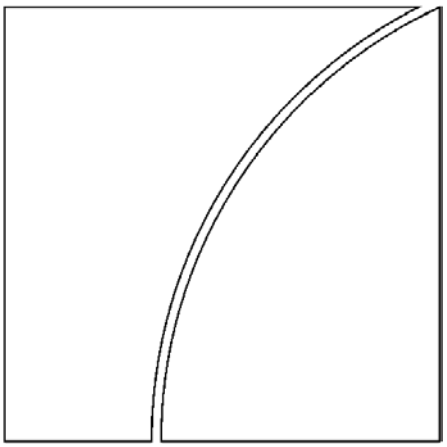
Basel Committee
on Banking Supervision



Regulatory consistency assessment programme (RCAP) – Analysis of risk-weighted assets for market risk

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Other contributors:

Mr Jason Au (Office of the Superintendent of Financial Institutions)
Ms Gaëlle Chalas (French Prudential Supervisory Authority)
Mr Giuseppe della Corte (Bank of Italy)
Mr Philippe Durand (French Prudential Supervisory Authority)
Mr Robert Molkentin (Bundesanstalt für Finanzdienstleistungsaufsicht)
Mr Dilip Patro (Office of the Comptroller of the Currency)
Mr Stefan Rehsmann (Deutsche Bundesbank)
Ms Kirstin Schloss (Office of the Comptroller of the Currency)

Abbreviations

ATM	At the money
CDS	Credit default swap
CRM	Comprehensive risk measure
CTP	Correlation trading portfolio
CVA	Credit valuation adjustment
EDTF	Enhanced Disclosure Task Force
FX	Foreign exchange
GAAP	Generally Accepted Accounting Principles
IFRS	International Financial Reporting Standards
IRC	Incremental risk charge
ITM	In the money
mRWA	Market risk–risk-weighted assets
OTC	Over the counter
OTM	Out of the money
PD	Probability of default
RWA	Risk-weighted assets
SEC	Securities and Exchange Commission
SVaR	Stressed Value-at-Risk
VaR	Value-at-risk

Introduction

Consistent implementation of the Basel framework is fundamental to raising the resilience of the global banking system, maintaining market confidence in regulatory ratios and providing a level playing field for internationally operating banks. Against this background, the Basel Committee has initiated the Regulatory Consistency Assessment Programme (RCAP). The assessment programme is conducted on three levels:

- Level 1: ensuring the timely adoption of Basel III;
- Level 2: ensuring regulatory consistency with Basel III; and
- Level 3: ensuring consistency of risk-weighted asset (RWA) outcomes.

This report presents the preliminary results of the Committee's analysis of RWA outcomes for banks' trading book assets (Level 3); a similar analysis is under way for the banking book. At the same time, the Committee is currently working on a fundamental review of the market risk framework.[1] One of the objectives of the fundamental review is to deliver a regulatory framework that can be implemented consistently by supervisors and which achieves comparable levels of capital across jurisdictions. The findings in this report will feed into the fundamental review and will inform the Committee about possible directions for further policy work.

Recently, a number of private sector studies using publicly available data have come to mixed conclusions on the variability of risk weighting for trading assets: some indicate that variability reflects genuine differences in business models and is commensurate to actual exposure to risk, while others suggest that variability is driven by other factors, such as different modelling approaches. In order to better understand the potential drivers of the variability in the measurement and disclosure of market risk – measured by RWAs based on the market risk framework (mRWAs) – the Committee undertook (i) an analysis of publicly available data of large globally active banks with significant trading operations and (ii) a hypothetical test portfolio exercise to examine what methodology choices are the greatest potential drivers behind the variability of internal market risk model outcomes.

Importantly, the objective of this work was not to judge the correctness of the modelling choices made by banks or to assess the compliance of supervisory approaches taken in different jurisdictions. Rather, the objective was to obtain a preliminary estimate of the potential for variation in mRWAs across banks and to highlight aspects of the Basel standards that contribute to this variation.

The review of public disclosures focused on a sample of 16 global banks with significant trading activity. The observation period includes the most recent changes related to Basel 2.5, which had taken effect in some jurisdictions but not all. Despite the asynchronous adoption of Basel 2.5, value was found in comparing mRWAs across pre- and post-Basel 2.5 jurisdictions because many of the issues carry over to the new regime, for example regarding the contribution to mRWAs from internal models and standardised approaches. For some banks, the disclosures required under Basel II (Pillar 3) factored into the analysis and provided a chance to evaluate the utility of such disclosures for this type of project.

[1] See the consultative document "Fundamental Review of the Trading Book" published by the Basel Committee in May 2012: www.bis.org/publ/bcbs219.pdf.

The focus of the hypothetical test portfolio exercise was to discover the design elements of internal models that have the greatest potential impact on the level of variability in mRWAs. Hypothetical test portfolios overcome the limitations encountered when attempting to use public and supervisory data on real portfolios to investigate potential sources of variation because they control for differences in portfolio composition. However, they show only potential and not realised variation in outcome. Moreover, in this case, the exercise focused on a series of simple long and short positions, designed to reveal the impact of model design features. To shed light on the effect of different sources of variation on more realistic portfolios, the Committee plans to conduct a further hypothetical test portfolio exercise later this year. This will include other, more complex, hypothetical test portfolios, with the aim of helping the Committee to deepen its analysis of the variation in risk measurement of trading books across banks.

Executive summary

Key findings of the analysis

The analysis of public reports on mRWAs, and the hypothetical test portfolio exercise, provided a clear picture of substantial variation in mRWAs across banks.

