*1d, >1y, unw*
EQ 3	35.9%	35.3%	30.0%	26.2%	35.0%	7.6%
IR 13	15.0%	14.4%	15.4%	15.4%	15.6%	12.6%
FX 31	14.2%	12.0%	11.0%	11.6%	11.8%	14.5%
CS 48	30.0%	36.1%	30.5%	32.7%	39.9%	15.7%
mean	23.8%	24.5%	21.8%	21.5%	25.5%	12.6%

Table 7: Average regulatory VaR by modelling choice

	Average VaR subsamples					
	1-day	*10-day*	*1y*	*>1y*	*1d, 1y, unw*	*1d, >1y, unw*
EQ 3	12,409	12,431	10,294	15,321	10,035	18,051
IR 13	148,786	138,907	143,999	149,020	143,155	152,640
FX 31	313,264	306,444	292,609	340,852	294,050	338,885
CS 48	8,429	9,375	8,151	10,342	8,079	8,552

5.2.5 Other drivers of variation

165. In addition to the drivers of variation discussed in the preceding two subsections, there may be other drivers of variation.

166. In subsection 5.2.4 'Modelling differences', for instance, only results obtained with HS VaR were discussed, although the methodological aspects considered are expected to be important for other model types (e.g., MC simulation) as well.

167. Another driver of variation are the risks not captured in a model. Due to the simplification of the exercise compared to initial benchmarking exercises (2016-2018), the majority of the most exotic instruments were deleted, so most of the possible risk factors not in the models are no longer present in the exercise. Moreover, banks that are not able to model specific trades are allowed by the Benchmarking RTS not to submit the risk measure. This is shown, for example, in instrument 23 (IR 'Cap and Floor' on 10-year note), where only 14 observations (across 41 banks) are available. Nonetheless, for this non-vanilla product the IQD is 32% for the VaR (portfolio 15), which is similar to other IR portfolios, which means that the submitting banks presented some consistent risk measures. As a result, it is likely that few risks not in VaR were present.

168. The use of proxies probably leads to spurious variability in some of the hypothetical portfolios characterised by less liquid risk factors, for example some credit spreads. This consideration also applies to the sVaR.

169. As in the previous exercise, the EBA also presents an analysis of aspects not considered in the past (2016-2018). Four additional drivers of variation will therefore be tested in the following areas: (a) size of the bank, (b) business model, (c) level of approval of model (e.g., general interest risk versus general and specific interest risk approval, or general equity risk versus general and specific equity risk approval) and (d) time window selected for the calibration of the stressed VaR. As for the previous exercise (2020 and 2021), the EBA also tested different definitions of size and business models.

a. Size of the bank

170. The size of the bank could have some impact on the internal model. Larger banks are expected to invest more in internal modelling, and this could have an impact on the quality of the model and the results submitted. The same can be said of banks that invest more in market activities in terms of their whole bank activity. The composition of the bank's trading portfolio could also have some influence on the design and performance of the internal model. Nonetheless, size is not a uniquely definable variable.

171. For the scope of the analysis, the size of the banks was selected based on banks' common reporting results concerning the RWA for market risk. The market risk RWA was preferred in selecting the size because a bigger bank in terms of total RWA can have a smaller market risk trading book in relative terms. The market risk RWA variable was therefore preferred. It should be noted that market risk RWA also incorporates the standardised measure but classifying the bank by the internal model market risk RWA did not change the composition of the sample substantially.

172. The banks were divided into three subsamples: large (above the 75th quantile), medium (between the 75th and 25th quantiles) and small (lower than the 25th quantile). Detailed VaR tables are presented in the annex (see Table 27, Table 28 and Table 29).

173. Table 8 summarises the effect of the bank's size. Because of the decreased number of submitters, the 'small banks' sample lost a little of its significance. Fewer banks means fewer submissions, and the smaller banks usually report less information. Therefore, it is more interesting to look at the difference in dispersion among medium and large banks. For all asset classes other than CS, it seems that dispersion decreases with the size of the banks. This implies that the banks' size does matter and that variability in size increases the dispersion of the general results submitted.

174. Further analysis of this aspect can be carried out in terms of the factors selected to define the size. If we run the same analysis using the size of the trading book[19] instead of the size of the bank (defined by RWA for market risk), we can see that dispersion varies again across different asset classes and different sizes of banks. The results are reported in Table 30, Table 31 and Table 32. Looking solely at the trading book size, we obtain different results. The average IQD ratio is not monotonic with the size of the trading book. The average IQD is 14% for small TB banks, 21% for medium TB and 12% for large TB banks.

175. The results concerning the impact of size on variability are mixed, but interesting, and these results merit investigation in the exercises.

Table 8: Asset class comparison for VaR in terms of banks' size

	VaR - Avg. Interquartile Range			
	All Banks	*Small Banks*	*Medium Banks*	*Large Banks*
Equity	25%	20%	29%	12%
Interest Rate	21%	12%	22%	13%
FX	11%	9%	11%	7%
Commodities	18%		20%	8%
Credit Spread	28%	16%	24%	21%
CTP				
All-in	10%	6%	8%	7%

b. Business model

176. The business model of the banks in the sample was selected based on a previous analysis run by the EBA (EBA – LCR Report[20]). In the sample of 41 banks, 23 were classified as cross-border universal banks, which is by far the most numerous business model in the sample. The

[19] The size of the trading book was defined as: (assets held for trading + liabilities held for trading) / (total assets × 2). Data source: FINREP data)

[20] https://eba.europa.eu/-/eba-reports-on-the-monitoring-of-the-lcr-implementation-in-the-eu

remaining banks were either not classified or had different business models (e.g., local universal banks), but they were too few to use as a subsample for this kind of analysis. As a result, the cross-border universal bank business model was selected.

177. Specific VaR results for banks classified as cross-border universal banks are shown in Table 33 of the annex. Table 9 summarises the impact of the business model on different asset classes. It is clear that the business model selected is so predominant in the sample that it does not allow for proper discrimination among the whole sample; therefore, the dispersion of the banks belonging to the same business model is very close to the dispersion of the whole sample for the banks. Judging from the results, there is some weak evidence that the business model has some effect in increasing the dispersion of the VaR submission.

178. Further analysis of the business model can be carried out in terms of factors selected to define the business model. If we run the analysis based on the amount of 'Level 3 assets and liabilities' in relation to the size of the trading book[21] (FINREP data), the results are reported in Table 34, Table 35 and Table 36. The average IQD is 17% for the low level of Level 3 A&L banks, 20% for the medium level and 16% for the high level of Level 3 A&L banks. Therefore, it seems that a more exotic composition of the bank's trading book does not affect the variability of the results.

Table 9: Asset class comparison for VaR within the same business model (cross-border universal bank)

	VaR - Avg. Interquartile Range	
	All Banks	*Cross-border Universal bank*
Equity	25%	21%
Interest Rate	21%	18%
FX	11%	10%
Commodities	18%	20%
Credit Spread	28%	21%
CTP		
All-in	10%	7%

c. Level of approval

179. Banks can have different levels of approval for equity and interest rate risks. To be more specific, banks can apply to obtain approval for the general equity or interest rate risk or they can apply for approval of the specific equity or interest rate risk as well. See also the discussion in Section 4.2 on this point. In general, having approval for both the general and the specific parts of the equity and interest rate risks allows banks to fully model the instruments in the equity and credit spread sections of the exercise. Nonetheless, banks with only general approval are required to report these instruments as well, but this has been known to generate additional

[21] (Level 3 assets held for trading + level 3 liabilities held for trading) / (assets held for trading+ liabilities held for trading)

dispersion in the risk measures submitted. For this reason, in this exercise the EBA filtered all the results submitted and produced IQD statistics for the banks belonging to the sample of banks with different levels of approval.

180. Among the banks that submitted results for interest rate risk, 22 banks in the report have general and specific approval (see Table 37) and 17 banks have only general approval (see Table 38). Among the banks that submitted results for equity asset risk, 26 banks in the report have general and specific approval (see Table 39) and 8 banks have only general approval (see Table 40).

181. Table 10 summarises the result of the analysis when the filter for the level of approval is applied. It is clear that the presence of banks with different levels of approval tends to slightly impact the benchmarking results.

182. Looking at Table 10, we see that the EQ asset class IQD is very slightly smaller when considering only the subsample of firms with the full level of approval with respect to the full sample. The CS asset class also decreases, but it should be considered that almost no banks without specific IR approval submitted any CS results. Finally, for the IR asset class splitting the sample between banks with general and specific approval and banks with only general approval produces some marginal changes in the benchmark for this asset class, confirming that the submissions from banks with partial approval tends to increase the IQD of the submissions.

Table 10: Asset class comparison for VaR in terms of level of approval

	VaR - Avg. Interquartile Range			
	All Banks	*IR Gen + Specific*	*IR Gen only*	*Eq Gen + Specific*
Equity	25%			24%
Interest Rate	21%	17%	16%	
Credit Spread	28%	23%		

d. Common stress period considered

183. The stress window applied by the participating banks has always been understood as one of the main sources of the greater dispersion of the sVaR compared to the VaR, but this hypothesis was tested only from the 2019 exercise onwards due to a lack of information regarding the time window applied by the banks to calibrate the sVaR. This information was collected for the 2020, 2021 and 2022 exercises as well and applied to test the impact of the stress time window selected to calibrate the sVaR.

184. Generally speaking, in their time window for the sVaR the banks select periods that include either 2008-2009 or 2011 in order to calibrate their sVaR, with a preference for 2008-2009. Because of the higher number of banks selecting 2008-2009, the EBA filtered the sample of the

banks that applied a 2008–2009-time window for sVaR calibration, obtaining a subsample of 30 banks. The benchmark and the related statistics for this subsample of banks are available in Table 41 in the annex, and they are easily comparable with the full sample sVaR statistics in Table 22.

185. Table 11 summarises this stress period filtering analysis. It seems clear that the different time window selected for the bank actually has a significant impact on sVaR statistics. This means that the subsample with the same stress period generally exhibits smaller dispersion results for sVaR than the whole sample.

Table 11: Asset class comparison for sVaR in terms of the time window applied

	SVaR - Avg. Interquartile	
	All Banks	*Stressed Period*
Equity	28%	20%
Interest Rate	33%	19%
FX	26%	13%
Commodities	18%	12%
Credit Spread	35%	27%
CTP		
All-in	28%	13%

5.2.6 Portfolio comparison

186. Selective comparison of VaR results across portfolios can be informative in instances where the riskiness of those portfolios may be ranked in a model-independent way. For example, all else being equal, it is expected that a more diversified and hedged portfolio would lead to a lower VaR than a more concentrated and unhedged portfolio.

187. This hypothesis can be tested with several portfolios in the 2022 exercise. Use of the following portfolios is suggested:

- portfolio 16, which is composed of instruments 24 (long 5 million German bond – 10 years) and 25 (short 2 million German bond – 5 years);
- portfolio 17, which is composed of instruments 24 (long 5 million German bond – 10 years), 25 (short 2 million German bond – 5 years) and 26 (long 5 million Italian bond – 10 years), so it is equal to portfolio 16 plus instrument 26.

188. Both of these portfolios comprise sovereign bond instruments, yet portfolio 16 is concentrated on only one issuer and is partially hedged (long and short positions). Portfolio 17 adds a second issuer to this portfolio without any hedge. Against this backdrop and in view of the specific portfolio definitions, we would expect the following result:

$$VaR_{Portfolio\ 17} > 200\% \times VaR_{Portfolio\ 16}$$

189. Table 12 reports when this hypothesis holds true.

Table 12: Portfolio comparison for VaR, sVaR and IRC

	VaR(P17) > VaR(P16)	sVaR(P17) > sVaR(P16)	IRC(P17) > IRC(P16)
Num of banks	31 out of 32	31 out of 32	22 out of 23
	VaR(P17) > 1.5*VaR(P16)	sVaR(P17) > 1.5*sVaR(P16)	IRC(P17) > 1.5*IRC(P16)
Num of banks	30 out of 32	31 out of 32	22 out of 23
	VaR(P17) > 1.75*VaR(P16)	sVaR(P17) > 1.75*sVaR(P16)	IRC(P17) > 1.75*IRC(P16)
Num of banks	30 out of 32	30 out of 32	22 out of 23
	VaR(P17) > 2*VaR(P16)	sVaR(P17) > 2*sVaR(P16)	IRC(P17) > 2*IRC(P16)
Num of banks	30 out of 32	24 out of 32	22 out of 23

190. The comparison between the two portfolios with respect to regulatory VaR shows that only 2 out of 32 banks do not meet the initial expectation. The same comparison based on sVaR yields 8 banks that are not in line with this expectation. With regard to the IRC model, one bank does not meet the a priori expectation.

5.3 Analysis of IRC

191. Banks with an approved IRC model constitute a subsample of those with an approved VaR model; only banks using internal models for specific risks of debt instruments are permitted to use IRC models (Article 372 of the CRR).

192. The full set of submissions for IRC results for each trade, after the data-cleaning process has been run as previously described, is reported in Table 13.

193. In the context of the HP exercise, only a subset of banks made submissions for IRC, and a number of those banks submitted very low figures. This suggests that important risk factors (in the context of the HPE) have not been modelled. While the submission of low figures may be linked to risk factors not modelled, this should not be taken to mean that banks with higher IRC figures included all risk factors from a given portfolio in their model.

194. The number of submissions is limited for some of the all-in portfolios. Statistical inferences for these portfolios are thus not appropriate. A prerequisite for consideration of banks' submissions for the all-in portfolios is that a bank needs to be able to model all the corresponding underlying portfolios.

195. As in the case of VaR, a selective comparison of IRC results across portfolios can be informative in instances where the riskiness of those portfolios may be ranked in a model-independent way. As shown in subsection 5.2.6, the expected diversification relationship holds true for all but one of the banks that submitted such results.

196. It is recommended that CAs assess the extent to which these missing risk factors are important in the context of banks' overall risk, and whether or not they need to be added to the model.

197. CAs should devote particular attention to portfolios 15-23, 26, 36, 39 44-51, 57 and 59, i.e., where IRC shows a higher level of dispersion (above 50%) above the average.

198. As is the case for VaR and sVaR, banks can choose from a range of permitted modelling approaches for IRC. For example, banks need to choose:

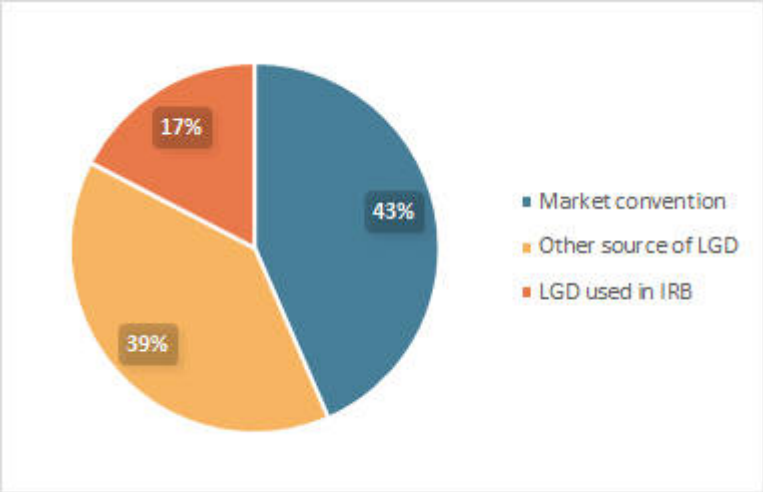
- a source of credit risk estimates such as PD and loss given default (LGD).
- the number of systemic factors used to model the co-movement among obligors in their portfolios.
- the size and granularity of credit spread shocks to apply to positions with an obligor following a rating transition; and
- the liquidity horizons to assign to positions with a particular obligor.

199. The responses to the qualitative questionnaire relating to the IRC methodological aspects suggest that the use of market LGD predominates among respondents (Figure 12), with 10 out of 23 banks using market convention as the source of LGD. A minority of banks – 4 out of 23 –

use their own IRB models as the source of LGD. The rest – 9 banks – use various other sources to obtain the LGD.

200. The PDs are provided by rating agencies in 63% of cases, by the IRB in 29% and by other sources in 8%. The transition matrices are mostly taken from rating agencies (19 respondents out of 23), and the rest of the banks use their IRB, 'market implied transition matrices and various other sources.

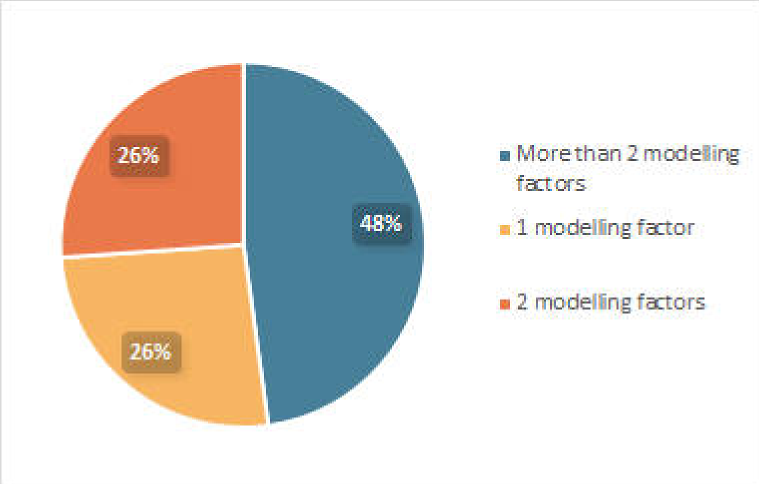
Figure 12: Qualitative data: source of LGD for IRC modelling



201. Moreover, a majority of respondents stated that they use more than two systemic modelling factors at the overall IRC model level (Figure 13).

202. The liquidity horizon applied at the portfolio level for the IRC model is predominantly between nine and 12 months (75% of the responses).

Figure 13: Qualitative data – number of modelling factors for IRC



203. Hence, in the context of IRC the modelling practices across the sample of banks participating in the benchmarking exercise seem to be consistent.

Table 13: IRC statistics and cluster analysis

EU Statistics for IRC

		Main statistics								Percentiles			
	Port. ID	Min	Max	Avg.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	25th	50th	75th	IQD
Interest Rate	13	50,444	658,318	255,021	154,309	218,554	120,157	72%	11	119,530	271,984	355,647	50%
	15	4,065	46,327	21,488	14,930	32,315	10,828	64%	19	7,524	21,232	39,838	58%
	17	132,561	826,400	401,152	232,927	282,415	118,856	58%	19	218,823	368,460	625,813	48%
	18	191,017	1,454,740	714,131	428,147	486,307	219,913	60%	20	399,181	627,500	1,152,953	50%
	23	439	287,524	100,809	81,856	102,330	50,458	81%	20	31,212	97,125	150,853	66%
	24	471,565	1,120,823	861,451	195,854	221,458	141,524	23%	18	779,877	814,790	1,012,411	13%
	26	201,455	1,839,809	909,141	516,737	531,987	370,879	57%	21	571,641	813,111	1,312,027	39%
Credit Spread	36	20,565	223,568	67,705	52,461	110,262	19,307	78%	10	34,725	52,688	65,618	42%
	37	21,870	151,255	75,517	28,270	45,535	7,202	37%	17	59,622	77,188	82,838	16%
	38	25,196	154,652	85,875	38,050	51,002	21,671	44%	10	57,210	81,505	111,847	32%
	39	20,501	257,559	90,564	71,565	151,651	31,071	79%	16	39,810	66,766	128,452	53%
	40	8,850	102,541	55,456	23,048	27,008	13,676	42%	10	39,600	56,574	78,744	33%
	41	451,154	1,017,002	587,515	154,965	192,086	45,108	26%	10	516,651	550,527	771,135	11%
	42	91,756	416,961	218,780	91,142	146,605	25,757	42%	17	172,005	197,880	224,569	13%
	43	567,561	1,070,258	795,205	136,329	151,520	55,550	17%	20	606,846	792,501	872,212	11%
	44	35,500	150,852	91,035	40,051	44,485	19,654	44%	21	55,643	95,411	119,545	38%
	45	51,205	246,770	154,535	58,751	72,207	48,467	38%	12	106,803	170,224	206,608	32%
	46	120	82,040	24,701	25,200	51,560	17,907	102%	10	1,125	20,595	39,504	94%
	47	35,582	228,776	114,241	52,614	130,620	41,662	46%	16	64,101	124,156	142,149	38%
	48	1,516	82,052	25,475	25,546	50,040	9,775	100%	10	4,952	21,422	37,424	77%
	49	11,186	247,565	95,725	80,546	132,756	40,462	84%	10	36,519	74,587	178,101	66%
	50	4,590	141,544	46,082	43,808	81,764	25,852	93%	10	12,120	51,525	69,917	70%
	51	1,760	178,101	45,425	49,071	135,065	11,707	108%	15	8,803	40,486	66,858	77%
	52	50,517	221,650	90,655	42,865	100,079	10,474	47%	15	61,475	80,247	96,785	22%
	53	55,485	352,445	110,587	70,212	137,046	16,951	64%	15	64,862	95,171	111,000	13%
	57	17,725	907,061	405,235	308,064	297,405	220,114	75%	22	124,168	355,727	562,865	65%
	58	6,546	64,544	30,164	19,017	26,690	8,525	40%	16	27,965	35,181	46,546	25%
	59	5,180	532,255	125,015	104,025	170,580	75,808	85%	10	26,964	120,686	226,224	79%
All Price CSP **	60	127,493	2,100,232	1,121,269	536,527	558,577	345,753	50%	15	770,809	1,052,404	1,619,116	35%
CS Cumulative **	62												

[1] STDev trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 65), banks that reported at least a missing portfolio (NR) among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

204. Table 13 shows that the average variability of IRC is higher than that observed for VaR. This table presents a summary of the descriptive statistics concerning the IRC values submitted, along with the median, first and third quartiles used to select out-of-range values to be discussed with the banks during the interviews. EBA received on average 18 submissions for IRC in relation to the IR and CS hypothetical trades.

205. In this exercise, the EBA also provided a disaggregated analysis of sources of LGD and numbers of modelling factors. It is possible to split the sample between market convention and non-market convention (IRB and other sources) and the number of modelling factors (1-2 vs. more than 2). In Table 14 below, the average interquartile is reported. The full set of results is also reported in Table 43, Table 44, Table 45 and Table 46.

206. The IQD dispersion of the subsample is very stable for the CS portfolios among different model choices. Market convention and 1-2 modelling factors seem to produce slightly less dispersed results for CS portfolios.

Table 14: Coefficient of variation for regulatory IRC by modelling choice (%)

	VaR - Avg. Interquartile Range				
	All Banks	Source of LGDss		No. modelling factors	
		Market Convention	Non-market Convention	1-2 factors	>2 factors
Interest Rate	48%	47%	39%	32%	51%
Credit Spread	43%	36%	40%	33%	42%
All-in	25%	13%	16%	18%	23%

5.4 Analysis of APR

207. This report is no longer reporting the summary of the responses to the qualitative questionnaire relating to the APR methodological aspects, since only 3 responses are available at the overall CTP model level, so no disclosure is possible without disclosing some specific information on the submitters.

208. The average variability of the APR charge is also no longer reported, since the limited data available do not allow a meaningful computation of the IQD of each CTP.

Table 15: APR statistics and cluster analysis

EU Statistics for APR

		Main statistics							Percentiles			
	Port I.D	Min	Max	Ave.	StDev	StDev_Cons[1]	MAD (median absolute deviation)	Coefficient of variation (StDev/Mean)	Num obs.[2]	25th	50th	75th	IQD
CTP	34								3				
	35								3				
	36								3				
CTP Cumulative	65								4				

[1] 'StDev_cons' is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (37 to 61), banks that reported at least a missing portfolio (NA) among the ones composing the aggregate are not included in the computation of the benchmark for that particular aggregate portfolio

5.5 P&L analysis

209. The P&L analysis is complementary to the outcome of the assessment of variability based on VaR modelling. For each individual portfolio, the P&L vectors provided by banks using HS were compared, and a benchmark analysis is provided in the annex (see Table 23).

210. A graphic exemplification of low and high IQD portfolios is presented below in Figure 14 and Figure 15. Even though the P&L vectors available are much longer, only 3 months (1 November 2021 to 1 February 2022) are reported to simplify the representation. Additional examples of low and high IQD portfolios can be found in the annex in Figure 31 and Figure 32. It is clear that P&L vector series that perform better tend to be closer to the benchmark. On the other hand, the low absolute value of the P&L, as per the risk measures, tends to provide misleading information if we consider the IQD figures alone.

Figure 14: P&L chart example of low IQD

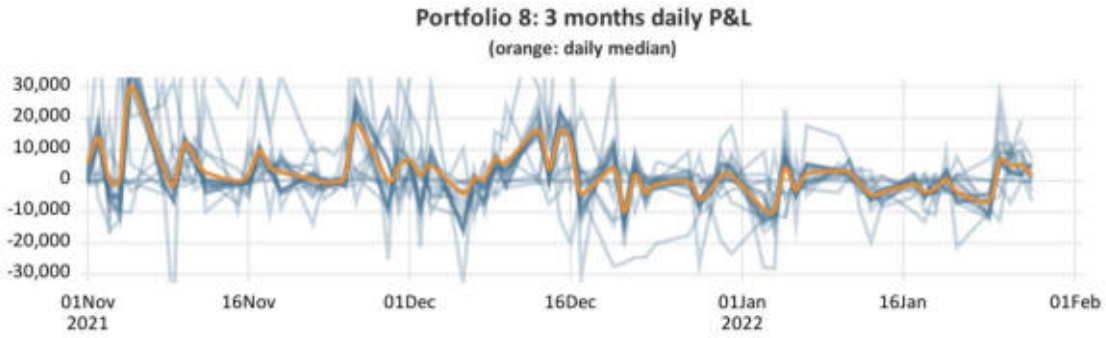
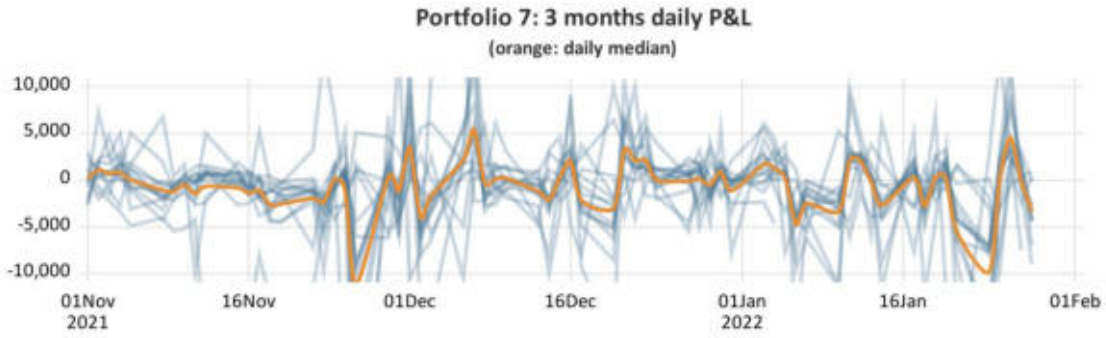


Figure 15: P&L chart example of high IQD



211. Another useful check for the P&L results submitted was a comparison of the ratio between the P&L VaR computed by the EBA (see Section 4.2 and Table 26) and the regulatory VaR submitted by the participating banks. A significant deviation of this ratio from 1 indicates an incoherent submission by the bank (see Table 26 in the annex). Moreover, it allows the tightness

or the width of the realised P&L distribution for each bank to be checked at each hypothetical trade position. This can be done by referring to the standard deviation of the P&L series.

212. Another metric computed by the EBA from the P&L series provided by HS banks is the empirical ES (see Table 24 in the annex). The empirical ES results have approximately the same level of dispersion as the P&L VaR (see Table 4 in Section 5.1).

5.6 Diversification benefit

213. An additional metric considered as part of the analysis was the diversification benefit observed for VaR, sVaR and IRC in the aggregated portfolios.

214. The diversification benefit of a given metric (e.g., VaR) is computed as the absolute benefit, i.e., the difference between the sum of the single results for each individual position and the result for the aggregated portfolio, divided by the sum of the single results from each individual portfolio. Table 16 summarises the results of the analysis.

215. As expected, there is evidence that larger aggregated portfolios exhibited greater diversification benefits than smaller ones. The diversification benefit for all-in portfolio 60 (all-in no-CTP portfolio), for instance, clearly exceeds the benefit for the other risk types, whose all-in portfolios are based on fewer individual instruments. With regard to the dispersion shown by the diversification benefits, it is possible to observe a significantly higher IQD for some portfolios than for others, and – in some cases – a quite comparable dispersion across VaR, sVaR and IRC (e.g., interest rate and commodity risk categories).

Table 16: Diversification benefit statistics

Diversification benefit statistics

Diversification benefit = (Sum of single portfolios VaR - Aggregated Port. VaR)/Sum of single portfolios VaR

VaR

	Port.	Other statistics			Percentiles			
		Ave.	STDev	Num obs. [3]	25th	50th	75th	Interquartile dispersion
ALL IN no CTP	60	66%	17%	8	64%	72%	74%	7%
Equity Cumulative	61	59%	27%	21	40%	62%	74%	30%
IR Cumulative	62	54%	6%	31	49%	56%	59%	9%
FX Cumulative	63	52%	7%	31	28%	52%	58%	35%
Commodity Cumulative	64	3%	4%	11	1%	1%	2%	33%
Credit spread Cumulative	65	11%	42%	6	24%	9%	7%	170%

sVaR

	Port.	Other statistics			Percentiles			
		Ave.	STDev	Num obs. [3]	25th	50th	75th	Interquartile dispersion
All-IN no-CTP	60	28%	22%	8	21%	22%	24%	8%
Equity Cumulative	61	28%	23%	21	14%	24%	39%	48%
IR Cumulative	62	37%	15%	31	24%	30%	44%	30%
FX Cumulative	63	17%	8%	31	9%	13%	19%	36%
Commodity Cumulative	64	2%	3%	11	0%	1%	2%	64%
Credit spread Cumulative	65	-1%	28%	6	-4%	-6%	3%	-179%

IRC

	Port.	Other statistics			Percentiles			
		Ave.	STDev	Num obs. [3]	25th	50th	75th	Interquartile dispersion
Credit spread (35 to 53)**	27			0				

5.7 Dispersion in capital outcome

216. As a final means of comparison, for each individual position a variable equating to the sum of the regulatory VaR and sVaR was computed. This variable was used in two ways: using the banks' total multiplication factor, and using only the regulatory multiplication factor, i.e., ignoring the banks' individual addend(s) set by the CAs. The results were averaged across a given risk type, thus arriving at a proxy for the implied capital outcome.

217. In addition, the exercise also attempted to isolate the effect of the time windows selected as the stress period. Therefore, the same statistics were reported for banks applying the 2008-9 stress period.

Table 17: Interquartile dispersion for capital proxy

Interquartile dispersion for capital proxy

	Capital proxy (banks own mult)	*Capital proxy (fixed mult, =3)*	*Capital proxy Stressed period (fixed mult, =3)*
Equity	22%	21%	14%
IR	22%	21%	16%
FX	17%	19%	11%
Commodity	15%	13%	9%
Credit spreads	26%	25%	22%
CTP			

218. Table 17 suggests that variability is slightly exacerbated by regulatory add-ons. The ranges of capital value dispersion remain broadly aligned whether or not the banks' actual multiplication factors are used. Moreover, filtering for banks with the same stress window seems to have a further impact in decreasing the variability. Nonetheless, we need to take into consideration the fact that the sample of banks decreases in number when analysing the subsample of banks with the same stress period, which – other things being equal – tends to increase the IQD.

5.8 Present value

219. The 2020 exercise introduced the PV as a statistic to be provided by the banks. The full set of statistics is provided in Table 42 for this year's exercise as well.

220. The average IQD of the PV among the single portfolios is 4% (it was 11% in 2021). This IQD would be much lower, at 2%, if 2 portfolios with a relatively high IQD (Portfolios 10 and 27) were excluded. By asset class, the IQD is distributed as follows: EQ (4%- or 2% if portfolio 10 is excluded), IR (7% - or 2% if portfolio 27 is excluded), FX (0%), CO (4%) and CS (1%).

221. PV measures are useful to CAs to verify the RM values. The ratio of RM over PV helps the CAs to quickly verify if the RM outlier comes from a simple mispricing of the portfolio or if it is indeed a true outlier with respect to the RM benchmark. Further analysis of these aspects is expected to be carried out in future.

6. Competent authorities' assessment

222. For each participating institution, the CAs provided individual assessments of any potential underestimation of the capital requirement as required by Article 78(4) of the CRD and Articles 9 and 10 of the draft RTS on supervisory benchmarking. This chapter highlights some key information derived from these assessments.

223. The EBA designed a questionnaire about this assessment, which asked CAs to provide detailed information concerning the level of priority, based on both judgemental and qualitative/quantitative examination results, the overall assessment concerning the MR capital requirements of the internal models and, finally, the CAs' ongoing monitoring activities.

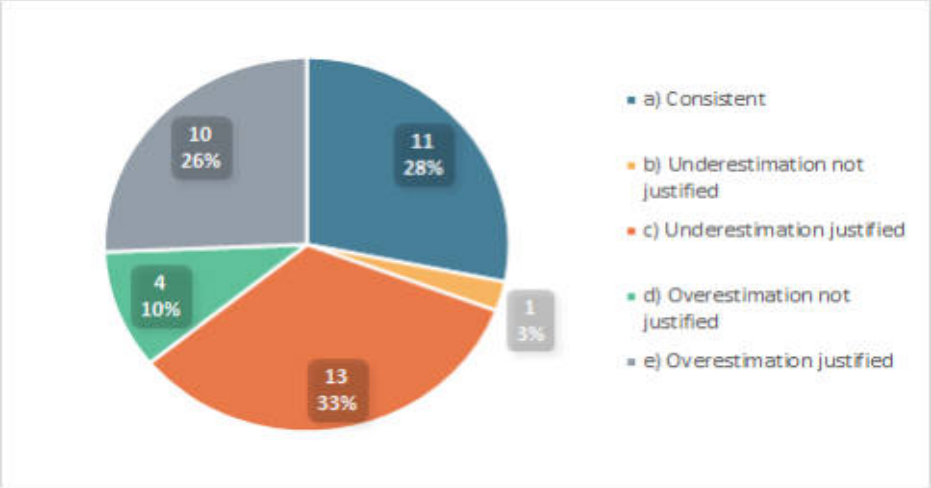
224. A total of 39 questionnaires from 12 jurisdictions, provided by the CAs, have been considered in this assessment of the MR benchmarking exercise.

225. Regarding the level of priority of the assessments, three banks were reported to be a high priority for intervention by CAs. The CA gave high priority because of the level of representativeness of the EBA portfolio in the trading portfolio of the bank or for the representativeness of the banks within the jurisdiction.

226. Figure 16 reports the CAs' own overall assessments of the levels of own funds requirements. When it comes to benchmark deviations, justified or not, 28 banks were reported by CAs as under or overestimating MR own funds requirements, of which 23 provided justifications for this. Obviously, 'not justified' implies that further and targeted CA investigation is required. Finally, 11 banks had consistent results (i.e., no benchmark deviations).

227. CAs' assessments acknowledge five cases out of 33 of unjustified under- or overestimation of internal model market capital requirements that require further in-depth analysis. Obviously, CAs – and the joint supervisory teams, where applicable – pay close attention to the potential cases of underestimation, both across the portfolio and across the risk categories. All these five cases were classified as low priority by their supervisors.

Figure 16: CAs' own assessments of the levels of MR own funds requirements (BM exercise 2022)



228. The main factors and reasons that may explain possible underestimations are as follows: benchmarking portfolios that do not represent the actual composition of the real trading portfolios of the institutions (9/88); differences in calibration or data used in modelling estimation and/or simulation (8/88); proxies applied (12/88); and differences attributable to the methodology used (18/88). These explanations, and very often a combination of these explanations, were offered by a large majority of the applicable respondents.

229. Just one bank was identified as possibly underestimating, without justification, during the banks' internal assessment process run by the CAs. Nonetheless, the unjustified part refers to just a single asset class of the whole set of portfolios examined. Therefore, only a limited set of aspects were still under clarification with the Cas.

230. The four banks identified as possibly overestimating, without justification, are also classified as 'low priority' by the CA. Differences in calibration or data used in modelling estimations and/or simulations were also identified by the CA, which was nonetheless unable to fully explain and investigate the misalignment; these misalignments did not raise substantial concerns for Cas, since the over-estimations was nonetheless consistent with the shortcoming of the models examined by the Cas, and generally refer to a minority of portfolio in the exercise.

231. Overall, CAs planned some action in respect of 15 banks, such as:

a. reviewing the banks' internal VaR and IRC models;

b. extra supervisory charges;

c. further internal model investigations at the peer level.

232. Currently, five banks have a due date for making improvements to their MR internal models, as already requested by CAs.

7. SBM OFR

233. The ITS 2022 introduced the sensitivities-based method (SBM) component of the alternative standardised approach (ASA)/FRTB SA to the EBA Benchmarking exercise.

234. The ITS 2022 required banks the submission of granular sensitivity data and aggregated OFR computed via SBM.

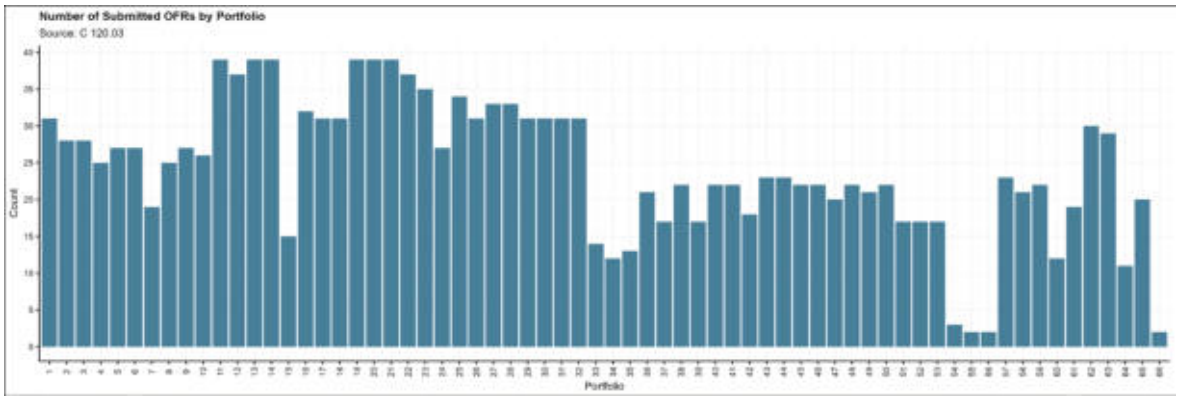
235. The high granularity, number of data submissions and remaining data quality issues for the sensitivities do not allow, for the moment, a concise representation. Therefore, this year's report focuses on the representation of the SBM OFR aggregated data.

7.1 Assessment of completeness of SBM OFR submissions

236. Overall, the submission rate for new SBM OFR data is considered broadly adequate and fairly high. Figure 17 shows the total number of SBM OFR submissions per portfolio. Overall, it can be concluded that, for each portfolio, SBM OFR figures were reported whenever the traditional risk measures (e.g., VaR or SVaR) was also reported.

237. Very few banks drive the discrepancy between the number of submissions for IMA and SBM.

Figure 17: SBM OFR total submissions by portfolio



238. This is also confirmed in Figure 34, which presents the differences in the numbers of submissions between the SBM OFR and the IMA OFR by portfolio. Almost all institutions that have submitted data for IMA, have also submitted figures for SBM. However, there are also institutions that have submitted SBM OFRs but no IMA figures for certain portfolios.

239. For cumulative Portfolios 60, 62 and 63, one additional bank (different for each portfolio) reported SBM OFR which did not report IMA data.

7.2 SBM Variation within Portfolios

240. As for the other risk measures, dispersion is a very important factor to consider and monitor in the benchmarking process for OFR-SBM. Average summarised statistics of dispersion can be seen in Table 4, while detailed figures for SBM OFR, such as benchmarking of the sample, quantiles of the distribution and IQD figures by portfolios, are reported in Table 47.

241. Figure 18 illustrates the variation of SBM-OFR by portfolios, where outliers are highlighted by applying the EBA market risk outlier definition[22] (median +/- two times truncated standard deviation).

242. Of course, other definitions of outliers are possible. For instance, the industry applies a simpler outlier definition[23] in its benchmarking exercise (see Figure 35). Alternatively, the Median Absolute Deviation, i.e., MAD[24] concept could be applied (see Figure 36) or the traditional boxplot outlier definition[25] (see Figure 37).

243. To achieve a harmonious appearance, all portfolio-OFRs are standardised by the respective portfolio median and the ordinate is log-2-transformed. In addition, the standardised OFR are top-coded at 1,600%. In Figure 18, Figure 35 and Figure 36, the cyan bars represent the standardised Interquartile Range of the respective portfolio, i.e. the distance between the ratio of the respective portfolio's first quartile to its median and the ratio of the third quartile to the portfolio's median. In all figures only portfolios are included for which at least 10 OFR observations are available.

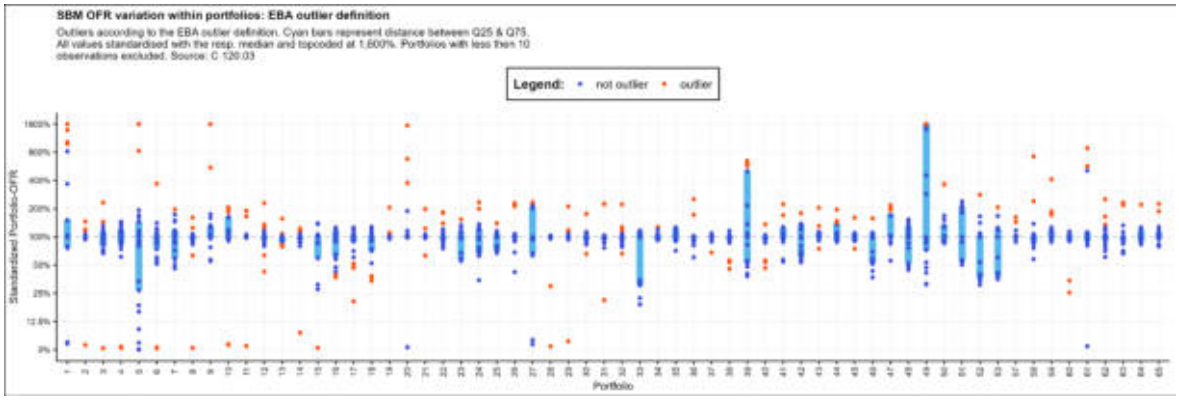
[22] EBA Outliers are defined as values outside the interval [ex − 2 ⋅ TSD, ex + 2 ⋅ TSD]. Where "ex" is the median of portfolio-OFRs., and TSD (truncated standard deviation) is the standard deviation of the portfolio-OFRs between the 5-th and the 95-th percentile.

[23] (50%-150% outlier definition) - Industry outliers are defined as values outside the interval [0.5 · ex, 1.5 · ex], where ex is the median of portfolio-OFRs.

[24] Median Absolute Deviation (MAD) defines outliers as values outside the interval [ex − 2 ·MAD, ex + 2 ·MAD], where MAD is the Median Absolute Deviation, i.e., MAD = median(|xi − ex|), where xi are the OFR observations of the respective portfolio and ex is their median.

[25] Outliers are defined as values outside the interval [Q25 − 1.5 · IQR,Q75 + 1.5 · IQR]. IQR is the Interquartile Range, i.e. IQR = Q75 − Q25.

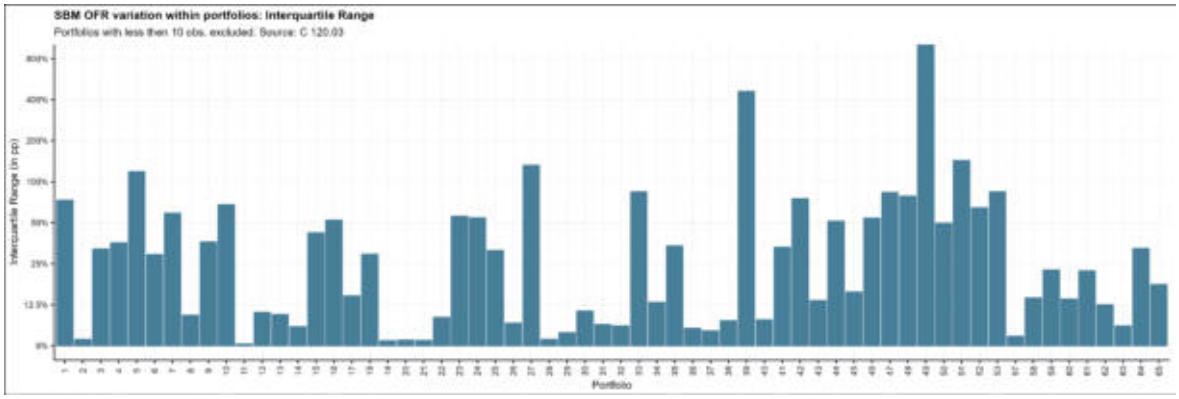
Figure 18: SBM OFR variation within portfolios (EBA outliers' definition)



244. Figure 18 demonstrates that for about half of the portfolios the reported OFR values are concentrated around the respective median. However, there are also several portfolios where a large dispersion is apparent, often in the form of clusters of observations. The varying dispersion can be observed more clearly in Figure 19, which depicts the standardised Interquartile Ranges in percentage points. While for 32 portfolios the standardised Interquartile Range amounts to less than 25 percentage points, 5 portfolios show values larger than 100 percentage points.

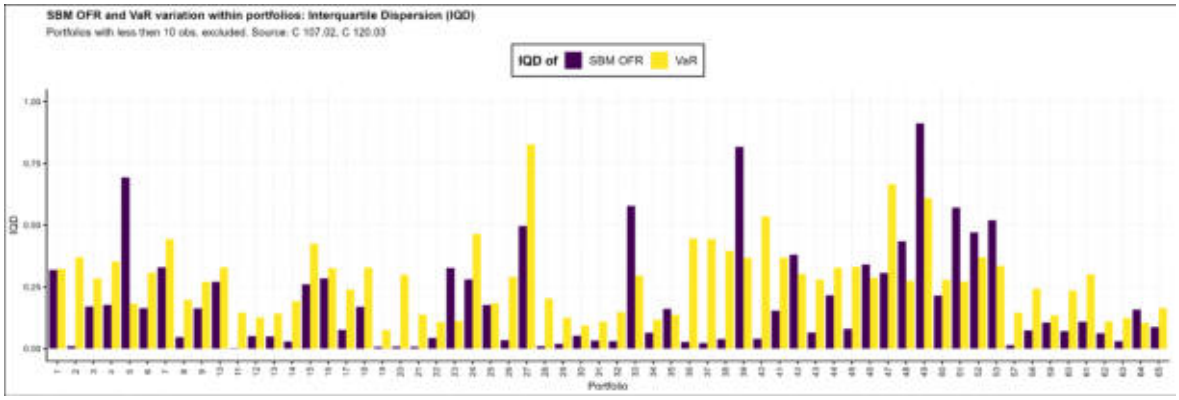
245. Figure 38, Figure 39, Figure 40, Figure 41, and Figure 42 illustrate the variations of SBM-OFR-components attributable to different risk classes, where each risk class portfolio with less than 5 observations has been excluded in the representation. Apparently, large dispersion is persistent even on the more granular risk-class level.

Figure 19: SBM OFR variation within portfolios: Interquartile Range



246. Figure 20 compares the IQDs of SBM OFR and the VaR by portfolio. As might be expected from a standardised approach, the IQDs of VaR are larger than those of SBM OFR for the majority of portfolios. Nevertheless, there are several portfolios for which the opposite holds.

Figure 20: SBM OFR and VaR variation within portfolios: Interquartile Dispersion (IQD)



247. A similar comparison, but also taking into account the IQDs of the SVaR as well can be seen in Figure 43. This comparison can be seen more clearly, when split by asset classes, as shown in Figure 45, Figure 46, Figure 47, Figure 48 and Figure 49.

248. Finally, a comparison of the dispersion of SBM OFR against VaR is informative for banks and supervisors. In general, a very low dispersion is expected for the SBM measure owing to the standardised nature of the calculation, so an increased dispersion of SBM – possibly even exceeding the dispersion observed for VaR – warrants increased attention. Figure 44 highlights several cases where IQD Ratio of SBM-OFR to VaR unexpectedly exceeds 1.

7.3 Comparison of SBM OFR by portfolio across risk class/component

249. Aside from the dispersion of the portfolio OFR, as presented in the previous section, the collected data allows the EBA and the supervisors to present the actual composition of these requirements, splitting each instrument and portfolio by the risk class and components (Delta, Curvature, Vega). In this context, it should be noted that under the SBM, total OFR are calculated as the simple sum of OFR across the relevant risk classes and components.

250. Looking at single portfolios, it appears that the reported Risk classes are to some degree heterogeneous across submissions, and this possibly reflects different interpretations of the ASA rules for modelling of these instruments.

251. This is shown in Figure 21, where the frequency of SBM submission by risk classes relative to the total number of submissions per portfolio is shown. The plot shows the relative frequency of banks who reported a non-zero figure in a given risk class for the given portfolio with respect to the total number of submissions.

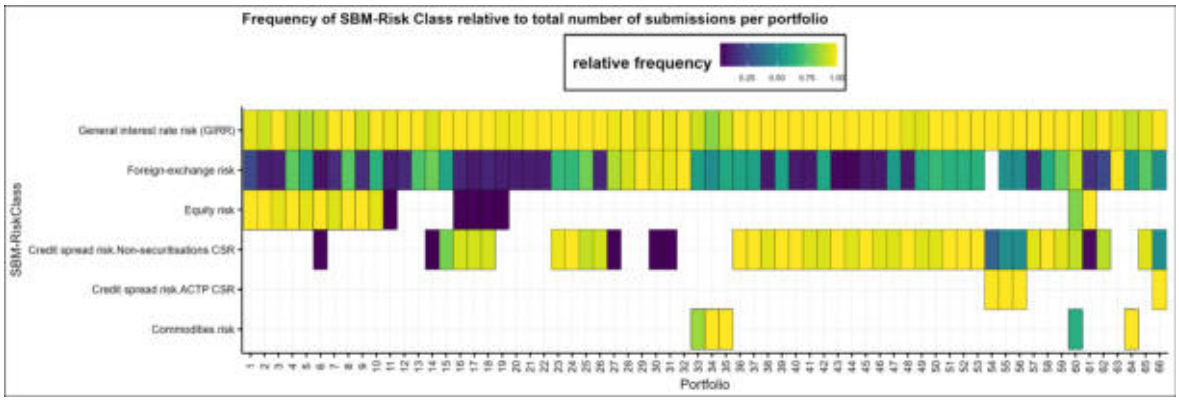
252. Most banks reported values in the same risk category in line with the expectation according to the asset class of the portfolio (e.g., for EQ portfolios, EQ risk expected). Nonetheless, for some EQ portfolios, not all banks submitted an EQ risk component. Interest rate risk is present

across all portfolios with the majority of banks submitting OFR relating to interest rate risk for all portfolios.

253. Some banks reported additional FX components for some portfolios (pf 11 and 16-19, which are just EUR IRS).

254. The plot does not necessarily allow for concluding whether deviating submissions are wrong, but identifies portfolios where bank-specific investigations are meaningful.

Figure 21: Frequency of SBM risk classes relative to the total number of submissions per portfolio



255. Furthermore, the frequency analysis was performed per risk component.

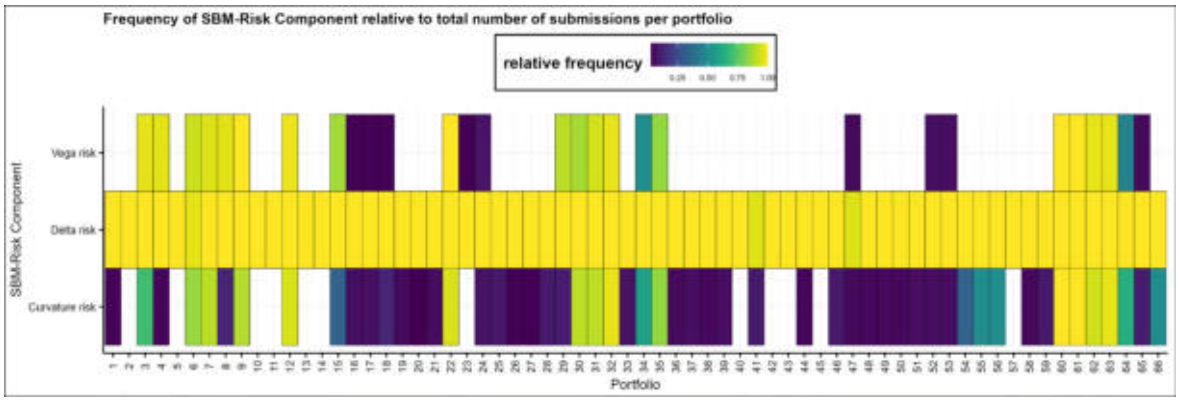
256. Figure 22 presents the frequency of SBM risk component relative to total number of submissions per portfolio.

257. Not surprisingly, most banks reported values in the same risk component. As expected, Delta risk for at least one risk class was reported by all banks in nearly all portfolios.

258. But differences are recognisable with respect to the other risk components.

259. The chart in Figure 22 does not immediately allow for the conclusion of whether deviating submissions are wrong but indicates portfolios where bank specific investigations are meaningful. Justified deviations may result from the use of methodological alternatives available to banks after supervisory approval (e.g., the inclusion of linear instruments in Curvature calculation).

Figure 22: Frequency of SBM risk component relative to the total number of submissions per portfolio



260. An overlapping of these two previous analyses can be seen in Figure 50, where the frequency of SBM risk component within SBM risk classes relative to the total number of submissions per portfolio is represented.

261. Within GIRR, delta risk is reported for nearly all portfolios, while only in some cases additionally Vega and Curvature risk are reported. From this analysis we can see that within EQ, some banks reported risk components for interest rate risk.

262. Most banks reported values in the same risk category in line with expectations (e.g., for EQ Pfs, Delta-EQ risk is expected).

263. Additional FX components for some portfolios (pf 11 and 15-19, EUR IR-) mentioned above fall within Delta risk.

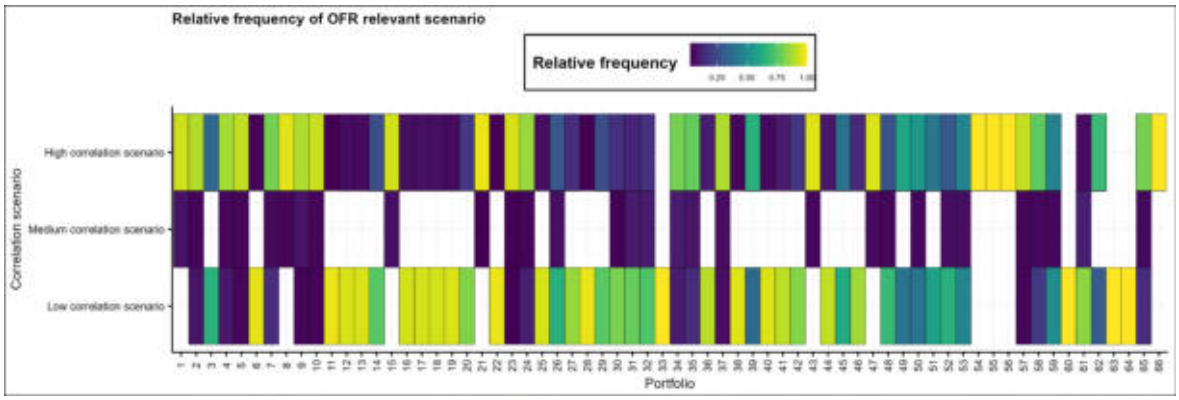
264. The data submitted allow the EBA and the supervisor to check, for each portfolio, which scenario is the one that maximises the SBM-OFR. From this analysis it is clear that the scenario maximising the OFR is not identical for all banks.

265. This is represented in Figure 23. For most portfolios, the high or low correlation scenario leads to the highest OFR. Very rarely the medium correlation scenario yields the highest OFR. For none of the portfolios the same scenario is chosen across all banks. Due to the simplicity of the calculation, it can be expected that the implementation of the correlation scenario logic in itself is not a driver of variability. Instead, the fact that differing correlation scenarios are

observed for the same portfolio may result from differences in the portfolio's interpretation, the risk classes and components considered, or the regulatory buckets that risk factors that have been allocated.

266. Nonetheless, as shown in the Figure 51 – where the median OFR per correlation scenario is represented - only in some portfolios there is a significant difference in OFR with respect to scenario (for instance, Pf 20, 28, 33, 38, 40, 63). Therefore, the impact of correlation scenarios is limited for submitted median OFR in most cases. It should be noted that the impact of the correlation scenario follows the design of the EBA hypothetical portfolio and is not indicative of impacts that can be observed for real trading portfolios.

Figure 23: Relative frequency of OFR relevant scenario



8. Conclusion

267. This report has presented an analysis of the observed variability across results provided by EU banks that have been granted permission to adopt internal models for MR own funds requirements.

268. It must be remembered and emphasised that, as the quantitative analysis is based on hypothetical portfolios, this report focuses solely on potential rather than actual variations. The analysis shows the extent of the variability in these hypothetical portfolios, but this cannot automatically lead to conclusions regarding real under- or overestimations for the MR capital charge.

269. However, the analysis might help in determining possible supervisory activities to address uniformity and harmonisation across the Member States and in promoting in-depth future cross-investigations of this matter.

270. The objective of the benchmarking exercise was not to reach a final judgement on the key drivers of variation and the calculation of the implied capital charges but to provide supervisors with insights into how to increase comparability and reduce the variability between banks that is attributable to non-risk-driven behaviours.

271. In particular, the report provides inputs for CAs on areas that may require further investigation, such as IMV variability for some credit spread products. Supervisors should pay attention to the materiality of risk factors not in VaR and in particular, not encompassed in the IRC models.

272. Moreover, the conclusions reached in regular supervisory model monitoring activities will take into account the outcome of the supervisory benchmarking exercises to achieve greater alignment between CAs' targeted internal model reviews and the EU's benchmarking analysis.

273. Overall, this exercise exhibits a small reduction in the IMV variability for FX, and stable dispersion for CS. IR IMV is substantially high, but this is due to a few instruments with very low IMVs that distort the IQD ratio. EQ and CO IQDs are very high, but for the EQ this is due to an error in the instruction that was fixed in the 2023 instruction, so this fourth submission of the (almost) same instruments and portfolios is acceptable overall. The variability of risk measures, especially the VaR, is lower than the previous exercise and more aligned with the past, and this should be due to a reduction in market volatility. The variability of the VaR aggregated portfolios is limited: the 'all-in portfolio' IQD is 11% (it was 16% in 2021). Aggregated by asset class, the portfolio IQD of the others is 9 (vs 15% in 2021) on average and never above 11%. The analysis carried out in the 2019-2021 exercise – relating to the considerations of the level of approval, size of banks, business model adopted and stress period – was repeated in the 2022 exercise and should now be considered a consolidated piece of information in the benchmarking report. The 2022 Market Risk benchmarking report also provides an analysis of the new SBM OFR. These

SBM OFRs are overall at an acceptable level in terms of data quality and exhibit, as they are supposed to do, a lower level of dispersion with respect to the IMA Risk measures (Table 4). The granularity of the data submitted, and their representation shed some light on where potential problems of ASA implementation could be at the bank-specific level.

274. Finally, this report provides a framework that can be considered useful for the purpose of future benchmarking exercises under Article 78 of the CRD. Therefore, the type of analysis conducted (i.e., the statistical tools provided to CAs, the graphs and tables created, and the methodology defined, etc.) offers a clear direction for future investigations into and activities relating to these issues.

9. Annex

Table 18: Banks participating in the 2022 EBA MR benchmarking exercise

Country	Bank name
AT	Erste Group Bank AG
AT	Raiffeisen Bank International AG
BE	Belfius Bank
BE	Dexia
BE	KBC Groep
DE	COMMERZBANK Aktiengesellschaft
DE	DEUTSCHE BANK AKTIENGESELLSCHAFT
DE	DZ BANK AG Deutsche Zentral-Genossenschaftsbank, Frankfurt am Main
DE	DekaBank Deutsche Girozentrale
DE	HSBC Germany Holdings GmbH
DE	Landesbank Baden-Württemberg
DE	Landesbank Hessen-Thüringen Girozentrale
DE	Norddeutsche Landesbank - Girozentrale -
DK	Danske Bank A/S
DK	Nykredit Realkredit A/S
ES	Banco Bilbao Vizcaya Argentaria, S.A.
ES	Banco Santander, S.A.
ES	CaixaBank, S.A.
ES	Credit Suisse Bank (Europe), S.A.
FI	Nordea Bank Abp
FR	BNP Paribas
FR	Groupe BPCE
FR	Groupe Crédit Agricole
FR	HSBC Continental Europe
FR	Société générale S.A.
GR	ALPHA SERVICES AND HOLDINGS S.A.
GR	Eurobank Ergasias Services and Holdings S.A.
GR	National Bank of Greece, S.A.
IE	Barclays Bank Ireland plc
IE	Citibank Holdings Ireland Limited
IT	BANCO BPM SOCIETA' PER AZIONI
IT	Intesa Sanpaolo S.p.A.
IT	UNICREDIT, SOCIETA' PER AZIONI
NL	ABN AMRO Bank N.V.
NL	Coöperatieve Rabobank U.A.
NL	ING Groep N.V.
NL	NIBC Holding N.V.
NL	RBS Holdings N.V.
PT	Banco Comercial Português, SA
SE	Skandinaviska Enskilda Banken - gruppen
SE	Swedbank - Grupp

Country	AT	BE	DE	DK	ES	FI	FR	GR	IE	IT	NL	PT	SE
N.banks	2	3	8	2	4	1	5	3	2	3	5	1	2

Table 19: Instruments/portfolios underlying the HPE

	Instruments
	EQUITY
1	Long EURO STOXX 50 index
2	Long 10000 BAYER (Ticker: BAYN GR) shares.
3	Short Future BAYER (Ticker: BAYN GR) (1 contract = 100 shares).
4	Short Future, STELLANTIS
5	Short Future, ALLIANZ
6	Short Future BARCLAYS
7	Short Future DEUTSCHE BANK
8	Short Future CRÉDIT AGRICOLE
9	Long Call Option. Underlying BAYER
10	Short Call Option. Underlying BAYER
11	Long Call Option. Underlying PFIZER
12	Long Put Option. Underlying PFIZER
13	Long Call Option. Underlying BAYER
14	Short Call Option. Underlying BAYER
15	Long Call Option. Underlying AVIVA
16	Long Put Option. Underlying AVIVA
17	Short Future NIKKEI 225
18	Auto-callable Equity product
	IR
19	5-year IRS EUR – Receive fixed rate and pay floating rate.

20	Two-year EUR swaption on 5-year interest rate swap.
21	5-year IRS USD. Receive fixed rate and pay floating rate.
22	2-year IRS GBP. Receive fixed rate and pay floating rate.
23	Long position on 'Cap and Floor' 10-year UBS AG (Ticker: UBSG VX) Notes.
24	Long GERMANY GOVT EUR 1 MLN
25	Short GERMANY GOVT EUR 1 MLN
26	Long ITALY GOVT EUR 1 MLN
27	Long ITALY GOVT EUR 1 MLN
28	Long SPAIN GOVT EUR 1 MLN
29	Short FRANCE GOVT EUR 1 MLN
30	Short GERMANY GOVT EUR 11 MLN
31	Long UNITED KINGDOM GOVT GBP 1 MLN
32	Long PORTUGAL GOVT EUR 1 MLN
33	Short UNITED STATES GOVT USD 1 MLN
34	Long BRAZIL GOVT 1 MLN USD
35	Long MEXICO GOVT 1 MLN USD
36	10-year IRS EURO – Receive floating rate and pay fixed rate.
37	5-year IRS EURO – Receive floating rate and pay fixed rate.
38	5-year Mark to Market (MtM) Cross Currency EUR/USD SWAP
	FX
39	6-month USD/EUR forward contract
40	6-month EUR/GBP forward contract.
41	Long 1 MLN USD Cash.
42	Long Call option. EUR 10 MLN.
43	Long Call option. EUR 10 MLN.

44	Short Call option. EUR 10 MLN
45	Short Call option. EUR 10 MLN.
46	Long Put option. EUR 10 MLN.
47	Short Put option. EUR 10 MLN
	COMMODITIES
48	Long 3,500,000 6-month ATM London Gold Forwards
49	Short 3,500,000 12-month ATM London Gold Forwards contracts
50	Long 30 contracts of 6-month WTI Crude Oil Call option
51	Short 30 contracts of 6-month WTI Crude Oil Put option
	CREDIT SPREAD
52	Long (i.e. Buy protection) USD 1 MLN CDS on PORTUGAL.
53	Long (i.e. Buy protection) USD 1 MLN CDS on ITALY.
54	Short (i.e. Sell protection) USD 1 MLN CDS on SPAIN.
55	Long (i.e. Buy protection) USD 1 MLN CDS on MEXICO.
56	Long (i.e. Buy protection) USD 1 MLN CDS on BRAZIL.
57	Long (i.e. Buy protection) USD 1 MLN CDS on UK.
58	Short (i.e. Sell protection) EUR 1 MLN CDS on Telefonica (Ticker TEF SM).
59	Long (i.e. Buy protection) EUR 1 MLN CDS on Telefonica (Ticker TEF SM).
60	Short (i.e. Sell protection) EUR 1 MLN CDS on Aviva (Ticker AV LN).
61	Long (i.e. Buy protection) EUR 1 MLN CDS on Aviva (Ticker AV LN).
62	Short (i.e. Sell protection) EUR 1 MLN CDS on Vodafone (Ticker VOD LN).
63	Short (i.e. Sell protection) EUR 1 MLN CDS on ENI SpA (Ticker ENI IM).
64	Short (i.e. Sell protection) USD 1 MLN CDS on Eli Lilly (Ticker LLY US).

65	Short (i.e. Sell protection) EUR 1 MLN CDS on Unilever (Ticker UNA NA).
66	Long (i.e. Buy protection) EUR 1 MLN CDS on Total SA (Ticker FP FP).
67	Long (i.e. Buy protection) EUR 1 MLN CDS on Volkswagen Group (Ticker VOW GR).
68	Long position on TURKEY Govt. notes USD 1 MLN (ISIN US900123CF53)
69	Long (i.e. Buy protection) USD 1 MLN CDS on TURKEY. Effective date as booking date.
70	Long position on Telefonica notes EUR 1 MLN
71	Long position on Volkswagen Group notes EUR 1 MLN
72	Short position Volkswagen Group notes EUR 1 MLN
73	Long position on Total SA notes EUR 1 MLN (ISIN XS0830194501)
74	Long Austria GOVT EUR 1 MLN
75	Long (i.e. Buy protection) USD 1 MLN CDS on Austria
76	Long NETHERLANDS GOVT EUR 1 MLN
77	Long (i.e. Buy protection) USD 1 MLN CDS on NETHERLANDS
78	Long BELGIUM GOVT EUR 1 MLN
79	Long (i.e. Buy protection) USD 1 MLN CDS on BELGIUM
	CTP
80	Short position in spread hedged Super Senior tranche of iTraxx Europe index on-the-run series.
81	Long (i.e. Buy protection) USD 1 MLN First to Default Basket Swap on {Brazil, Mexico and Turkey}.
Individual Portfolio	**Combination of instruments:**

1	1 – 1 instrument
2	3 – 1 instrument
	4 – 1 instrument
	5 – 1 instrument
3	13 – 1 instrument
	10 – 1 instrument
4	15 – 1 instrument
	16 – 1 instrument
5	17 – 1 instrument
6	9 – 1 instrument
	10 – 1 instrument
7	18 – 1 instrument
8	11 – 1 instrument
	12 – 1 instrument
9	2 – 1 instrument
	14 – 1 instrument
10	6 – 1 instrument
	7 – 1 instrument
	8 – 1 instrument
11	19 – 1 instrument
12	20 – 1 instrument
13	21 – 1 instrument
14	22 – 1 instrument
15	23 – 1 instrument
16	24 – 1 instrument
	25 – 1 instrument

17	24 – 1 instrument
	25 – 1 instrument
	26 – 1 instrument
18	24 – 1 instrument
	25 – 1 instrument
	26 – 1 instrument
	27 – 1 instrument
	28 – 1 instrument
	29 – 1 instrument
	30 – 1 instrument
19	19 – 1 instrument
	36 – 1 instrument
20	19 – 1 instrument
	37 – 1 instrument
21	36 – 1 instrument
	37 – 1 instrument
22	19 – 1 instrument
	20 – 1 instrument
23	31 – 1 instrument
24	33 – 1 instrument
	34 – 1 instrument
	35 – 1 instrument
25	21 – 1 instrument
	33 – 1 instrument
26	26 – 1 instrument
	27 – 1 instrument

	28 – 1 instrument
	32 – 1 instrument
27	38 – 1 instrument
28	39 – 1 instrument
	40 – 1 instrument
29	41 – 1 instrument
	42 – 1 instrument
30	42 – 1 instrument
	43 – 1 instrument
	44 – 1 instrument
31	45 – 1 instrument
	46 – 1 instrument
32	47 – 1 instrument
33	48 – 1 instrument
	49 – 1 instrument
34	50 – 1 instrument
	51 – 1 instrument
35	48 – 1 instrument
	51 – 1 instrument
36	52 – 1 instrument
	53 – 1 instrument
	54 – 1 instrument
37	55 – 1 instrument
	56 – 1 instrument
38	58 – 1 instrument
	59 – 1 instrument

39	54 – 1 instrument
	55 – 1 instrument
40	60 – 1 instrument
	61 – 1 instrument
41	62 – 1 instrument
	63 – 1 instrument
	65 – 1 instrument
	66 – 1 instrument
	67 – 1 instrument
42	68 – 1 instrument
	69 – 1 instrument
43	70 – 1 instrument
	71 – 1 instrument
	73 – 1 instrument
44	71 – 1 instrument
	72 – 1 instrument
45	70 – 1 instrument
	59 – 1 instrument
46	66 – 1 instrument
	73 – 1 instrument
47	64 – 1 instrument
48	71 – 1 instrument
	72 – 1 instrument
	67 – 1 instrument
49	57 – 1 instrument
	54 – 1 instrument

50	53 – 1 instrument
	27 – 1 instrument
51	55 – 1 instrument
	35 – 1 instrument
52	56 – 1 instrument
	34 – 1 instrument
53	55 – 1 instrument
	35 – 1 instrument
	56 – 1 instrument
	34 – 1 instrument
54	80 – 1 instrument
55	81 – 1 instrument
56	81 – 1 instrument
	68 – 1 instrument
	34 – 1 instrument
	35 – 1 instrument
57	74 – 1 instrument
	76 – 1 instrument
	78 – 1 instrument
58	75 – 1 instrument
	77 – 1 instrument
	79 – 1 instrument
59	74 – 1 instrument
	75 – 1 instrument
	76 – 1 instrument
	77 – 1 instrument

	78 – 1 instrument 79 – 1 instrument

Aggregated Portfolio	**Combination of individual portfolios:**
60 ALL-IN no-CTP	1, 2, 6, 7, 9, 11, 12, 18, 21, 27, 28, 30, 31, 32, 33, 34, 38, 41, 43, 59
61 EQUITY Cumulative	1, 2, 6, 7, 9
62 IR Cumulative	11, 12, 18, 21
63 FX Cumulative	28, 30, 31, 32
64 Commodity Cumulative	33, 34
65 Credit Spread cumulative	38, 41, 43, 59
66 CTP cumulative EUR	54, 56

For a detailed description of the portfolios, please refer to the EBA website:

https://www.eba.europa.eu/regulation-and-policy/supervisory-benchmarking-exercises/its-package-2022-benchmarking-exercise

Adopted as:

Commission Implementing Regulation (EU) 2022/951 of 24 May 2022 amending Implementing Regulation (EU) 2016/2070 laying down implementing technical standards for templates, definitions and IT solutions to be used by institutions when reporting to the European Banking Authority and to competent authorities in accordance with Article 78(2) of Directive 2013/36/EU of the European Parliament and of the Council (text with EEA relevance)

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Table 20: VaR cluster analysis – number of banks by range

2022 VaR cluster analysis: number of banks by range

(X = ratio with the median)

	Port. ID	50% < X	100% > X >50%	200% > X >150%	150% > X >100%	100% > X >50%	50% ≥ X >0	Num obs.
Equity	1		5	5	4	14	1	27
	2		5	5	5	14	1	25
	3			4	8	12	1	25
	4		1	4	6	10	5	26
	5			1	12	10	1	24
	6			1	10	11	5	25
	7			2	5	8	8	23
	8				15	10		25
	9			1	10	11	5	25
	10			1	9	15	1	26
Interest Rate	11				16	20		36
	12				17	16		33
	13				17	19		36
	14				17	20		37
	15		1	2	3	6	2	14
	16			1	13	14	1	29
	17			1	12	14	1	28
	18			3	11	12	4	30
	19				16	20		36
	20			3	14	18		35
	21				16	17		33
	22				16	18		34
	23				14	19		33
	24		3	3	5	8	6	25
	25			1	15	17		33
	26			1	14	15	1	28
	27	3	2		5	15	2	27
FX	28				14	16		30
	29				12	16		28
	30				14	16		30
	31				14	16		30
	32				12	16		28
Commodities	33			2	4	4	3	13
	34				4	6		10
	35				6	6		12
Credit Spread	36			1	7	8	8	24
	37		5		4	9		18
	38		1	5	4	10	2	22
	39		2	1	4	9		16
	40		1	5	5	11	1	23
	41		1	5	2	11	1	22
	42			2	5	10		17
	43	1	1	4	5	12	1	24
	44		1	5	5	15		26
	45		2	4	2	11	1	20
	46		1	2	5	11	1	20
	47	2	5		2	9	2	20
	48			1	6	11	1	20
	49	2	5	1	2	11		21
	50			5	5	12		22
	51			2	5	7	2	16
	52			5	5	8	1	19
	53			4	5	8	1	18
	54				9	15		24
	55		2	1	6	9	2	20
	56				9	12		21
CVA	57							0
	58							0
	59							0
All-Weather	60			2	5	5	1	13
Equity Cumulative	61		1	1	4	11		17
IR Cumulative	62				11	16		27
FX Cumulative	63				12	15		27
Commodity Cumulative	64				4	6		10
CS Cumulative	65			5	22	2		29
CVA Cumulative	66							0

Table 21: VaR statistics

EU Statistics for VaR

	Port. ID	Main statistics: Min	Max	Avg.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	Percentiles: 25th	50th	75th	IQD
Equity	1	181,481	10,626,420	4,174,049	2,209,746	2,344,222	929,742	51%	25	3,054,419	3,931,522	5,918,600	32%
	2	1,295,110	5,918,479	3,192,008	1,278,906	1,310,222	495,704	40%	25	2,351,789	2,767,530	4,492,038	31%
	3	3,170	19,170	11,903	4,099	4,159	2,140	34%	25	9,314	11,985	13,205	17%
	4	339	2,823	1,284	612	930	240	48%	24	920	1,209	1,402	20%
	5	443,523,353	1,911,290,183	1,285,910,415	312,856,031	445,130,273	111,206,424	24%	24	1,056,777,023	1,161,090,051	1,522,754,494	18%
	6	1,381	9,545	5,067	2,022	2,102	1,604	40%	25	3,778	5,530	6,535	27%
	7	10,073	60,790	28,288	15,005	20,280	8,515	53%	18	17,650	31,955	33,750	31%
	8	21,062	54,731	42,551	8,912	11,270	7,326	21%	23	35,222	41,891	52,005	19%
	9	9,331	83,437	41,090	16,409	20,209	10,600	40%	25	30,628	44,050	48,754	23%
	10	209,500	748,309	472,893	156,452	278,209	96,208	33%	24	340,024	493,584	627,493	30%
Interest Rate	11	51,080	121,564	84,190	15,565	16,786	9,202	19%	37	60,700	80,200	95,068	15%
	12	26,100	48,067	34,084	5,221	5,020	3,947	15%	34	30,564	34,645	38,447	11%
	13	110,616	197,869	146,619	22,819	25,675	19,768	16%	37	122,881	146,805	161,912	14%
	14	26,645	60,068	42,321	9,110	9,242	8,347	22%	36	35,564	44,160	48,904	18%
	15	11,124	67,902	27,064	13,926	16,890	8,661	52%	14	16,842	26,880	31,611	32%
	16	14,605	62,307	20,282	10,477	11,265	9,525	55%	30	10,066	31,604	36,464	31%
	17	32,427	134,015	75,011	21,935	27,465	15,302	30%	26	58,613	75,442	89,560	21%
	18	36,367	144,620	81,066	31,448	36,387	26,165	30%	30	54,168	85,684	99,867	30%
	19	102,562	157,602	126,651	12,561	16,216	8,829	10%	37	115,848	121,667	132,515	7%
	20	3,000	8,448	5,087	1,610	1,750	1,307	32%	36	3,625	5,084	6,465	28%
	21	205,690	389,957	285,772	38,304	46,520	28,254	14%	34	248,724	300,065	319,862	14%
	22	40,121	127,144	83,661	16,955	25,251	6,464	20%	36	71,861	85,402	91,562	12%
	23	22,686	62,275	37,005	5,362	7,000	2,460	15%	36	35,924	37,114	40,021	8%
	24	12,005	104,801	46,687	26,513	34,771	18,463	57%	25	22,946	46,426	66,120	48%
	25	76,676	199,920	130,684	26,106	36,080	24,004	20%	34	106,908	130,036	154,444	19%
	26	42,861	169,507	101,646	30,306	36,020	28,426	30%	26	77,668	101,705	124,901	23%
	27	1,646	257,848	46,527	60,012	106,025	6,900	130%	27	18,760	26,480	36,222	30%
FX	28	250,421	517,434	372,112	79,605	89,250	34,755	21%	31	325,174	351,505	459,440	17%
	29	14,041	30,497	21,464	3,601	4,251	1,398	17%	29	19,672	20,997	23,417	9%
	30	150,575	234,707	192,168	23,152	21,435	17,946	12%	31	176,520	191,531	210,574	9%
	31	240,168	401,491	311,384	41,950	41,957	39,044	14%	31	259,510	315,545	340,606	13%
	32	272,434	405,526	358,210	35,454	65,515	34,958	10%	29	322,138	346,422	384,035	9%
Commodities	33	1,445	15,002	7,067	3,954	16,655	2,216	50%	16	5,611	6,890	10,341	30%
	34	361,384	540,960	454,574	57,850	204,071	48,327	13%	10	417,550	455,407	519,577	11%
	35	390,770	720,768	515,026	101,046	156,487	70,206	20%	12	454,774	486,574	575,728	14%
Credit Spread[3]	36	4,951	21,083	10,291	4,875	15,144	3,730	47%	19	6,837	11,724	15,926	45%
	37	15,579	26,319	25,465	19,414	21,539	2,750	55%	16	20,126	22,207	25,338	17%
	38	2,121	10,836	5,440	2,414	3,251	1,151	45%	20	3,790	5,159	7,242	31%
	39	8,325	26,350	13,627	5,530	12,252	1,482	41%	16	10,337	11,328	14,856	18%
	40	1,589	8,672	3,827	2,002	3,049	1,058	51%	19	2,196	3,927	4,100	30%
	41	2,023	17,726	9,273	4,244	6,213	2,210	47%	20	7,033	8,470	13,641	32%
	42	26,210	97,253	48,152	18,914	32,334	12,736	39%	17	35,640	50,516	53,440	20%
	43	13,159	105,172	37,048	20,135	44,527	5,312	54%	22	25,327	30,235	45,716	29%
	44	4,714	17,120	8,292	3,400	9,510	1,618	39%	22	6,025	7,714	11,119	27%
	45	2,463	35,900	16,241	7,675	12,118	1,725	47%	20	11,602	13,269	21,448	30%
	46	1,179	18,873	9,429	3,607	13,175	1,700	39%	20	7,315	8,075	11,814	24%
	47	750	6,942	2,589	2,031	2,749	808	79%	16	922	1,915	4,085	63%
	48	1,570	16,035	8,327	2,828	9,265	1,150	33%	19	7,490	8,961	10,018	14%
	49	2,033	13,857	5,439	3,936	5,111	1,427	72%	19	2,687	3,909	8,759	53%
	50	10,440	26,515	15,294	4,625	7,592	1,922	29%	20	12,590	15,169	16,826	14%
	51	3,243	47,699	23,298	11,036	15,040	5,458	45%	16	17,208	24,004	28,857	24%
	52	4,219	55,151	30,077	13,734	16,754	8,019	45%	17	19,694	29,107	37,120	31%
	53	2,776	89,131	53,051	24,040	24,045	17,435	45%	18	36,331	48,919	72,958	34%
	57	105,089	222,270	162,159	28,458	42,524	14,532	18%	22	144,400	160,257	181,751	11%
	58	15,838	67,953	35,201	15,506	18,869	9,285	45%	20	26,801	32,555	45,496	26%
	59	99,037	238,474	158,343	28,903	44,242	20,600	18%	21	141,025	157,380	178,658	12%
CTP	54								3				
	55								2				
	56								2				
ALL (w/o CTP) **	60	851,190	4,456,540	2,678,089	1,036,796	1,148,000	299,225	39%	11	2,222,621	2,580,624	2,790,925	11%
Equity Cumulative **	61	1,537,143	6,107,625	2,932,447	1,079,678	9,580,539	323,812	37%	17	2,411,352	2,784,022	2,961,826	11%
IR Cumulative **	62	160,463	236,855	210,867	29,156	41,321	17,818	14%	27	199,306	220,725	237,443	9%
FX Cumulative **	63	503,202	901,613	725,540	90,200	101,075	39,316	12%	25	657,851	702,199	759,611	8%
Commodity Cumulative **	64	363,341	521,219	451,561	52,358	201,064	41,418	12%	10	420,822	456,075	500,641	9%
CS Cumulative **	65	101,510	226,750	175,366	39,451	71,135	14,256	22%	19	158,845	174,097	191,956	10%
CTP Cumulative ***	66								2				

[1] STDev_trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 65), banks that reported at least a missing portfolio VaR among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

Table 22: sVaR statistics

EU Statistics for SVaR

	Port. ID	Main statistics								Percentiles			
	Port. ID	Min	Max	Ave.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	25th	50th	75th	KID
Equity	1	4,043,046	11,902,610	8,131,891	1,875,738	22,006,571	1,104,427	23%	22	7,145,715	8,082,887	9,492,297	14%
	2	3,080,613	14,097,219	8,032,457	2,991,053	3,191,481	2,228,456	37%	20	6,427,337	8,051,890	11,134,249	26%
	3	5,081	26,058	11,915	5,609	6,087	2,753	30%	25	12,739	15,795	18,356	18%
	4	196	3,506	1,041	916	1,272	416	53%	24	1,017	1,578	1,959	31%
	5	323,341,295	3,904,853,697	2,195,226,013	1,121,675,727	1,131,040,180	912,504,573	51%	25	1,016,623,680	2,124,434,972	3,152,035,359	51%
	6	1,944	11,750	6,006	2,903	2,869	2,723	45%	27	3,810	6,721	9,347	42%
	7	19,116	130,239	71,080	32,191	42,219	18,851	45%	15	47,530	72,758	85,262	26%
	8	11,131	68,459	40,004	17,601	17,601	12,650	44%	24	27,618	40,007	53,908	32%
	9	31,385	114,439	73,179	22,437	21,380	12,142	31%	25	58,059	74,102	83,317	18%
	10	434,321	2,485,018	1,251,531	457,950	610,979	223,029	37%	26	1,037,364	1,286,630	1,453,442	18%
Interest Rate	11	86,866	262,206	176,004	59,055	57,310	46,754	34%	36	128,161	194,280	225,140	29%
	12	15,692	99,127	51,691	20,600	25,741	15,372	40%	36	38,472	56,111	67,400	64%
	13	134,632	467,268	280,040	64,212	86,696	57,304	23%	36	224,855	311,257	342,608	21%
	14	16,246	150,207	70,440	33,315	30,726	28,154	47%	40	57,802	74,687	97,968	44%
	15	24,076	200,306	80,184	53,856	80,664	27,858	67%	14	60,963	66,572	121,142	50%
	16	10,203	60,488	44,680	17,347	13,734	10,100	39%	30	33,947	44,631	58,761	27%
	17	37,066	208,568	113,367	39,234	40,405	26,335	35%	20	80,062	110,570	134,120	20%
	18	46,510	208,930	135,754	68,240	85,741	41,819	53%	26	80,908	127,606	160,626	33%
	19	86,646	368,915	227,380	77,602	79,210	56,512	34%	36	160,641	236,256	281,900	29%
	20	116	58,955	13,257	12,806	24,425	4,756	97%	36	6,613	11,463	15,263	39%
	21	231,427	746,962	490,190	165,954	150,256	135,564	34%	30	320,167	541,280	637,669	36%
	22	80,656	223,506	154,226	48,754	51,476	42,711	32%	36	107,761	156,371	189,942	30%
	23	26,636	80,660	56,376	13,868	21,080	11,065	25%	32	42,950	57,720	64,706	21%
	24	26,137	232,979	96,696	55,861	64,624	41,119	60%	25	47,510	87,646	137,868	49%
	25	112,140	550,642	244,587	80,764	85,790	51,361	33%	36	182,865	276,442	305,036	30%
	26	56,510	564,242	177,636	98,106	131,150	47,564	55%	20	136,804	146,660	215,041	30%
	27	16,622	464,661	154,145	118,860	204,626	47,358	77%	27	77,909	140,446	161,268	32%
FX	28	315,519	1,200,656	785,122	241,491	251,572	170,456	31%	32	658,510	813,477	998,954	21%
	29	24,007	91,418	51,997	20,773	20,475	17,419	40%	32	34,822	51,530	71,675	35%
	30	267,145	585,073	444,524	91,875	95,965	65,549	21%	30	378,915	458,570	526,175	16%
	31	410,513	1,204,279	802,304	251,673	258,519	196,216	31%	33	634,849	791,507	1,056,000	25%
	32	381,365	1,520,256	937,194	342,894	331,145	233,542	37%	32	591,307	962,481	1,214,557	35%
Commodities	33	2,495	68,252	27,716	18,425	25,741	5,456	67%	13	17,654	22,327	27,568	22%
	34	326,646	1,268,269	770,424	270,172	327,605	189,848	35%	13	600,500	790,386	924,016	21%
	35	592,676	1,359,348	1,136,461	148,300	325,676	108,878	13%	12	1,025,257	1,106,604	1,255,545	9%
Credit Spread[1]	36	11,099	72,539	24,003	14,714	20,383	5,437	61%	19	14,810	20,922	31,023	36%
	37	44,565	168,520	87,243	40,575	50,523	16,257	47%	16	58,741	77,153	108,129	30%
	38	5,724	18,647	12,581	3,531	4,970	2,110	28%	20	10,216	12,545	14,916	19%
	39	12,134	90,350	40,565	23,438	32,277	12,742	58%	16	22,635	37,395	51,818	39%
	40	4,477	31,706	14,591	6,935	9,060	3,692	47%	20	10,512	14,061	18,472	27%
	41	12,731	56,030	24,240	12,908	24,850	6,721	53%	20	14,123	23,525	30,052	40%
	42	29,577	182,905	95,018	47,357	47,382	40,494	50%	19	50,978	100,592	134,936	45%
	43	24,531	177,310	85,509	41,135	57,255	27,419	48%	22	51,830	81,956	112,560	29%
	44	7,047	51,925	25,221	12,738	14,240	8,553	50%	21	16,510	21,499	33,627	34%
	45	19,777	91,599	51,502	22,696	22,090	17,736	44%	21	32,301	50,007	62,199	32%
	46	2,744	46,357	20,280	10,101	19,429	6,160	50%	19	13,833	21,485	26,091	31%
	47	1,335	18,628	7,461	4,453	10,492	2,910	60%	19	3,047	5,080	10,312	55%
	48	4,143	62,497	27,305	16,508	20,251	8,113	61%	20	15,034	21,506	31,123	35%
	49	4,081	68,790	19,142	16,357	23,299	6,205	85%	20	7,426	14,332	27,440	57%
	50	14,960	71,709	31,051	14,163	23,641	4,214	46%	20	23,314	27,263	31,853	15%
	51	6,962	104,076	47,281	26,850	31,395	16,390	57%	16	26,316	42,127	66,022	43%
	52	16,442	105,127	46,501	24,958	45,627	17,628	51%	15	27,938	46,328	66,775	41%
	53	7,310	185,490	85,080	43,737	67,126	32,504	51%	16	48,959	81,800	112,679	39%
	57	181,254	439,850	301,091	66,439	71,079	40,476	22%	22	244,909	301,399	331,172	15%
	58	25,313	220,856	94,174	63,718	85,199	29,257	68%	19	46,020	86,272	149,600	53%
	59	169,286	427,691	323,592	99,638	96,001	74,890	31%	23	247,026	296,334	402,739	24%
CTP	54								3				
	55								2				
	56								2				
ALL (w/o CTP) **	60	1,102,171	13,909,817	5,803,183	3,350,134	6,346,302	1,477,100	58%	11	3,607,105	5,244,300	6,541,811	28%
Equity Cumulative **	61	2,136,198	26,996,292	8,113,990	6,001,609	27,120,304	1,610,450	95%	17	3,193,601	5,542,422	6,353,306	33%
IR Cumulative **	62	184,250	690,513	431,109	146,814	165,581	108,952	34%	25	322,846	461,271	540,750	25%
FX Cumulative **	63	534,171	3,029,451	1,513,434	685,326	641,050	585,574	38%	31	1,130,431	2,021,329	2,305,300	35%
Commodity Cumulative **	64	320,510	1,238,379	764,545	274,596	302,573	99,746	30%	11	592,931	784,907	956,053	33%
CS Cumulative **	65	234,290	542,050	391,563	96,753	96,353	71,962	25%	20	306,842	405,326	473,712	21%
CTP Cumulative ***	66								2				

[1] STDev trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 66), banks that reported at least a missing portfolio sVaR among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