Based on public reports, the analysis shows considerable variation in average published mRWAs for trading assets and provides some indication that differences in the composition and size of trading positions are correlated with banks' average mRWAs. However, the quality of disclosures was found to be insufficient to allow investors and other interested parties to assess how much of the variation reflects differing levels of actual risk and how much is a result of other factors.

The hypothetical test portfolio exercise indicated that, using a hypothetical diversified portfolio consisting primarily of simple long and short positions, there can be a substantial difference between the bank reporting the lowest mRWAs and the bank reporting the highest. This outcome is attributed to a range of factors:

- A sizeable portion of the variation is due to supervisory decisions applied either to all banks in a jurisdiction, or to individual banks. An example of the former would be policy decisions to restrict modelling options (eg to disallow any diversification benefit between types of risk). An example of the latter would be the application of supervisory multipliers: around one-quarter of the total variation in the hypothetical diversified portfolio could be attributed to this single factor. These supervisory actions typically result in higher capital requirements than would otherwise be the case but can also increase the variation in mRWA between banks, particularly across jurisdictions. These supervisory actions, particularly at an individual bank level, are often not disclosed.
- Another important source of variation is due to modelling choices made by banks. The exercise found that a small number of key modelling choices are the main drivers of the remaining model-driven variability.

It is important pointing out that the Basel standards deliberately allow banks and supervisors some flexibility in measuring risks in order to accommodate for differences in risk appetite and local practices, but with the goal of also providing greater accuracy. Some variation in mRWA should therefore be expected. In addition, from a financial stability perspective, it is desirable to have some diversity in risk management practices so as to avoid that all banks act in a similar way, which potentially could create additional instability. At the same time, excessive variation in risk measurement is undesirable. This study did not seek to determine what the optimal level of variation should be, but the preliminary findings highlight potential policy options that can be considered if the Committee wished to narrow the potential for variation in the future. These policy options complement important policy initiatives that are already under way, including work on disclosures – notably as recommended by the Enhanced Disclosure Task Force (EDTF) – and the fundamental review of the trading book.

Further detail of the above findings and the potential policy options are set out in the report.

Analysis of publicly available data

The analysis of publicly available data shows significant differences across individual banks in the size of regulatory mRWAs relative to trading assets. Across the banks in the sample,[2] the average risk weighting of trading assets varies from around 10% to nearly 80%, with most banks between 15% and 45%. Such differences could be justified, provided that they are driven by differences in actual risk taking and business models. In this regard, the public data provides some indication that differences in the composition and size of trading positions are correlated with mRWAs. For example, banks with a greater proportion of illiquid trading assets, including holdings of distressed debt and illiquid equity, tend to report slightly higher average risk weighting of their trading assets. However, this correlation does not fully explain variations across banks and the observations are based on only a small subset of banks. So, while there is some evidence that variations in mRWAs can be explained by actual risk taking, there are indications that a considerable part of the variation cannot be explained by that factor. Instead, the analysis suggests that other factors may also be driving the observed variations across banks and jurisdictions:

1. Differences in supervisory approaches and requirements, contributing to differences in the levels of reliance on the internal models approach, as well as an asynchronous adoption of Basel 2.5. For example, during the period under review, nine out of 16 banks in the sample were subject to Basel 2.5. The remaining seven banks became subject to Basel 2.5 standards on 1 January 2013.

2. Differences in methodologies and modelling choices for market risk regulatory capital calculations. For example, the current Basel framework allows banks to choose different historical data periods for value-at-risk (VaR) or use different methods to arrive at a regulatory capital figure.

Analysing public data requires taking into account differences in accounting regimes to allow for appropriate comparison across jurisdictions. For example, an important difference concerns the netting of derivatives. Netting can lead to material differences in the way trading assets are measured and accounting regimes differ regarding the degree of netting permitted. To the extent possible, the public data used in this report is adjusted for the differences in netting across accounting regimes. Other accounting differences that may play a role, such as the rules for classifying assets into the accounting trading book, could not be corrected for and some of the variation in mRWAs relative to trading assets may stem from these differences.

Looking more closely at the findings, and in particular drivers of variation not related to risk, the analysis indicates a significant disparity in reliance on internal models. The portion of mRWAs that is calculated with internal models can range from approximately 10% to nearly 80% for the sample of banks across jurisdictions. Before the implementation of Basel 2.5, the greater use of internal models would tend to result in lower average mRWAs due to the recognition of diversification and netting benefits. However, with the implementation of Basel 2.5 this relationship may be reversing as banks with internal models are now required to capitalise for sVaR (stressed value-at-risk), IRC (incremental risk charge) and CRM

[2] The sample of banks used for the analysis of public data and the hypothetical portfolio exercise is not identical, although there is some overlap.

(comprehensive risk measure) under the new regime, resulting in higher observed levels of modelled capital charges in comparison to prior periods.[3]

Other factors that could explain variation in mRWAs include regulatory and internal capital add-ons and the use of regulatory multipliers higher than the minimum of 3, which are applied at the discretion of supervisors as a general incentive to improve models and risk management systems.[4] This information is, however, not transparent in public disclosures and its impact could not be examined using publicly available data. Instead, the hypothetical test portfolio exercise allowed examination of the importance of the regulatory multiplier in more detail, the results of which are presented in Chapter 2.

As a second step, the Committee considered using supervisory data, but it was found that the structure and content of periodic supervisory financial reports outlining the condition and income of financial institutions is disparate across jurisdictions. This disparity resulted in deeming the utility of public supervisory data as relatively low when attempting to perform a cross-jurisdictional comparison of mRWAs and the underlying drivers.