Table 23: P&L VaR statistics

EU Statistics for PnL VaR

	PnL ID	Main statistics								Percentiles			
		Min	Max	Ave.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	25th	50th	75th	IQD
Equity	1	19,302	10,326,809	4,175,261	2,197,050	2,165,105	110,691	50%	19	3,444,011	3,486,443	5,809,120	26%
	2	2,041,087	5,795,295	3,118,870	1,450,685	1,245,185	550,621	41%	18	2,285,074	3,061,251	5,302,720	40%
	3	1,149	18,627	10,071	4,405	2,043	1,022	41%	18	8,544	9,421	11,805	16%
	4	481	2,354	1,121	499	561	251	35%	18	993	1,274	1,485	20%
	5	2,901,087	2,011,705,410	982,060,226	518,095,802	757,445,268	314,100,222	57%	20	636,721,954	1,021,298,970	1,311,279,740	35%
	6	4,119	10,020	6,827	1,571	1,818	720	21%	17	6,105	6,903	7,517	10%
	7	13,980	99,706	34,245	19,614	92,757	11,349	57%	14	18,031	32,407	46,609	44%
	8	30,109	59,013	40,944	5,854	15,197	1,624	13%	17	44,561	45,454	49,626	5%
	9	18,770	84,406	38,021	14,105	31,512	5,627	30%	18	32,426	37,780	42,994	14%
	10	274,059	831,453	480,801	171,726	290,043	141,412	30%	17	330,206	552,199	608,620	31%
Interest Rate	11	60,444	166,842	91,187	21,145	76,594	7,514	25%	24	78,022	86,621	98,262	9%
	12	20,574	62,215	36,535	8,069	16,481	3,608	24%	21	29,759	33,618	36,741	10%
	13	134,074	206,675	166,545	58,880	82,542	10,157	25%	24	144,255	156,457	172,556	9%
	14	30,154	76,577	42,624	10,860	27,280	4,657	25%	24	37,301	41,682	46,656	10%
	15	11,546	57,311	18,775	9,158	46,207	2,206	40%	10	14,559	15,007	17,427	10%
	16	14,414	64,512	27,682	12,061	27,656	9,717	44%	10	16,759	30,666	36,116	37%
	17	16,735	152,808	72,687	25,818	75,202	17,001	35%	10	55,045	70,756	89,024	25%
	18	41,010	240,822	81,354	44,356	84,151	18,401	55%	20	51,666	75,014	90,272	27%
	19	106,095	234,232	126,211	22,277	72,882	5,577	17%	24	117,151	122,646	127,600	4%
	20	2,765	10,250	5,072	1,677	4,387	865	33%	25	3,826	4,024	5,954	22%
	21	260,190	526,157	306,541	52,564	126,272	15,600	17%	24	262,456	296,255	315,179	5%
	22	70,565	209,604	95,485	30,411	75,205	5,767	32%	25	80,625	87,525	96,221	9%
	23	6,755	68,977	35,777	11,717	18,046	3,959	33%	22	32,500	35,765	39,362	10%
	24	17,790	125,244	56,255	35,507	110,565	11,548	65%	16	24,851	41,550	66,957	22%
	25	115,026	220,645	145,580	27,400	60,785	10,750	19%	20	127,047	136,056	150,465	12%
	26	42,085	300,906	117,697	58,357	110,216	10,175	46%	20	92,400	116,242	150,705	17%
	27	11,514	459,840	77,016	120,650	264,650	9,858	155%	21	17,561	19,505	59,672	55%
FX	28	272,364	590,913	365,109	95,458	265,222	42,410	26%	22	292,040	344,280	458,256	21%
	29	17,535	31,694	22,511	4,425	11,589	914	20%	20	19,916	21,120	22,646	6%
	30	121,542	259,011	200,571	33,249	109,062	20,671	16%	20	177,450	219,154	233,108	14%
	31	240,113	416,456	287,505	47,432	225,281	21,555	17%	20	274,300	290,565	330,402	9%
	32	259,572	438,960	320,998	53,857	251,225	22,312	17%	20	292,891	311,218	345,206	8%
Commodities	33	2,236	28,656	11,296	7,426	11,802	2,820	66%	10	7,836	10,401	12,476	23%
	34	425,002	1,629,144	656,507	405,057	651,470	68,406	62%	8	445,510	575,256	609,256	15%
	35	60,212	1,554,108	564,092	408,458	557,202	21,211	72%	9	471,567	495,256	507,859	4%
Credit Spread[1]	36	2,581	31,300	10,526	8,773	12,771	2,459	83%	15	4,503	7,197	13,443	49%
	37	12,162	57,301	34,171	24,952	30,080	1,300	73%	12	24,100	25,517	26,730	5%
	38	2,495	12,022	6,214	2,897	8,943	2,343	47%	15	3,911	6,182	8,932	39%
	39	6,435	33,452	12,461	7,104	12,529	516	55%	11	9,896	10,795	12,076	10%
	40	1,591	10,790	4,042	2,014	5,261	1,253	50%	15	3,102	3,927	5,740	30%
	41	4,042	23,250	9,842	5,138	11,019	2,616	52%	15	6,453	9,252	12,759	33%
	42	21,860	106,820	53,970	40,148	69,439	17,579	74%	13	29,291	47,545	54,635	30%
	43	13,005	104,630	37,562	24,232	180,162	4,592	65%	16	24,097	29,317	42,040	27%
	44	4,553	18,740	8,858	3,771	36,487	1,474	43%	16	6,219	7,575	10,424	25%
	45	2,335	37,659	15,881	9,335	67,925	2,397	59%	15	11,341	13,721	17,146	20%
	46	1,732	119,058	17,890	28,748	57,751	1,130	161%	16	7,204	8,005	9,433	13%
	47	545	4,712	2,151	1,262	1,969	1,261	59%	14	787	2,313	3,651	65%
	48	1,292	35,536	9,331	8,404	29,524	721	87%	15	6,609	7,521	8,149	10%
	49	2,267	16,118	5,980	4,195	14,777	709	70%	14	3,500	3,977	7,291	35%
	50	9,320	33,045	15,291	5,511	32,501	2,142	36%	15	12,842	14,595	16,504	12%
	51	2,990	47,230	19,005	11,351	29,127	5,618	58%	11	13,534	19,535	25,034	30%
	52	3,913	61,595	25,132	14,849	41,978	2,460	59%	11	18,526	22,544	33,237	28%
	53	2,485	93,121	42,959	24,253	62,250	7,453	57%	11	34,887	38,739	49,675	18%
	57	101,591	458,534	171,224	81,946	245,052	10,891	48%	16	134,249	145,342	178,050	14%
	58	15,151	121,644	51,950	31,932	32,255	19,956	62%	15	27,137	49,053	76,427	48%
	59	90,890	472,053	162,171	79,589	239,565	17,600	48%	15	129,200	149,501	173,134	15%
CTP	54								2				
	55												
	56												
ALL (w/o CTP) **	60	2,201,264	8,039,900	3,251,872	1,922,330	5,616,149	231,985	61%	8	2,277,107	2,805,962	3,140,841	16%
Equity Cumulative **	61	2,322,980	18,525,191	4,272,561	4,526,631	9,462,539	199,018	106%	13	2,598,354	2,780,542	2,858,212	5%
IR Cumulative **	62	103,675	225,150	215,942	40,219	149,583	33,861	19%	19	192,510	223,753	244,545	12%
FX Cumulative **	63	573,070	852,579	673,853	84,652	471,584	35,459	13%	20	620,718	661,185	687,198	5%
Commodity Cumulative **	64	429,022	1,649,300	648,252	409,518	830,431	56,734	63%	8	445,750	566,045	581,035	13%
CS Cumulative **	65	95,361	409,437	195,534	90,939	481,275	31,910	47%	14	147,451	172,516	204,119	16%
CTP Cumulative **	66												

[1] STDev_trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 66), banks that reported at least a missing portfolio VaR among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

Table 24: Empirical expected shortfall statistics

EU Statistics for empirical expected shortfall

		Main statistics								Percentiles			
	Port. ID	Min	Max	Ave.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	25th	50th	75th	IQD
Equity	1	17,990	9,750,297	4,081,778	2,146,012	2,800,127	175,615	40%	19	3,739,112	3,801,610	6,720,512	29%
	2	2,120,900	5,944,776	3,130,497	1,453,344	1,279,271	400,397	41%	18	2,327,612	2,544,541	4,034,614	34%
	3	1,317	18,224	10,952	4,215	6,853	923	39%	18	9,192	10,279	10,938	9%
	4	473	2,216	1,369	454	579	225	33%	18	1,007	1,394	1,447	18%
	5	5,105,109	2,107,207,917	1,005,157,842	599,010,250	741,129,330	349,052,673	59%	20	622,400,412	1,043,450,161	1,259,984,874	35%
	6	2,027	9,032	6,126	1,606	2,024	758	26%	17	5,417	6,477	6,718	11%
	7	17,549	77,472	35,339	19,544	42,335	9,721	55%	14	19,374	30,805	48,851	43%
	8	35,024	56,095	45,436	5,335	15,790	3,163	12%	17	41,609	45,332	47,877	7%
	9	15,561	54,941	40,751	16,414	34,025	3,759	41%	18	31,658	36,625	39,246	11%
	10	294,036	806,171	475,413	149,994	280,425	113,163	32%	17	342,125	522,334	595,957	27%
Interest Rate	11	60,210	172,116	86,850	20,829	66,465	7,216	25%	24	76,727	84,475	92,720	9%
	12	20,146	57,821	32,715	10,579	10,575	1,671	32%	22	28,850	30,514	32,154	5%
	13	151,551	258,568	162,035	38,858	84,624	6,157	24%	24	141,562	147,565	157,508	8%
	14	35,050	90,426	40,885	12,745	20,815	4,148	26%	24	44,029	45,540	52,940	9%
	15	12,255	55,856	17,481	7,560	46,655	1,208	46%	10	15,764	14,525	16,169	8%
	16	16,505	58,804	27,507	11,726	25,561	9,710	45%	10	16,756	32,507	36,874	38%
	17	16,064	156,800	75,156	26,679	74,244	17,215	37%	10	51,600	80,146	92,024	28%
	18	40,500	251,150	86,072	51,069	92,722	22,942	59%	20	50,656	84,046	98,150	30%
	19	107,872	214,401	125,444	21,808	75,895	7,750	17%	24	115,241	125,591	129,914	6%
	20	2,755	9,810	5,290	1,858	4,260	1,068	35%	23	3,853	5,595	6,532	24%
	21	260,150	506,610	294,067	49,020	137,215	9,157	17%	24	272,407	281,119	290,414	5%
	22	67,415	178,961	90,150	25,946	65,577	4,404	29%	23	76,024	79,056	95,834	12%
	23	5,025	58,657	35,095	11,402	19,546	3,517	33%	22	31,555	35,775	38,258	10%
	24	17,241	125,660	52,545	33,066	117,764	10,671	63%	16	32,565	42,156	58,863	29%
	25	117,515	226,350	141,095	27,848	58,364	9,013	20%	20	125,052	132,044	150,240	13%
	26	44,784	320,950	117,252	56,602	106,475	17,341	48%	20	60,571	100,591	139,041	14%
	27	10,655	464,450	78,702	114,255	266,084	7,506	145%	21	17,664	28,196	55,160	51%
FX	28	297,500	677,134	381,331	102,121	249,569	29,422	27%	22	311,727	334,791	500,552	33%
	29	15,491	38,942	21,974	4,415	13,580	771	20%	20	19,652	20,434	21,736	5%
	30	121,090	257,311	205,029	26,658	105,005	10,552	13%	20	192,932	212,013	218,946	6%
	31	249,108	409,310	289,338	47,331	212,945	9,592	16%	20	263,371	272,478	286,156	4%
	32	262,591	425,717	326,971	58,743	251,565	14,756	18%	20	290,632	305,815	336,673	7%
Commodities	33	2,295	29,650	14,616	9,819	9,612	2,910	67%	11	7,509	10,575	27,163	56%
	34	446,025	1,620,255	547,240	322,607	791,202	48,758	63%	8	460,654	542,256	576,426	10%
	35	70,295	540,811	442,562	156,700	505,255	52,340	35%	8	464,944	515,592	562,565	8%
Credit Spread[3]	36	1,787	22,538	8,826	6,474	11,867	2,013	73%	14	4,406	6,871	13,137	49%
	37	10,000	91,949	34,752	25,121	34,515	900	73%	12	24,656	21,895	26,932	4%
	38	2,491	12,113	5,860	3,038	8,050	1,897	52%	15	3,344	5,056	8,252	42%
	39	6,147	33,958	12,519	7,248	11,972	194	57%	11	10,636	10,851	11,500	4%
	40	1,645	12,126	4,517	2,851	5,895	1,001	62%	15	2,500	3,501	7,009	48%
	41	5,104	28,419	10,767	5,145	11,325	3,015	48%	15	6,913	9,523	15,519	38%
	42	30,465	130,001	50,531	27,093	61,546	8,241	54%	12	35,219	50,131	54,202	21%
	43	11,559	128,351	36,551	28,592	161,530	5,317	72%	16	25,691	33,165	39,056	22%
	44	5,059	18,048	8,261	3,857	30,121	1,275	44%	16	6,072	7,795	10,102	26%
	45	2,115	34,024	16,156	9,121	59,501	3,058	53%	15	10,910	14,929	19,915	29%
	46	1,795	102,780	15,159	24,014	51,504	1,173	161%	15	7,281	7,533	9,618	14%
	47	695	4,249	2,413	1,114	1,490	857	45%	14	1,260	2,515	3,205	44%
	48	1,740	33,094	9,779	8,474	21,261	510	87%	15	6,515	6,909	8,312	12%
	49	2,509	11,145	5,041	2,652	14,257	596	53%	14	3,182	3,559	6,563	35%
	50	10,245	34,042	15,431	5,853	29,530	1,474	38%	15	12,072	14,547	17,404	18%
	51	3,130	43,127	15,818	10,285	28,539	5,316	55%	11	13,213	17,970	22,096	26%
	52	3,245	67,315	24,957	16,301	40,753	2,495	65%	11	18,676	22,084	25,415	15%
	53	2,274	82,219	36,519	21,209	67,850	4,464	54%	11	31,039	34,177	44,727	18%
	57	99,527	459,536	171,974	83,691	253,385	7,951	49%	16	133,918	145,127	154,168	16%
	58	14,816	112,959	49,177	29,701	34,382	21,859	60%	15	26,563	48,021	71,973	46%
	59	93,205	444,705	167,067	83,679	251,812	13,592	50%	15	127,937	141,400	156,592	10%
CTP	54								2				
	55												
	56												
ALL (w/o CTP) **	60	2,072,031	8,057,294	3,170,154	2,020,371	5,702,326	350,398	64%	8	2,112,752	2,860,595	3,045,292	18%
Equity Cumulative **	61	2,315,545	17,075,520	3,943,857	4,204,033	11,275,924	145,658	107%	13	2,297,758	2,418,504	2,659,502	7%
IR Cumulative **	62	99,105	295,857	211,031	42,392	149,581	21,292	20%	19	187,790	212,958	244,352	13%
FX Cumulative **	63	578,848	924,758	673,119	96,337	472,505	44,954	14%	20	625,540	651,245	694,128	7%
Commodity Cumulative **	64	442,367	1,606,514	645,081	391,709	781,582	50,808	61%	8	458,598	542,145	571,141	10%
CS Cumulative **	65	94,481	492,305	195,333	98,238	392,159	17,619	50%	14	147,864	169,427	181,814	10%
CTP Cumulative **	66												

[1] STDev trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 65), banks that reported at least a missing portfolio (ES) among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

Table 25: sVaR/VaR statistics

EU Statistics for sVaR/VaR

	Port. ID	Main statistics: Min	Max	Avg.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	Percentiles: 25th	50th	75th	IQD
Equity	1	0.35	4.29	2.09	0.93			44%	22	1.16	2.23	2.59	31%
	2	1.20	5.24	2.82	1.27			45%	25	2.02	2.63	3.08	20%
	3	0.61	2.60	1.51	0.54			36%	21	1.00	1.45	1.91	30%
	4	0.41	3.05	1.43	0.64			45%	21	1.02	1.25	1.68	25%
	5	0.64	3.05	2.07	0.91			44%	21	1.28	2.14	2.84	38%
	6	0.51	2.26	1.41	0.55			40%	24	0.87	1.37	1.97	39%
	7	0.55	5.29	2.64	1.47			56%	16	1.71	2.34	3.21	31%
	8	0.23	1.93	1.01	0.39			39%	22	0.63	1.05	1.26	33%
	9	0.62	3.99	1.85	0.75			40%	22	1.43	1.85	2.00	17%
	10	1.11	4.99	2.69	1.02			38%	24	2.06	2.32	3.35	24%
Interest Rate	11	0.81	4.08	2.21	0.90			41%	35	1.56	1.80	2.68	26%
	12	0.50	2.09	1.55	0.65			42%	32	0.96	1.56	2.00	35%
	13	0.91	6.18	2.05	0.67			33%	31	1.64	2.20	2.57	22%
	14	0.27	5.44	1.81	0.99			55%	35	0.81	1.95	2.72	54%
	15	0.86	6.68	3.52	2.34			66%	16	2.10	2.61	4.40	35%
	16	0.46	2.71	1.64	0.58			35%	26	1.34	1.75	2.10	22%
	17	0.57	3.62	1.65	0.53			32%	26	1.29	1.61	1.87	18%
	18	0.31	5.26	1.93	1.23			63%	27	1.11	1.46	2.35	36%
	19	0.64	2.66	1.80	0.61			32%	35	1.45	1.95	2.42	25%
	20	0.01	11.52	2.95	2.20			75%	32	1.58	2.47	3.39	36%
	21	0.75	3.09	1.85	0.61			33%	35	1.41	1.86	2.29	24%
	22	0.64	3.60	1.94	0.81			42%	35	1.20	1.71	2.63	37%
	23	0.50	2.40	1.40	0.45			32%	20	1.21	1.36	1.68	22%
	24	0.65	6.08	2.39	1.53			64%	22	1.18	2.36	2.68	42%
	25	0.72	3.65	1.94	0.77			40%	31	1.21	2.04	2.51	35%
	26	0.62	4.68	1.90	1.17			62%	26	1.06	1.56	2.21	35%
	27	0.47	16.05	5.51	3.58			65%	26	2.60	4.65	7.68	49%
FX	28	0.64	3.39	2.17	0.75			34%	29	1.77	2.31	2.67	20%
	29	1.16	3.98	2.34	0.83			35%	25	1.68	2.05	2.82	25%
	30	1.40	3.17	2.34	0.53			23%	25	1.88	2.39	2.77	19%
	31	1.30	4.52	2.63	0.90			34%	31	1.80	2.54	3.49	32%
	32	1.20	4.35	2.64	1.05			40%	25	1.81	2.45	3.45	31%
Commodities	33	1.46	7.68	3.65	1.82			50%	16	2.33	3.30	4.70	34%
	34	0.72	3.20	1.75	0.81			46%	9	1.22	1.47	1.80	19%
	35	1.64	3.33	2.23	0.47			21%	12	1.92	2.11	2.48	13%
Credit Spread[1]	36	0.74	11.10	2.72	2.71			95%	16	1.27	1.90	3.30	45%
	37	0.59	6.26	2.95	1.46			49%	14	1.91	2.71	3.73	32%
	38	1.00	4.14	2.53	0.98			39%	17	1.44	2.61	3.22	38%
	39	0.55	7.91	3.50	2.28			67%	15	1.85	2.75	4.50	46%
	40	0.73	9.51	4.67	2.56			55%	16	2.05	4.21	6.60	40%
	41	0.79	15.10	3.15	3.12			99%	16	1.75	2.25	3.30	31%
	42	0.69	3.82	1.99	0.97			49%	17	1.11	2.10	2.75	40%
	43	0.86	6.99	2.61	1.59			60%	20	1.20	2.61	3.36	47%
	44	0.81	6.37	3.21	2.06			64%	20	2.07	2.34	4.57	38%
	45	0.94	6.90	3.26	1.75			54%	16	2.08	2.99	4.26	34%
	46	0.76	4.70	2.43	1.26			52%	17	1.56	2.00	3.50	38%
	47	0.53	6.89	3.65	2.00			55%	16	1.85	3.64	4.90	45%
	48	0.99	6.36	2.81	1.65			59%	16	1.75	2.64	3.33	30%
	49	0.53	15.57	5.73	5.93			104%	16	1.39	2.71	11.92	79%
	50	0.84	4.79	2.09	0.90			43%	19	1.50	2.12	2.43	24%
	51	0.96	3.85	2.04	0.84			41%	15	1.45	1.86	2.20	21%
	52	0.76	3.71	1.89	0.91			48%	15	1.10	1.69	2.34	36%
	53	0.74	3.51	1.81	0.70			39%	16	1.41	1.65	2.29	24%
	57	1.05	2.05	1.95	0.43			22%	20	1.73	2.12	2.33	13%
	58	1.02	6.80	2.53	1.59			62%	17	1.26	1.91	3.13	42%
	59	0.91	3.06	2.11	0.78			37%	20	1.73	2.11	2.36	15%
CTP	54												
	55												
	56												
ALL (w/o CTP) **	60	0.75	3.28	2.15	0.82			38%	11	1.56	2.29	2.80	28%
Equity Cumulative **	61	0.73	4.38	1.95	1.00			51%	17	1.04	2.14	2.51	42%
IR Cumulative **	62	0.73	3.31	2.00	0.65			32%	26	1.62	2.00	2.44	20%
FX Cumulative **	63	0.91	4.11	2.56	1.00			39%	25	1.80	2.70	3.31	30%
Commodity Cumulative **	64	0.72	3.28	1.75	0.81			47%	9	1.23	1.42	1.84	20%
CS Cumulative **	65	0.71	3.31	2.04	0.65			32%	27	1.64	2.00	2.48	20%
CTP Cumulative **	66	0.91	4.11	2.39	0.98			41%	29	1.69	2.34	3.24	31%

[1] STDev trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 66), banks that reported at least a missing portfolio (47) among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

Table 26: P&L VaR/VaR statistics

EU Statistics for P&L VaR/VaR

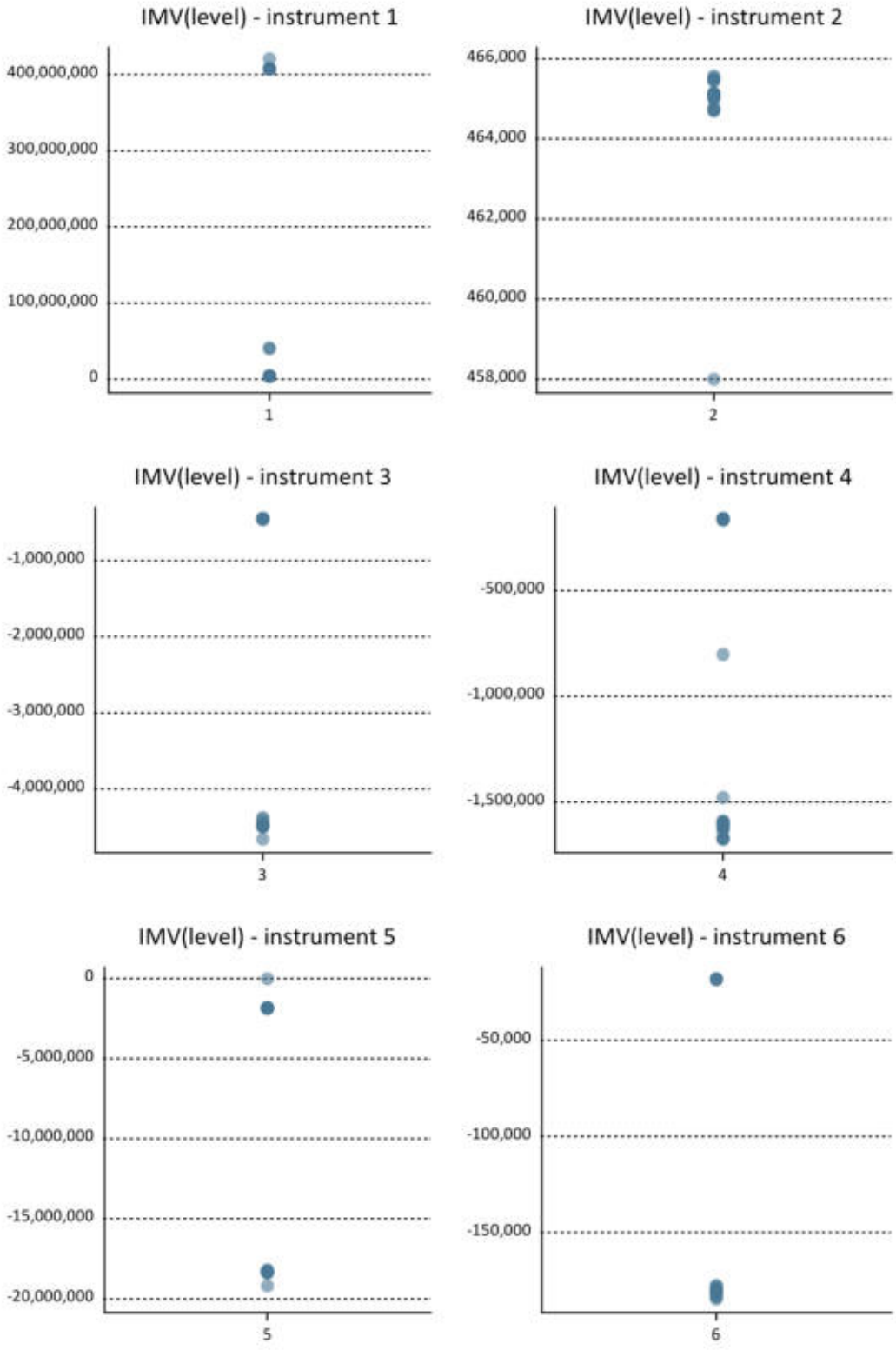
		Main statistics								Percentiles		
	Port. ID	Min	Max	Ave.	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Mean)	Num obs.[2]	25th	50th	75th
Equity	1	0.34	9.52	1.62	1.91			118%	20	1.00	1.09	1.50
	2	0.34	2.50	1.21	0.52			43%	17	1.02	1.07	1.19
	3	0.34	2.31	1.18	0.45			38%	17	1.07	1.10	1.27
	4	0.43	1.54	0.97	0.29			30%	19	0.85	1.03	1.10
	5	0.33	132.56	8.25	30.17			365%	19	1.00	1.13	1.50
	6	0.28	1.17	0.81	0.25			31%	17	0.68	0.90	0.99
	7	0.32	2.03	1.13	0.45			40%	13	0.95	1.00	1.26
	8	0.29	1.24	0.85	0.21			24%	15	0.82	0.93	0.97
	9	0.49	1.85	1.17	0.28			24%	17	1.07	1.16	1.26
	10	0.34	2.75	1.21	0.50			41%	16	1.00	1.02	1.35
Interest Rate	11	0.34	1.27	0.95	0.20			20%	24	0.92	1.05	1.09
	12	0.32	1.42	0.95	0.28			29%	24	0.96	1.05	1.11
	13	0.30	1.43	0.90	0.26			29%	25	0.89	0.99	1.01
	14	0.33	1.71	0.99	0.33			33%	26	0.92	1.03	1.08
	15	0.74	2.56	1.35	0.51			38%	10	1.03	1.17	1.58
	16	0.32	1.52	1.03	0.29			28%	19	1.00	1.03	1.18
	17	0.32	1.48	0.95	0.29			30%	15	0.88	1.03	1.07
	18	0.33	1.89	1.05	0.36			34%	20	1.01	1.03	1.10
	19	0.32	1.15	0.92	0.26			28%	24	0.87	1.02	1.08
	20	0.32	1.73	0.95	0.35			37%	26	0.94	1.04	1.13
	21	0.32	1.31	0.92	0.28			30%	22	0.93	1.02	1.06
	22	0.31	1.20	0.91	0.24			25%	24	0.87	1.02	1.05
	23	0.34	9.46	1.35	1.78			132%	22	0.98	1.02	1.08
	24	0.32	2.45	1.12	0.50			45%	16	0.96	1.03	1.16
	25	0.30	1.07	0.89	0.22			24%	22	0.89	0.95	1.02
	26	0.35	1.54	0.99	0.22			22%	15	0.97	1.02	1.05
	27	0.09	1.58	1.01	0.35			34%	20	0.97	1.01	1.11
FX	28	0.32	1.75	1.05	0.34			33%	21	0.92	1.04	1.16
	29	0.29	1.35	0.96	0.26			28%	19	0.92	0.96	1.07
	30	0.26	1.78	0.82	0.31			38%	21	0.68	0.94	1.00
	31	0.31	1.46	0.97	0.30			31%	21	0.89	1.05	1.12
	32	0.33	1.52	1.03	0.28			27%	19	1.01	1.07	1.11
Commodities	33	0.20	1.45	0.80	0.37			47%	11	0.49	0.97	1.02
	34	0.32	1.07	0.86	0.27			32%	7	0.65	1.00	1.05
	35	0.37	1.33	0.90	0.31			34%	9	0.65	1.05	1.00
Credit Spread	36	0.31	3.09	1.30	0.73			56%	15	0.96	1.25	1.40
	37	0.31	3.13	1.30	0.80			62%	12	0.96	1.13	1.25
	38	0.35	1.42	1.01	0.30			30%	14	0.91	1.02	1.24
	39	0.30	2.71	1.19	0.63			53%	12	1.03	1.05	1.28
	40	0.32	1.76	0.99	0.37			38%	13	0.81	1.03	1.11
	41	0.35	1.71	1.13	0.34			30%	15	0.99	1.14	1.33
	42	0.32	1.42	0.99	0.30			30%	13	1.04	1.04	1.08
	43	0.34	1.59	1.09	0.31			29%	16	1.01	1.09	1.14
	44	0.34	1.52	1.05	0.28			27%	16	0.99	1.02	1.13
	45	0.32	1.76	1.07	0.31			29%	15	1.02	1.03	1.15
	46	0.32	1.52	1.03	0.29			28%	14	0.94	1.05	1.21
	47	0.31	2.05	1.15	0.44			37%	14	1.01	1.22	1.38
	48	0.32	1.91	1.12	0.32			28%	14	1.04	1.05	1.23
	49	0.32	3.21	1.12	0.69			61%	14	0.78	1.02	1.22
	50	0.33	1.93	1.12	0.36			32%	15	1.01	1.05	1.13
	51	0.30	1.83	1.03	0.43			41%	13	0.90	1.01	1.08
	52	0.31	1.74	0.97	0.40			42%	13	0.83	1.01	1.13
	53	0.31	3.18	1.04	0.67			65%	13	0.84	1.02	1.08
	57	0.35	1.50	1.07	0.24			22%	15	1.04	1.05	1.12
	58	0.32	1.07	0.93	0.38			42%	14	0.79	1.00	1.16
	59	0.35	1.53	1.07	0.25			24%	14	1.08	1.05	1.10
CTP	54											
	55											
	56											
ALL (w/o CTP) **	60	0.32	1.46	1.02	0.33			32%	8	1.00	1.12	1.20
Equity Cumulative **	61	0.30	1.57	0.90	0.33			34%	15	0.89	1.01	1.15
IR Cumulative **	62	0.32	1.55	0.96	0.30			32%	20	0.94	1.02	1.06
FX Cumulative **	63	0.32	1.42	1.00	0.27			28%	19	1.01	1.05	1.06
Commodity Cumulative **	64	0.32	1.07	0.84	0.27			32%	7	0.69	1.00	1.05
CS Cumulative **	65	0.32	1.55	1.04	0.24			23%	19	1.01	1.05	1.08
CTP Cumulative **	66	0.32	1.55	1.00	0.32			32%	21	1.01	1.05	1.12

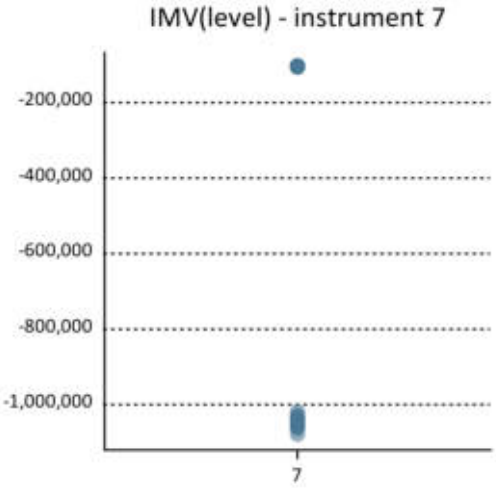
[1] STDev trunc. is the standard deviation computed excluding values below the 5th and above the 95th percentile

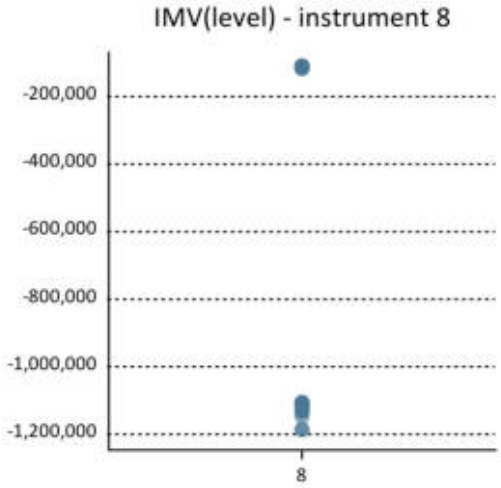
[2] Refers to the number of banks included in the computation of the statistics

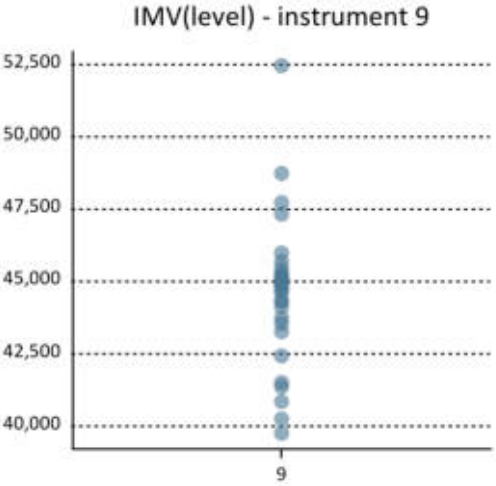
** For the aggregated portfolios (57 to 63), banks that reported at least a missing portfolio (NA) among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio

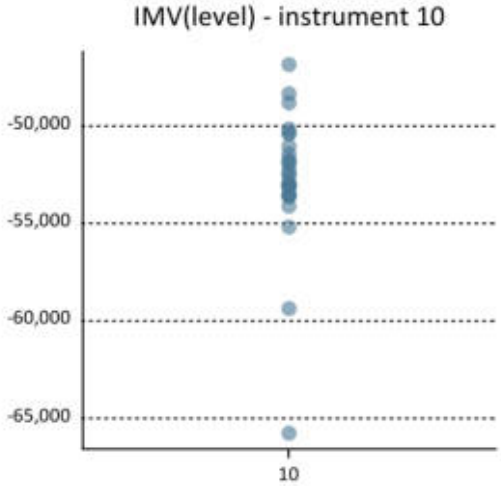
Figure 24: IMV scatter plots (all)

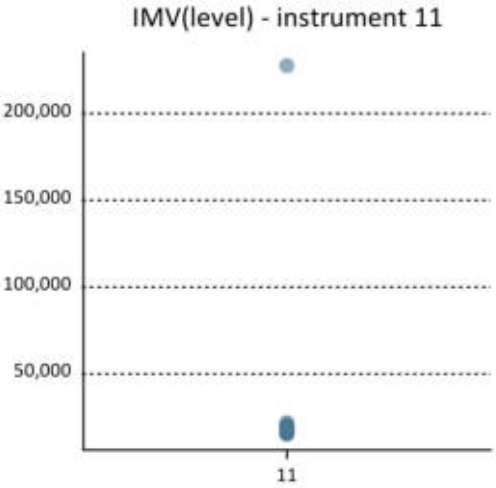


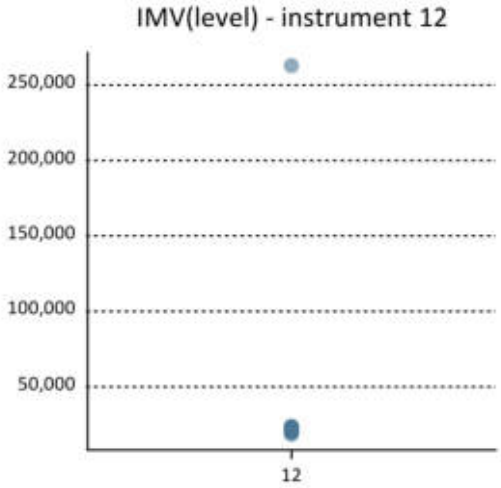

IMV(level) - instrument 7
-200,000
-400,000
-600,000
-800,000
-1,000,000
7

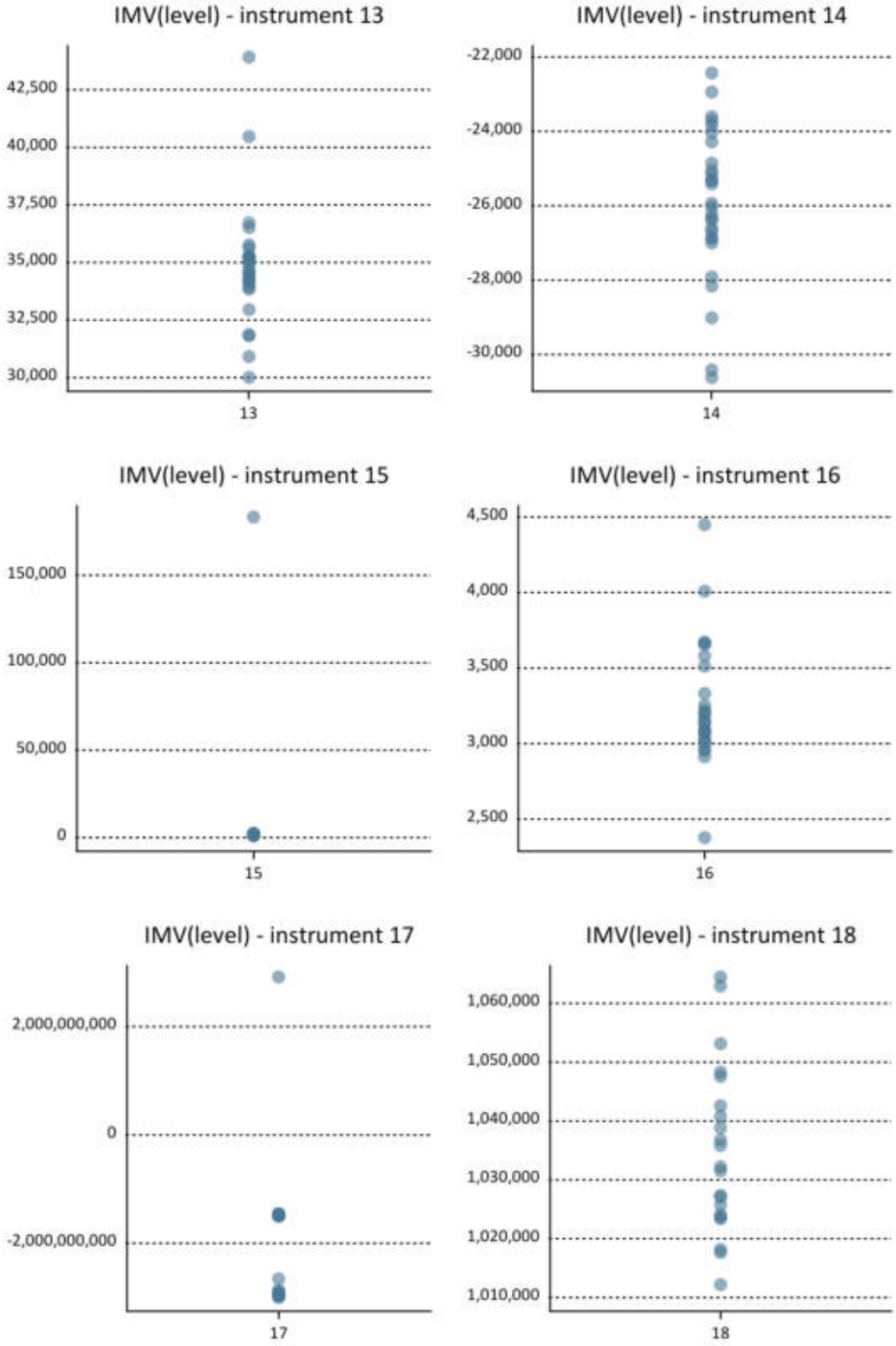

IMV(level) - instrument 8
-200,000
-400,000
-600,000
-800,000
-1,000,000
-1,200,000
8

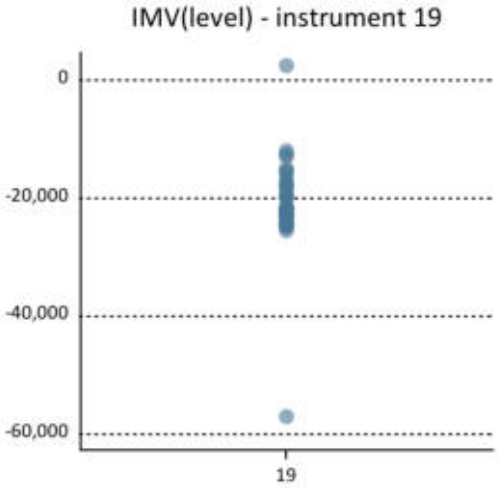

IMV(level) - instrument 9
52,500
50,000
47,500
45,000
42,500
40,000
9

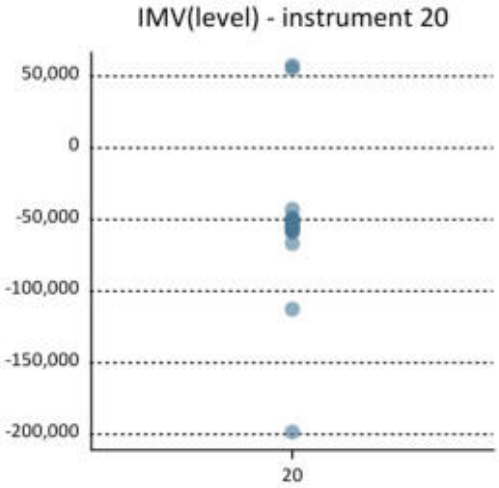

IMV(level) - instrument 10
-50,000
-55,000
-60,000
-65,000
10

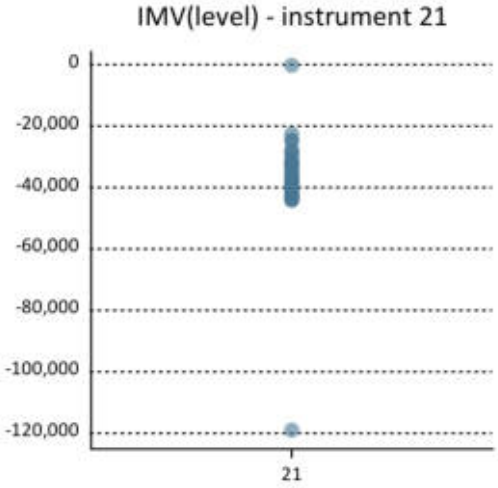

IMV(level) - instrument 11
200,000
150,000
100,000
50,000
11

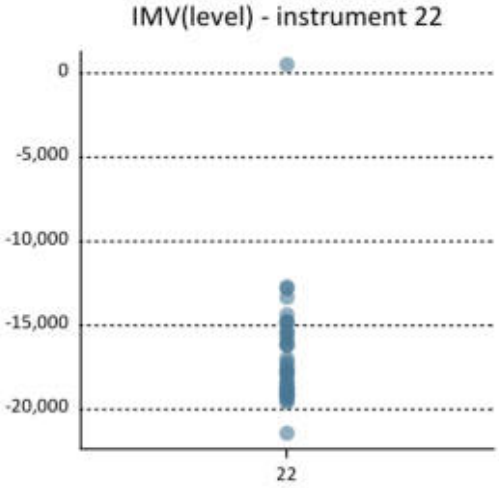

IMV(level) - instrument 12
250,000
200,000
150,000
100,000
50,000
12

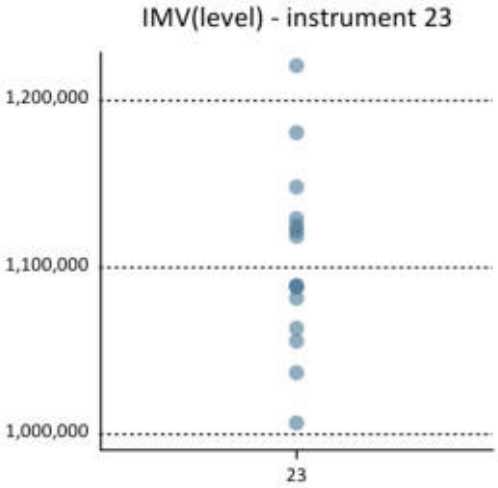

IMV(level) - instrument 13
42,500
40,000
37,500
35,000
32,500
30,000
13
IMV(level) - instrument 14
-22,000
-24,000
-26,000
-28,000
-30,000
14
IMV(level) - instrument 15
150,000
100,000
50,000
0
15
IMV(level) - instrument 16
4,500
4,000
3,500
3,000
2,500
16
IMV(level) - instrument 17
2,000,000,000
0
-2,000,000,000
17
IMV(level) - instrument 18
1,060,000
1,050,000
1,040,000
1,030,000
1,020,000
1,010,000
18

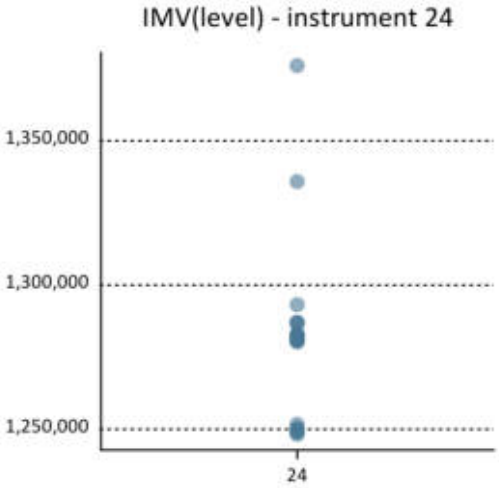

IMV(level) - instrument 19
0
-20,000
-40,000
-60,000
19

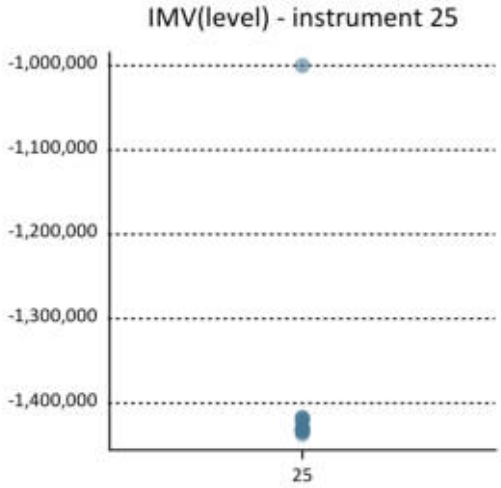

IMV(level) - instrument 20
50,000
0
-50,000
-100,000
-150,000
-200,000
20

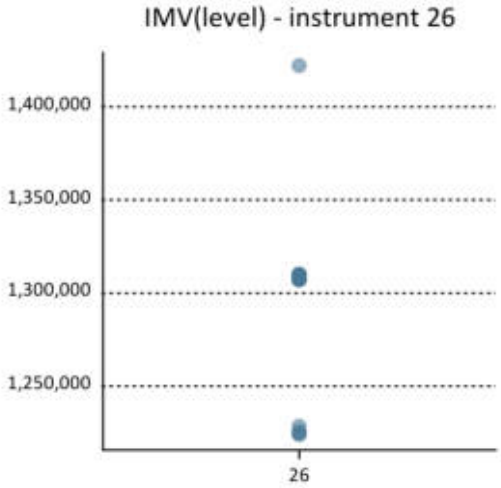

IMV(level) - instrument 21
0
-20,000
-40,000
-60,000
-80,000
-100,000
-120,000
21

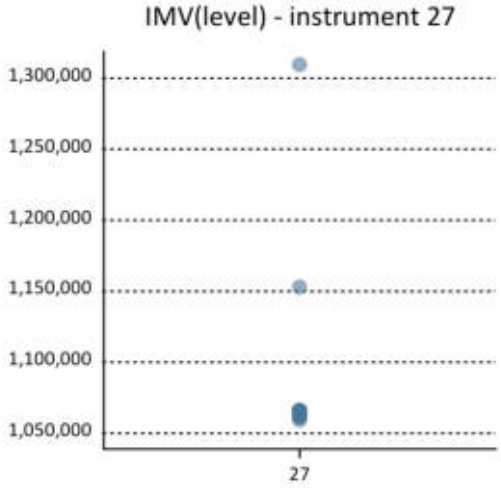

IMV(level) - instrument 22
0
-5,000
-10,000
-15,000
-20,000
22

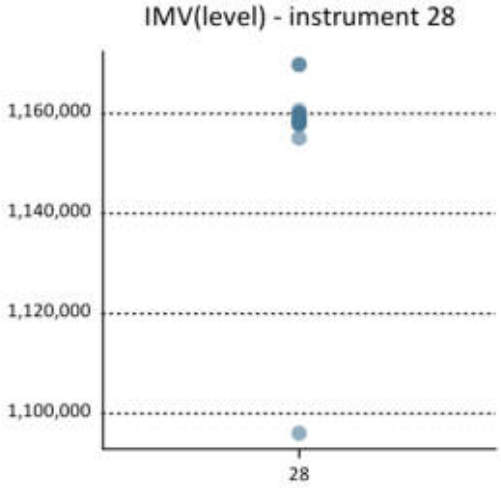

IMV(level) - instrument 23
1,200,000
1,100,000
1,000,000
23

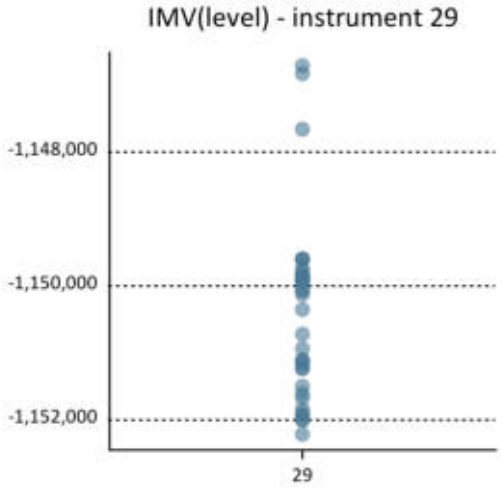

IMV(level) - instrument 24
1,350,000
1,300,000
1,250,000
24

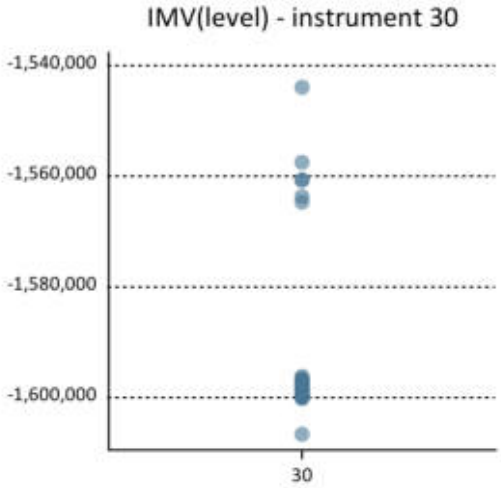

IMV(level) - instrument 25
-1,000,000
-1,100,000
-1,200,000
-1,300,000
-1,400,000
25

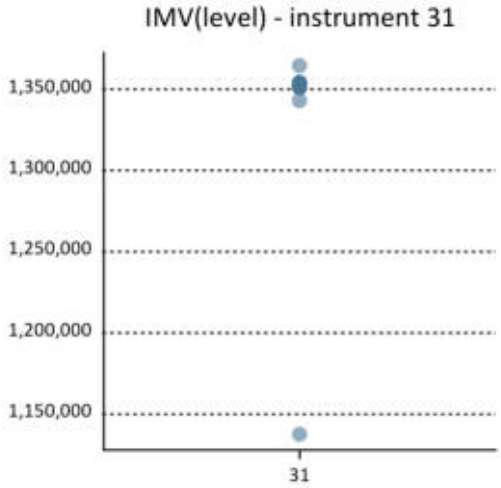

IMV(level) - instrument 26
1,400,000
1,350,000
1,300,000
1,250,000
26

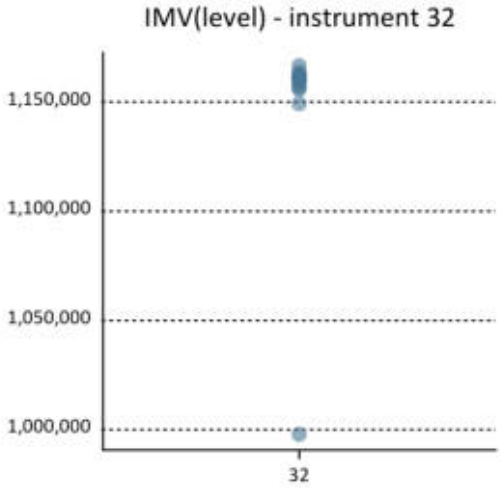

IMV(level) - instrument 27
1,300,000
1,250,000
1,200,000
1,150,000
1,100,000
1,050,000
27

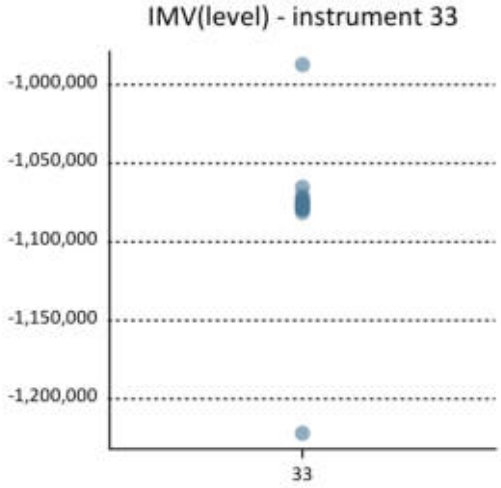

IMV(level) - instrument 28
1,160,000
1,140,000
1,120,000
1,100,000
28

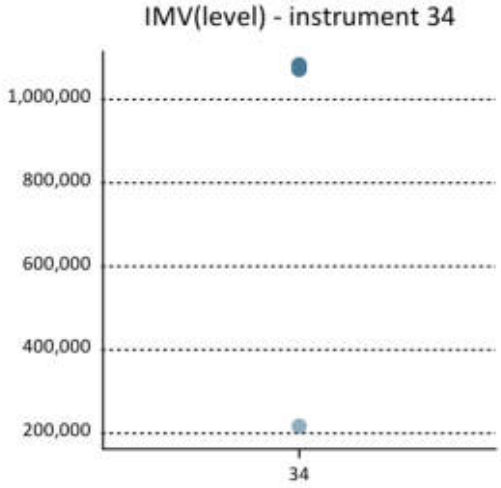

IMV(level) - instrument 29
-1,148,000
-1,150,000
-1,152,000
29

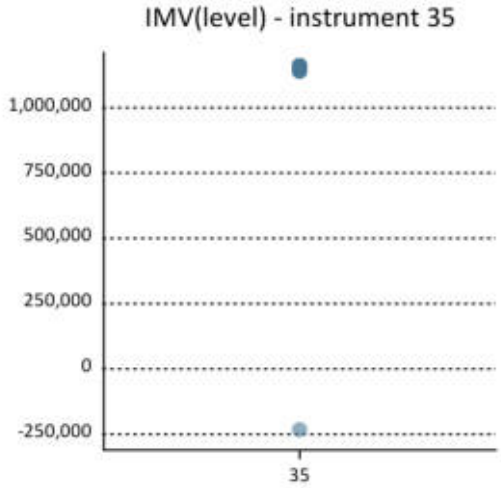

IMV(level) - instrument 30
-1,540,000
-1,560,000
-1,580,000
-1,600,000
30

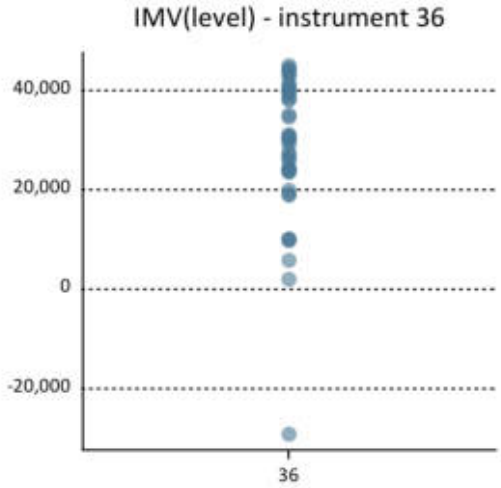

IMV(level) - instrument 31
1,350,000
1,300,000
1,250,000
1,200,000
1,150,000
31

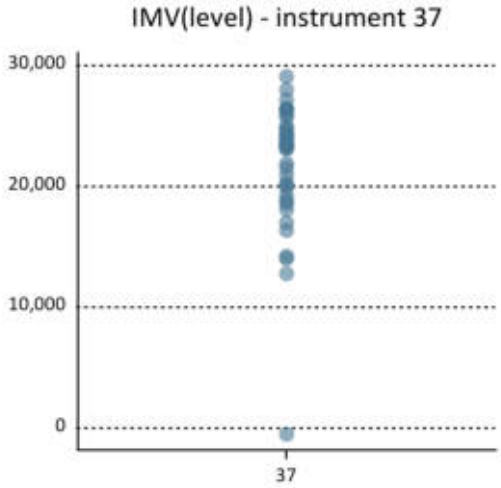

IMV(level) - instrument 32
1,150,000
1,100,000
1,050,000
1,000,000
32

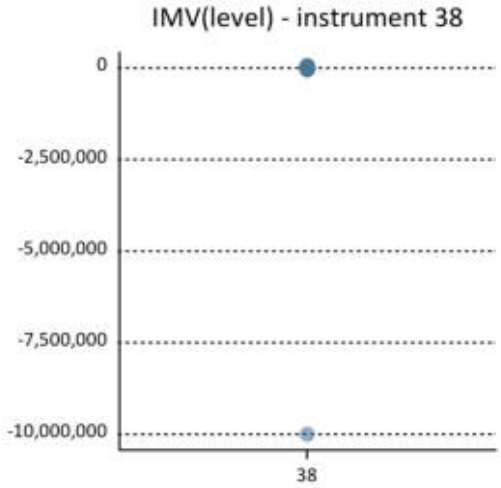

IMV(level) - instrument 33
-1,000,000
-1,050,000
-1,100,000
-1,150,000
-1,200,000
33

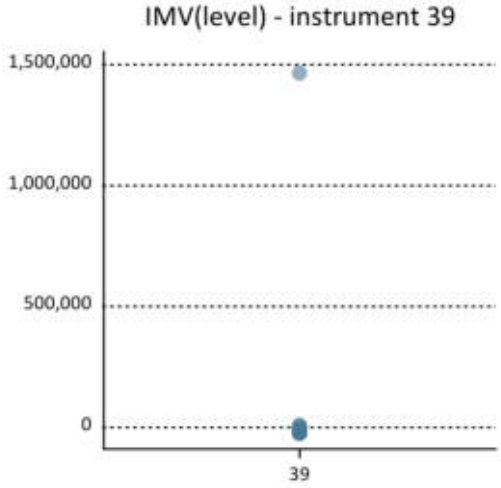

IMV(level) - instrument 34
1,000,000
800,000
600,000
400,000
200,000
34

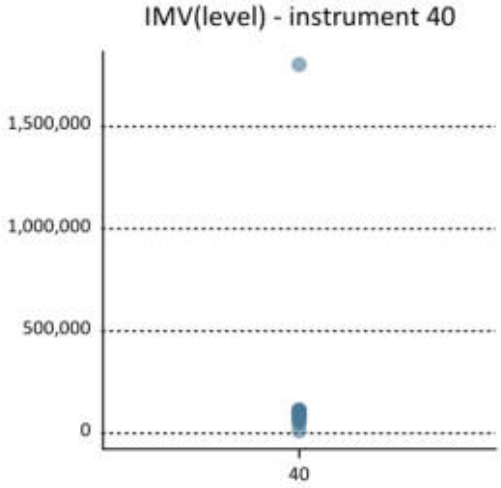

IMV(level) - instrument 35
1,000,000
750,000
500,000
250,000
0
-250,000
35

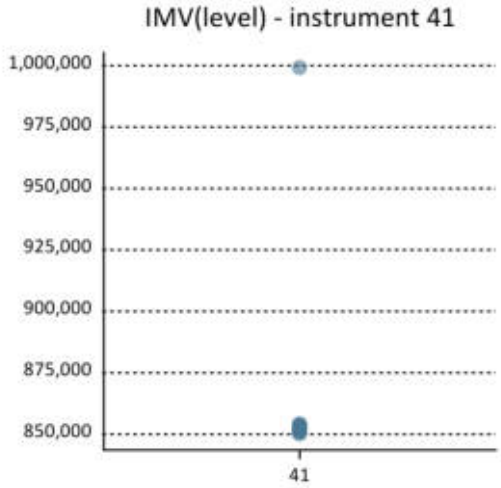

IMV(level) - instrument 36
40,000
20,000
0
-20,000
36

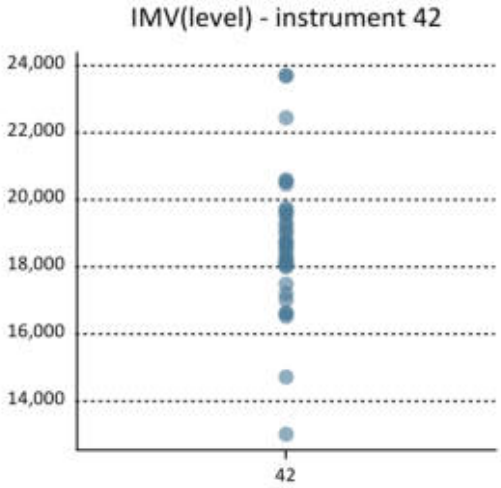

IMV(level) - instrument 37
30,000
20,000
10,000
0
37

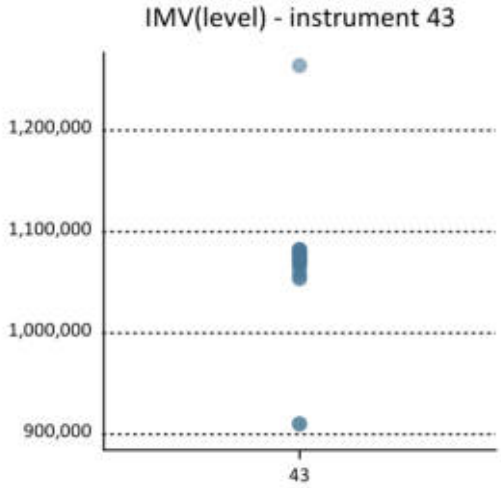

IMV(level) - instrument 38
0
-2,500,000
-5,000,000
-7,500,000
-10,000,000
38

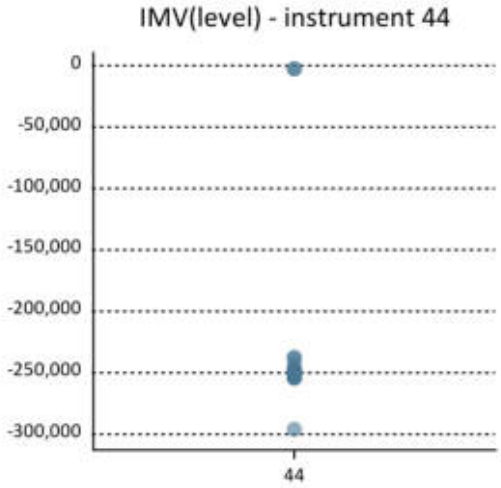

IMV(level) - instrument 39
1,500,000
1,000,000
500,000
0
39

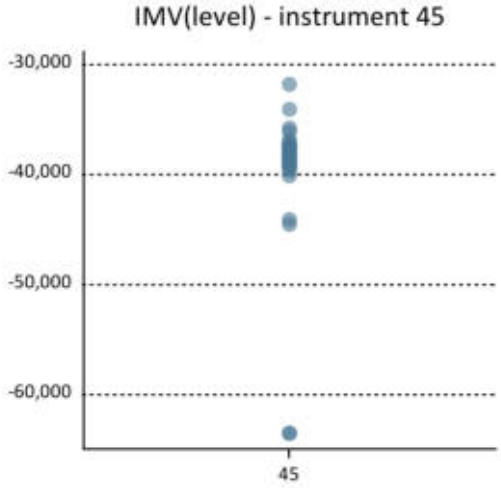

IMV(level) - instrument 40
1,500,000
1,000,000
500,000
0
40

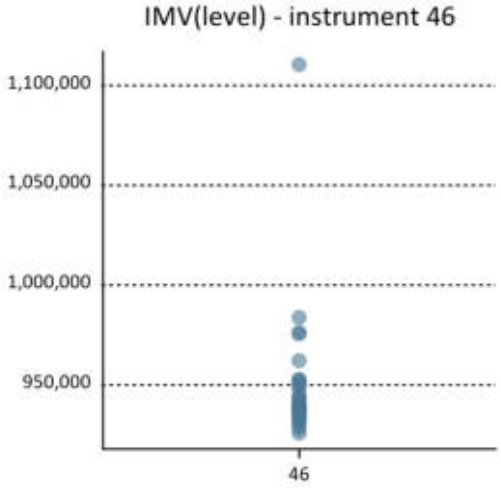

IMV(level) - instrument 41
1,000,000
975,000
950,000
925,000
900,000
875,000
850,000
41

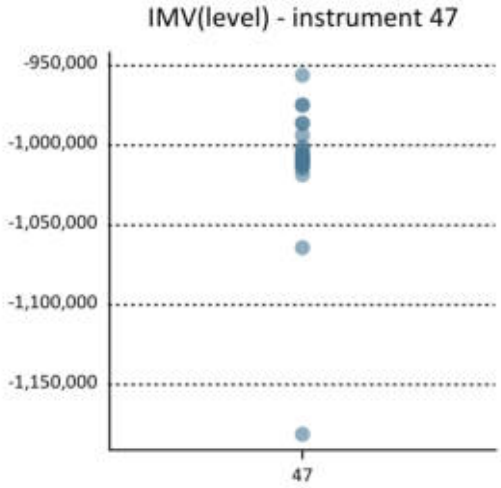

IMV(level) - instrument 42
24,000
22,000
20,000
18,000
16,000
14,000
42

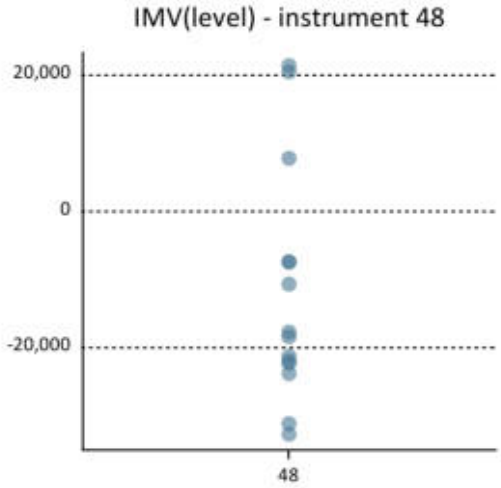

IMV(level) - instrument 43
1,200,000
1,100,000
1,000,000
900,000
43

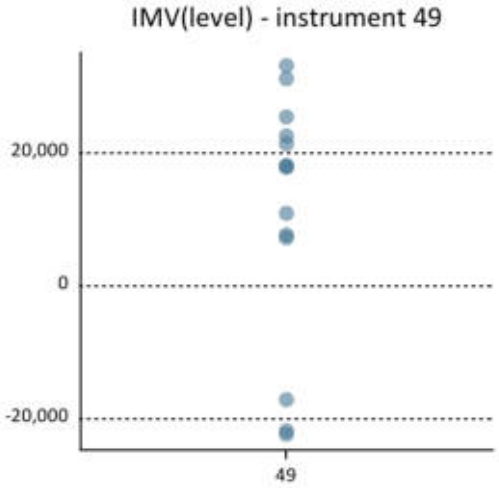

IMV(level) - instrument 44
0
-50,000
-100,000
-150,000
-200,000
-250,000
-300,000
44

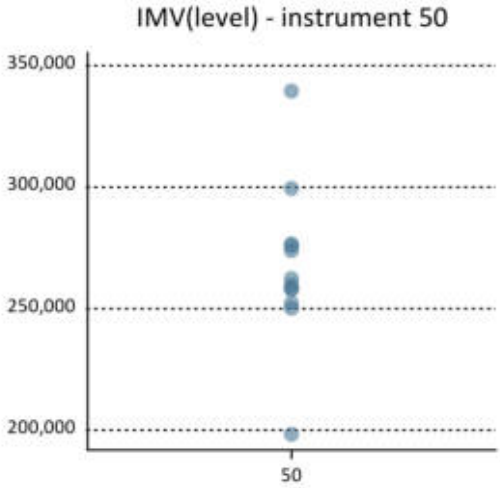

IMV(level) - instrument 45
-30,000
-40,000
-50,000
-60,000
45

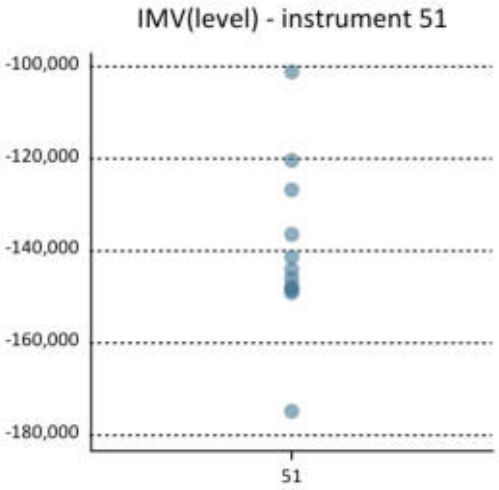

IMV(level) - instrument 46
1,100,000
1,050,000
1,000,000
950,000
46

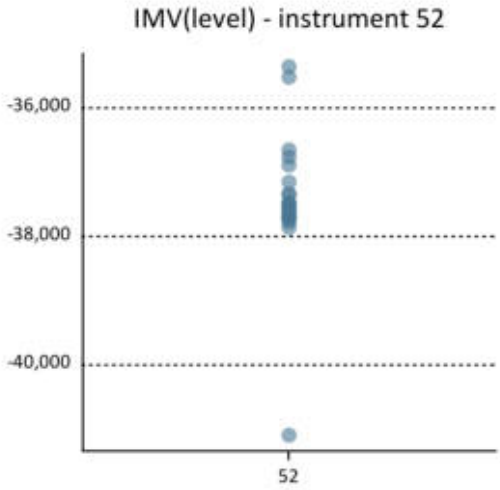

IMV(level) - instrument 47
-950,000
-1,000,000
-1,050,000
-1,100,000
-1,150,000
47

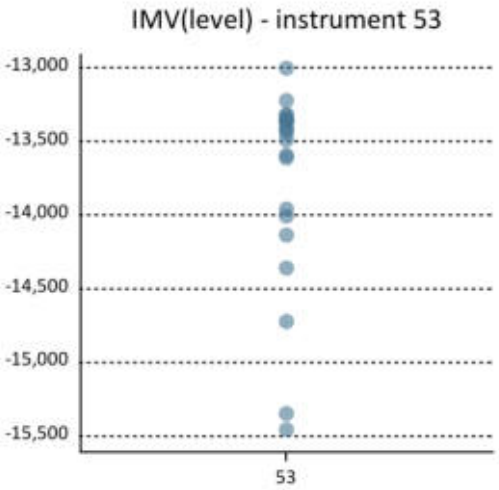

IMV(level) - instrument 48
20,000
0
-20,000
48

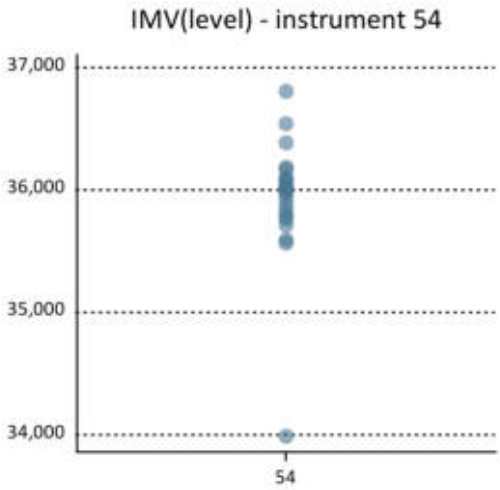

IMV(level) - instrument 49
20,000
0
-20,000
49

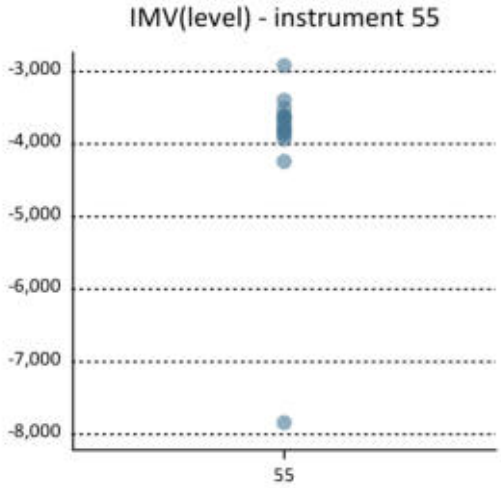

IMV(level) - instrument 50
350,000
300,000
250,000
200,000
50

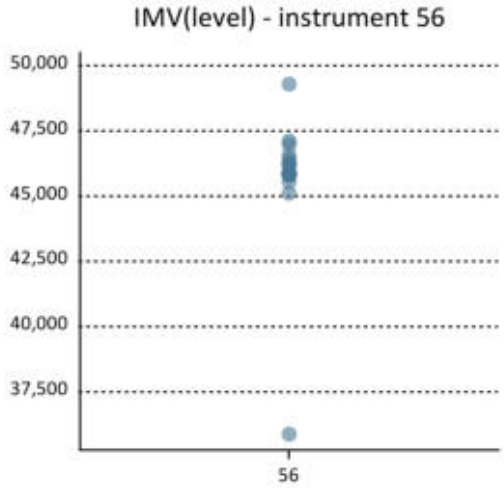

IMV(level) - instrument 51
-100,000
-120,000
-140,000
-160,000
-180,000
51

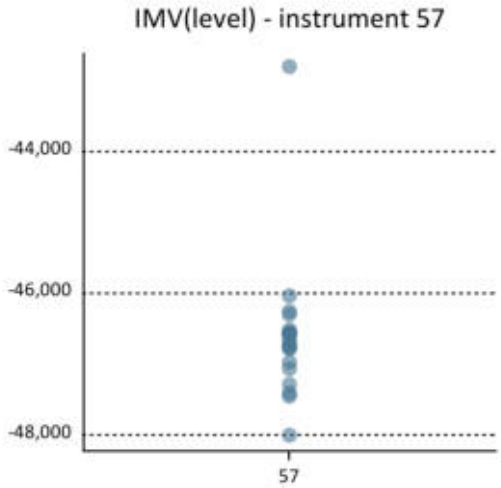

IMV(level) - instrument 52
-36,000
-38,000
-40,000
52

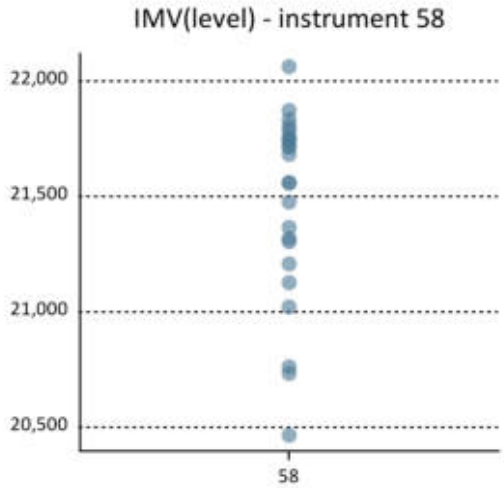

IMV(level) - instrument 53
-13,000
-13,500
-14,000
-14,500
-15,000
-15,500
53

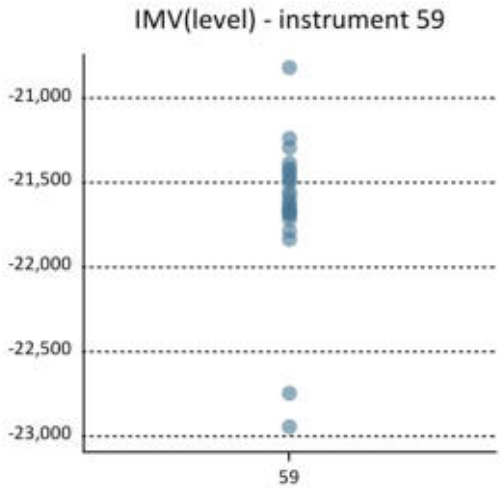

IMV(level) - instrument 54
37,000
36,000
35,000
34,000
54

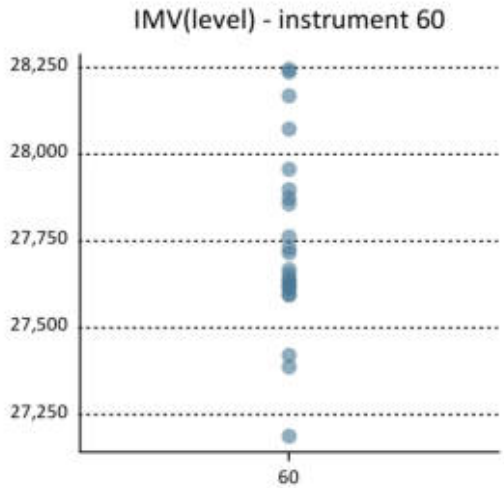

IMV(level) - instrument 55
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
55

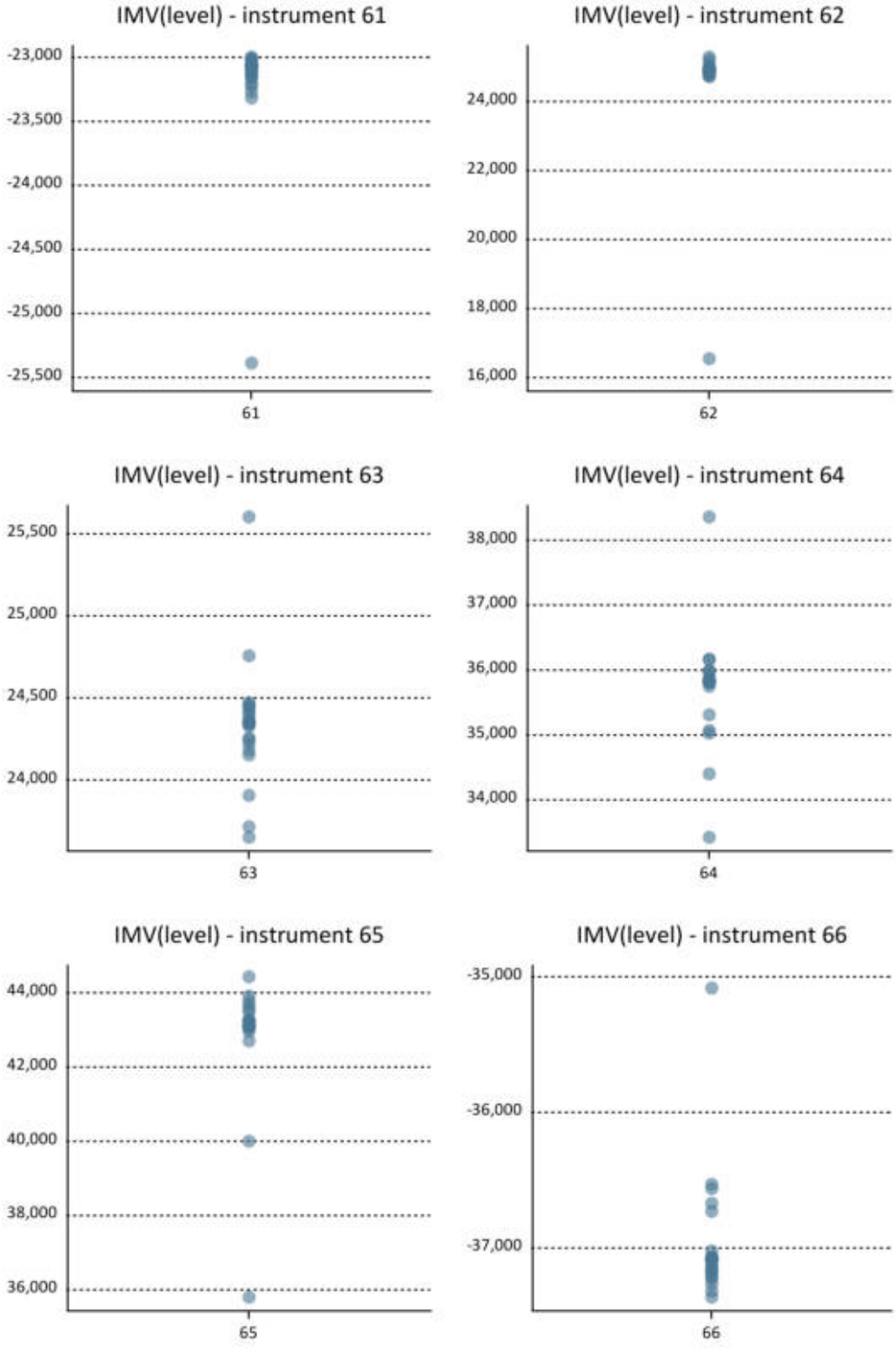

IMV(level) - instrument 56
50,000
47,500
45,000
42,500
40,000
37,500
56

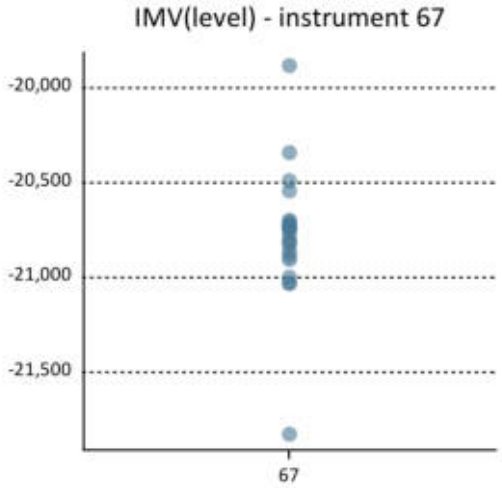

IMV(level) - instrument 57
-44,000
-46,000
-48,000
57

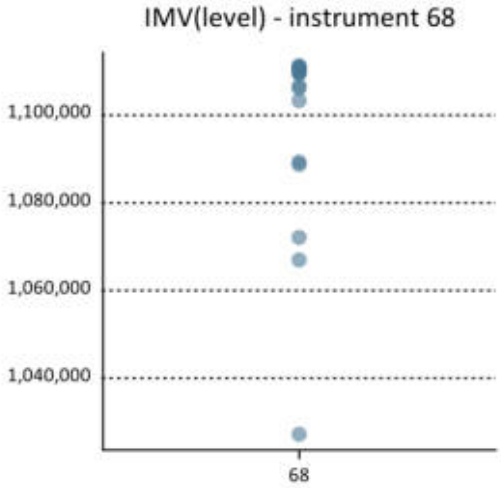

IMV(level) - instrument 58
22,000
21,500
21,000
20,500
58

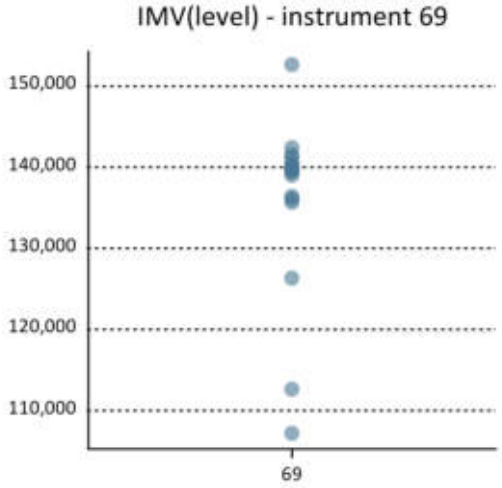

IMV(level) - instrument 59
-21,000
-21,500
-22,000
-22,500
-23,000
59

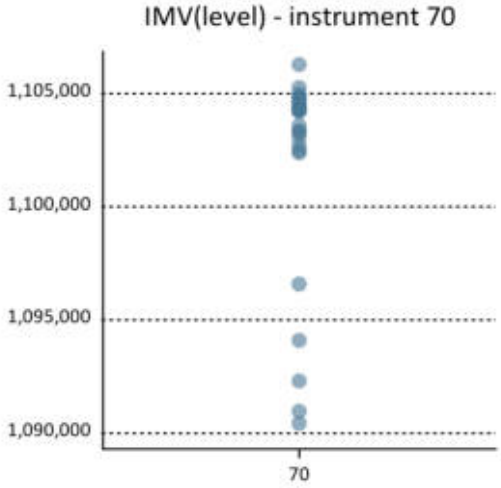

IMV(level) - instrument 60
28,250
28,000
27,750
27,500
27,250
60

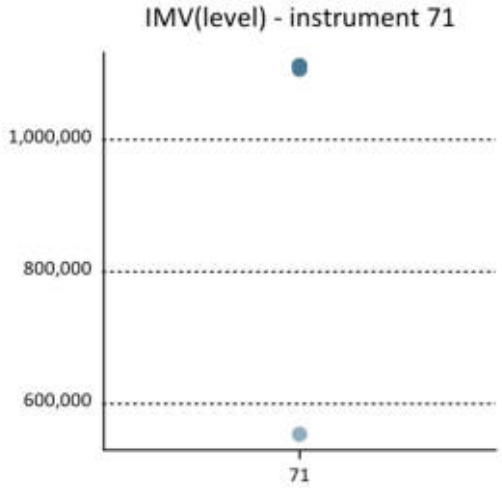

IMV(level) - instrument 61
-23,000
-23,500
-24,000
-24,500
-25,000
-25,500
61
IMV(level) - instrument 62
24,000
22,000
20,000
18,000
16,000
62
IMV(level) - instrument 63
25,500
25,000
24,500
24,000
63
IMV(level) - instrument 64
38,000
37,000
36,000
35,000
34,000
64
IMV(level) - instrument 65
44,000
42,000
40,000
38,000
36,000
65
IMV(level) - instrument 66
-35,000
-36,000
-37,000
66

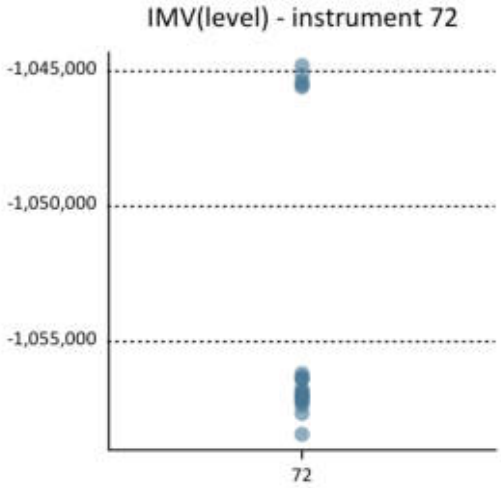

IMV(level) - instrument 67
-20,000
-20,500
-21,000
-21,500
67

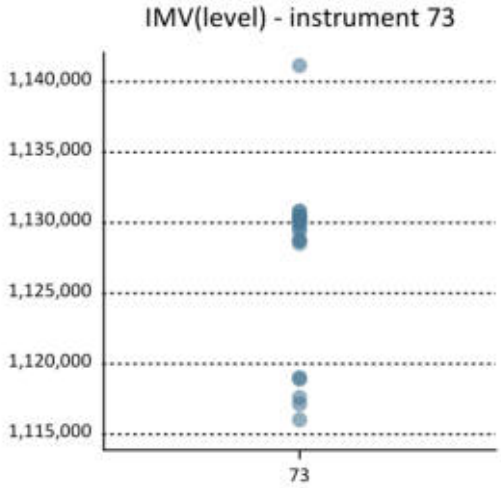

IMV(level) - instrument 68
1,100,000
1,080,000
1,060,000
1,040,000
68

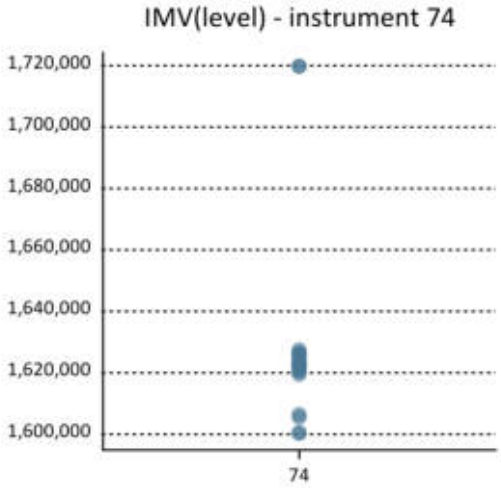

IMV(level) - instrument 69
150,000
140,000
130,000
120,000
110,000
69

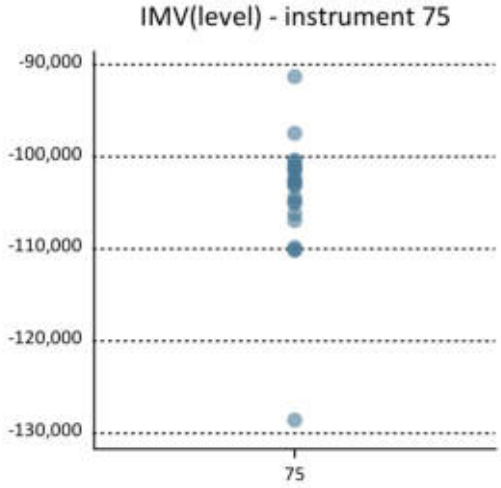

IMV(level) - instrument 70
1,105,000
1,100,000
1,095,000
1,090,000
70

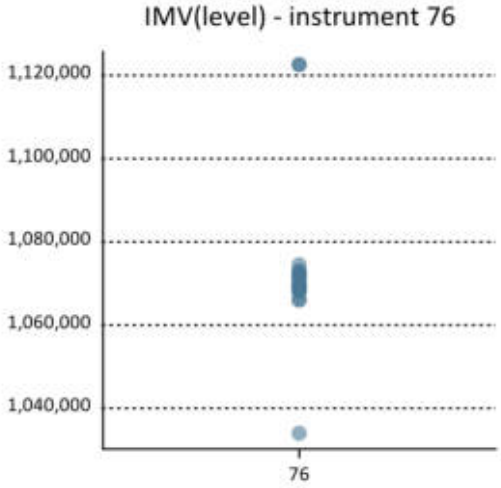

IMV(level) - instrument 71
1,000,000
800,000
600,000
71

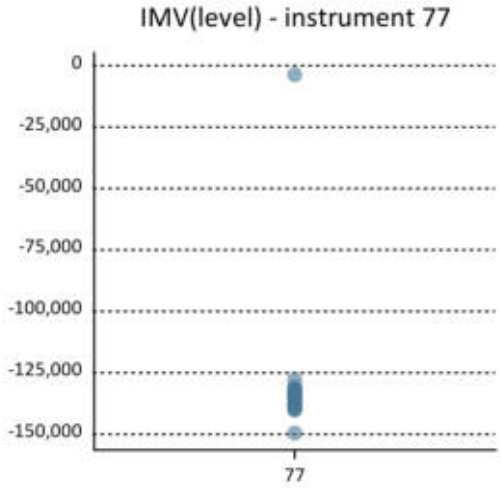

IMV(level) - instrument 72
-1,045,000
-1,050,000
-1,055,000
72

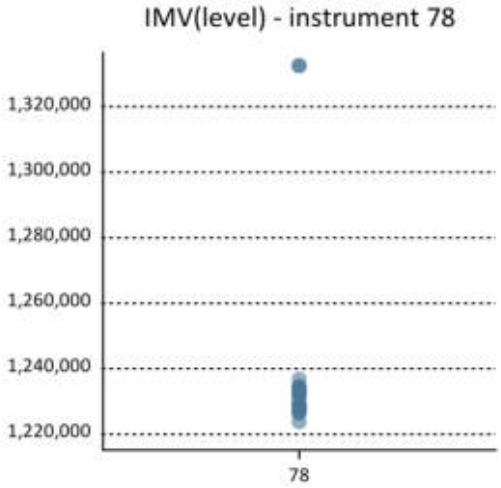

IMV(level) - instrument 73
1,140,000
1,135,000
1,130,000
1,125,000
1,120,000
1,115,000
73

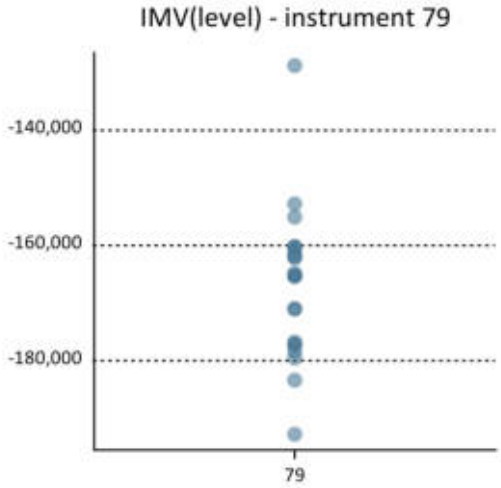

IMV(level) - instrument 74
1,720,000
1,700,000
1,680,000
1,660,000
1,640,000
1,620,000
1,600,000
74