From the beginning of the analysis, it was understood that public disclosures have historically not provided stakeholders with enough information to appropriately assess and compare mRWAs and regulatory capital across banks and jurisdictions. The observations in this report corroborate that finding, as the full scope of mRWA dispersion across banks could not be fully explained by publicly available information. While some banks provide more detailed disclosure than others, in general public disclosures did not provide sufficiently granular information to establish conclusively what is driving the differences.

Hypothetical test portfolio exercise

Due to the limitations encountered when attempting to use public and supervisory data to investigate variability of mRWAs, a hypothetical test portfolio exercise was undertaken to investigate the level of variability of mRWAs stemming from internal models. A total of 15 internationally active banks with significant trading assets participated in this exercise.[5] Following the receipt of the results, nine of the participating banks received an on-site visit by an international team of supervisors. These visits allowed the Committee to better understand the modelling choices and other factors that might underlie the observed differences in results for each portfolio.

The modelling of individual positions exhibited wide variations in some cases, but this reduced as portfolios became more diversified (and more realistic). This suggests the wide variation for narrowly-focused portfolios did not compound as additional positions were added, but rather was reduced as idiosyncratic issues became less prominent. Furthermore,

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[3] IRC and CRM models were introduced in part in order to reduce arbitrage incentives between the trading book and the banking book. They are generally of a more complex nature than the traditional VaR models because they combine elements from the regulatory banking book and trading book framework.

[4] For VaR and sVaR models, banks are required to multiply the output of the model by a number which is a minimum of 3 but can be higher at the discretion of the bank's supervisor. This multiplied output is then used as the basis of the regulatory capital requirement for market risk.

[5] Importantly, the sample of banks that participated in the hypothetical test portfolio exercise is not the same as that used for the survey of publicly available data. Therefore, no attempt should be made to draw conclusions about the identity of the banks that participated in the hypothetical portfolio exercise.

from a regulatory capital perspective, the result for the aggregate portfolio is the most important, as it is at the this level that regulatory capital requirements are generally determined.

The high-level results of the exercise highlight two main sources of differences in mRWAs: (i) differences in the model choices made by banks, and (ii) differences in supervisory practices, including the use of supervisory multipliers. These sources of differences were also indicated in the analysis of public data. In the exercise for a hypothetical diversified portfolio there was a substantial difference between the bank reporting the lowest mRWAs and that reporting the highest. Of this, around one-quarter was due to supervisory multiplier alone:

- *Variation caused by banks' model choices:* The current market risk requirements allow flexibility for banks to make a variety of choices when developing internal models. The hypothetical test portfolio exercise, and subsequent on-site visits, allowed the group to identify the most important model choices that drive variation in mRWAs. One important observation is that there is generally more variability in mRWAs from the new, more complex, IRC models than VaR and sVaR models. Supervisors may also influence outcomes here by determining, within their national frameworks, the extent of modelling options available to banks.
- *Variation caused by differences in supervisory multipliers:* When calculating mRWAs from VaR and sVaR models, the results of market risk internal models are converted to a capital requirement by applying a multiplier. The multiplier is at least 3, but can be higher at the supervisor's discretion. In the exercise, significant variation was observed in the multipliers to be applied to the output of banks' models and this variation has a direct impact on variability of reported market risk capital requirements. The multipliers for the participating banks in the exercise showed a considerable range, from 3 to 5.5.

Key modelling choices that drive variability

The test portfolio exercise provided clear evidence that differences in modelling choices can be very important drivers of variability across banks. The group was able to identify the most important modelling choices that drive variation in outcomes:

- For VaR and sVaR models:
    1. Length of data period for calibrating and the weighting scheme applied;
    2. Aggregation approach across asset classes and across specific and general risk;
    3. The choice of whether to scale a one-day risk estimate to a 10-day measure or estimate risk over 10 days directly; and
    4. Approach to choosing stress period (for sVaR) and the resulting stress period calibration.
- For IRC models:
    1. The overall modelling approach (the use of spread-based models or transition matrix-based models);
    2. Calibration of the transition matrix and the initial credit rating assigned to positions; and

3. Correlation assumptions across obligors.

In addition to highlighting the level of variation of mRWAs from internal models, and the most important modelling choices driving the variability, the exercise highlighted a direct relationship between complexity of risk metric/product and the associated variability of the metric across banks. The relatively more complex IRC models in the exercise displayed much more variability than VaR and sVaR models, and portfolios containing less simple products also typically showed more variability in results. This suggests considering a second phase of analysis to explore specific methodological issues related to more complex products and CRM models.

Whilst the exercise highlighted that some modelling choices are more conservative than others, in most cases this result is due to the nature of the portfolios tested (hypothetical portfolios made of simple long and short positions) and each choice could be aggressive or conservative for different portfolios and market conditions. For example, a short dataset will tend to produce a more conservative outcome in periods of high volatility, but a less conservative outcome during periods of very low volatility. The important result is the highlighting of the areas of flexibility in rules that drive variation rather than which choice is the most prudent.

Potential policy issues for future consideration

As noted above, the analysis shows there is a considerable variation in average mRWAs for trading assets and that only a part of the differences can be explained by variation in actual risk taking or business models. While some amount of variation in mRWAs is expected in any regime based on internal models and views may differ as to what is an acceptable amount of variation–to develop a "variation benchmark" would require further analysis which was beyond the scope of this report–the findings in this report suggest a direction for future policy work that could narrow down the potential variation in outcomes.

The analysis highlights three potential types of policy options that could be considered in the future: (i) improvement of public disclosure and regulatory data collection to aid the understanding of mRWAs; (ii) narrowing down the modelling choices for banks; and (iii) a further harmonisation of supervisory practices with regard to model approvals (to reduce the level of variation in mRWAs). A second phase of analysis may result in exploring further potential types of policy options to address specific methodological issues related to more complex products and CRM models.