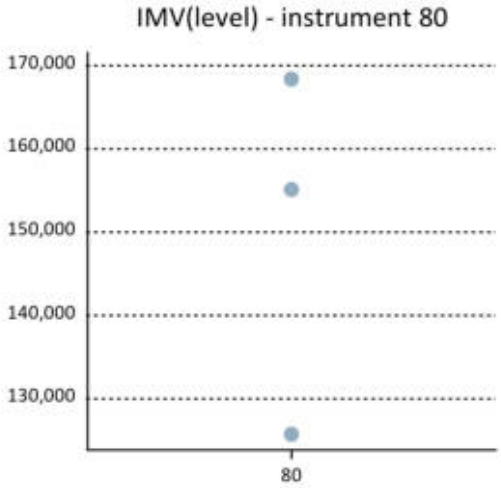

IMV(level) - instrument 75
-90,000
-100,000
-110,000
-120,000
-130,000
75


IMV(level) - instrument 76
1,120,000
1,100,000
1,080,000
1,060,000
1,040,000
76


IMV(level) - instrument 77
0
-25,000
-50,000
-75,000
-100,000
-125,000
-150,000
77


IMV(level) - instrument 78
1,320,000
1,300,000
1,280,000
1,260,000
1,240,000
1,220,000
78


IMV(level) - instrument 79
-140,000
-160,000
-180,000
79


IMV(level) - instrument 80
170,000
160,000
150,000
140,000
130,000
80

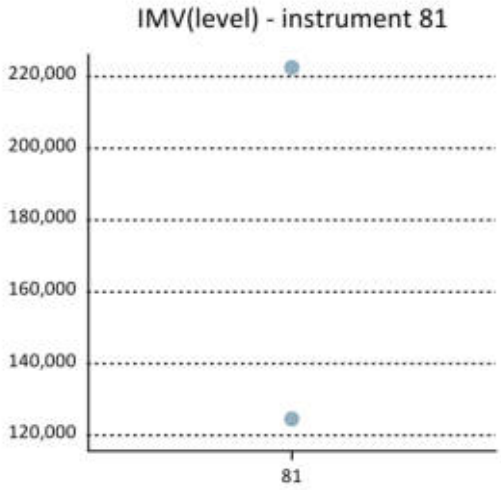
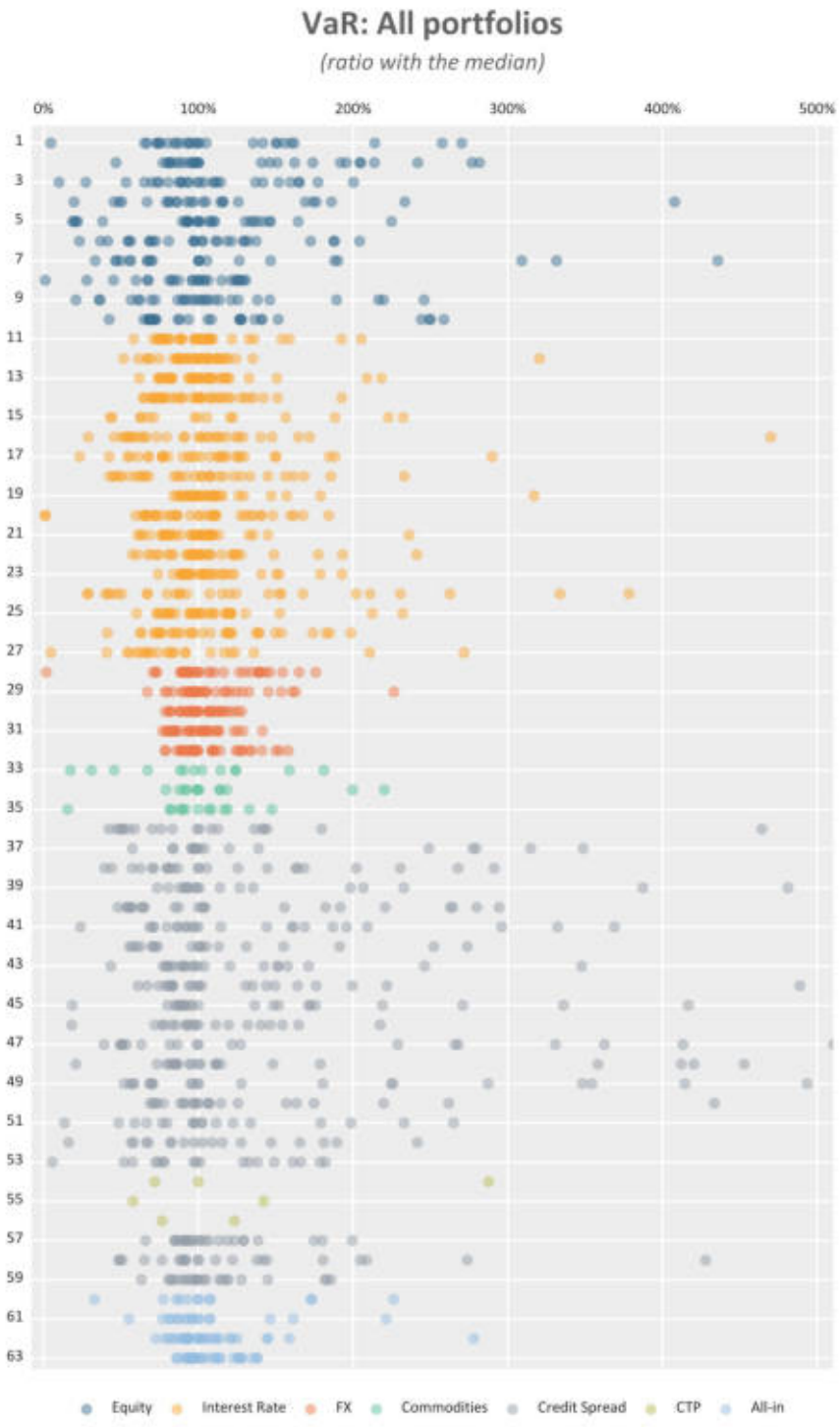
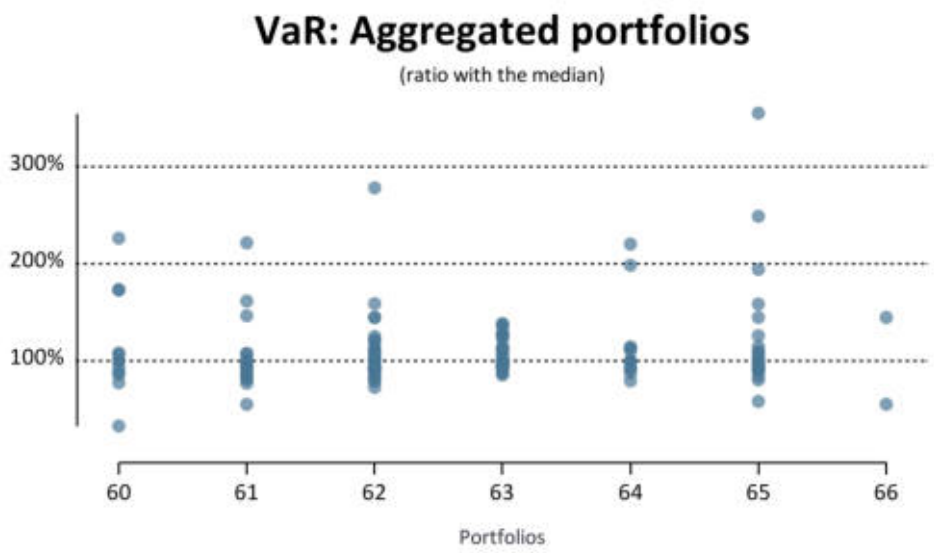
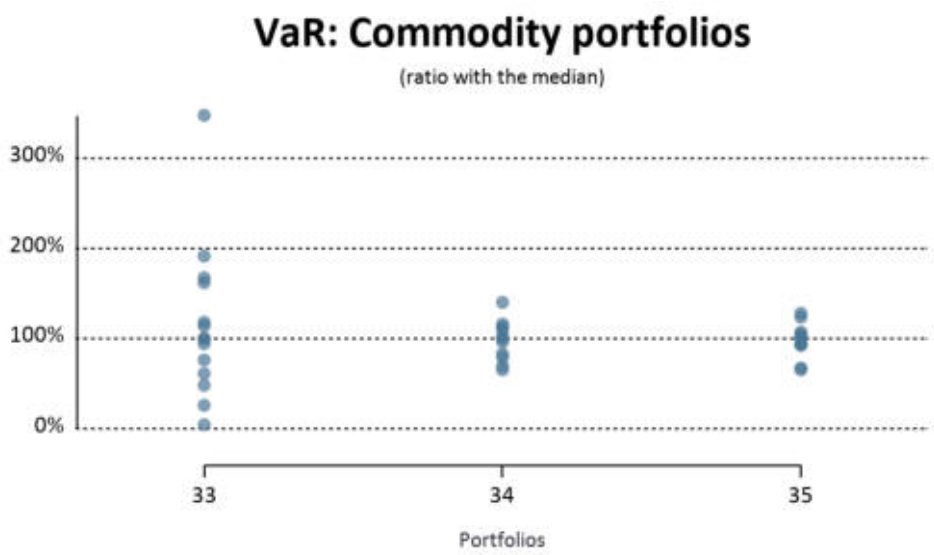
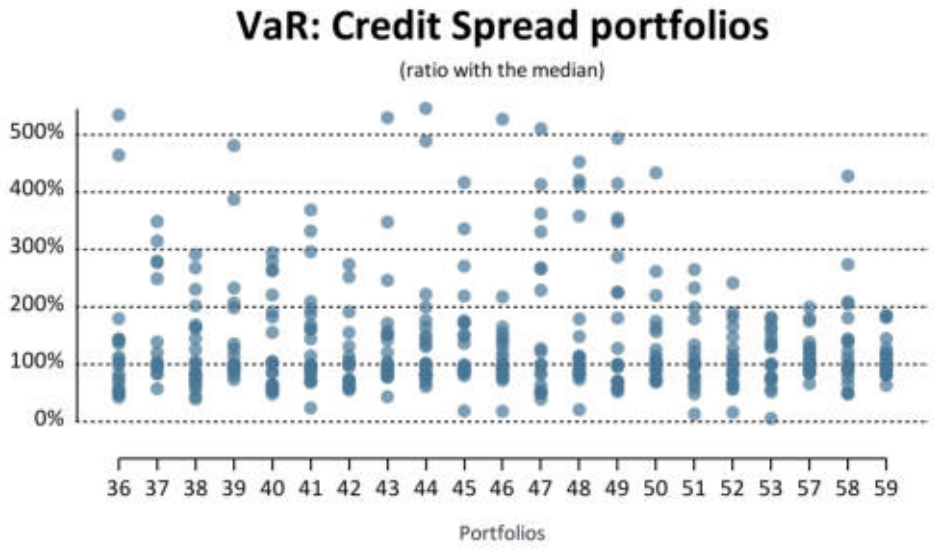

IMV(level) - instrument 81
220,000
200,000
180,000
160,000
140,000
120,000
81

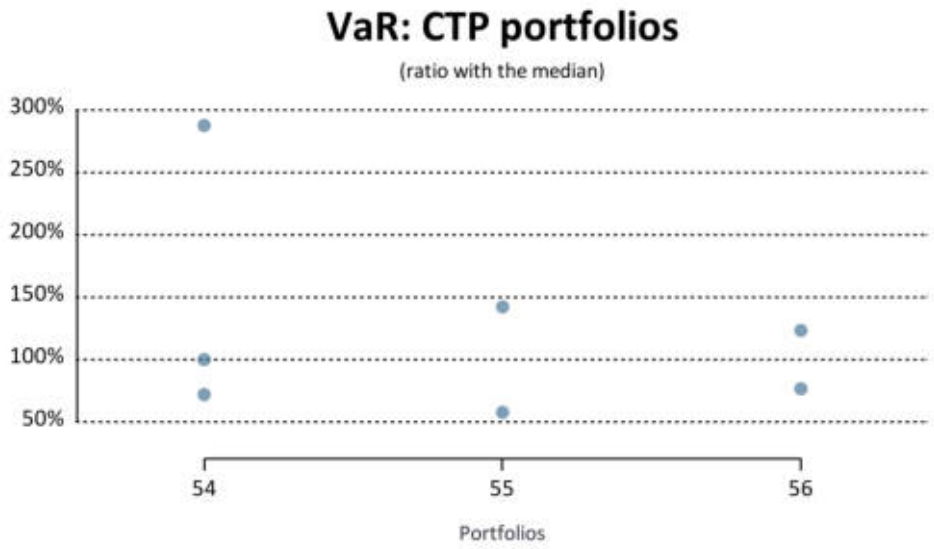
Figure 25: VaR submissions normalised by the median of each portfolio (by asset class)

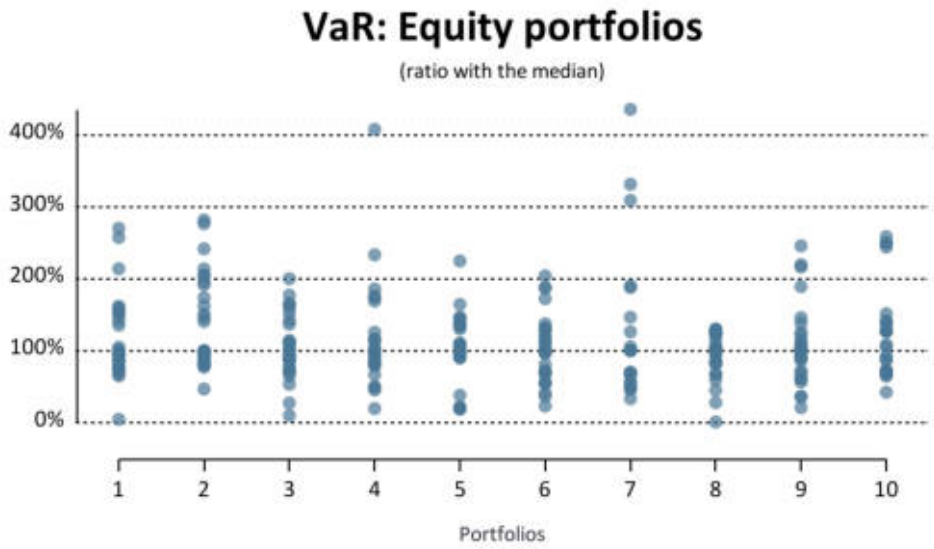


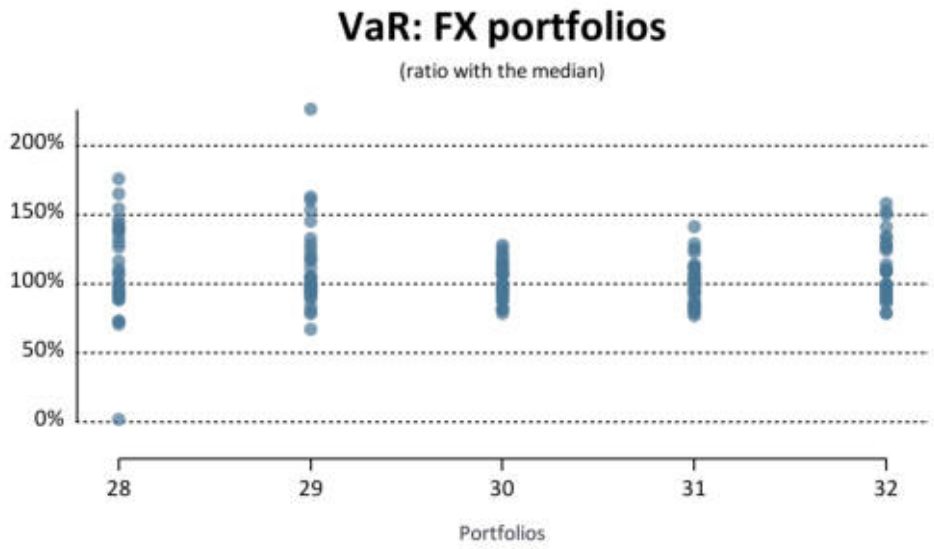

VaR: Aggregated portfolios
(ratio with the median)
300%
200%
100%
60
61
62
63
64
65
66
Portfolios


VaR: Commodity portfolios
(ratio with the median)
300%
200%
100%
0%
33
34
35
Portfolios


VaR: Credit Spread portfolios
(ratio with the median)
500%
400%
300%
200%
100%
0%
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 57 58 59
Portfolios


VaR: CTP portfolios
(ratio with the median)
300%
250%
200%
150%
100%
50%
54
55
56
Portfolios


VaR: Equity portfolios
(ratio with the median)
400%
300%
200%
100%
0%
1
2
3
4
5
6
7
8
9
10
Portfolios


VaR: FX portfolios
(ratio with the median)
200%
150%
100%
50%
0%
28
29
30
31
32
Portfolios

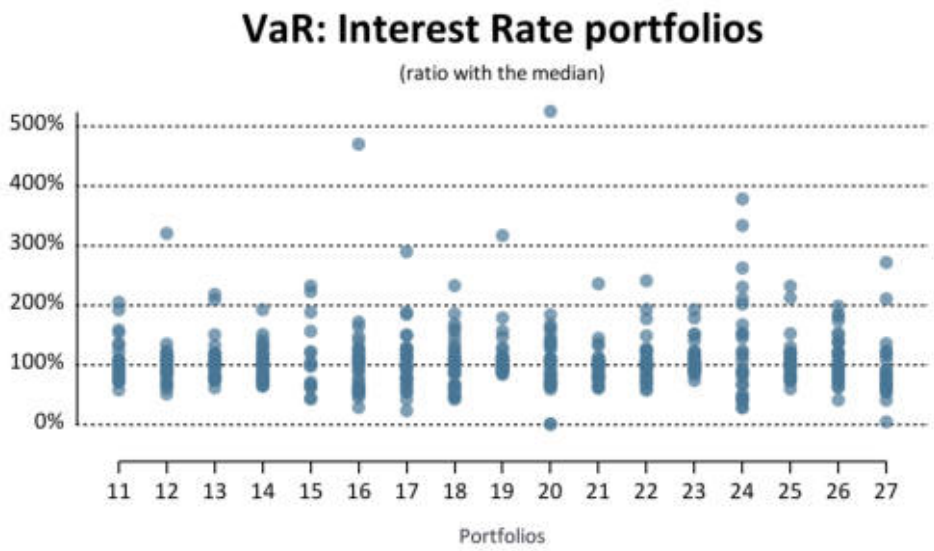
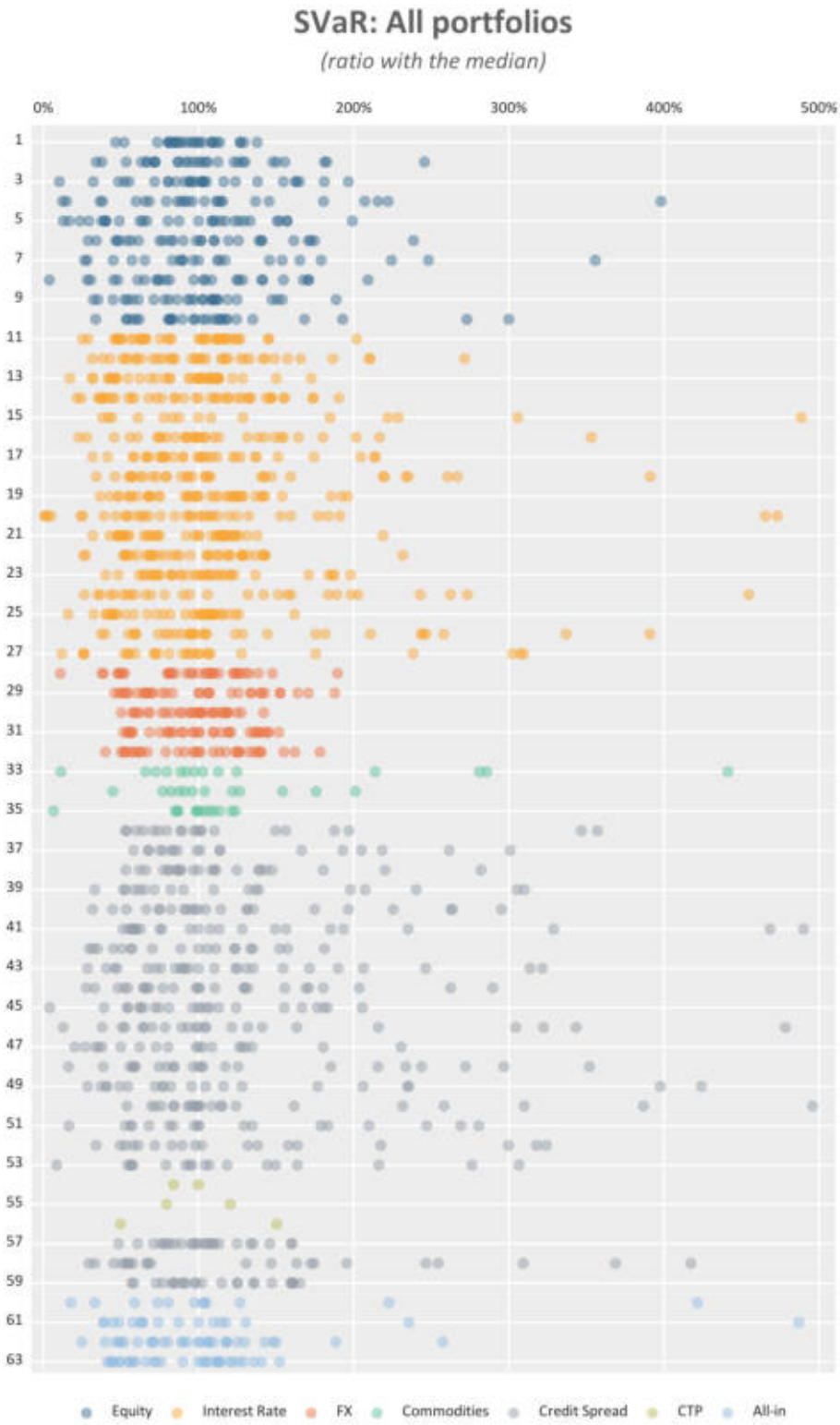
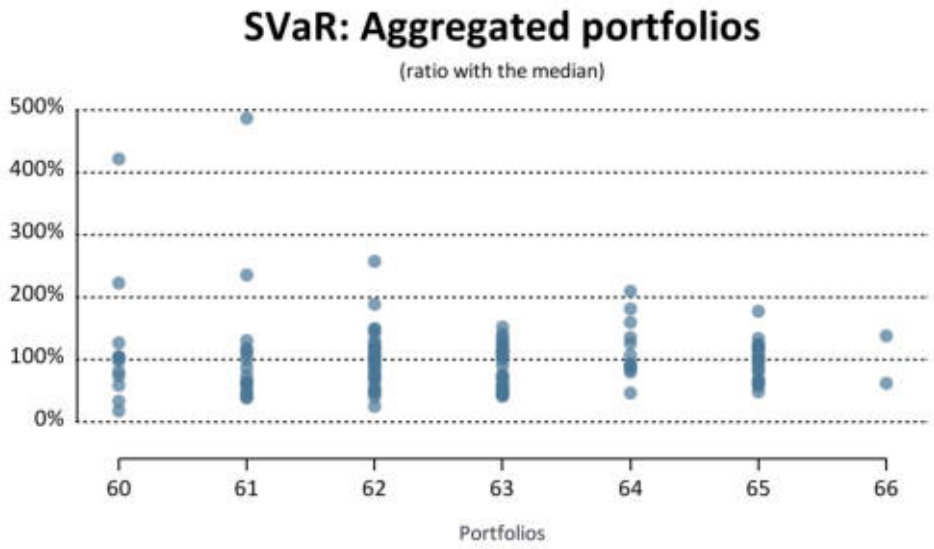
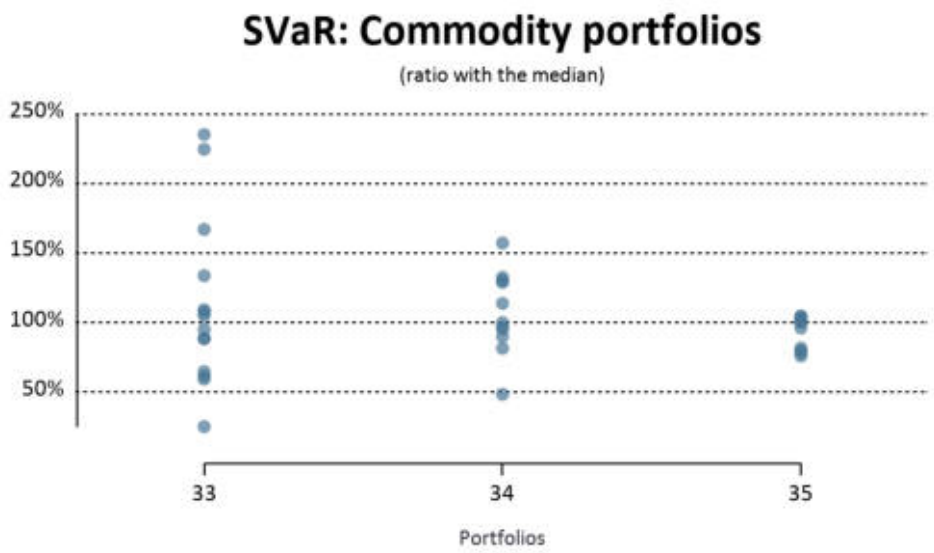
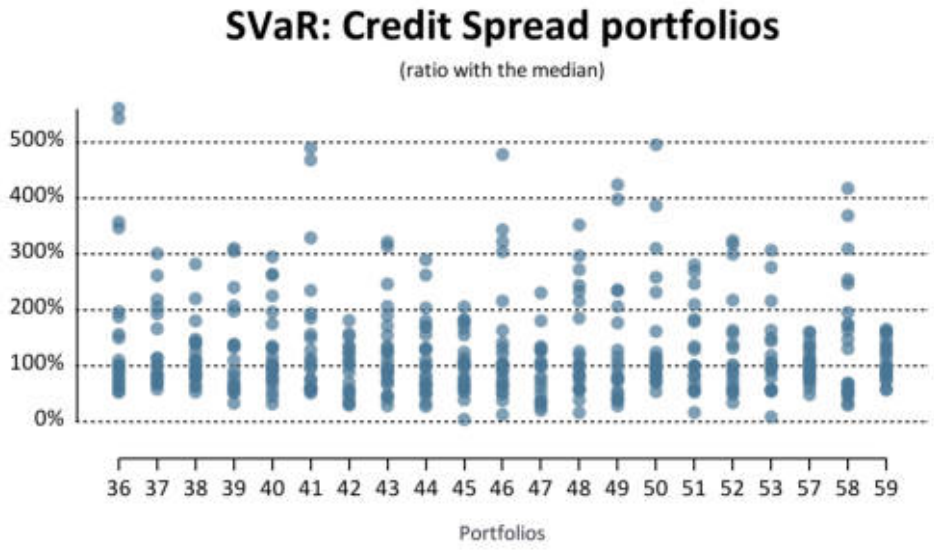

VaR: Interest Rate portfolios
(ratio with the median)
500%
400%
300%
200%
100%
0%
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
Portfolios

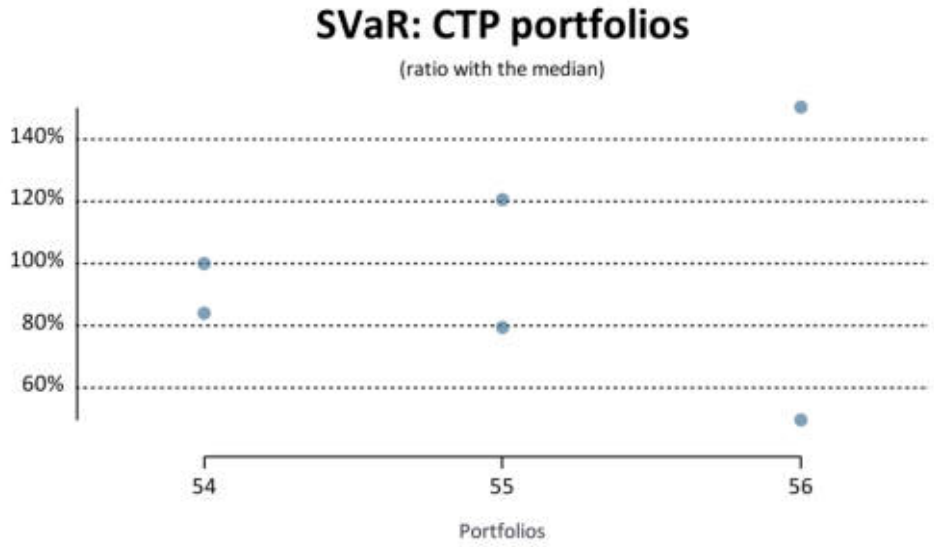
Figure 26: sVaR submissions normalised by the median of each portfolio (by asset class)

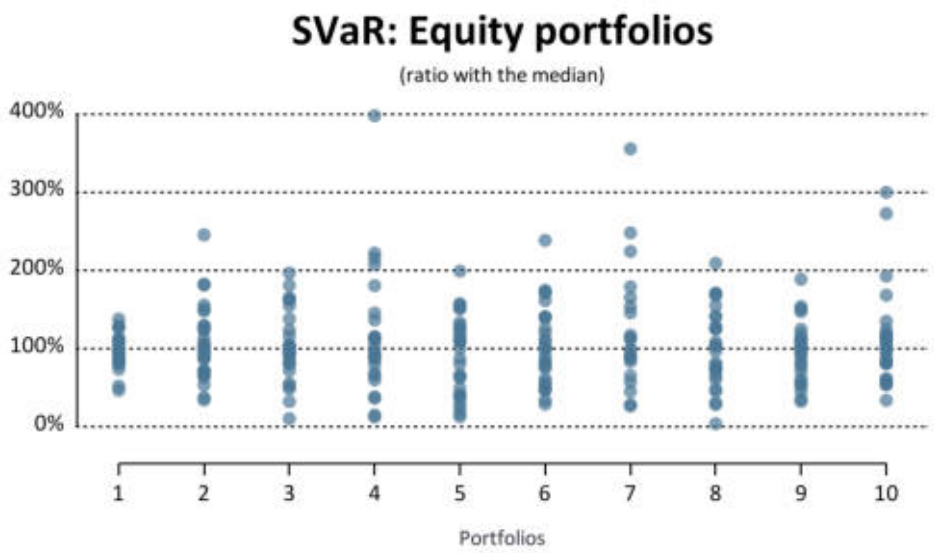


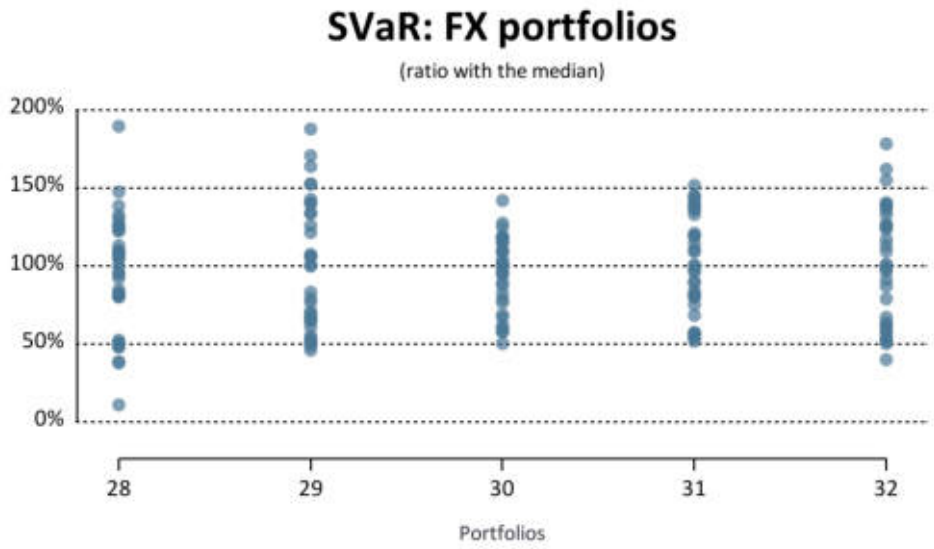

SVaR: Aggregated portfolios
(ratio with the median)
500%
400%
300%
200%
100%
0%
60
61
62
63
64
65
66
Portfolios


SVaR: Commodity portfolios
(ratio with the median)
250%
200%
150%
100%
50%
33
34
35
Portfolios


SVaR: Credit Spread portfolios
(ratio with the median)
500%
400%
300%
200%
100%
0%
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 57 58 59
Portfolios


SVaR: CTP portfolios
(ratio with the median)
140%
120%
100%
80%
60%
54
55
56
Portfolios


SVaR: Equity portfolios
(ratio with the median)
400%
300%
200%
100%
0%
1
2
3
4
5
6
7
8
9
10
Portfolios


SVaR: FX portfolios
(ratio with the median)
200%
150%
100%
50%
0%
28
29
30
31
32
Portfolios

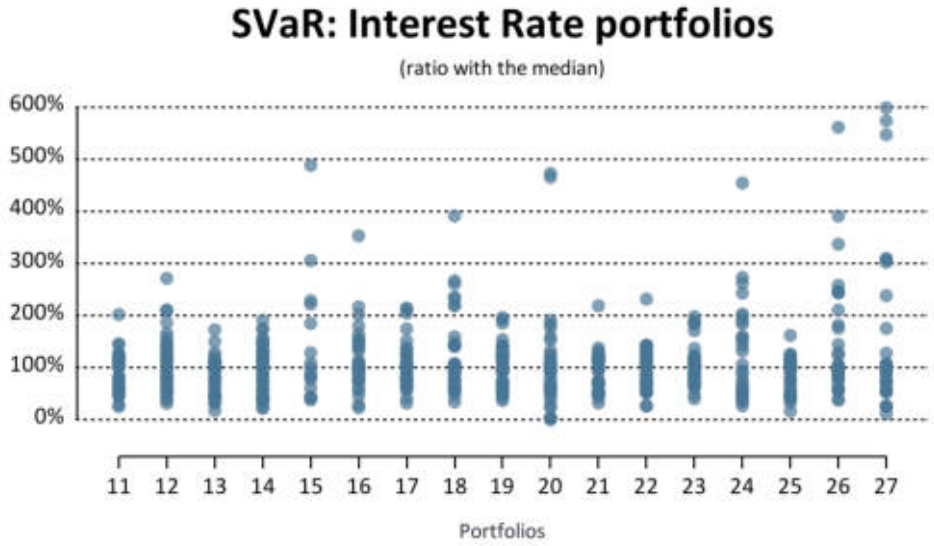

SVaR: Interest Rate portfolios
(ratio with the median)
600%
500%
400%
300%
200%
100%
0%
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
Portfolios

Figure 27: sVaR submissions normalised by the median of each portfolio (by methodological approach)

Table 27: VaR statistics (small banks only)

EU Statistics for VaR

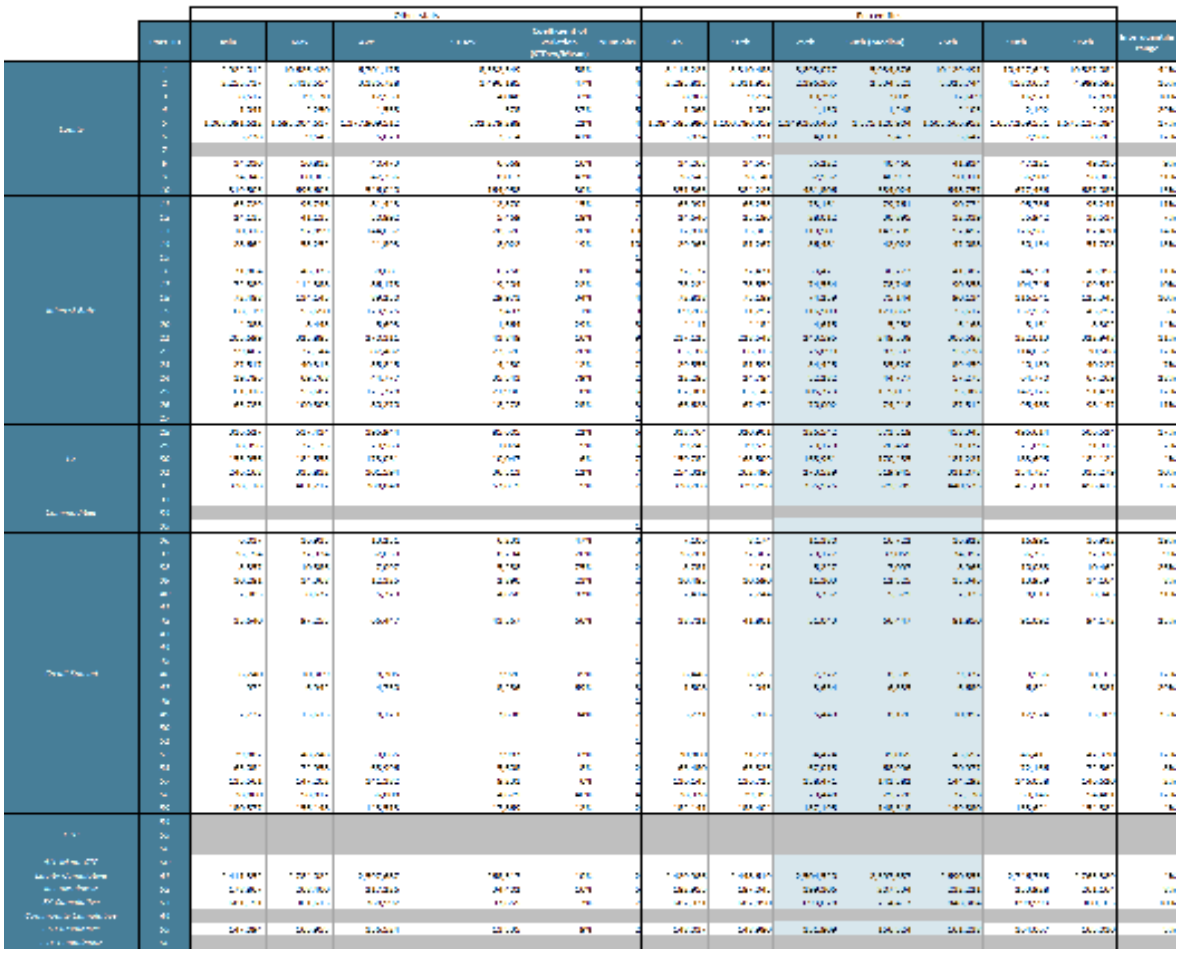


Figure 28: VaR ratio with median (focus on small banks)

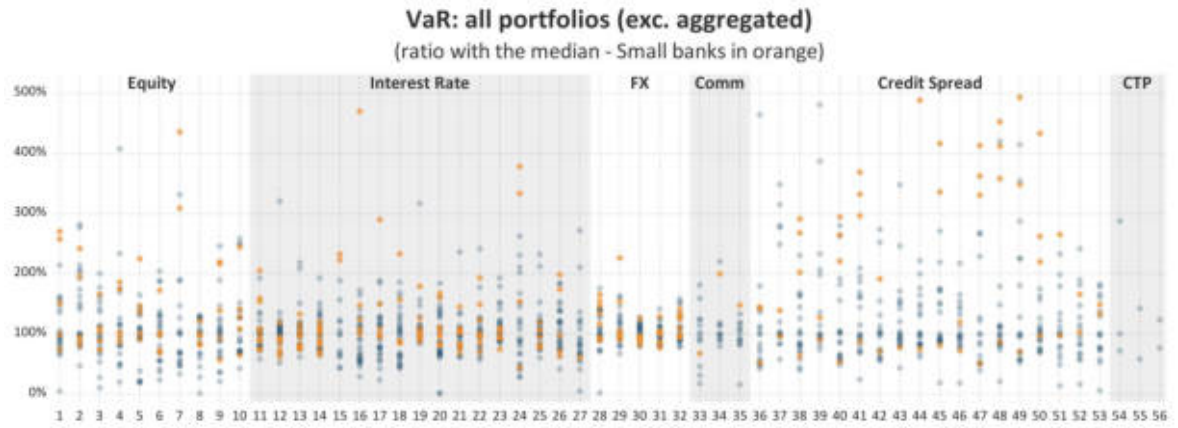


Table 28: VaR statistics (medium-sized banks only)

EU Statistics for VaR

		Other stats						Percentiles							
	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (STDev/Mean)	Num obs.	5th	10th	25th	50th (Median)	75th	90th	95th	Interquantile range
Equity	1	164,465	8,419,557	4,076,126	1,970,177	48%	13	1,653,005	2,604,562	2,936,205	3,663,940	5,461,321	6,152,850	6,384,765	30%
	2	1,205,510	5,938,479	3,566,162	1,448,422	41%	13	1,547,605	2,225,650	2,286,425	3,806,922	4,402,088	5,506,308	5,774,087	33%
	3	3,170	19,130	11,070	4,976	45%	11	4,575	6,162	6,574	10,563	15,772	18,401	18,801	24%
	4	289	2,045	1,104	528	48%	10	395	558	695	1,146	1,307	1,573	1,802	33%
	5	448,522,356	1,911,230,168	1,250,506,395	371,502,354	30%	12	772,297,725	1,045,127,314	1,085,202,021	1,200,200,319	1,522,966,507	1,654,568,026	1,764,342,465	17%
	6	1,263	7,600	4,240	2,139	50%	11	1,660	2,057	2,574	3,827	5,929	7,140	7,570	39%
	7	10,679	46,865	26,701	13,163	49%	8	12,146	13,622	14,087	26,769	34,257	42,571	44,626	39%
	8	28,115	58,466	41,484	10,065	24%	9	26,225	28,362	34,765	48,474	52,065	52,736	56,301	20%
	9	9,265	64,402	37,340	17,065	46%	12	12,634	15,819	27,001	41,408	47,317	54,851	59,456	27%
	10	200,500	748,369	504,657	174,375	35%	13	285,170	365,778	387,701	524,726	627,602	681,169	716,626	30%
Interest Rate	11	51,959	118,547	81,099	15,956	20%	20	62,525	65,012	69,074	80,112	92,710	95,200	97,165	15%
	12	23,100	41,300	33,646	5,354	16%	17	27,334	26,734	29,926	34,689	36,715	39,370	40,335	10%
	13	111,115	172,297	142,175	19,997	14%	18	111,193	114,016	122,796	147,593	157,972	163,941	169,318	13%
	14	28,545	60,050	41,255	9,675	23%	20	30,025	31,022	33,435	40,360	45,518	56,450	58,801	15%
	15	16,342	48,699	29,974	12,808	43%	8	16,026	16,910	19,418	28,427	38,258	44,586	46,543	33%
	16	14,505	37,540	23,339	8,130	34%	16	15,258	16,450	17,559	20,237	29,853	36,027	36,748	26%
	17	32,427	96,311	61,500	19,057	31%	15	38,520	42,040	49,118	59,111	81,851	88,450	91,177	25%
	18	36,527	144,620	73,487	36,032	49%	17	38,321	39,360	47,121	54,620	97,128	138,156	140,001	35%
	19	106,026	157,602	123,325	12,957	11%	19	107,091	108,451	114,071	119,348	129,943	136,050	142,595	6%
	20	3,000	8,100	5,096	1,748	34%	18	3,179	3,250	3,345	4,728	6,636	7,152	7,362	33%
	21	226,711	326,308	275,156	35,225	13%	17	231,157	232,536	238,998	285,711	300,125	320,636	322,305	12%
	22	49,121	108,971	80,055	18,311	23%	18	51,484	55,092	64,786	80,619	91,446	104,447	107,023	17%
	23	31,038	52,275	37,520	5,650	15%	18	32,542	32,951	33,563	36,191	40,694	45,218	48,072	9%
	24	12,900	95,800	43,085	27,755	64%	15	13,065	15,173	20,121	36,235	59,008	85,547	91,004	49%
	25	78,873	178,741	124,855	24,045	19%	18	91,422	96,100	108,775	126,894	139,659	155,875	163,518	13%
	26	42,881	155,658	100,319	33,072	33%	16	59,175	69,927	77,381	88,541	129,654	144,557	147,411	25%
	27	1,346	237,840	48,070	64,685	135%	18	10,107	14,207	19,365	25,013	35,021	114,698	207,170	29%
FX	28	250,429	508,305	377,297	81,825	22%	15	255,023	256,328	326,297	364,372	450,505	494,256	500,205	16%
	29	16,457	30,407	21,641	3,851	18%	14	16,683	17,654	18,702	20,869	23,058	26,726	28,395	6%
	30	150,875	264,757	195,064	25,621	13%	15	155,320	157,251	180,240	206,102	212,370	220,258	224,680	8%
	31	255,410	364,045	310,556	40,505	13%	15	260,545	264,115	260,276	308,001	346,405	359,757	361,440	13%
	32	273,565	465,526	347,592	54,156	16%	14	282,480	300,001	305,295	337,760	378,078	436,824	445,060	10%
Commodities	33	1,415	15,092	8,370	5,050	61%	7	1,786	2,126	4,970	8,510	11,791	13,950	14,530	41%
	34	361,354	519,577	429,910	65,742	15%	4	369,509	378,214	403,309	419,346	445,742	490,013	501,510	5%
	35	399,770	649,454	491,945	101,813	21%	5	400,292	400,814	409,380	427,256	537,952	609,759	629,626	13%
Credit Spread	36	5,945	16,547	11,255	4,300	38%	7	6,085	6,225	7,664	11,654	14,500	16,204	16,375	31%
	37	15,679	76,510	32,557	21,830	67%	6	17,446	19,217	23,581	26,430	27,408	51,955	64,142	8%
	38	3,071	8,757	5,760	1,821	32%	8	3,487	3,903	4,452	5,522	6,957	8,048	8,395	22%
	39	8,325	26,356	14,807	7,016	47%	7	9,010	9,715	10,037	11,422	18,171	24,606	25,406	29%
	40	2,106	7,166	4,182	1,657	40%	8	2,312	2,428	3,203	3,957	4,604	6,427	6,701	18%
	41	6,000	15,844	9,767	3,628	37%	9	6,015	6,025	7,517	8,518	13,604	14,111	14,978	27%
	42	28,210	66,506	51,075	12,701	25%	5	35,662	39,515	50,041	51,652	56,155	62,070	64,355	5%
	43	13,159	74,400	38,147	17,104	45%	11	16,582	24,004	26,510	29,255	46,710	51,758	65,150	28%
	44	4,714	17,120	8,555	3,916	46%	11	4,046	5,178	6,156	6,458	11,554	12,670	14,805	30%
	45	2,456	29,074	16,074	8,008	50%	9	6,071	9,676	11,725	12,765	22,757	24,116	26,695	32%
	46	1,579	18,879	8,791	4,822	55%	9	2,550	5,721	7,310	8,001	9,669	12,980	16,001	14%
	47	972	5,002	2,115	1,401	66%	7	980	1,006	1,207	1,902	2,128	3,465	4,264	28%
	48	1,870	16,065	8,187	3,629	45%	9	3,755	5,641	7,161	7,775	8,508	11,169	13,602	9%
	49	2,066	18,857	6,654	4,400	66%	8	2,110	2,168	3,388	4,462	9,400	12,020	12,090	47%
	50	10,440	26,515	16,379	5,761	35%	9	10,714	10,987	11,745	13,863	19,078	24,369	25,494	24%
	51	3,248	47,609	24,384	15,840	65%	7	6,515	9,757	16,182	19,170	38,880	44,809	46,205	39%
	52	4,719	55,161	27,782	16,806	61%	7	6,385	12,051	16,317	26,414	35,568	47,770	51,480	37%
	53	2,776	80,161	51,306	33,978	66%	7	9,580	16,564	30,580	57,742	68,147	68,124	86,626	46%
	57	106,669	207,508	165,265	32,313	19%	10	122,306	148,726	150,486	168,778	193,640	206,905	207,252	13%
	58	16,013	57,963	35,165	18,106	51%	7	16,175	16,338	23,165	32,600	41,611	55,307	61,650	29%
	59	99,657	168,056	156,461	29,872	19%	9	111,620	123,620	144,254	153,274	161,751	166,710	187,582	12%
CTP	54														
	55														
	56														
All VaR ex-CTP	60	853,100	4,456,545	2,562,275	1,203,315	48%	5	1,165,172	1,477,155	2,415,006	2,764,618	2,708,925	3,800,406	4,146,010	7%
Equity Cumulative	61	1,557,148	4,425,610	2,727,555	902,852	33%	7	1,756,067	1,958,900	2,597,565	2,601,420	2,805,900	3,504,667	4,045,140	5%
IR Cumulative	62	150,456	276,055	214,420	34,150	16%	14	160,126	176,758	195,067	206,411	240,540	251,417	260,546	10%
FX Cumulative	63	602,702	857,766	724,754	99,928	14%	15	605,532	617,148	661,256	675,855	776,472	879,002	885,177	8%
Commodity Cumulative	64	352,541	510,948	481,405	55,506	15%	4	371,115	379,865	405,202	421,851	447,146	490,827	505,588	5%
CS Cumulative	65	101,810	220,007	171,114	37,948	22%	7	115,584	135,557	150,590	174,524	194,669	208,146	214,077	10%
CTP Cumulative	66														