At this stage, the following suggestions for policy options should not be seen as comprehensive, nor as pre-empting any specific policy measures, but rather as potential directions for future work to be considered by the relevant Basel Committee working groups. Furthermore, the potential policy measures should not be seen as mutually exclusive: some combination of the three could be appropriate going forward. It should also be noted that there are important trade-offs between model harmonisation and the use test rule. Strict harmonisation of internal models may make it more difficult to implement the "use test" rule, ie a requirement for banks to not just develop models to satisfy regulators, but also to use those models in their internal risk management. Furthermore, models harmonisation may have pro-cyclical effects stemming from a high correlation between banks' capital adequacy requirements.

Improving public disclosure

Regarding public disclosures, the potential policy options should be seen in the broader context of the regulatory and industry work on public disclosures, notably by the Committee's Working Group on Disclosure and the Enhanced Disclosure Task Force (EDTF), which has recently published its report on public disclosure by banks.[6] The findings in this analysis support the recommendations and proposals in the EDTF report to enhance the public disclosure of regulatory RWAs for market risk and promote further work on Pillar 3 disclosure requirements for market risk.

Based on the results of this analysis, disclosures could be improved by including more granular information regarding the components of mRWAs, the VaR and other market risk models used for regulatory capital purposes. When performing the cross jurisdictional comparison of mRWAs the Committee found in general that disclosures could be clearer on the drivers of market risk, be outlined more consistently across jurisdictions, be provided on a more timely and consistent basis, and provide more relevant information to their users that is based on information presented to management, risk committees and boards of directors for decision making purposes. Suggestions for improving the quality, content and consistency of disclosures related to mRWAs that could be considered include the following:

1. Common standards for the frequency of reporting – less than half of the banks in the sample reported information on a quarterly basis;

2. Common standards for explanations of the drivers of the change in mRWAs from period to period;

3. A more granular and consistent segmentation of the components of mRWAs to facilitate a deeper recognition of a bank's market risks;

4. Disclosure of key modelling choices, particularly those highlighted by the hypothetical test portfolio exercise as driving the greatest variation in the results of models; and

5. Disclosure of key differences in models used for internal risk management and those used for regulatory capital calculations. It was found that banks seldom directly report the 10-day 99% VaR used in regulatory capital calculations.

These suggestions are closely in line with the earlier EDTF's recommendations. Another potential area for future policy work concerns harmonisation and/or consistency of the content and accessibility of supervisory and regulatory reports across jurisdictions.

Narrowing down banks' modelling choices

Future policy work that might consider narrowing down the modelling choices for banks, and therefore reduce variability, needs to consider the broader context of the fundamental review of the trading book, which is currently being undertaken by the Basel Committee's Trading

[6] See the report entitled "Enhancing the Risk Disclosure of Banks" by the Enhanced Disclosure Task Force, as published on 29 October 2012: www.financialstabilityboard.org/publications/r_121029.pdf, and in particular the recommendations regarding the disclosure of market risk in Figure 4 and Figure 7 in the report.

Book Group.[7] This work reflects the Committee's increased focus on achieving a regulatory framework that can be implemented consistently by supervisors and which achieves comparable levels of capital across jurisdictions.

While there may be practical limits to narrowing the modelling choices for banks under an internal models-based approach, the list of modelling choices that were the strongest potential drivers of variability, set out above, provides areas for consideration to directly reduce variability, for example:

- Closely defining the modelling approach for the IRC model, including the assumptions used for migration and default probabilities and the correlation structure;
- Reducing the flexibility in choosing the length of historical data to calibrate VaR models; and
- Defining a single scaling approach to obtain a 10-day VaR and sVaR measure.

These areas can be considered in addition to policy options which already form part of the fundamental review of the trading book, namely:

- Strengthening the relationship between standardised approaches and internal models to be able to benchmark internal model results;
- Moving from separate VaR and sVaR based measures to a single Expected Shortfall based measure; and
- Enhancing regulatory oversight through a more granular approval process of internal models.

Further harmonising supervisory practices

Another, potentially complementary, approach to address the variability across model outcomes indirectly would be to develop additional supervisory guidance for upholding consistent model standards and approving the use of models, including the use of supervisory multipliers. Other more structural changes could include creating an international team that actively monitors international modelling standards. In this regard, increased supervisory scrutiny of models could address some of the drivers of variation that have been identified. At the same time, it should be noted that the Basel framework in certain areas allows for supervisory discretion to appropriately reflect domestic circumstances.

[7] See the consultative document "Fundamental review of the Trading Book" published by the Basel Committee in May 2012: www.bis.org/publ/bcbs219.pdf.

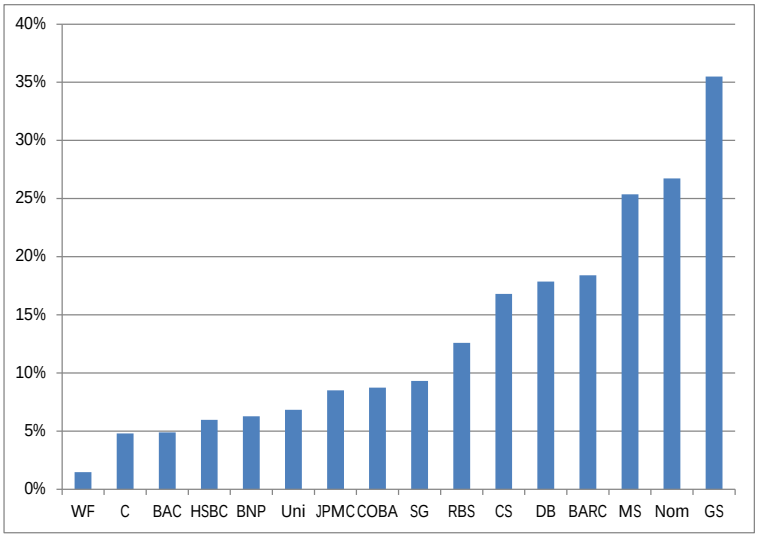
Chapter 1: Analysis of observed variation for mRWAs from public disclosures

This chapter summarises the investigation into the variation in mRWAs based on public disclosures for a sample of large, internationally active banks across a number of jurisdictions.[8] The review of publicly available quantitative data from annual and quarterly financial reports is first described, then the qualitative information available in public reports about regulatory market risk measures is discussed in more detail.