Figure 29: VaR ratio with median (focus on medium-sized banks)

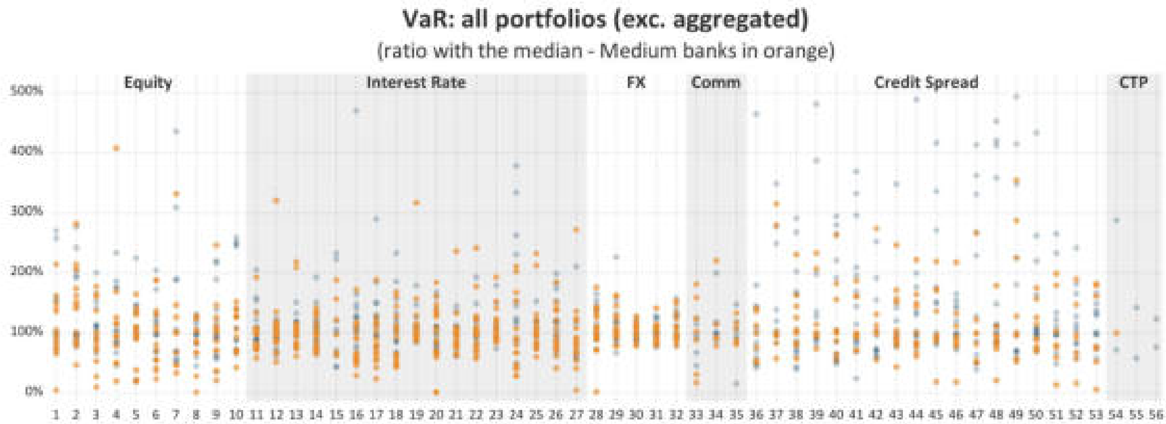


Table 29: VaR statistics (large banks only)

EU Statistics for VaR

	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (ST Dev/Mean)	Num obs	5th	10th	25th	50th (Median)	75th	90th	95th	Interquantile range
		Other stats						Percentiles							
Equity	1	2,635,651	6,250,314	4,174,446	1,312,014	32%	8	2,876,835	3,320,005	3,457,140	3,795,515	4,420,424	5,170,291	6,230,902	13%
	2	2,158,047	5,656,852	3,220,255	1,297,482	40%	9	2,235,544	2,255,041	2,650,755	2,705,005	2,757,556	5,380,151	5,518,402	2%
	3	7,558	17,636	12,572	3,081	25%	9	8,501	9,524	10,808	12,641	15,265	16,570	17,143	10%
	4	551	2,825	1,361	715	54%	9	654	757	979	1,056	1,403	2,262	2,546	18%
	5	1,078,654,502	1,408,522,817	1,279,564,901	246,722,560	19%	8	1,078,120,700	1,082,624,697	1,057,150,856	1,205,545,702	1,355,011,845	1,551,016,141	1,657,720,470	11%
	6	3,017	7,306	5,726	1,494	26%	9	3,528	3,580	5,546	6,211	6,722	7,202	7,258	11%
	7	16,008	60,708	30,458	16,627	55%	10	16,751	17,515	18,041	22,546	35,900	60,157	60,478	27%
	8	25,052	54,731	44,854	9,247	21%	9	31,102	37,141	41,948	44,602	52,570	54,240	54,465	11%
	9	26,807	65,467	45,241	15,565	35%	10	27,157	27,417	39,607	42,056	48,311	56,464	60,051	10%
	10	335,408	454,551	371,771	41,697	11%	7	337,456	330,560	345,472	354,520	395,569	451,225	452,867	7%
Interest Rate	11	54,700	121,534	92,327	15,306	16%	10	73,417	77,175	81,556	92,308	97,151	110,039	115,757	9%
	12	31,956	43,057	36,893	3,461	9%	10	32,310	32,535	34,628	37,063	38,956	40,404	41,740	6%
	13	122,281	178,879	155,535	19,082	12%	9	128,830	135,479	146,457	151,523	172,906	177,111	178,045	9%
	14	30,941	57,535	45,954	8,345	18%	8	33,938	38,504	43,095	48,138	51,090	54,325	55,880	8%
	15	11,124	31,195	20,208	7,873	39%	7	11,236	11,129	13,759	18,433	26,584	28,851	30,023	32%
	16	19,056	52,397	34,750	10,391	30%	10	20,927	22,705	27,070	34,792	40,790	45,427	48,912	20%
	17	58,573	114,815	85,810	19,140	22%	9	58,605	58,535	71,801	90,211	97,096	102,145	108,611	15%
	18	56,095	114,510	87,913	19,567	22%	9	57,347	57,995	84,309	91,592	99,857	107,151	110,912	8%
	19	102,552	139,093	126,326	11,055	9%	9	108,596	114,524	118,153	129,557	134,817	135,979	138,016	7%
	20	3,333	7,090	4,591	1,347	27%	10	3,434	3,544	3,632	4,073	5,529	5,764	6,437	21%
	21	300,853	339,957	317,233	14,085	5%	8	300,852	300,102	300,549	315,410	327,136	332,949	336,453	4%
	22	78,024	105,725	87,425	8,171	9%	10	79,877	80,931	83,207	85,403	86,894	95,751	102,210	2%
	23	32,996	43,637	36,708	4,305	11%	8	33,192	33,189	33,832	34,875	39,254	42,532	43,247	7%
	24	22,945	104,801	54,542	24,259	44%	8	28,533	34,162	39,754	53,502	58,851	77,724	91,263	19%
	25	99,733	199,920	145,618	27,072	19%	10	118,152	120,541	129,636	150,105	157,846	162,769	181,344	10%
	26	77,915	159,597	114,409	23,929	21%	9	83,540	89,165	97,737	121,925	124,445	131,130	146,319	12%
	27	15,809	128,815	46,847	57,551	121%	8	16,450	17,151	18,837	21,528	39,896	95,511	117,213	36%
FX	28	258,425	425,564	352,964	76,573	22%	9	260,202	301,072	330,054	344,212	365,029	401,175	402,960	4%
	29	14,003	27,875	21,477	4,425	21%	9	15,451	15,560	18,832	20,702	24,752	25,527	26,851	14%
	30	176,520	220,108	201,329	15,564	9%	9	180,177	185,534	190,121	192,175	218,009	225,024	227,516	7%
	31	253,979	401,401	320,050	50,571	16%	9	257,301	260,502	229,655	312,751	328,871	394,050	398,221	5%
	32	272,454	444,951	351,755	52,235	15%	8	289,830	307,227	322,752	339,820	361,451	410,155	427,560	8%
Commodities	33	3,806	10,341	7,875	2,527	32%	5	4,539	5,111	7,539	8,127	9,530	10,015	10,179	11%
	34	400,862	510,930	471,016	51,181	11%	6	413,318	425,531	451,629	450,492	505,061	530,717	515,824	6%
	35	416,805	551,402	496,726	59,795	12%	5	418,998	441,190	447,738	485,171	529,530	560,251	571,020	8%
Credit Spread	36	4,951	21,063	9,659	5,055	53%	9	5,161	5,412	5,808	6,254	11,704	14,574	17,419	34%
	37	22,915	75,661	38,519	20,687	54%	8	24,157	25,455	26,815	27,890	41,558	70,288	72,065	22%
	38	2,121	9,024	4,852	2,352	48%	10	2,226	2,332	3,779	4,522	5,161	6,620	8,022	16%
	39	9,159	22,473	12,719	4,742	37%	7	9,565	9,582	10,177	10,601	15,265	16,196	20,364	19%
	40	1,859	7,529	3,167	1,772	56%	9	1,905	2,101	2,152	2,490	3,364	4,765	6,140	21%
	41	2,025	17,726	10,019	5,061	51%	10	3,725	5,422	6,804	8,790	15,774	16,702	17,214	39%
	42	29,218	78,850	42,514	15,664	37%	9	29,717	30,215	31,865	35,707	48,664	56,516	68,674	21%
	43	24,157	105,172	39,400	24,270	62%	10	24,414	24,572	27,151	29,005	41,305	51,611	78,401	21%
	44	6,417	15,308	9,259	3,080	33%	10	6,422	6,425	7,200	7,795	10,344	13,777	14,568	17%
	45	11,254	35,960	17,148	7,854	46%	10	11,309	11,564	11,976	12,720	20,048	24,590	30,250	25%
	46	6,675	14,300	10,316	2,801	27%	9	7,101	7,707	8,429	8,675	12,702	13,574	13,967	20%
	47	760	5,135	2,157	1,685	77%	8	818	885	955	1,485	2,926	4,610	4,878	50%
	48	7,400	18,208	9,879	1,885	20%	9	7,519	7,546	7,665	9,110	10,025	10,880	12,080	13%
	49	2,106	8,827	4,020	2,340	58%	9	2,264	2,272	2,667	2,761	5,918	7,415	8,120	10%
	50	10,468	24,805	15,364	3,860	25%	10	10,860	10,957	14,012	15,066	16,171	17,125	20,066	7%
	51	11,642	32,156	28,306	5,785	20%	8	18,168	14,594	21,404	24,005	27,465	30,314	31,175	12%
	52	16,520	52,765	30,865	11,675	38%	8	17,409	18,475	22,774	27,868	34,514	41,548	47,305	20%
	53	28,158	81,344	51,022	16,050	35%	9	31,060	35,020	38,165	46,560	65,201	70,407	75,876	25%
	57	136,377	222,270	162,648	26,675	17%	10	136,986	137,405	146,300	154,470	170,328	191,515	208,042	8%
	58	15,858	66,675	35,626	15,605	44%	9	17,902	20,147	24,945	32,510	44,916	50,195	58,454	29%
	59	127,119	228,454	161,202	31,142	19%	10	130,665	134,245	142,701	155,252	165,924	204,103	216,250	7%
CTP	54														
	55														
	56														
All-W non-CTP	60	2,004,400	4,471,615	2,714,543	1,004,045	37%	5	2,048,051	2,091,714	2,222,671	2,275,562	2,508,369	3,721,515	4,006,054	8%
Equity Cumulative	61	2,141,617	6,157,625	3,105,155	1,342,505	42%	8	2,101,620	2,241,540	2,356,276	2,756,590	3,255,547	4,704,710	5,456,172	16%
IR Cumulative	62	189,516	248,143	220,911	17,062	8%	8	195,125	200,730	215,569	225,140	229,221	230,155	241,148	3%
FX Cumulative	63	659,815	801,652	620,679	50,251	8%	8	641,714	645,515	664,016	686,070	710,700	785,550	705,756	3%
Commodity Cumulative	64	300,968	521,219	464,940	42,020	9%	6	412,850	425,712	452,156	456,575	492,510	512,480	516,825	4%
CS Cumulative	65	140,550	276,730	186,920	45,765	25%	10	148,326	156,102	160,106	171,570	180,408	255,267	256,020	8%
CTP Cumulative	66														

Figure 30: VaR ratio with median (focus on large banks)

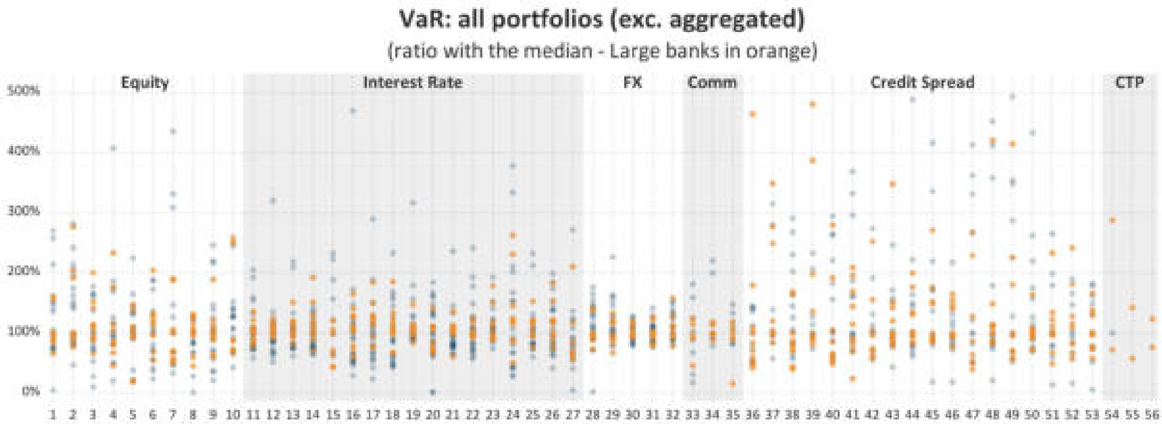


Table 30: VaR statistics (small TB banks only)

EU Statistics for VaR

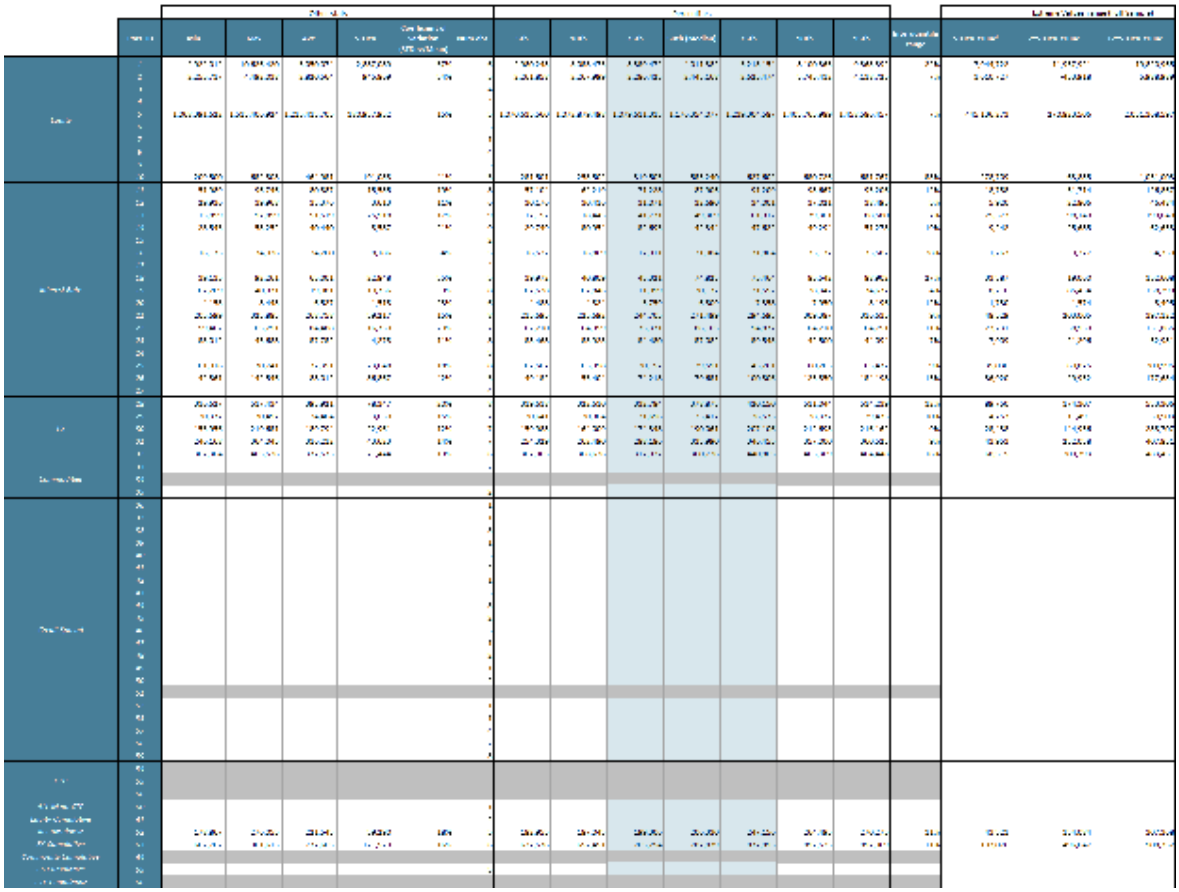


Table 31: VaR statistics (medium TB banks only)

EU Statistics for VaR

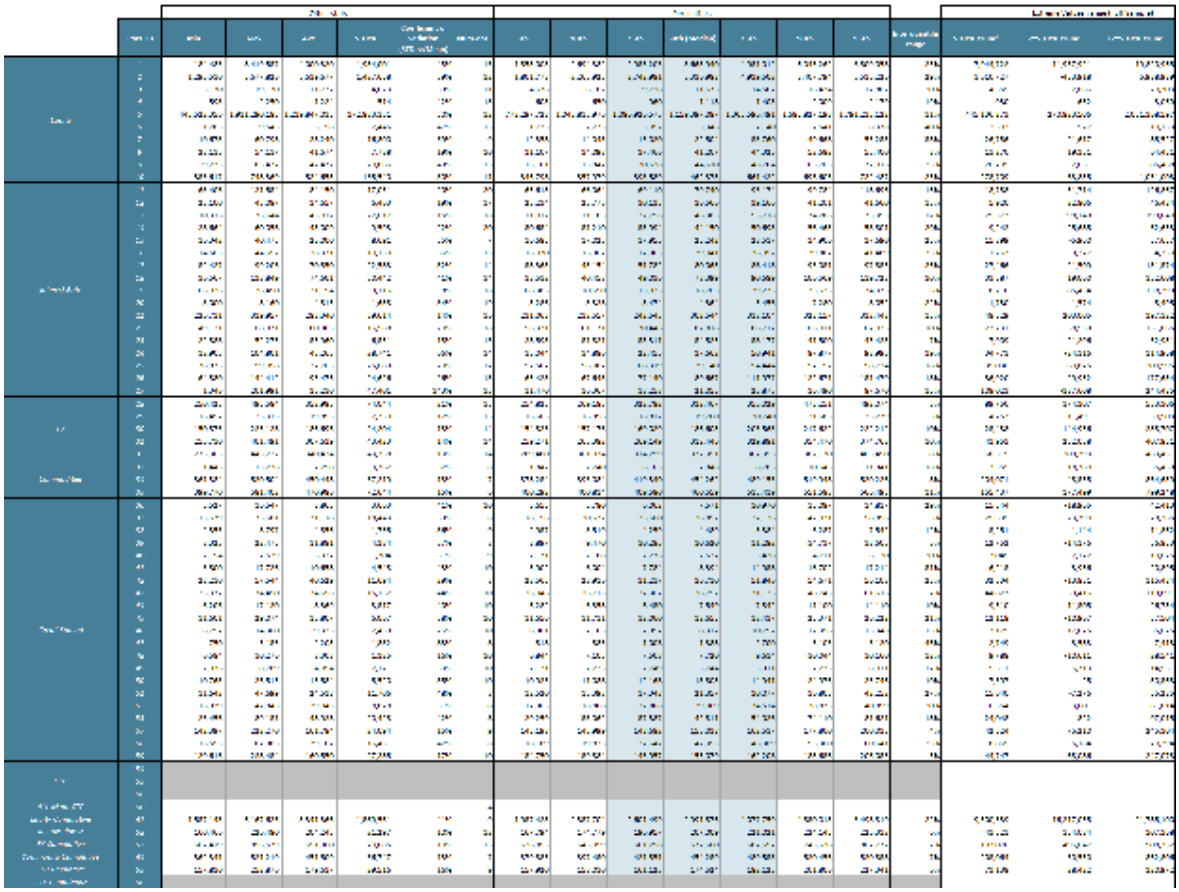


Table 32: VaR statistics (large TB banks only)

EU Statistics for VaR

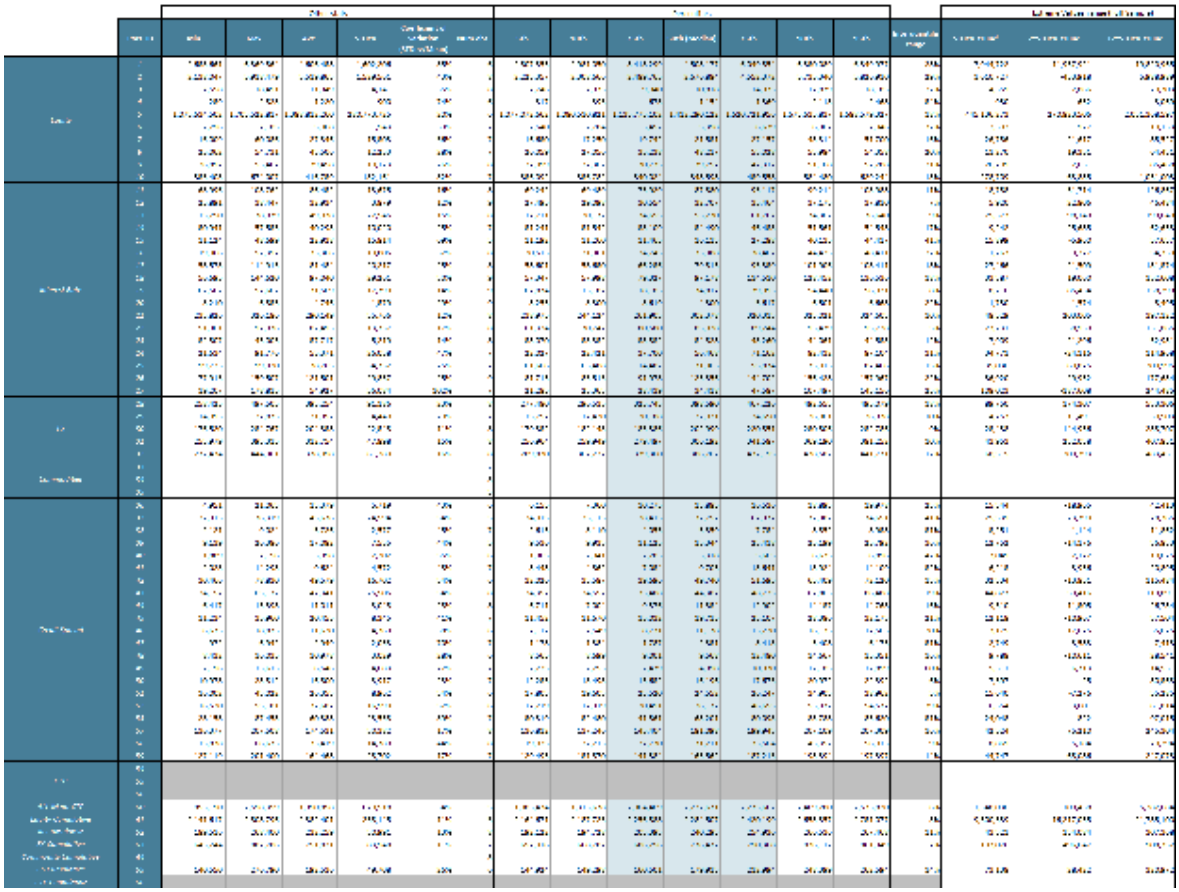


Table 33: VaR statistics (same business model – cross-border universal bank)

EU Statistics for VaR

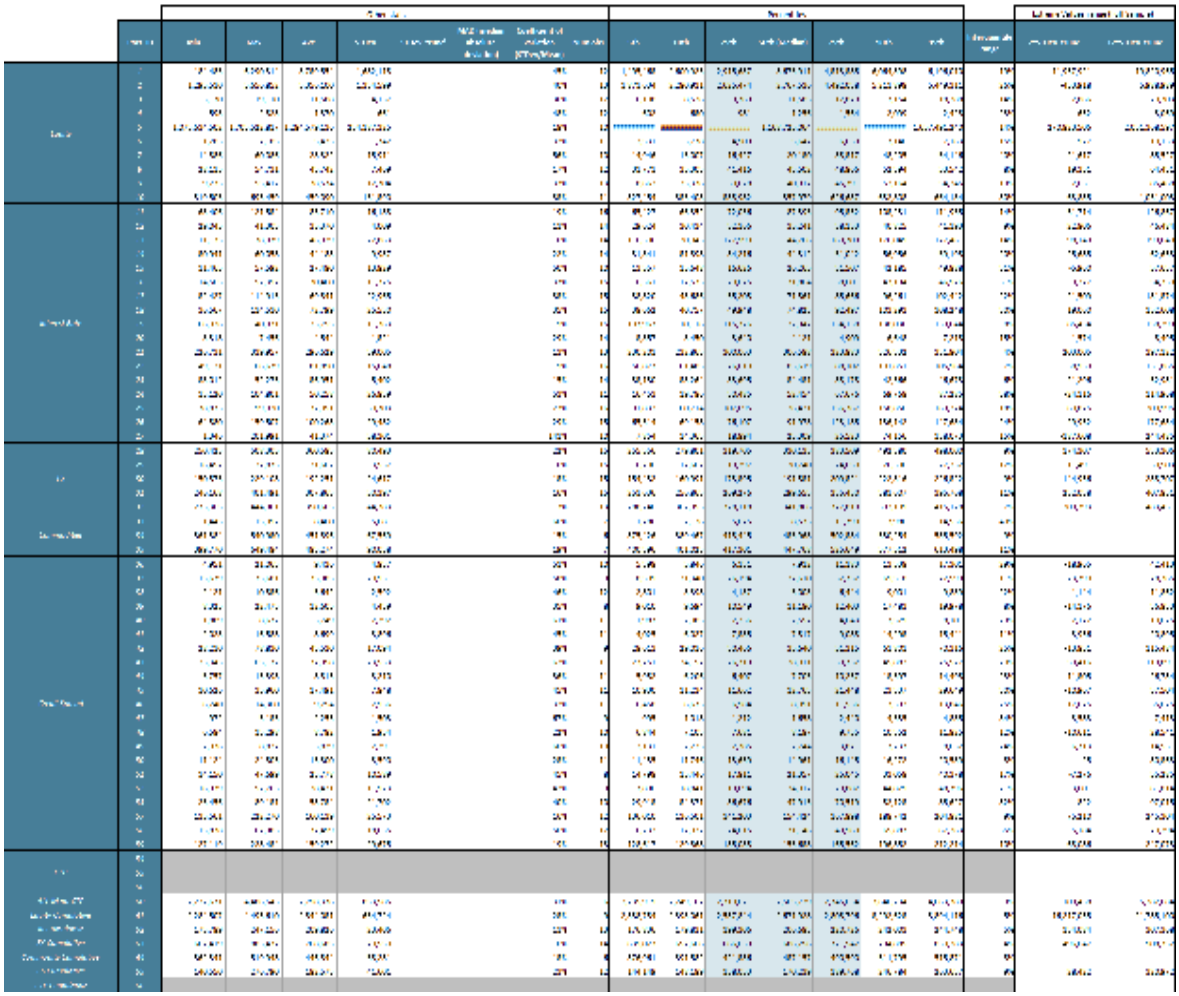


Table 34: VaR statistics (low L3 A&L banks only)

EU Statistics for VaR

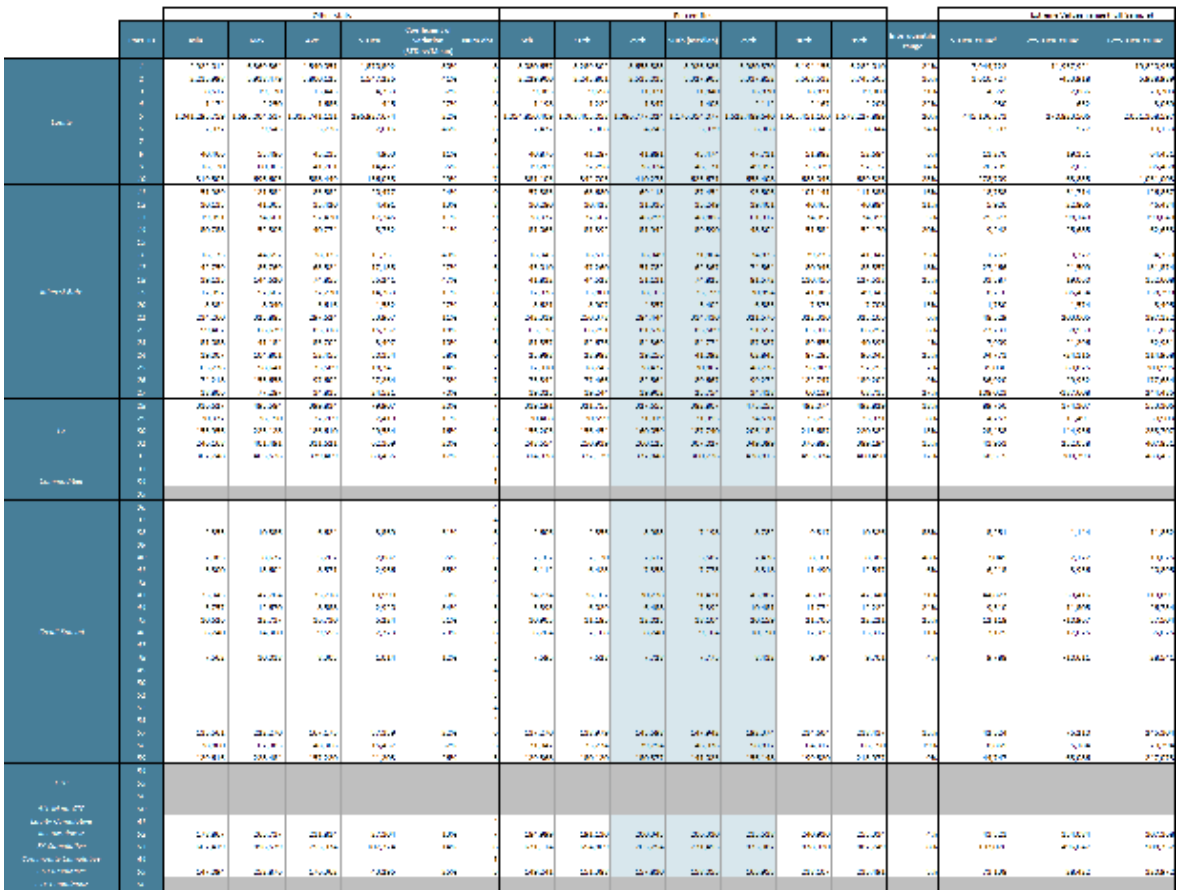


Table 35: VaR statistics (medium L3 A&L banks only)

EU Statistics for VaR

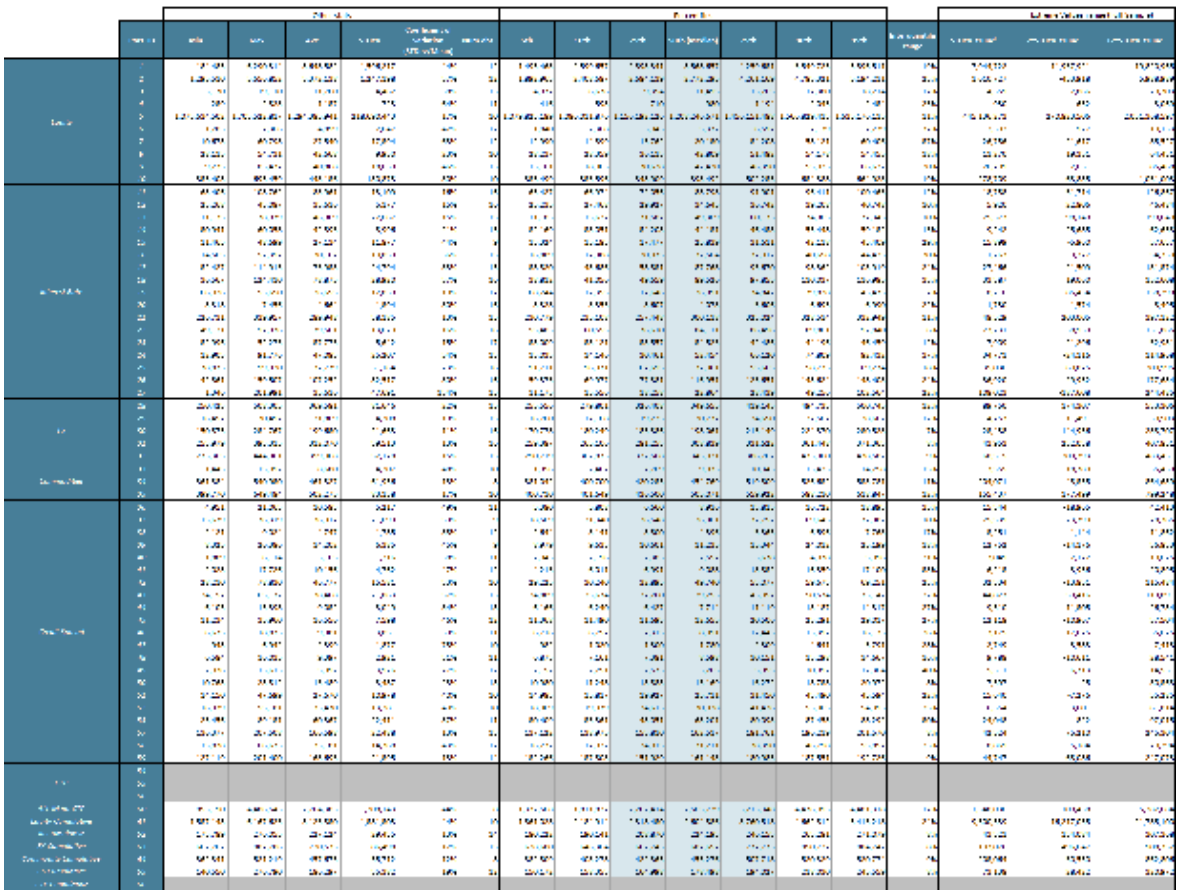


Table 36: VaR statistics (high L3 A&L banks only)

EU Statistics for VaR

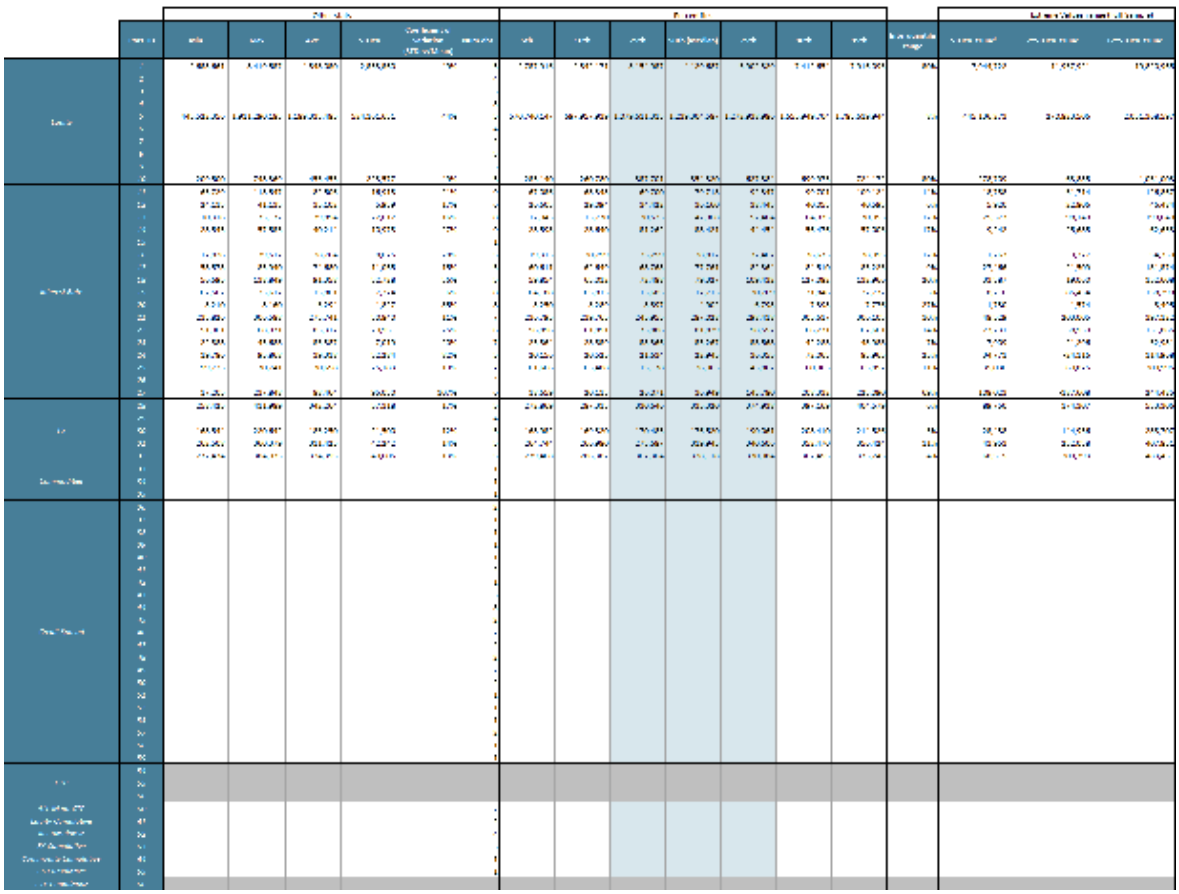


Table 37: VaR statistics (IR and CS asset classes – only banks with general and specific IR risk approval)

EU Statistics for VaR

	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (STDev/Mean)	Num obs.	5th	10th	25th	50th (Median)	75th	90th	95th	Interquantile range
		Other stats						Percentiles							
Interest Rate	11	56,603	121,534	89,810	14,561	16%	21	62,790	71,160	79,345	89,290	95,506	108,752	115,547	9%
	12	29,045	48,057	35,455	4,150	12%	21	29,090	30,554	31,085	34,709	38,972	40,106	41,303	10%
	13	119,001	197,859	152,401	22,142	15%	21	122,265	122,281	136,779	151,529	172,297	176,644	176,979	11%
	14	30,941	60,058	45,537	9,435	21%	20	31,525	31,905	38,655	46,138	51,614	57,665	58,301	14%
	15	11,124	57,502	24,882	13,400	54%	12	11,512	11,590	16,285	21,838	28,255	59,545	46,177	27%
	16	14,505	52,307	32,264	10,656	33%	19	15,891	17,760	24,290	33,953	38,837	45,117	47,517	23%
	17	32,427	114,915	79,050	23,249	29%	18	40,190	45,701	61,356	86,535	93,800	108,746	114,425	20%
	18	36,557	144,620	85,282	34,044	39%	21	39,560	43,521	56,524	87,660	105,564	138,840	144,520	29%
	19	102,562	157,602	127,045	14,751	12%	20	105,255	106,522	116,042	127,161	134,829	140,944	157,502	7%
	20	3,518	8,150	5,017	1,477	29%	21	3,525	3,575	3,881	5,001	6,417	6,835	7,000	25%
	21	254,260	380,957	304,305	30,356	10%	17	241,725	257,255	300,065	316,957	325,859	327,729	351,547	4%
	22	59,462	127,144	83,419	13,922	16%	22	70,411	79,056	84,005	86,250	91,552	106,564	106,556	4%
	23	32,906	52,275	37,214	5,154	14%	17	33,445	33,777	34,514	35,013	40,515	43,369	45,381	8%
	24	18,252	104,801	51,425	24,257	47%	18	21,772	26,705	34,895	46,256	66,828	80,772	95,082	32%
	25	99,725	199,920	157,575	26,155	19%	19	104,721	105,587	115,642	153,119	165,924	158,724	163,144	15%
	26	42,861	169,507	107,266	31,277	29%	19	71,082	74,002	85,791	106,750	124,901	155,658	156,046	20%
	27	15,557	201,901	47,554	56,940	119%	18	15,704	16,766	19,105	27,249	35,469	119,564	184,603	30%
Credit Spread	36	4,911	21,003	9,970	4,820	48%	19	5,181	5,065	6,014	8,575	12,021	16,740	17,962	33%
	37	15,674	76,314	36,096	19,926	55%	15	20,532	22,819	26,371	26,905	35,318	72,599	75,872	15%
	38	2,121	10,816	5,424	2,513	47%	19	2,332	2,925	3,790	4,459	7,198	8,842	9,287	31%
	39	8,025	26,356	12,978	5,240	40%	14	8,854	9,105	10,109	10,852	13,612	20,314	21,841	14%
	40	1,859	8,672	3,870	2,199	57%	18	2,050	2,131	2,216	2,946	4,080	7,258	7,700	29%
	41	2,023	17,726	9,855	4,319	44%	19	5,422	5,967	7,004	8,318	13,604	15,993	16,702	32%
	42	28,218	97,213	46,594	19,511	42%	15	25,910	29,717	31,767	37,490	52,378	78,316	84,157	22%
	43	23,345	105,172	38,090	20,021	53%	20	24,115	24,577	27,161	29,905	45,718	58,353	70,024	20%
	44	5,757	17,120	9,235	3,443	37%	20	6,085	6,195	6,425	7,710	11,507	13,777	15,484	28%
	45	10,626	35,950	16,265	7,007	43%	19	11,173	11,429	11,542	12,760	19,917	24,454	29,761	27%
	46	6,240	14,300	9,157	2,411	26%	19	6,532	6,741	7,092	8,528	10,907	12,840	13,481	17%
	47	738	6,315	2,411	1,756	73%	16	845	958	1,015	1,750	2,926	5,114	5,435	49%
	48	6,554	13,298	8,300	1,601	18%	18	7,074	7,339	7,385	8,412	9,742	10,100	10,729	12%
	49	2,036	11,213	4,430	2,854	65%	16	2,150	2,221	2,373	3,240	4,700	8,808	9,429	29%
	50	10,763	26,515	15,905	4,644	29%	18	10,945	11,080	13,507	14,921	16,213	24,118	25,067	9%
	51	11,642	47,699	21,597	8,922	37%	14	13,272	14,705	15,501	23,402	26,247	31,312	37,581	17%
	52	16,520	52,760	30,094	11,163	37%	15	16,513	17,590	21,810	28,311	35,399	46,057	49,501	24%
	53	25,456	89,131	51,581	20,920	38%	16	27,481	31,760	37,387	48,919	58,994	84,399	87,571	30%
	57	135,561	222,270	160,305	27,194	16%	20	130,130	137,495	140,507	157,648	183,984	206,995	205,745	11%
	58	15,818	67,953	37,302	15,958	41%	17	16,412	19,355	25,058	32,510	46,076	61,959	65,935	27%
	59	127,119	229,414	156,621	26,526	17%	18	129,241	130,499	141,537	155,079	161,990	190,852	205,157	8%
IR Cumulative	62	175,760	276,055	225,315	28,815	13%	19	176,550	187,885	205,560	221,905	240,235	255,757	265,762	8%
CS Cumulative	65	140,550	276,750	180,505	35,658	20%	17	145,785	151,555	156,065	167,859	189,088	221,294	257,552	9%

Table 38: VaR statistics (IR and CS asset classes – only banks with general IR risk approval)

EU Statistics for VaR

	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (STDev/Mean)	Num obs.	5th	10th	25th	50th (Median)	75th	90th	95th	Interquantile range
		Other stats						Percentiles							
Interest Rate	11	51,969	96,746	77,284	13,644	18%	17	61,125	64,800	67,545	72,759	90,830	95,019	95,400	14%
	12	25,100	41,153	32,185	5,950	19%	15	25,201	25,487	29,095	33,765	35,709	39,517	40,454	9%
	13	110,516	175,172	157,515	20,609	15%	15	110,090	111,160	115,707	142,505	149,424	161,250	165,227	13%
	14	28,545	58,252	37,715	7,252	19%	17	26,540	29,508	32,695	34,400	48,527	45,904	49,294	14%
	15						1								
	16	16,175	39,517	22,571	7,961	35%	10	15,430	15,584	17,547	19,002	27,052	35,118	35,515	23%
	17	42,759	82,354	61,061	14,249	23%	8	44,190	45,540	50,602	59,059	71,013	79,142	80,756	17%
	18	39,135	100,452	64,035	24,765	38%	9	40,502	41,860	46,521	54,138	79,527	95,605	102,564	26%
	19	107,200	140,951	116,090	8,348	7%	17	107,097	110,146	114,725	118,516	120,915	127,779	135,591	3%
	20	3,900	8,443	5,202	1,865	35%	15	3,147	3,256	3,711	5,054	6,864	7,806	8,161	30%
	21	205,609	321,546	265,525	35,315	13%	17	222,525	230,201	235,625	257,256	305,407	305,617	305,580	13%
	22	40,121	105,291	74,746	17,252	23%	14	50,025	54,512	62,002	75,800	82,429	98,522	104,120	15%
	23	22,868	45,668	35,555	5,455	15%	14	25,185	31,560	33,057	34,616	38,965	40,800	42,725	8%
	24	12,903	95,868	30,590	28,015	92%	8	12,073	13,055	16,060	19,507	26,742	58,207	77,098	22%
	25	78,875	170,741	121,080	24,178	20%	15	90,855	95,054	105,507	125,117	135,200	140,580	150,535	13%
	26	42,851	144,412	87,552	34,208	39%	9	51,560	60,475	65,785	79,661	87,415	142,919	143,565	14%
	27	1,946	257,848	45,200	66,654	147%	11	6,567	15,587	18,005	23,020	30,628	77,257	157,565	26%
Credit Spread	36														
	37														
	38						1								
	39														
	40						1								
	41						1								
	42														
	43						2								
	44						2								
	45						1								
	46						1								
	47														
	48						1								
	49														
	50						1								
	51														
	52														
	53														
	57						2								
	58														
	59						2								
IR Cumulative	62	150,456	276,055	200,021	36,154	17%	8	166,595	175,720	195,646	208,855	237,200	255,826	265,040	6%
CS Cumulative	65						2								

Table 39: VaR statistics (EQ asset class – only banks with general and specific EQ risk approval)

EU Statistics for VaR

		Other stats						Percentiles							
	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (STDev/Mean)	Num obs.	5th	10th	25th	50th (Median)	75th	90th	95th	Interquantile range
Equity	1	164,465	10,129,401	4,668,546	2,146,520	46%	25	2,574,640	2,621,361	3,400,905	3,908,550	6,026,664	6,569,864	8,214,570	28%
	2	2,158,047	5,918,479	3,852,177	1,415,180	37%	20	2,240,554	2,360,162	2,684,130	3,536,968	5,357,852	5,701,821	5,815,470	33%
	3	7,558	19,170	13,257	3,745	28%	21	8,512	8,652	10,605	12,660	16,454	18,401	19,110	21%
	4	259	2,823	1,352	620	47%	22	554	650	979	1,256	1,492	2,128	2,244	21%
	5	443,512,336	1,911,200,163	1,345,802,175	335,622,405	25%	20	1,042,126,605	1,065,129,562	1,156,614,380	1,278,662,063	1,611,560,061	1,804,056,457	1,715,211,185	17%
	6	2,226	9,545	5,657	1,805	32%	19	2,045	3,626	4,185	5,647	6,951	7,365	7,795	25%
	7	14,866	60,708	30,253	15,585	52%	15	14,080	15,416	17,579	22,504	37,009	54,806	60,300	35%
	8	25,062	54,731	42,953	9,045	21%	22	26,129	28,950	37,465	42,762	52,005	53,456	54,085	16%
	9	24,946	65,457	46,010	13,551	29%	21	26,897	27,475	33,577	46,301	50,097	60,905	64,402	13%
	10	319,505	748,360	514,959	157,304	31%	19	336,613	335,574	351,460	524,726	656,405	605,668	701,781	30%
Equity Cumulative	GT	2,141,617	6,107,675	3,019,654	1,051,434	35%	16	2,228,070	2,270,698	2,417,987	2,670,296	2,990,421	4,236,685	4,911,614	11%

Table 40: VaR statistics (EQ asset class – only banks with general EQ risk approval)

EU Statistics for VaR

		Other stats						Percentiles							
	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (STDev/Mean)	Num obs.	5th	10th	25th	50th (Median)	75th	90th	95th	Interquantile range
Equity	1	2,865,862	10,626,420	4,511,112	3,030,735	67%	6	2,857,002	2,890,171	2,961,117	3,265,110	3,941,066	7,376,054	9,002,257	14%
	2	1,205,510	4,046,941	2,465,500	800,512	35%	6	1,525,652	1,755,754	2,255,604	2,364,796	2,505,110	3,285,540	3,665,825	6%
	3						4								
	4						5								
	5	1,041,205,759	1,230,304,567	1,117,090,666	61,225,425	7%	5	1,046,714,962	1,052,154,104	1,058,391,622	1,070,511,515	1,161,026,061	1,206,021,175	1,225,652,850	4%
	6	1,265	4,010	2,606	1,055	39%	5	1,454	1,585	2,057	3,052	3,100	3,550	3,850	21%
	7						2								
	8						1								
	9						4								
	10	200,500	565,240	380,550	124,727	33%	5	255,140	260,780	337,701	357,579	462,575	505,005	520,657	16%
Equity Cumulative	GT						1								

Table 41: Stress VaR statistics (2008-2009 stress period only)

EU Statistics for SVaR

		Other stats						Percentiles							
	Port. ID	Min	Max	Ave.	STDev	Coefficient of variation (STDev/Mean)	Num obs.	5th	10th	25th	50th (Median)	75th	90th	95th	Interquartile range
Equity	1	6,350,028	11,962,650	8,556,560	1,275,701	15%	17	7,142,425	7,378,969	7,640,466	8,410,044	9,406,680	9,578,267	10,156,186	10%
	2	5,412,159	14,057,259	10,070,814	2,570,061	27%	16	5,751,420	8,054,465	8,896,572	9,565,011	11,657,281	13,508,958	13,741,755	15%
	3	5,061	26,068	16,510	6,725	41%	16	7,462	8,423	12,564	15,019	22,466	25,708	25,832	29%
	4	256	3,506	1,770	922	52%	15	441	677	1,401	1,750	2,357	3,074	3,364	25%
	5	506,908,604	3,954,883,607	3,000,170,260	857,856,575	29%	15	1,725,212,582	2,363,332,647	2,745,757,450	3,116,321,655	3,584,706,046	3,915,029,954	3,954,682,340	13%
	6	1,944	11,750	5,947	3,040	51%	16	2,207	2,765	3,542	5,410	7,456	10,159	11,077	36%
	7	20,623	180,259	71,229	32,854	46%	12	27,295	54,256	57,240	65,271	81,084	118,852	124,756	17%
	8	11,361	68,460	45,979	16,521	37%	15	22,687	30,120	32,571	40,926	56,600	66,051	67,562	27%
	9	33,368	92,760	70,165	19,097	27%	14	37,864	41,857	56,619	78,420	85,095	86,920	89,866	17%
	10	1,057,364	2,465,058	1,429,824	440,261	31%	14	1,046,756	1,051,859	1,082,095	1,268,650	1,575,086	2,089,827	2,270,486	18%
Interest Rate	11	91,818	252,205	199,852	55,099	28%	25	92,381	102,077	194,280	218,300	230,252	245,507	274,727	8%
	12	16,692	99,127	58,958	19,565	33%	22	29,565	39,172	44,129	61,155	70,159	82,845	87,517	23%
	13	214,118	407,288	322,652	55,129	17%	25	228,552	247,110	290,899	313,009	347,250	368,217	395,089	8%
	14	54,583	130,297	92,480	21,105	23%	25	58,199	63,414	80,853	93,653	109,258	116,315	122,424	15%
	15	24,928	145,617	66,907	42,062	63%	6	28,329	32,481	43,001	60,173	69,537	108,248	126,941	23%
	16	10,200	50,433	30,728	12,521	25%	19	30,002	33,731	39,038	49,144	65,120	69,933	74,007	24%
	17	37,958	208,533	112,590	40,120	36%	19	65,487	76,900	85,003	100,338	135,105	154,626	163,091	24%
	18	59,044	279,538	119,132	53,418	45%	20	69,471	71,754	78,329	116,028	134,489	184,242	202,392	26%
	19	56,643	333,915	200,153	74,595	29%	24	115,822	134,330	228,969	285,616	302,810	333,874	330,918	14%
	20	336	58,955	15,928	15,545	98%	21	665	3,027	5,123	12,755	16,481	33,808	57,995	34%
	21	211,427	745,932	564,018	142,913	25%	25	275,224	357,254	526,270	621,625	658,196	678,200	705,000	11%
	22	50,875	223,596	172,934	44,581	26%	23	82,919	95,157	152,172	184,333	201,953	221,590	221,050	13%
	23	20,635	100,850	50,930	13,536	27%	19	36,955	40,420	51,565	62,532	68,475	74,199	82,001	14%
	24	23,117	127,821	100,421	50,195	50%	14	32,202	38,425	53,009	97,300	155,151	171,402	175,205	49%
	25	186,521	350,642	287,402	45,042	16%	21	201,201	215,920	261,201	301,019	311,173	333,154	345,045	9%
	26	55,619	307,111	144,624	66,341	46%	20	59,200	79,509	115,201	140,874	155,022	190,602	222,045	15%
	27	16,622	324,800	136,809	72,282	53%	16	61,401	77,174	100,615	131,056	150,015	212,756	265,412	20%
FX	28	690,165	1,127,901	918,157	124,147	14%	19	744,451	757,458	851,767	894,423	1,020,305	1,054,252	1,082,255	10%
	29	26,075	67,720	51,563	16,590	30%	18	31,600	34,779	54,271	56,206	75,005	81,663	82,505	16%
	30	410,218	572,350	494,606	46,407	9%	18	420,595	455,603	460,026	500,964	538,521	544,408	550,147	8%
	31	665,501	1,152,277	958,842	160,151	18%	19	702,085	714,125	781,742	947,012	1,095,075	1,155,778	1,146,012	17%
	32	857,410	1,402,368	1,119,463	190,012	17%	18	871,288	914,017	965,435	1,158,970	1,302,010	1,348,032	1,375,266	15%
Commodities	33	16,073	63,252	38,914	15,126	39%	9	17,465	18,850	20,155	22,725	27,385	52,406	62,529	15%
	34	561,628	924,016	717,352	131,585	18%	8	575,195	558,701	626,591	653,020	791,005	900,009	912,017	11%
	35	919,028	1,257,140	1,093,696	116,129	11%	9	940,291	952,701	961,075	1,097,365	1,181,549	1,222,558	1,239,564	10%
Credit Spread	36	11,029	61,325	18,810	6,060	32%	10	11,141	11,163	15,025	19,463	21,171	25,868	27,505	17%
	37	57,954	168,525	110,127	45,682	42%	8	60,265	62,567	66,256	108,048	151,240	161,258	164,601	39%
	38	7,842	18,115	12,641	3,784	30%	12	8,110	8,474	10,004	11,053	15,224	17,659	17,856	29%
	39	19,841	90,380	50,316	27,646	55%	8	20,690	21,367	25,565	46,525	75,296	81,608	85,020	49%
	40	7,518	31,706	17,004	8,014	47%	10	8,644	10,169	12,524	15,500	22,471	28,049	29,676	27%
	41	12,251	46,152	26,665	16,501	51%	10	12,851	15,421	14,580	24,265	36,651	44,322	45,227	44%
	42	56,807	182,965	125,756	40,031	33%	10	57,167	57,468	111,247	129,908	140,466	161,318	172,142	15%
	43	40,758	147,480	93,502	31,121	33%	12	40,082	50,065	75,550	90,360	116,502	151,140	150,404	20%
	44	13,871	46,016	27,569	9,787	35%	11	15,626	17,375	20,475	25,646	36,616	39,706	42,661	24%
	45	31,059	91,500	57,256	26,714	41%	12	31,164	31,757	36,086	58,223	80,632	90,100	90,040	37%
	46	13,841	46,357	25,308	9,066	36%	10	14,374	14,907	16,686	22,440	30,606	36,217	41,602	29%
	47	4,065	18,628	9,479	4,200	44%	9	4,770	5,506	6,405	10,213	10,663	12,428	15,626	24%
	48	14,901	59,807	38,704	15,396	40%	9	17,181	20,060	21,621	26,941	47,514	56,164	56,041	37%
	49	4,063	25,346	12,660	6,066	48%	10	4,691	5,609	10,409	11,412	14,667	19,051	22,190	17%
	50	20,008	34,476	27,378	4,201	15%	11	20,646	21,002	26,686	27,464	30,140	32,012	33,144	6%
	51	28,711	104,076	61,500	28,116	46%	8	31,016	33,332	30,656	58,714	80,024	98,062	96,570	34%
	52	40,011	106,127	68,200	22,646	36%	7	40,066	41,026	46,180	68,664	71,642	97,848	96,486	22%
	53	48,362	165,409	100,913	46,136	50%	8	50,026	60,678	81,560	107,800	151,403	158,941	160,717	24%
	57	213,874	407,657	300,782	67,667	22%	10	225,126	256,572	262,751	298,687	364,667	402,646	405,156	16%
	58	46,020	213,964	113,666	56,775	52%	10	45,544	47,068	56,264	120,414	151,000	174,072	194,026	44%
	59	160,256	477,601	341,025	94,505	28%	12	211,056	247,429	281,015	356,042	402,265	469,975	477,556	18%
CTP	54														
	55														
	56														
All-in Non-CTP	60	2,072,620	15,900,817	6,807,457	3,640,024	40%	8	3,107,625	4,145,057	5,610,510	6,454,858	8,884,402	9,711,678	11,610,747	8%
Equity Cumulative	61	3,109,601	26,056,202	7,948,154	6,652,505	86%	11	3,565,765	3,567,051	4,467,545	6,071,447	6,675,126	15,089,525	20,022,000	21%
IR Cumulative	62	164,256	630,515	445,200	130,457	29%	17	210,546	260,328	411,057	463,843	546,401	568,174	590,607	14%
FX Cumulative	63	1,455,608	3,070,461	2,213,627	437,402	20%	18	1,465,690	1,514,865	2,046,424	2,274,227	2,452,535	2,650,156	2,706,585	9%
Commodity Cumulative	64	563,070	956,065	700,918	146,124	20%	8	574,105	564,256	615,515	647,944	785,245	908,852	932,485	12%
CS Cumulative	65	250,057	542,060	382,265	86,580	23%	10	260,774	270,510	335,102	378,240	425,047	462,546	512,505	12%
CTP Cumulative	66														

Table 42: PV statistics

EU Statistics for PV

	Port. ID	Min	Max	Avg	STDev	STDev_trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Avg)	Num obs.[2]	25th	50th (Median)	75th	Interquantile range
		Main statistics								*Percentiles*			
Equity	1	270,987	46,406,975	30,049,182	13,307,030	141,019,035	30,416	33%	20	41,031,013	41,081,000	41,098,215	0%
	2	-37,195,187	-23,211,950	-25,454,283	1,807,681	6,618,562	40,654	7%	24	-28,345,405	-25,310,069	-28,251,209	0%
	3	-25,062	-26,201	-27,150	457	881	293	2%	23	-27,502	-27,157	-26,900	1%
	4	3,444	4,300	3,877	207	244	128	5%	23	3,760	3,882	4,019	3%
	5	-11,061,265,075	-2,713,300,000	-10,968,550,169	4,729,317,256	5,594,520,584	28,019,811	-43%	25	-13,529,000,000	-11,530,250,000	-13,475,200,057	0%
	6	-10,983	-5,737	-7,940	1,004	1,904	587	13%	23	-8,532	-8,009	-7,224	8%
	7	1,014,045	1,041,140	1,025,144	8,553	8,557	7,855	1%	19	1,019,451	1,027,325	1,036,157	1%
	8	67,090	74,640	71,099	2,072	2,430	1,798	3%	24	69,545	71,181	72,409	2%
	9	475,381	482,409	479,025	1,591	1,841	721	0%	25	478,173	478,790	479,530	0%
	10	-4,791,985	-229,324	-2,971,482	1,340,309	1,320,875	85,079	-45%	25	-4,573,184	-2,621,105	-2,593,120	28%
Interest Rate	11	174,130	167,561	170,674	1,510	2,572	841	1%	34	171,869	171,005	169,753	1%
	12	55,554	24,700	51,403	2,453	5,455	1,154	5%	35	52,926	51,202	29,740	5%
	13	295,025	279,989	286,235	4,377	5,204	2,246	2%	37	221,060	290,362	287,364	1%
	14	115,075	100,513	105,281	3,127	5,664	1,662	3%	35	110,169	107,827	106,573	2%
	15	1,027,292	1,161,604	1,095,065	58,458	55,465	52,144	4%	15	1,062,647	1,095,101	1,128,245	5%
	16	411,690	62,010	142,725	75,952	575,240	18,500	53%	25	148,555	110,510	110,163	11%
	17	220,595	1,329,671	1,075,065	280,154	695,510	50,577	26%	25	1,126,756	1,150,575	1,157,601	2%
	18	695,615	878,471	600,565	280,547	695,624	27,924	47%	25	644,210	680,611	662,060	5%
	19	110,075	121,460	117,575	2,860	5,695	1,520	2%	34	116,304	117,621	119,528	1%
	20	11,734	9,565	10,180	546	785	300	5%	35	10,455	10,182	9,864	5%
	21	457,525	456,657	446,355	5,275	7,080	5,844	1%	34	444,614	445,651	452,056	1%
	22	204,074	195,615	201,571	2,947	5,550	2,113	2%	34	205,760	201,650	199,408	1%
	23	1,296,445	1,319,961	1,300,260	4,656	16,701	152	0%	32	1,299,512	1,299,502	1,299,635	0%
	24	1,080,152	1,156,136	1,102,626	19,954	195,860	407	2%	25	1,096,400	1,097,680	1,098,123	0%
	25	1,577,005	1,515,440	1,527,650	11,254	50,025	2,525	1%	35	1,528,762	1,525,557	1,525,957	0%
	26	4,580,510	4,725,051	4,570,025	60,718	511,505	9,804	2%	25	4,565,270	4,587,587	4,560,148	0%
	27	90,472	61,908	9,655	51,356	197,565	9,618	516%	30	17,455	11,515	752	92%
FX	28	81,905	153,547	135,965	16,698	140,015	2,508	5%	31	139,204	140,475	143,039	1%
	29	849,975	1,130,242	891,245	46,155	255,283	501	5%	29	850,150	850,142	857,056	0%
	30	649,463	658,458	654,940	2,353	3,013	1,534	0%	30	653,335	651,282	656,652	0%
	31	921,965	901,156	934,165	8,206	10,099	1,601	1%	30	930,004	931,124	936,534	0%
	32	-1,174,977	-1,158,821	-1,170,460	3,874	5,394	2,179	0%	27	-1,172,914	-1,171,099	-1,169,027	0%
Commodities	33	21,550	8,168	14,171	3,169	5,052	808	22%	15	14,567	15,081	15,129	5%
	34	520,711	505,821	547,505	24,517	55,057	16,666	5%	11	525,340	557,470	571,252	4%
	35	207,197	240,912	215,702	9,069	54,670	5,544	4%	12	215,865	215,641	221,565	2%
Credit Spread[1]	36	-5,121	-4,213	-5,224	498	1,019	31	9%	20	-5,175	-5,155	-5,113	1%
	37	49,778	55,100	53,912	1,194	4,999	109	2%	17	53,905	53,982	54,298	0%
	38	-5,182	-3,211	-4,200	426	785	40	10%	21	-4,211	-4,169	-4,134	1%
	39	31,278	33,175	32,569	418	2,312	75	1%	16	32,646	32,715	32,815	0%
	40	2,572	3,015	2,841	128	192	34	5%	20	2,626	2,569	2,657	1%
	41	27,064	30,455	28,179	776	1,040	310	3%	18	27,716	28,013	28,734	2%
	42	1,155,365	1,285,007	1,194,303	26,994	94,469	1,305	2%	18	1,158,854	1,191,130	1,192,244	0%
	43	3,245,183	3,351,301	3,283,285	22,406	90,415	1,750	1%	22	3,281,182	3,284,439	3,284,675	0%
	44	39,110	47,239	42,170	2,457	4,524	1,123	6%	22	40,211	42,992	44,009	4%
	45	1,050,567	1,078,502	1,055,591	7,548	29,739	1,004	1%	21	1,052,245	1,053,279	1,053,627	0%
	46	1,062,565	1,104,653	1,083,205	8,363	30,925	328	1%	21	1,053,226	1,083,574	1,084,191	0%
	47	33,713	35,601	34,252	438	512	120	1%	18	34,489	34,707	34,755	0%
	48	19,977	30,451	26,061	2,610	4,550	1,399	10%	20	24,244	26,905	27,930	7%
	49	-10,920	-10,451	-10,720	91	511	42	1%	19	-10,758	-10,703	-10,687	0%
	50	1,030,531	1,040,940	1,034,511	2,206	10,025	258	0%	19	1,033,456	1,034,465	1,034,633	0%
	51	1,085,015	1,105,032	1,105,582	15,875	105,245	257	1%	17	1,102,694	1,103,595	1,103,620	0%
	52	1,065,435	1,139,752	1,085,909	17,519	95,757	864	2%	17	1,053,712	1,084,585	1,085,071	0%
	53	2,163,570	2,204,774	2,192,087	31,017	310,305	623	1%	16	2,185,577	2,188,191	2,188,504	0%
	57	3,781,047	3,850,602	3,829,951	26,997	35,385	2,102	1%	21	3,821,426	3,831,957	3,832,950	0%
	58	-467,981	-347,654	-410,865	25,137	37,225	7,738	6%	20	-422,131	-401,567	-399,538	3%
	59	3,421,070	3,594,207	3,475,885	41,624	85,470	12,950	1%	21	3,455,512	3,474,017	3,484,944	0%
CTP	54								3				
	55								2				
	56								2				
All Prime CTP **	60	-25,302,232	23,458,385	12,002,361	15,916,208	110,585,963	2,050,907	132%	11	7,353,696	21,916,573	22,318,058	52%
Equity Cumulative **	61	-25,302,232	14,328,824	6,615,361	12,020,458	152,332,132	2,024,855	182%	16	-1,350,146	14,241,324	14,342,181	121%
IR Cumulative **	62	319,585	1,124,753	884,755	158,657	732,492	11,089	18%	20	893,179	929,754	934,326	2%
FX Cumulative **	63	-47,251	1,440,025	763,465	253,524	475,490	7,908	33%	25	753,945	784,563	798,929	2%
Commodity Cumulative **	64	353,573	583,207	514,505	58,349	153,612	13,718	11%	11	507,634	521,175	538,896	3%
CS Cumulative **	65	6,590,577	6,979,219	6,793,418	59,127	90,561	14,627	1%	19	6,753,107	6,781,514	6,794,121	0%
CTP Cumulative **	66								2				

[1] STDev_trunc is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (57 to 65), banks that reported at least a missing portfolio (NF) among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio.

Table 43: IRC – modelling choice: source of LGD – market convention

EU Statistics for IRC

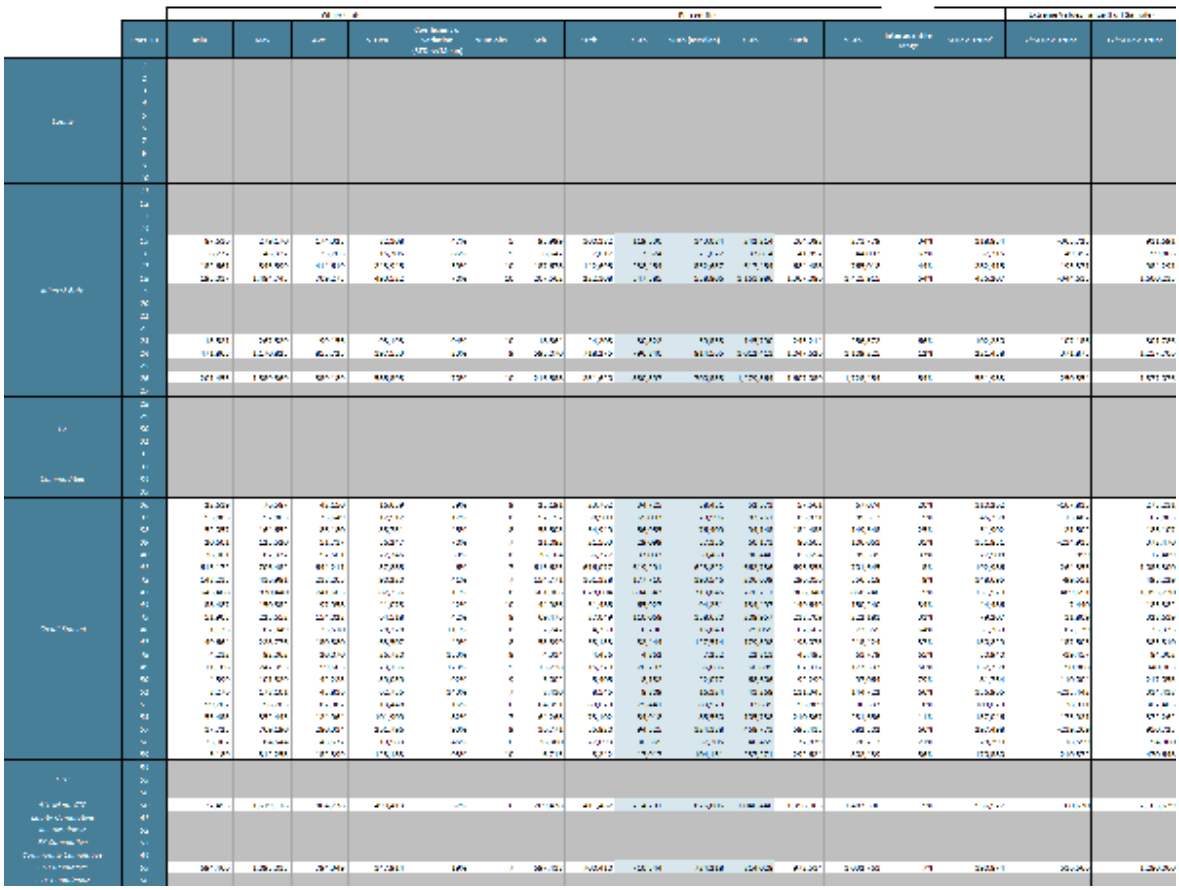


Table 44: IRC – modelling choice: source of LGD – non-market convention

EU Statistics for IRC

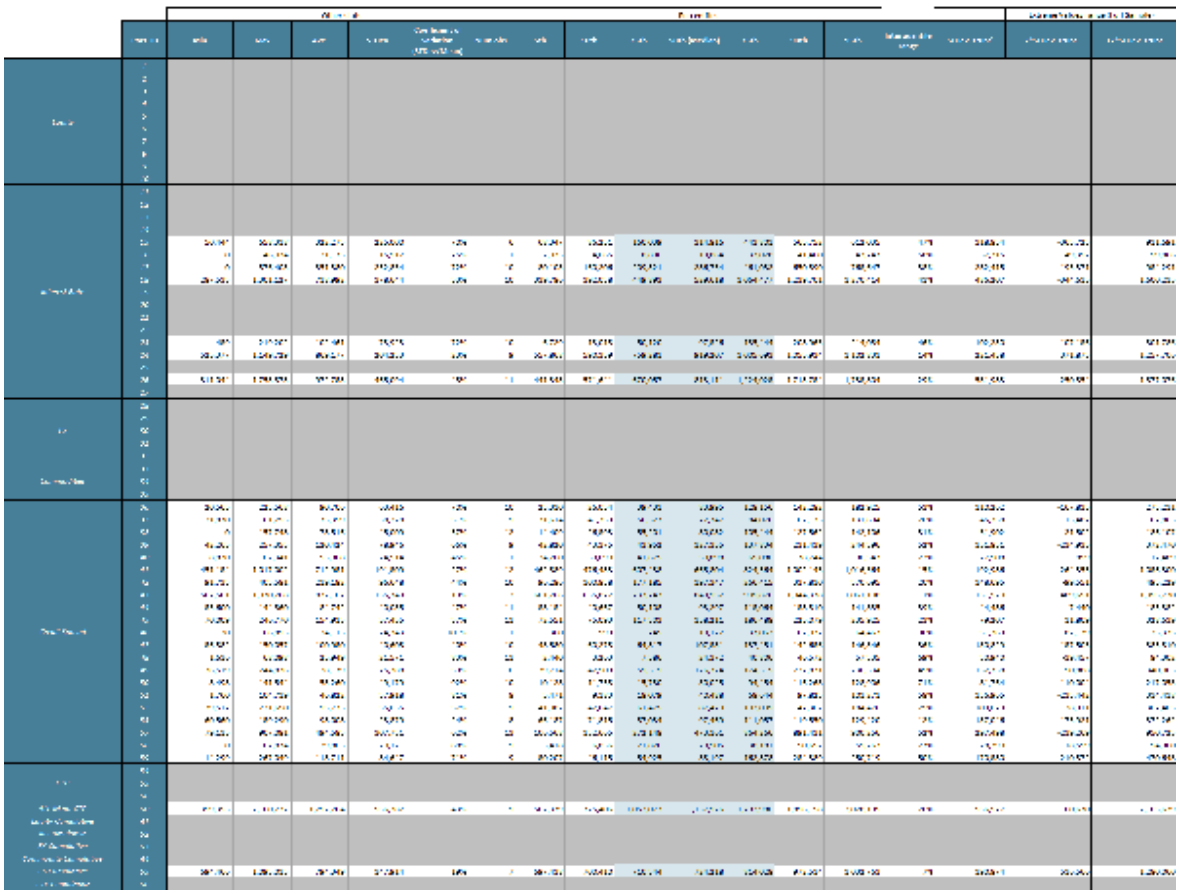


Table 45: IRC – modelling choice: source of LGD – 1-2 modelling factors

EU Statistics for IRC

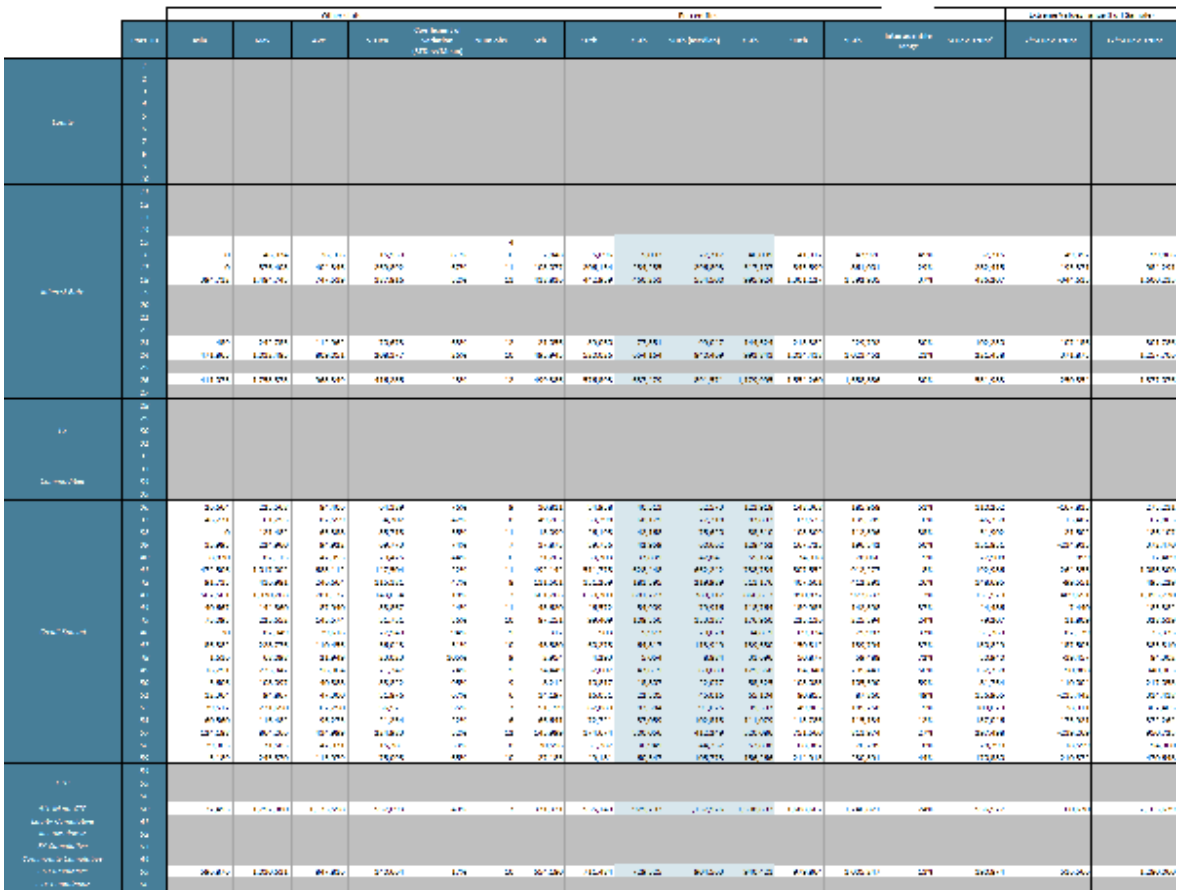


Table 46: IRC – modelling choice: source of LGD – >2 modelling factors

EU Statistics for IRC

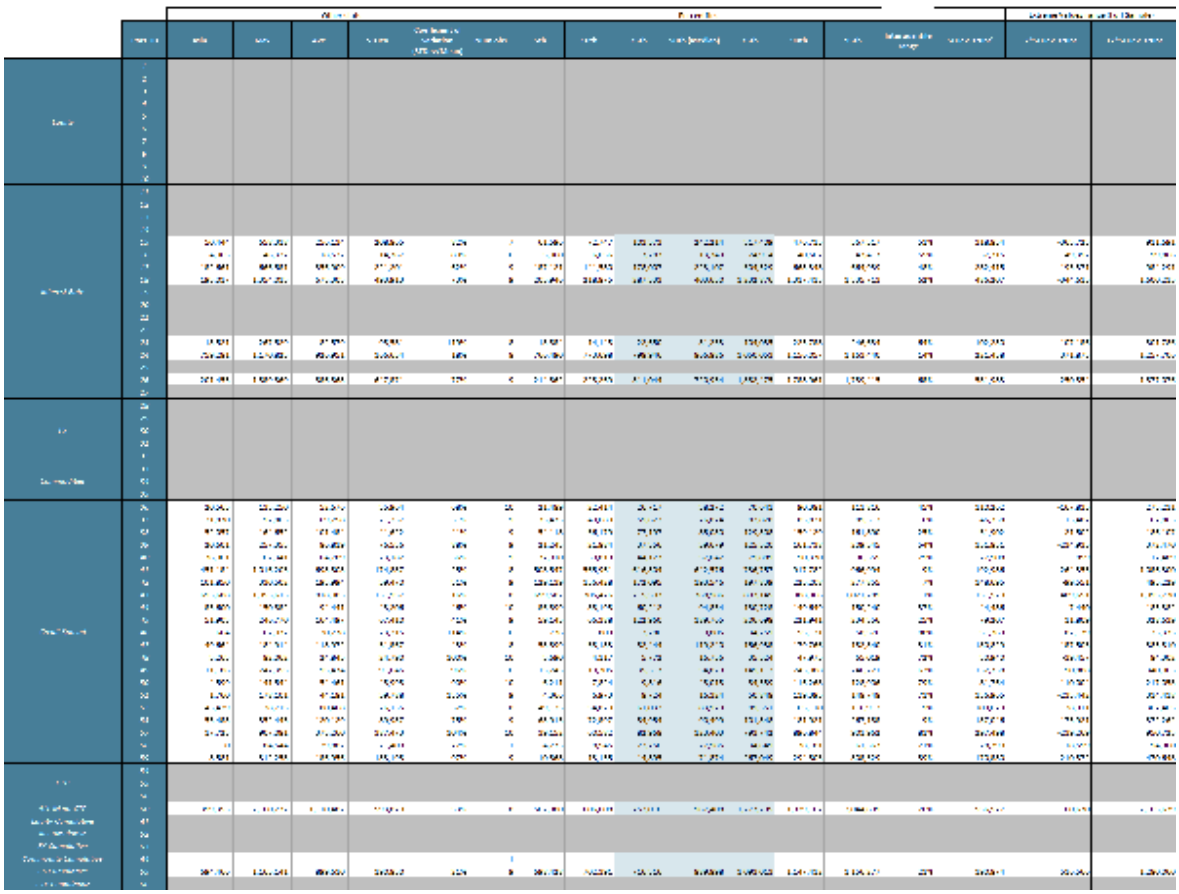
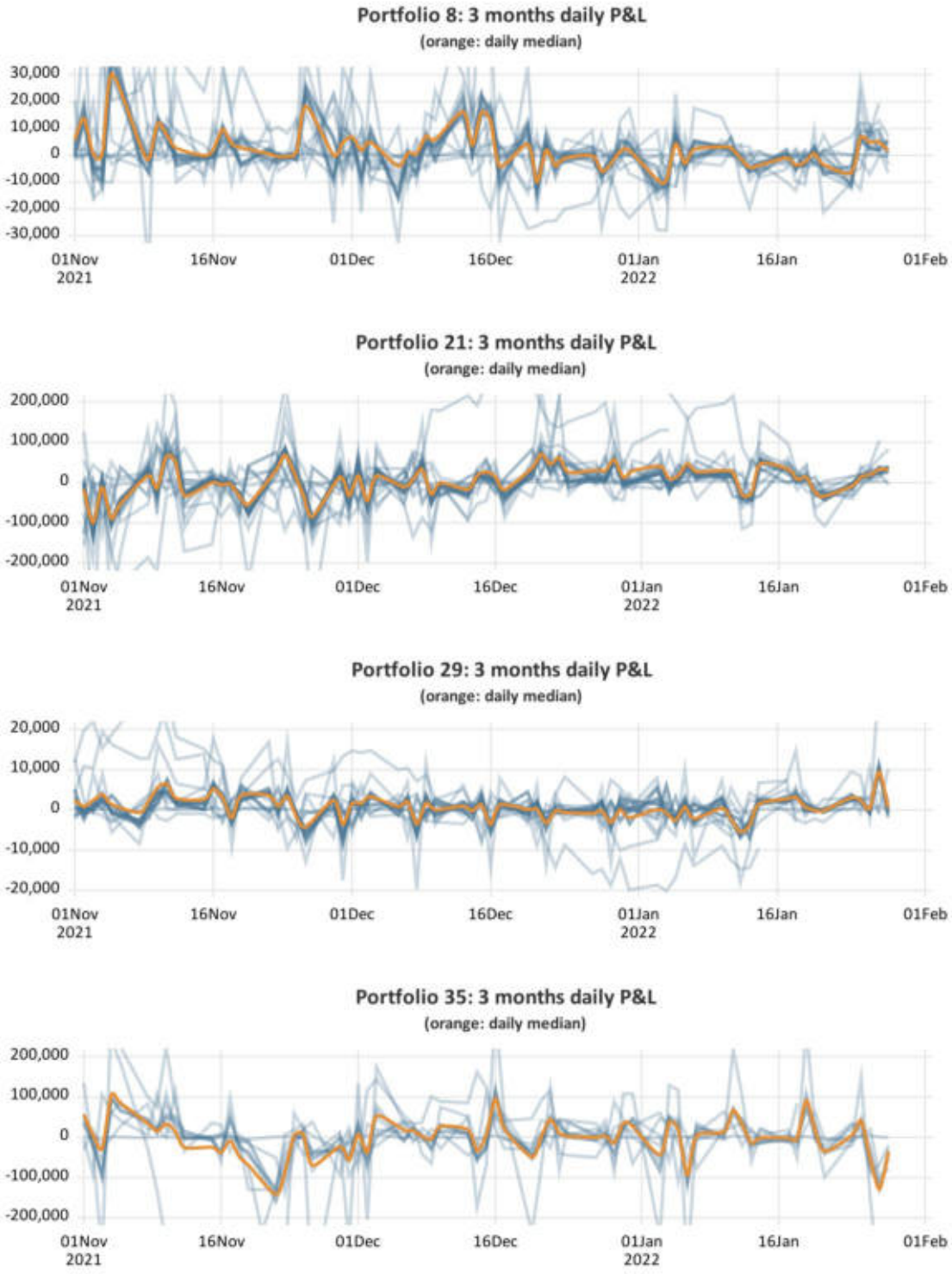
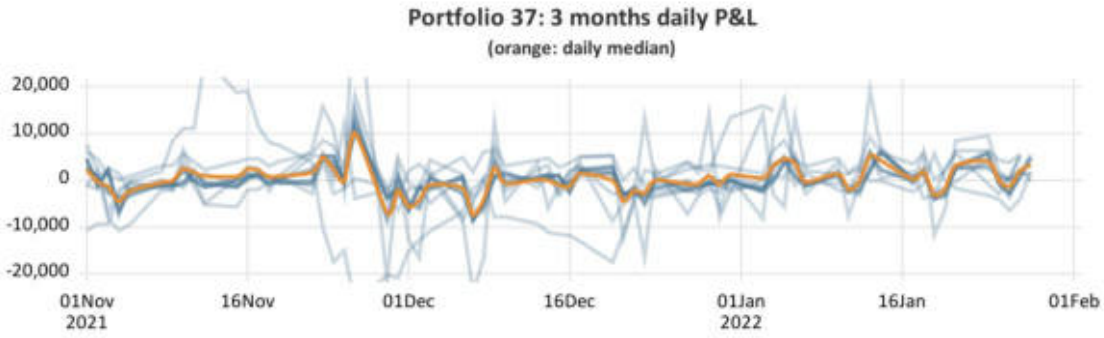


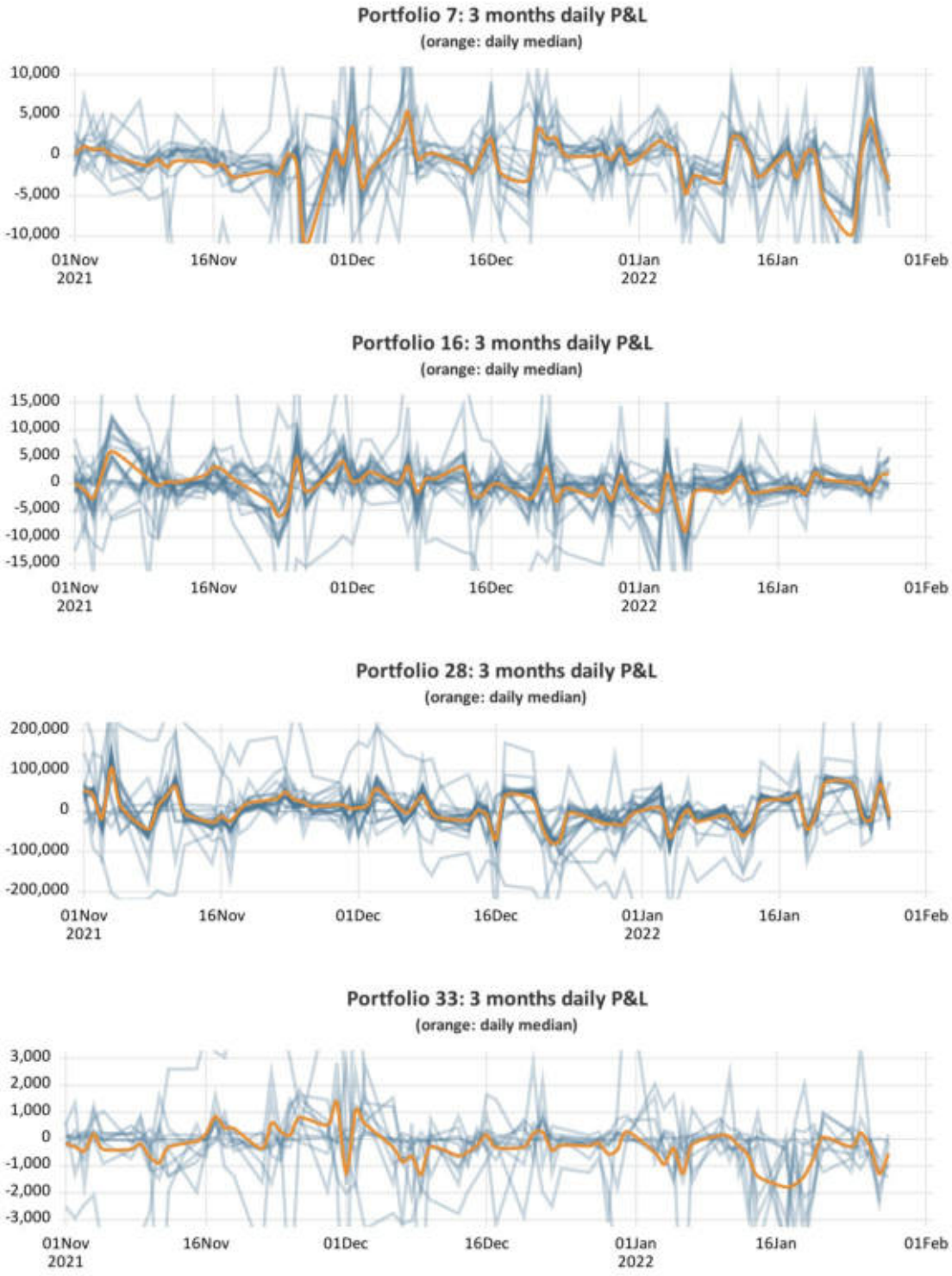
Figure 31: Additional P&L charts with examples of low IQD