1.1 Variation in mRWA across banks

The following figures examine the relationship between mRWAs relative to trading assets, total assets, and total RWAs at the end of 2011.[9] The figures provide an overview of the variation that exists in reported mRWAs when reviewing public disclosures.[10]

Figure 1: RWA for market risk as a percentage of total RWA (end-2011 data)



8 The sample of banks includes Bank of America (BAC), Barclays (BARC), BNP Paribas (BNP), Citigroup (C), Commerzbank (COBA), Credit Suisse (CS), Deutsche Bank (DB), Goldman Sachs (GS), HSBC (HSBC), JP Morgan (JPMC), Morgan Stanley (MS), Nomura (Nom), Royal Bank of Scotland (RBS), Société Générale (SG), Wells Fargo (WF), UniCredit (Uni). All public data used within this report was reviewed by the respective national supervisory authorities.

9 Across the sample of banks deductions may not be fully taken into account when showing ratios of RWAs over trading assets and total assets. This may cause the ratios to be underestimated. A review of all financial disclosures indicated that deductions are generally not reported clearly enough to determine: a) their full amount, and b) if they are related to credit or market risk. For some banks deductions can be material. Deductions will also be inconsistent for banks under different Basel regimes. In this regard, the introduction of Basel III will correct for these inconsistencies.

10 The group also pursued the option of analysing revenue to risk metrics across jurisdictions, however, the cross jurisdictional disparity in the reporting of the key components of market risk revenues (mark-to-market gains and losses, net interest payments, customer fees and bid-ask spread) in publicly available data was too wide to provide for meaningful analysis about drivers of variability in the measuring and reporting of mRWAs.

Figure 1 shows the share of RWAs for market risk in overall RWAs. For the banks at the left hand side of the figure, mRWAs represent a small part of total RWAs, 10% or less.[11] These banks are typically classified as retail banks or universal banks and are predominately active in traditional banking activities such as mortgage lending. The limited contribution of mRWAs holds true even after the introduction of Basel 2.5 which increased the level of mRWAs by an estimated factor of two to three. As of end-2011, nine of the 16 banks in the sample reported results based on Basel 2.5 standards.[12] At the right hand side of the figure are banks that predominantly engage in trading and investment banking activities instead of more traditional banking activities such as retail lending.

Figure 2: RWA for market risk as a percentage of trading assets (end-2011 data)

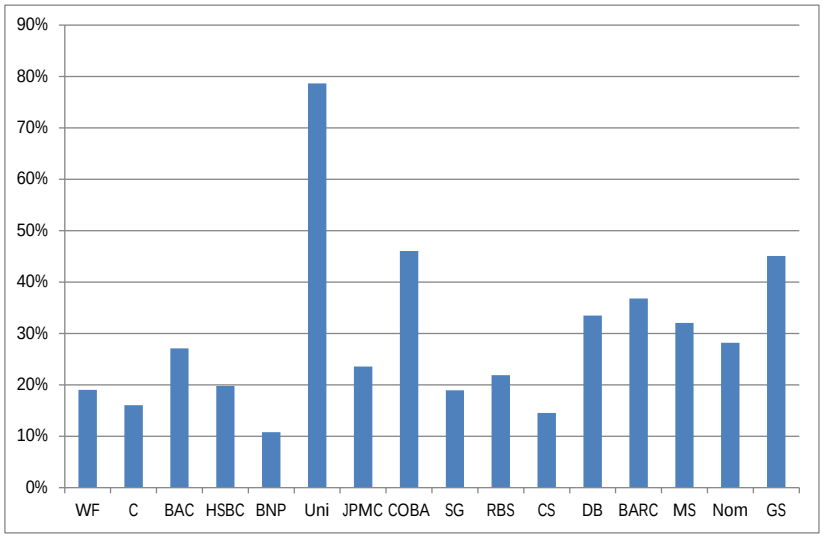


Figure 2 presents the banks in the same order as Figure 1 and shows the share of mRWAs as percentage of trading assets. This ratio can be thought of as an indicative average risk weight for trading assets. The measurement of trading assets has been adjusted to the extent possible for differences in accounting regimes across jurisdictions that arise due to differences in netting.[13]

Figure 2 shows considerable variation across the banks. The ratio of mRWAs to trading assets ranges from around 10% to 80%, with most banks between 15% and 45%. This is likely to be driven by the following factors:

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[11] The risk weighted assets of these banks are typically dominated by credit risk in the banking book. Another working group – the Standards Implementation Group Banking Book (SIG BB) – is looking into the variability in the measurement of banking book RWAs.

[12] Switzerland implemented Basel 2.5 on 1 January 2011. Europe and Japan followed on 31 December 2011. In the United States Basel 2.5 is implemented on 1 January 2013. For more information about the impact of Basel 2.5 on RWAs, see "Results of the Basel III monitoring exercise as of 31 December 2011" published by the Basel Committee on its website in September 2012.

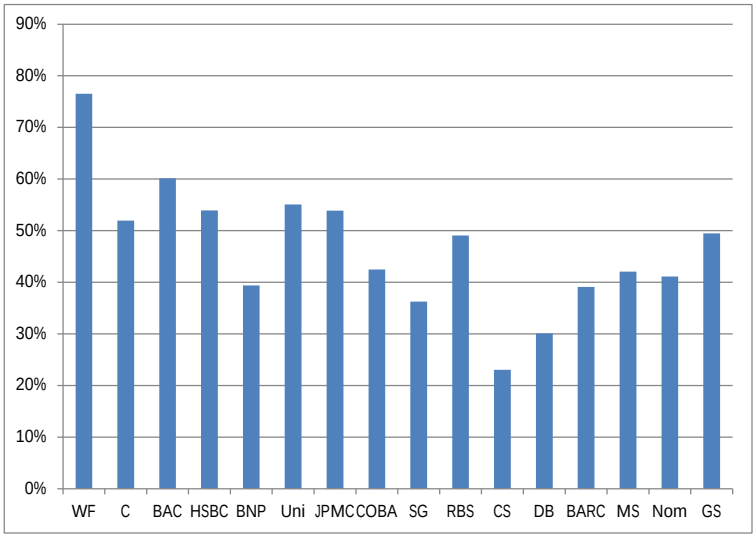
[13] For this analysis the denominator of trading assets is defined as the sum of cash assets in the trading account and net value of trading derivatives with positive value, leaving aside trading derivatives with negative value. Based on the data available, 90% netting was used as an approximation to put trading assets, including derivatives, on a comparable footing for banks that do not report netting on an economic basis.

- *Business model*: investment banks that take open trading positions and principal risk as market makers would be expected to report a higher ratio of mRWAs to trading assets compared to banks that do not engage in this activity as a core part of their business model. Figure 2 suggests that there may be a weak relationship between the business model of the banks and the ratio of mRWAs to trading assets, with retail banks and universal banks on average reporting slightly lower mRWAs than investment banks. However, significant variation cannot be explained by business model.
- *The composition of trading assets:* banks investing in more inherently risky trading assets would be expected to report a higher ratio of mRWAs to trading assets than banks investing in low risk trading assets. At the same time, however, banks investing in risky assets can hedge the associated risks so that a low mRWAs would result nevertheless. *A priori* it is not clear if composition of trading assets plays an important role in the level of mRWAs that banks report.
- *Market risk methodology and modelling choices*: the fraction of mRWAs to trading assets will also depend on the way banks calculate the RWAs for market risk. Banks that rely more heavily on the standardised approaches of the Basel framework would be expected to report relatively higher mRWAs as a ratio of trading assets, because the less risk sensitive standardised approaches tend to be more conservative than the internal model approaches.
- *Supervisory approaches*: differences in supervisory approaches across jurisdictions may explain differences in RWAs for market risk, the application of RWA add-ons for certain trading positions being an example. Also, supervisors may apply different regulatory multipliers, which can contribute to differences across banks. Another example would be differences in the adoption of Basel 2.5, the timing of which varies across jurisdictions.

These factors are examined in greater detail in the next section.

The relatively low share of mRWAs in total RWAs in some banks as indicated in Figure 1 implies that variation in mRWAs may not be an important explanatory factor behind the observed variance in total RWAs across banks. This is illustrated in Figure 3 below, which depicts the ratio between total RWAs to total assets. The retail and universal banks seem to have a slightly higher average RWAs per asset than the investment banks, although the relation is not very strong. This supports the notion that variation in mRWAs across banks is unlikely to help explain variation in total RWAs across banks.

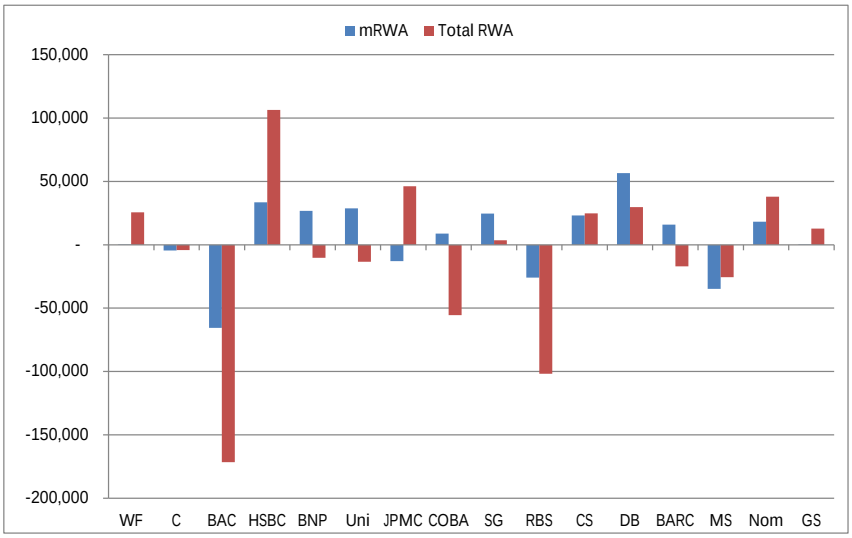
Figure 3: Total RWAs as a percentage of total assets (end-2011 data)



1.2 Variation in mRWA over time

While for some banks mRWAs may only be a relatively small part of total RWAs, movements in mRWAs can play an important role in explaining changes in total RWAs over time. In some cases movements in mRWAs can account for around 50% of the total change in overall RWAs. Figure 4 illustrates the changes in mRWAs and total RWAs for the banks in the sample during 2011.