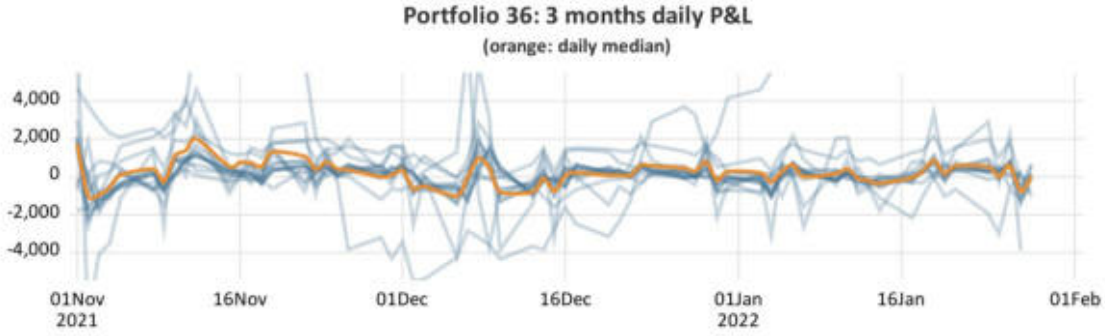



Portfolio 37: 3 months daily P&L
(orange: daily median)
20,000
10,000
0
-10,000
-20,000
01Nov 2021
16Nov
01Dec
16Dec
01Jan 2022
16Jan
01Feb


Portfolio 61: 3 months daily P&L
(orange: daily median)
2,000,000
1,000,000
0
-1,000,000
-2,000,000
01Nov 2021
16Nov
01Dec
16Dec
01Jan 2022
16Jan
01Feb

Figure 32: Additional P&L charts with examples of high IQD




Portfolio 36: 3 months daily P&L
(orange: daily median)
4,000
2,000
0
-2,000
-4,000
01Nov 2021
16Nov
01Dec
16Dec
01Jan 2022
16Jan
01Feb

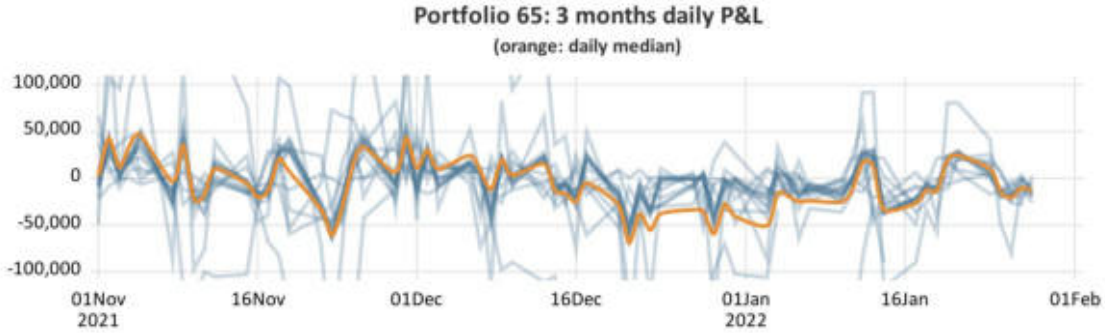

Portfolio 65: 3 months daily P&L
(orange: daily median)
100,000
50,000
0
-50,000
-100,000
01Nov 2021
16Nov
01Dec
16Dec
01Jan 2022
16Jan
01Feb

Figure 33: Comparison between IMV and truncated STD deviation method to select outliers for risk measures

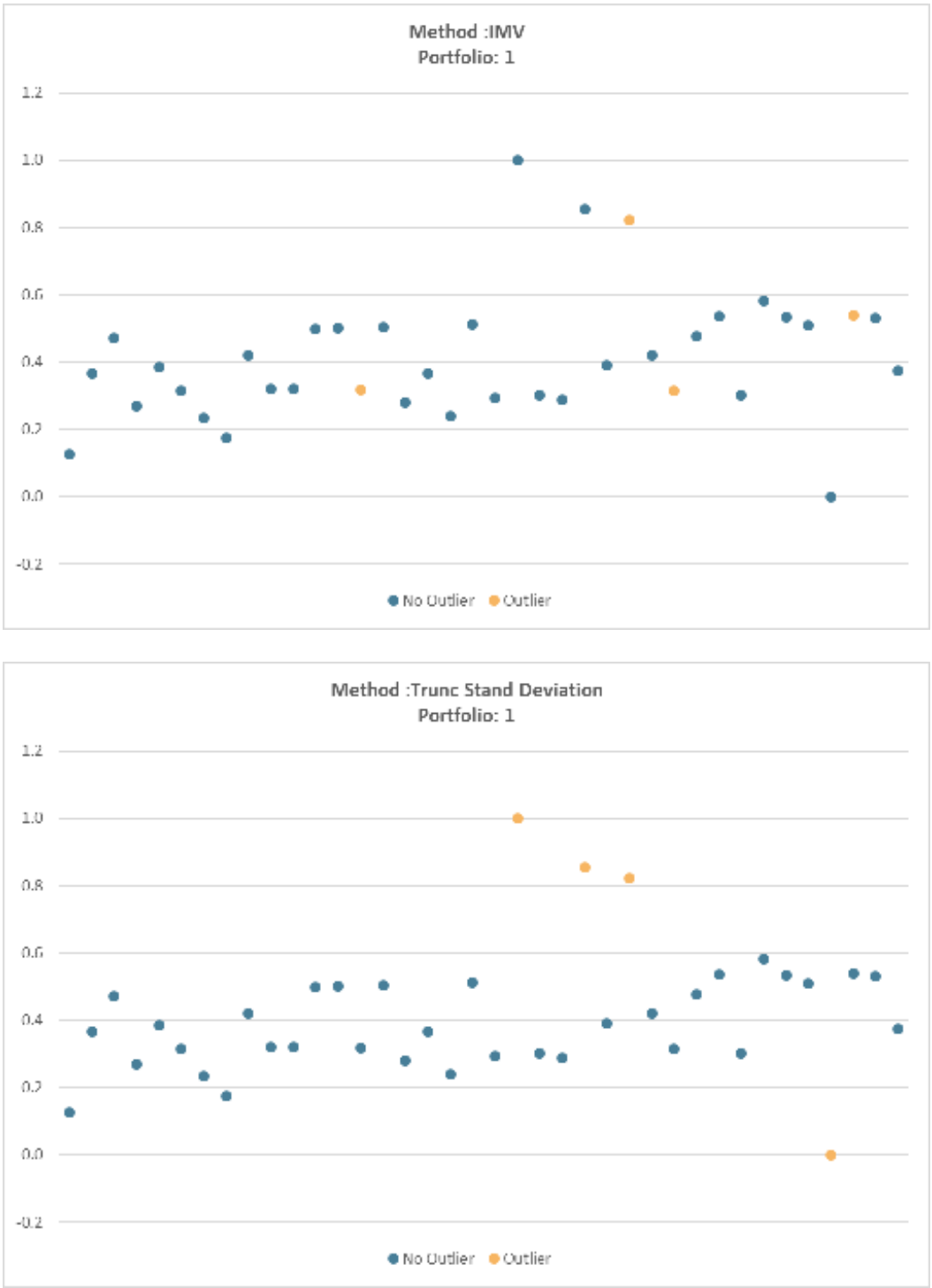


Figure 26. Example of dispersion in VaR submission for portfolio 1. Above the chart, marked in yellow: the portfolios which would have been excluded based on the IMV methodology outlier, which was used in 2019 (and before) to detect outliers among risk measures. Below the chart: the same submission, but marked in yellow, indicating the submissions that have been excluded in VaR and benchmarking statistics in the 2020 exercise (and onward) based on the +/- two times truncated standard deviation of the sample.

Table 47: EU Statistics for SBM OFR

EU Statistics for SBM OFR

	Part. ID	Main statistics: Min	Max	Ave	STDev	STDev trunc[1]	MAD (median absolute deviation)	Coefficient of variation (STDev/Ave)	Num obs[2]	Percentiles: 25th	50th (Median)	75th	Interquantile range
Equity	1	212,677	53,868,758	11,752,254	15,768,124	20,190,780	1,260,040	134%	27	6,311,748	7,725,040	8,069,980	12%
	2	11,481,080	13,226,126	12,016,675	354,128	1,062,292	48,126	3%	22	11,904,728	12,002,256	12,066,605	1%
	3	24,257	47,946	35,018	6,245	7,252	4,414	18%	25	29,702	34,548	37,017	11%
	4	6,243	14,757	10,267	2,229	2,256	1,502	22%	25	8,522	9,882	12,057	17%
	5	6,290	4,957,151,457	1,027,180,838	1,310,442,058	3,581,071,250	1,260,564,617	66%	25	616,808,606	2,242,544,002	2,448,734,177	60%
	6	15,701	44,857	20,209	7,008	8,060	2,850	24%	24	26,747	30,012	32,632	10%
	7	70,457	308,029	166,891	65,554	74,290	40,039	39%	18	105,539	160,005	194,410	30%
	8	134,635	171,251	154,011	9,549	17,702	6,824	6%	21	148,000	154,018	159,606	4%
	9	81,240	256,452	156,490	41,576	136,802	17,422	25%	25	130,289	141,557	181,935	16%
	10	1,024,690	1,804,351	1,286,021	344,414	487,895	58,124	27%	21	1,070,612	1,302,134	1,379,415	13%
Interest Rate	11	347,307	352,000	355,157	6,826	42,999	759	2%	33	352,900	351,564	354,448	0%
	12	323,419	426,807	381,491	37,228	59,107	16,991	10%	31	354,631	381,389	400,594	5%
	13	332,121	354,000	360,107	17,529	20,519	5,953	5%	34	338,841	368,255	373,100	5%
	14	131,269	177,275	156,865	9,059	11,175	1,851	6%	34	151,574	159,095	159,856	3%
	15	161,069	816,010	530,490	194,600	231,495	55,016	37%	14	498,341	561,255	597,925	9%
	16	95,522	292,000	216,758	57,630	61,222	41,503	27%	29	204,491	218,867	262,518	12%
	17	255,558	534,275	418,950	64,353	92,970	16,004	15%	23	397,813	400,227	452,552	6%
	18	210,005	531,981	407,046	76,436	109,237	26,574	19%	23	389,481	392,525	408,340	0%
	19	395,127	425,000	409,845	5,451	17,158	2,743	1%	34	407,051	410,404	412,454	1%
	20	261	44,001	24,226	5,333	25,069	72	23%	33	22,916	23,019	23,143	0%
	21	1,050,417	1,125,590	1,080,491	31,599	59,065	3,507	3%	33	1,071,319	1,074,142	1,079,308	0%
	22	481,611	722,220	601,411	54,181	136,180	20,435	9%	31	576,181	600,530	612,509	3%
	23	136,563	341,507	221,277	73,908	71,775	75,873	33%	34	143,630	240,750	281,393	32%
	24	71,095	299,470	200,332	62,940	70,065	56,702	31%	27	148,211	206,495	259,629	27%
	25	304,051	514,436	399,291	68,857	67,299	58,404	17%	31	325,530	424,084	405,272	10%
	26	167,247	417,832	367,417	46,624	121,205	7,497	13%	28	309,125	370,112	380,223	3%
	27	15,574	1,821,108	1,090,477	581,679	558,560	742,181	53%	33	540,627	777,929	1,642,938	50%
FX	28	1,180,619	1,274,065	1,216,244	20,375	150,807	7,140	2%	33	1,200,905	1,217,104	1,224,273	1%
	29	92,890	108,757	96,174	3,400	6,006	1,175	4%	27	96,414	97,528	99,166	1%
	30	966,095	1,223,461	1,106,642	90,826	96,082	55,220	8%	28	1,040,856	1,106,704	1,149,006	5%
	31	1,146,240	1,405,960	1,390,404	76,472	357,654	67,011	6%	28	1,371,872	1,415,806	1,462,369	3%
	32	1,252,028	1,726,679	1,495,664	98,960	154,020	67,675	6%	27	1,469,718	1,510,060	1,568,706	3%
Commodities	33	37,209	230,946	144,248	84,751	84,201	40,327	59%	14	90,155	183,094	224,047	50%
	34	889,130	1,190,802	960,284	91,624	121,545	40,141	10%	11	890,852	945,181	990,445	5%
	35	1,300,787	2,298,659	1,545,561	230,307	330,382	194,807	15%	13	1,602,871	1,710,914	2,218,913	16%
Credit Spread	36	26,515	38,569	35,077	3,469	7,367	1,200	10%	10	35,100	37,680	38,008	4%
	37	97,176	119,709	107,179	4,946	6,615	2,500	5%	15	104,868	106,161	109,665	2%
	38	75,006	101,660	84,284	5,667	11,644	2,261	7%	10	80,978	85,646	86,164	3%
	39	1,042	25,872	5,732	6,564	12,635	848	115%	15	2,546	4,654	5,448	40%
	40	186,652	225,548	200,488	9,715	20,172	4,769	5%	18	202,065	210,656	216,548	3%
	41	156,294	375,448	286,695	57,208	66,657	10,979	20%	20	266,664	277,064	306,324	7%
	42	84,025	222,780	152,655	56,825	62,791	58,465	37%	17	98,476	151,115	216,001	37%
	43	380,290	480,962	410,085	29,202	42,145	7,463	7%	20	401,415	407,065	457,601	4%
	44	110,891	179,868	131,227	25,228	20,686	4,504	19%	20	114,678	122,004	156,256	9%
	45	137,744	189,510	151,656	12,227	12,227	10,820	8%	20	140,060	146,676	168,527	8%
	46	70,115	206,765	146,011	50,629	57,556	48,556	35%	20	55,971	176,616	195,015	54%
	47	46,420	150,825	75,450	17,465	36,130	1,611	23%	15	73,405	74,790	76,273	2%
	48	70,540	279,919	171,632	65,054	60,071	54,606	38%	22	92,556	175,064	254,919	48%
	49	590	27,820	5,406	8,968	16,540	741	166%	15	856	1,790	5,420	73%
	50	41,474	82,101	56,177	13,363	20,861	2,246	25%	20	42,303	46,780	65,056	21%
	51	56,625	105,227	105,652	60,320	60,520	57,911	56%	17	46,722	76,756	160,106	57%
	52	55,466	500,068	196,196	78,201	110,275	52,464	57%	15	56,006	172,016	163,451	47%
	53	100,435	457,461	232,571	127,044	146,654	113,157	55%	15	108,047	266,080	340,908	52%
	54	692,020	965,126	767,040	48,652	94,606	8,054	6%	21	755,014	761,155	769,560	1%
	55	182,475	469,775	294,624	49,645	116,604	21,948	17%	19	257,852	300,656	316,829	8%
	56	551,590	761,940	616,627	75,972	157,747	25,447	12%	19	560,558	585,082	668,252	9%
CTP	57								7				
	58								7				
	59								7				
All-Non-CTP	60	13,657,546	17,855,440	15,481,595	1,369,666	4,410,506	1,057,568	9%	10	14,071,714	14,962,202	16,069,529	7%
Equity Cumulative	61	181,502	60,341,278	15,270,242	12,445,056	25,190,075	664,924	94%	17	10,951,866	11,157,101	11,251,661	4%
IR Cumulative	62	855,730	1,729,561	1,291,512	152,904	252,024	71,157	14%	27	1,217,551	1,297,550	1,353,863	6%
FX Cumulative	63	1,556,762	3,071,540	2,120,746	265,101	595,965	48,408	15%	27	2,064,575	2,177,252	2,206,000	3%
Commodity Cumulative	64	562,565	1,365,105	1,032,000	154,601	404,280	72,029	15%	10	911,400	994,785	1,005,567	9%
CS Cumulative	65	921,003	1,504,564	1,146,253	150,479	265,597	100,405	13%	15	1,075,608	1,106,295	1,215,612	6%
CTP Cumulative	66								2				

[1] STDev trunc. is the standard deviation computed excluding values below the 5th and above the 95th percentile

[2] Refers to the number of banks included in the computation of the statistics

** For the aggregated portfolios (60 to 66), banks that reported at least a missing portfolio OFR among the ones composing the aggregate are not included in the computation of the benchmarks for that particular aggregate portfolio

Figure 34: Difference in total number of submissions

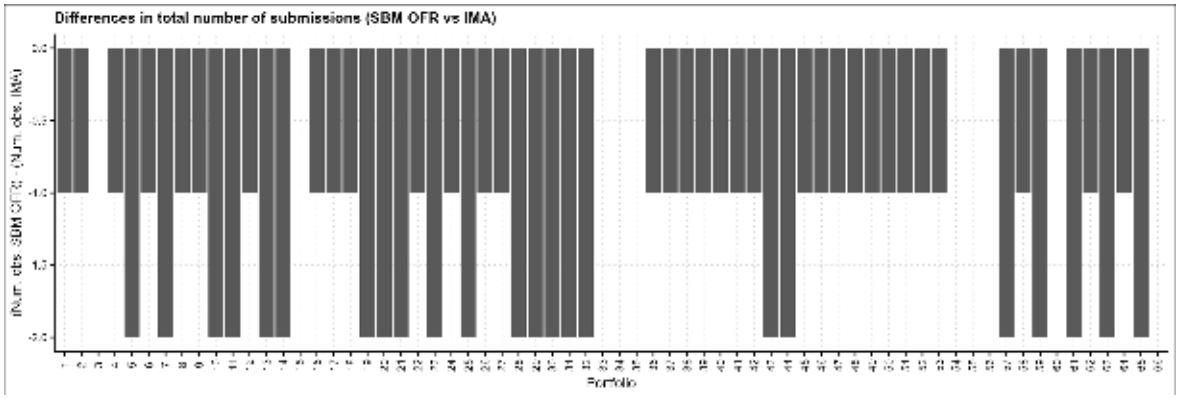
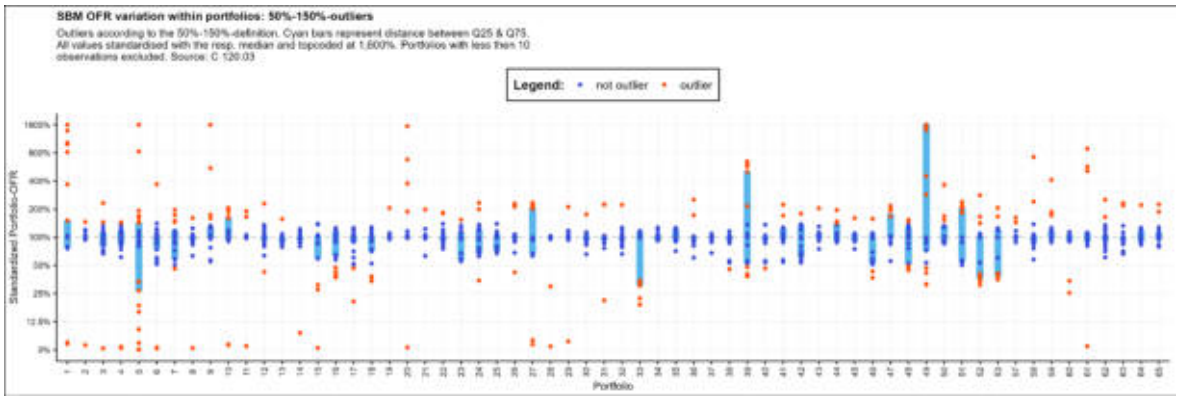


Figure 35: BM OFR variation within portfolios: 50%-150%-outliers

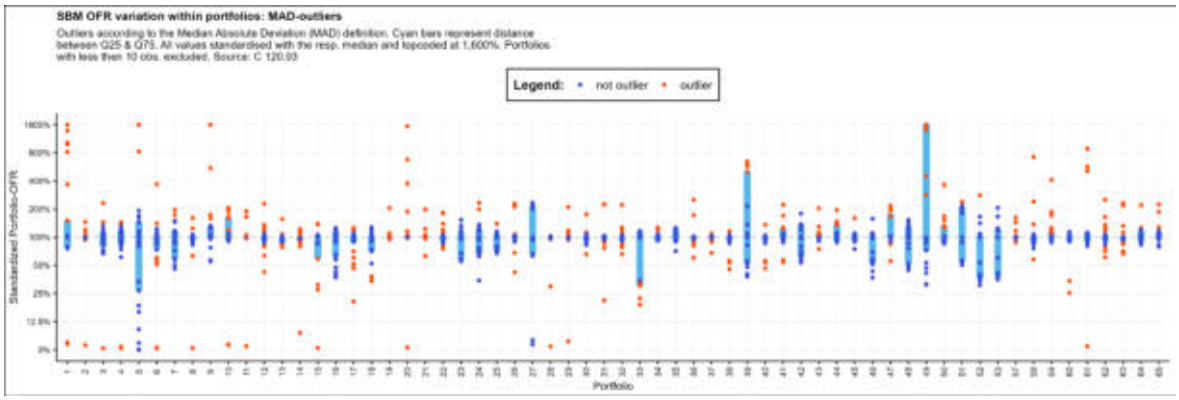


50%-150% outlier definition

• Outliers are defined as values outside the interval [0.5 · ex, 1.5 · ex].

• ex is the median of portfolio-OFRs.

Figure 36: SBM OFR variation within portfolios: MAD-outliers

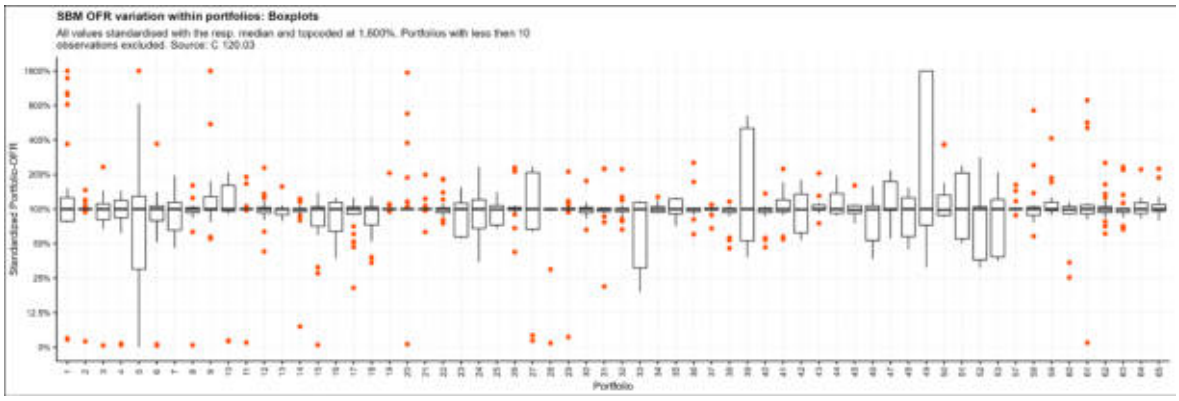


Median Absolute Deviation (MAD) outlier definition

• Outliers are defined as values outside the interval [ex − 2 ·MAD, ex + 2 ·MAD].

• MAD is the Median Absolute Deviation, i.e., MAD = median(|xi − ex|), where xi are the OFR observations of the respective portfolio and ex is their median.

Figure 37: SBM OFR variation within portfolios: Boxplots



Boxplots with 1.5 IQR outlier definition

• Outliers are defined as values outside the interval [Q25 − 1.5 · IQR,Q75 + 1.5 · IQR].

• IQR is the Interquartile Range, i.e., IQR = Q75 − Q25.

Figure 38: SBM OFR variation within EQ portfolio (EBA outliers' definition)

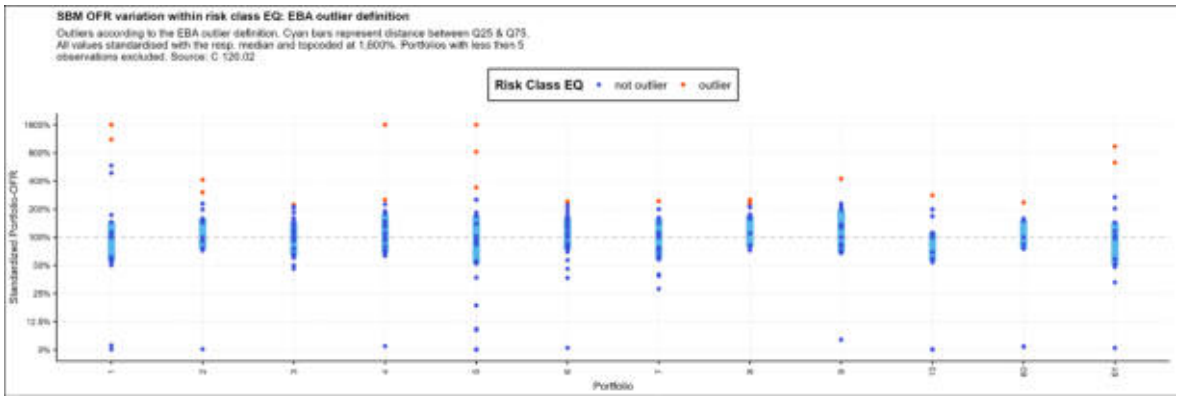


Figure 39: SBM OFR variation within FX portfolio (EBA outliers' definition)

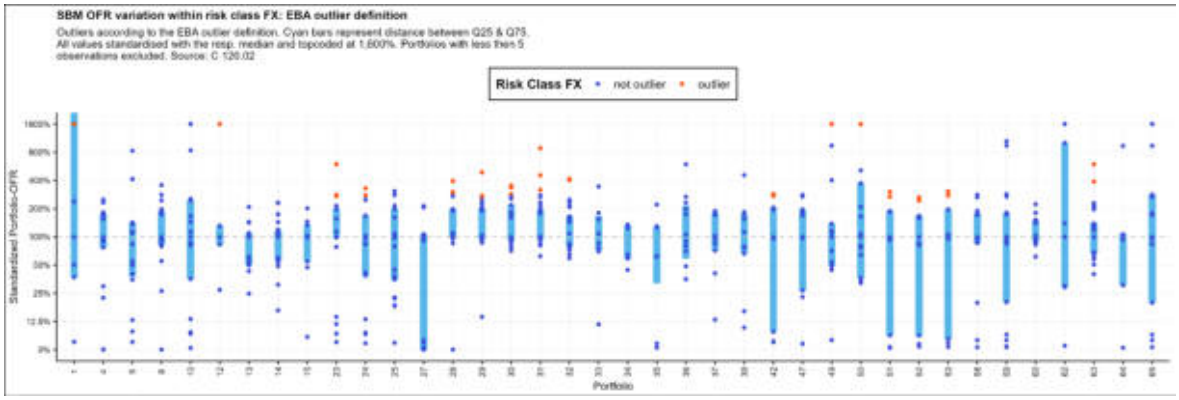


Figure 40: SBM OFR variation within GIRR portfolio (EBA outliers' definition)

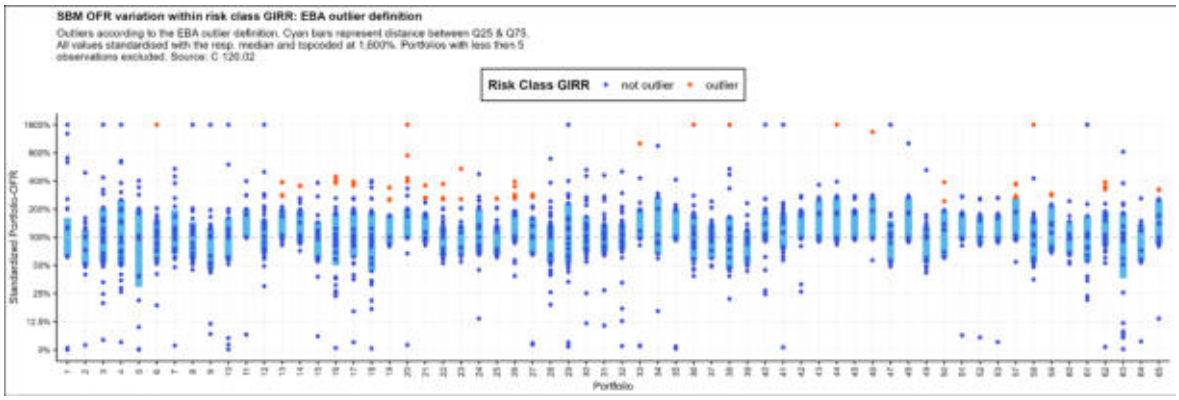


Figure 41: SBM OFR variation within CS portfolio (EBA outliers' definition)

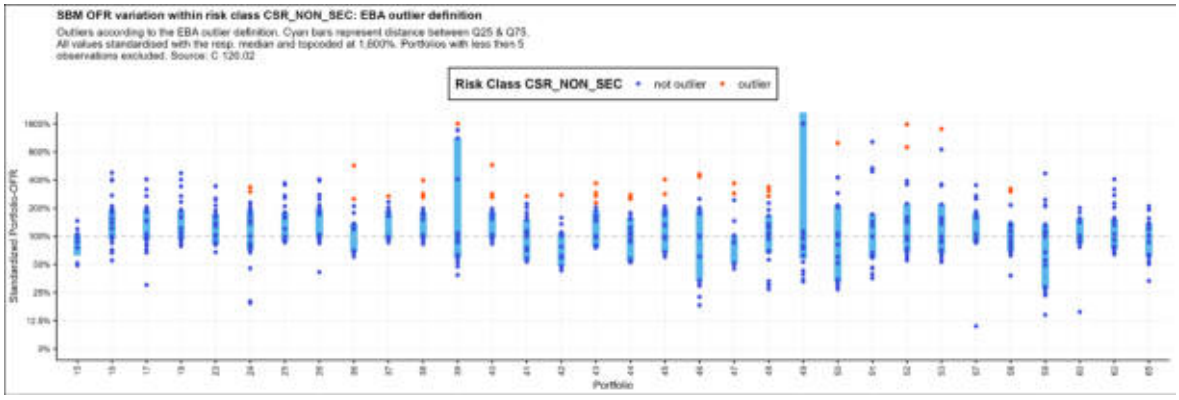


Figure 42: SBM OFR variation within CO portfolio (EBA outliers' definition)

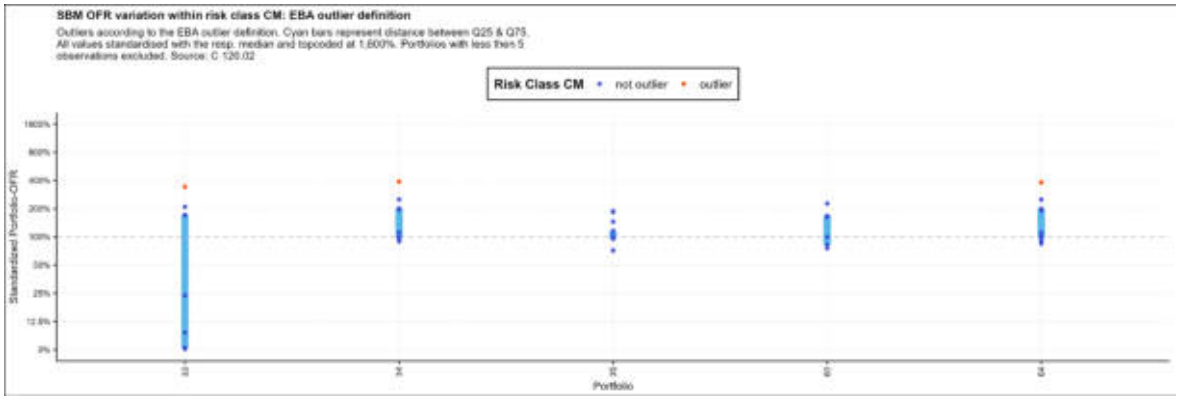


Figure 43: SBM OFR VaR and SVaR variation within portfolios: Interquartile Dispersion (IQD)

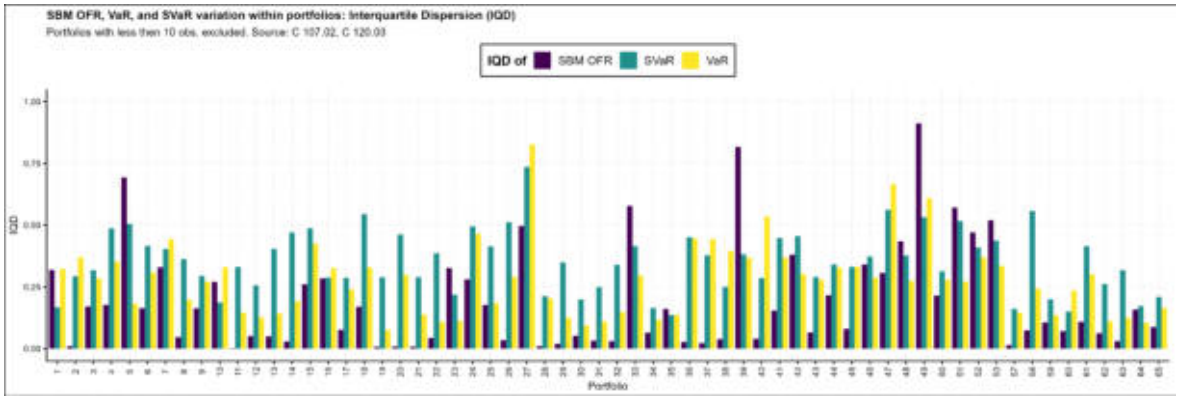


Figure 44: IQD-Ratio of SBM-OFR to VaR

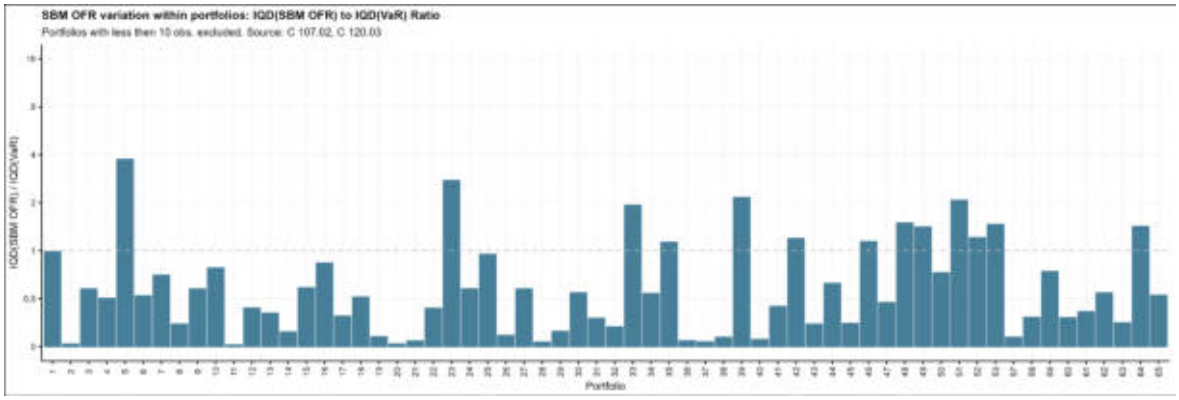


Figure 45: SBM OFR VaR and SVaR variation within EQ portfolios: Interquartile Dispersion (IQD)

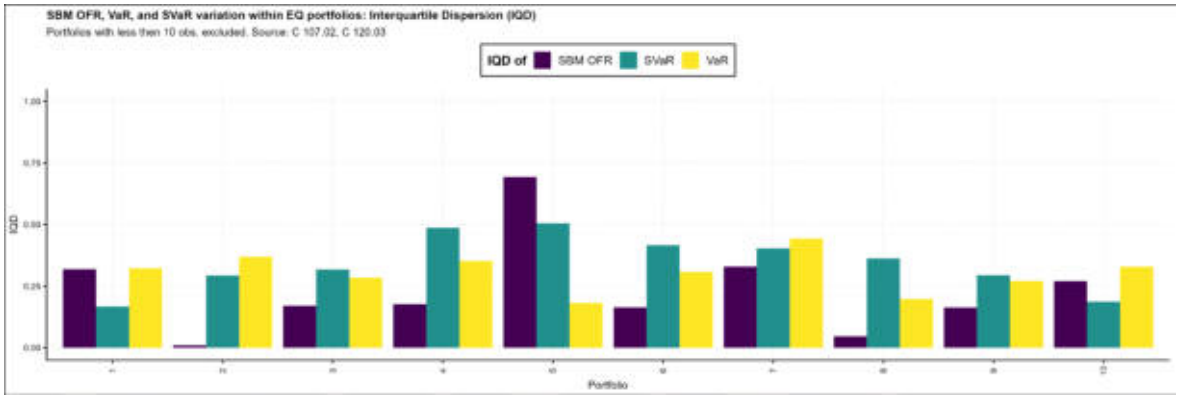


Figure 46: SBM OFR VaR and SVaR variation within IR portfolios: Interquartile Dispersion (IQD)

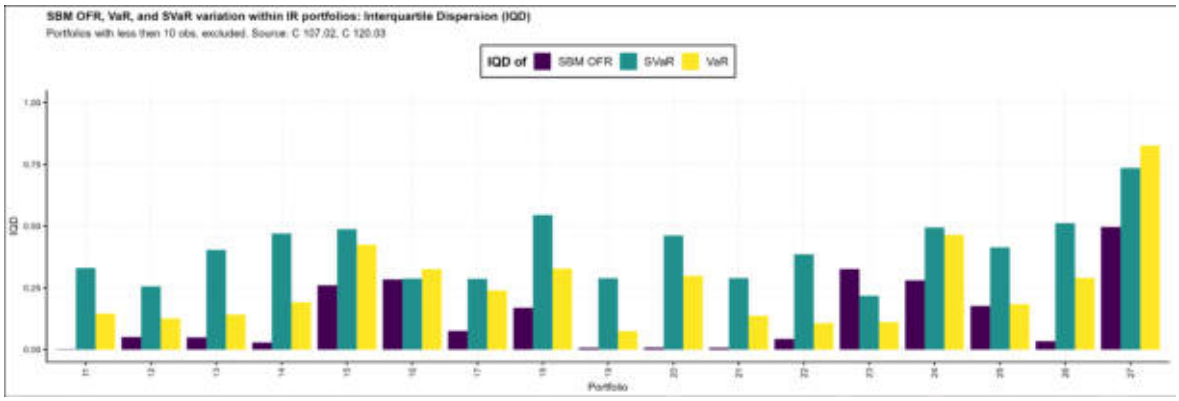


Figure 47: SBM OFR VaR and SVaR variation within FX portfolios: Interquartile Dispersion (IQD)

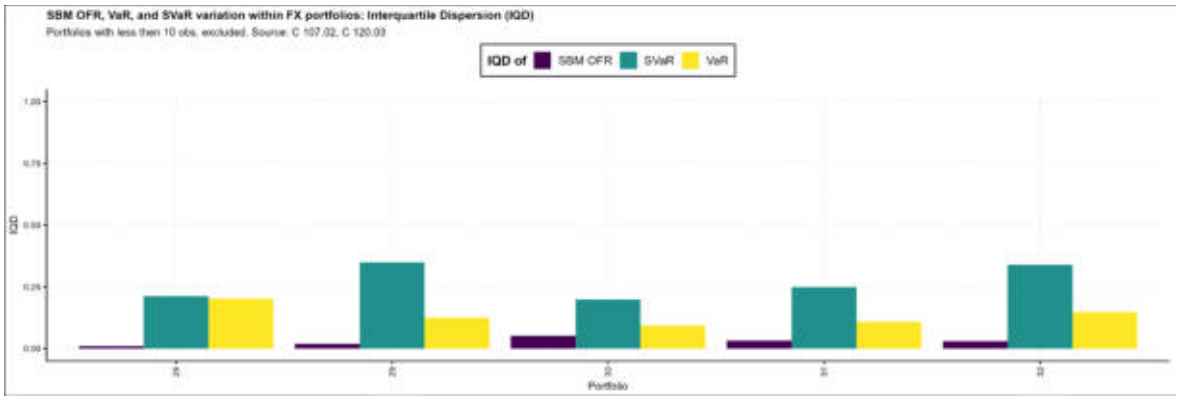


Figure 48: SBM OFR VaR and SVaR variation within CO portfolios: Interquartile Dispersion (IQD)

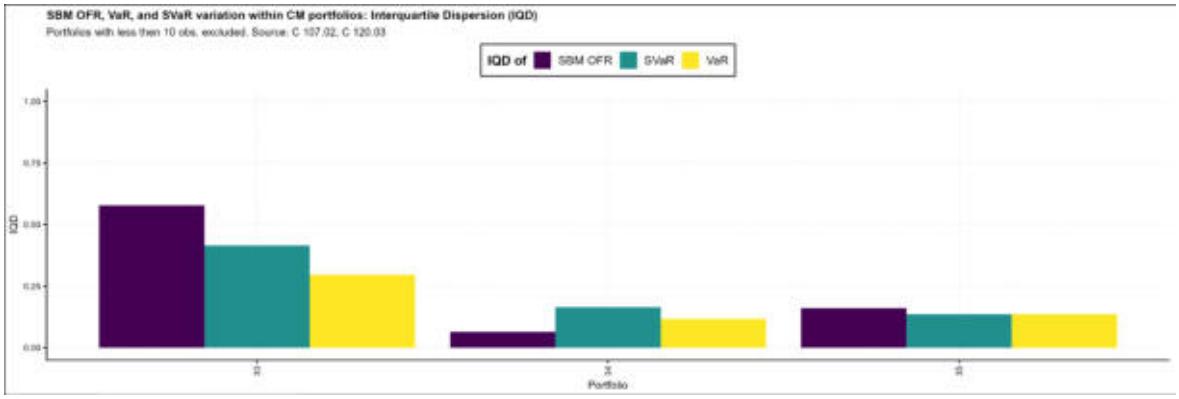


Figure 49: SBM OFR VaR and SVaR variation within CS portfolios: Interquartile Dispersion (IQD)

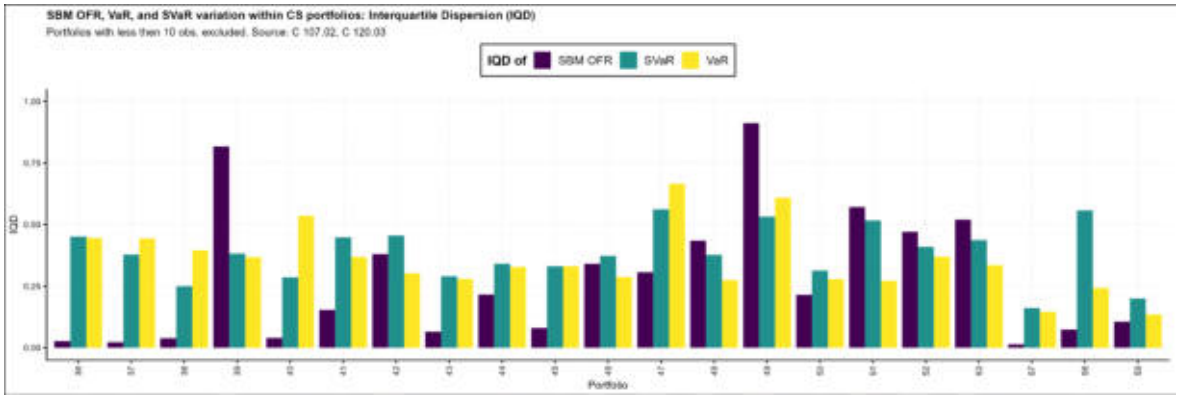


Figure 50: Frequency of SBM risk component within SBM risk classes relative to total number of submissions per portfolio

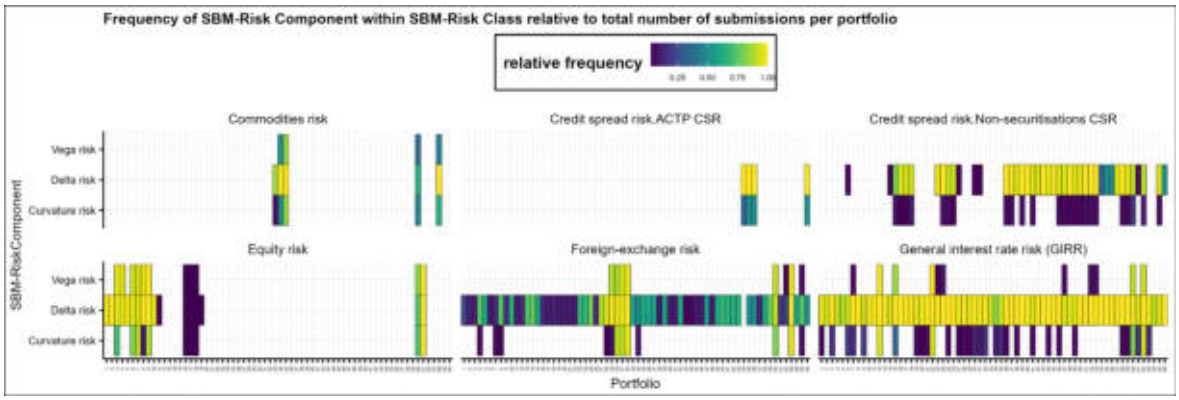
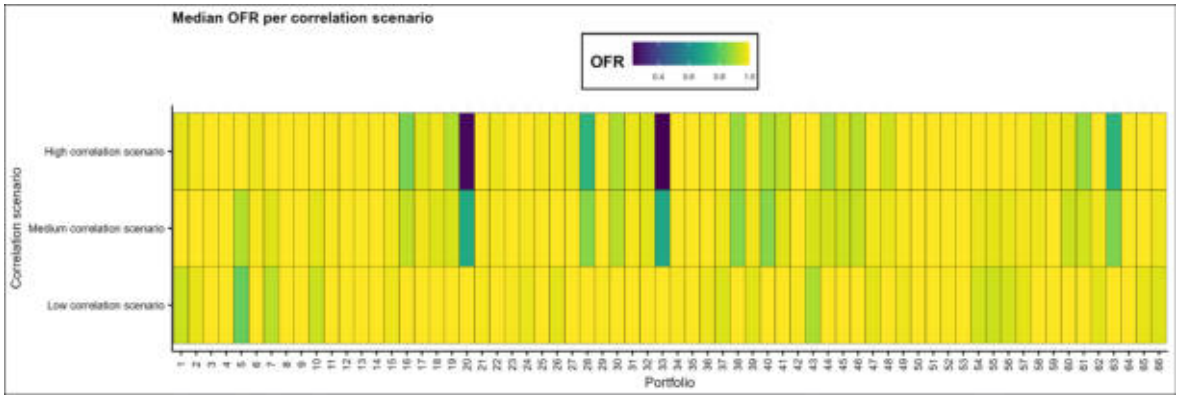


Figure 51: Median OFR per correlation scenario


Median OFR per correlation scenario
OFR
Correlation scenario
High correlation scenario
Medium correlation scenario
Low correlation scenario
Portfolio

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