Figure 4: Change in mRWA and total RWA in 2011 (USD million)



A number of reasons for changes in mRWAs were cited by banks in public disclosures:

- Changes in positions: eg due to increased sovereign risk, economic conditions, and the sale of legacy positions from the early financial crisis period;

- Changes in model inputs for a given methodology: eg stressed market data naturally falling out of the historical window used to calibrate internal models;
- Changes in model methodology: eg placing different weighting schemes on historical data, improving time series used for model calibration; and
- Regulatory changes: eg the introduction of Basel 2.5 in some jurisdictions, or for those jurisdictions yet to implement Basel 2.5 sale of positions in anticipation of the impact of Basel 2.5 on mRWAs.

1.3 Disclosure of factors driving mRWA

In order to understand the variability in mRWAs across jurisdictions in more detail, consistent disclosure by banks of the underlying components of mRWAs is important. Analysis of public reports showed that disclosure was incomplete in a number of areas. For example, a key component of mRWAs of the banks in the sample is the regulatory measure of Value-at-Risk (VaR) calculated at a 99% quantile and 10-day holding period. Changes in regulatory VaR drive changes and differences in mRWAs. The following summarises the disclosure by banks regarding VaR:

In financial reports:

- Five banks report 1-day 95% VaR, the one used for business risk management, some with both trading VaR and another measure including economic market risk in non-trading positions or otherwise positions not included in regulatory VaR, for example, including the market risk of Credit Valuation Adjustments (CVA) to the value of derivatives contracts; and
- Twelve banks disclose information on a 1-day 99% VaR, nominally the regulatory VaR standard in percentile, but sometimes indicated as a management VaR.

In Pillar 3 reports:

- Six banks report values for regulatory VaR at a 1-day 99% standard in their annual required filings, different from the one that determines the VaR-based capital measure in terms of the horizon (many of those banks do not take the option of reporting on an intra-annual basis);
- One bank reported a 10-day 99% regulatory VaR for both dates; and
- Five banks are not compelled by current regulations to file Pillar 3 reports and they do not explicitly report the VaR that determines mRWAs. Some disclose in financial reports a 1-day 99% VaR that may be the same as their regulatory VaR.

The overview shows that banks usually do not report directly the regulatory 10-day 99% VaR used in regulatory capital calculations. This makes it more difficult to assess what explains changes in regulatory mRWAs as management VaR can differ considerably from regulatory VaR.[14]

[14] The distinction between regulatory VaR and management VaR is important. The scope of positions and business units in risk management VaR may differ from those in regulatory VaR. An example of this is derivative hedges of non-trading positions. Derivatives are typically under trading, except for a limited amount

It also appears unusual for banks to provide thorough explanations for changes in mRWAs (see Annex 2 for an overview of available disclosures across jurisdictions). Banks are much more likely to explain changes in credit related RWAs or, for market risk, changes in VaR. Most commentary and figures in financial reports and Pillar 3 reports dealing with changes in total RWAs are directed toward explaining credit RWAs. This may be in part because mRWAs are considered a small part of total RWAs for most banks. However, with the implementation of Basel 2.5 more detail would be warranted about the impact on mRWAs. As indicated, changes in mRWAs can account for a substantial portion of the total change in overall RWAs and experience has shown that market risk related revenues and losses can be substantial.

Aside from the level of detail of the disclosures, there are considerable differences between banks in terms of reporting details regarding market risk, making comparisons difficult. For example, non-US banks that are under Basel 2 are subject to Pillar 3 disclosures to report on the components of total RWAs, including mRWAs, and, with some variation in scope and extent, explain the changes in mRWAs. In contrast, US banks (there are five within the sample) are not yet subject to Pillar 3 and most do not report mRWAs except in the bank holding company consolidated report of condition and income, or the "FR Y-9C", mandated by the Federal Reserve, where banks are required to disclose mRWAs. Only one US bank includes the figure for mRWAs in its financial reports, though in a footnote without commentary or detail. All US banks report and discuss management VaR in their financial reports since accounting standards and the SEC require disclosure of market risk.

Going forward, the public reporting by banks may become more consistent as Basel 2.5 and III and Pillar 3 rules are being implemented across jurisdictions. Pillar 3 requires banks to report regulatory VaR, which will allow better understanding of the drivers behind differences in mRWAs. Sometimes, however, the banks' Pillar 3 reports cross-refer to the notes to the financial statements and there is the challenge of knowing which data are management data and which are regulatory data. In that sense, the analysis suggests that more convergence and consistency in Pillar 3 reporting is needed.

1.4 Key contributing factors to mRWA variation

This section provides greater detail on factors that can explain variation in mRWAs for banks within the sample. Business models can indicate the general composition of a bank's asset mix and thereby the role of trading assets when comparing mRWAs across banks. Nevertheless, as set out above the business model cannot fully explain the differences and other key contributing factors appear to play a role, including differences in methodologies for measuring mRWAs, supervisory approaches related to mRWAs modelling, the use of multipliers and add-ons within trading book portfolios and possibly accounting differences.

Differences in the composition of trading assets

The composition of trading assets may help explain variations in mRWAs to the extent that holdings of more risky trading assets would be expected to result in higher levels of mRWAs.

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that qualifies as formal hedges. This will include both the trading desk derivative positions and what could be called economic hedges. If economic hedges are included in the regulatory VaR while the associated positions that are being hedged are excluded, then regulatory VaR will be risk higher than risk management VaR.

A preliminary review suggests that differences in the composition of trading assets can only partially explain variation in mRWAs. For example, upon examining the US banks in the sample,[15] some with higher mRWAs have a greater proportion of illiquid trading assets, including distressed debt and illiquid equity. However, the relationship appears weak and some banks with illiquid equity holdings report relatively low mRWAs. One reason may be that these banks are able to hedge their investments in risky trading assets, lowering their mRWAs. Overall, the correlation of the composition of trading assets to mRWAs appears low. More generally, there is insufficient public information available to allow a comprehensive study across banks regarding the effect of the composition of trading assets on the variation in mRWAs.[16]

Differences in market risk methodology

The Basel market risk framework allows for the use of internal model approaches and standardised approaches. An overview of the current Basel Market Risk framework is presented in Annex 1. In practice, a considerable degree of variation is observed across banks in their reliance on internal models or standardised approaches for market risk.

Supervisors play an important role in the degree of reliance on internal models by banks. The Basel framework requires supervisors to approve internal models before they are eligible for regulatory capital calculations. Supervisors may apply different approval criteria that lead to differences in the reliance on internal models. For example, in the US, supervisors adopted only the internal models approach for general market risk and either the internal models or standardised approach for specific risk. In the EU and other jurisdictions, both general market risk and specific risks can be calculated based on either the internal model or standardised approach.

In addition, for banks that use internal models, supervisors may apply certain regulatory add-ons and regulatory multipliers to account for model uncertainty at their discretion. This can contribute to variation in mRWAs as well.[17]

In addition to differences in supervisory approaches, there may be other factors that can explain the variation in the degree of reliance on internal models, including: cost; business

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[15] US banks are required to publicly report detailed information in the FR Y-9C schedule on trading assets on a common basis and therefore it provided a consistent format on which to base the analysis. There were no other jurisdictional public regulatory reports that provided for a sufficient level of detail to include in the analysis. The results cannot be generalised for all banks across jurisdictions and are limited since they only apply directly to US banks.

[16] Supervisory data collection while consistent within jurisdictions is not consistent across jurisdictions. In addition, as mRWAs is for most banks only a small share of total RWAs (less than 10%), some jurisdictions collect only limited additional data for supervisory purposes. The Committee surveyed each jurisdiction within the sample of banks to gain an understanding of the level and extent of supervisory information related to the regulatory reporting of mRWAs and its components. For purposes of this report it was determined that the utility of supervisory data to perform a meaningful cross jurisdictional comparison of mRWAs and the underlying drivers relative to the composition of a trading portfolio is limited.

[17] The level at which supervisory authorities set the multiplication factor will in part depend on the extent to which banks meet the qualitative criteria of Basel. Only models are in full compliance with the quantitative and qualitative criteria will be eligible for application of the minimum multiplication factor of 3. In this regard, the test portfolio exercise suggests that the level of the multiplier appears not related to the quantitative outcomes of the model is (see section 2.4 in this report), ie more aggressive models do not necessarily attract a higher supervisory multiplier. Anecdotal information suggests that supervisory practices regarding the setting of the multiplier differ: some jurisdictions only allow a multiplier of 3 or would otherwise reject the model, while in other jurisdictions higher multipliers are used extensively.

strategy (and therefore portfolio composition); and risk philosophy with respect to particular products.

Figure 5 shows how differences related to use of internal models and standardised charges can lead to variation in mRWAs. The figure plots the banks according to their ratio of mRWAs to trading assets (vertical scale) and the portion of mRWAs generated from internal models (horizontal scale).

The top figure provides some evidence that in 2010 banks that relied more heavily on internal models report a relatively low mRWAs as a ratio of trading assets.[18] The size of the circles provides perspective on the size of trading assets for each bank (ranked in USD), and hollow circles indicate banks in jurisdictions that have not implemented Basel 2.5.

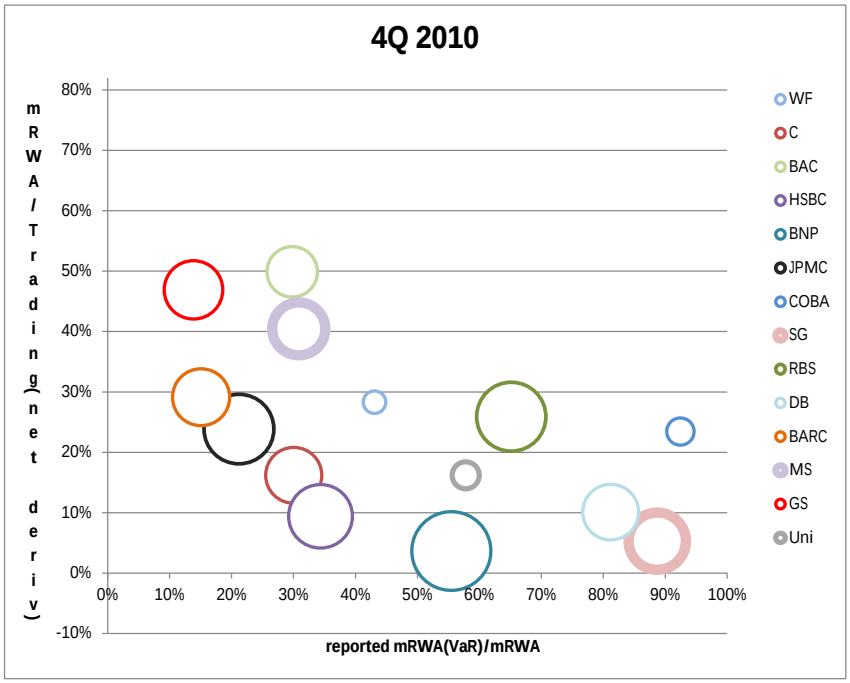
This observation supports the notion that internal models provide greater recognition of diversification and hedging benefits which result in a lower average risk weight as compared to the standardised approach, which is calibrated more conservatively. However, the figure also shows that the relationship is not very consistent across banks and that there are banks with the same degree of reliance on internal models that have very different levels of mRWAs.

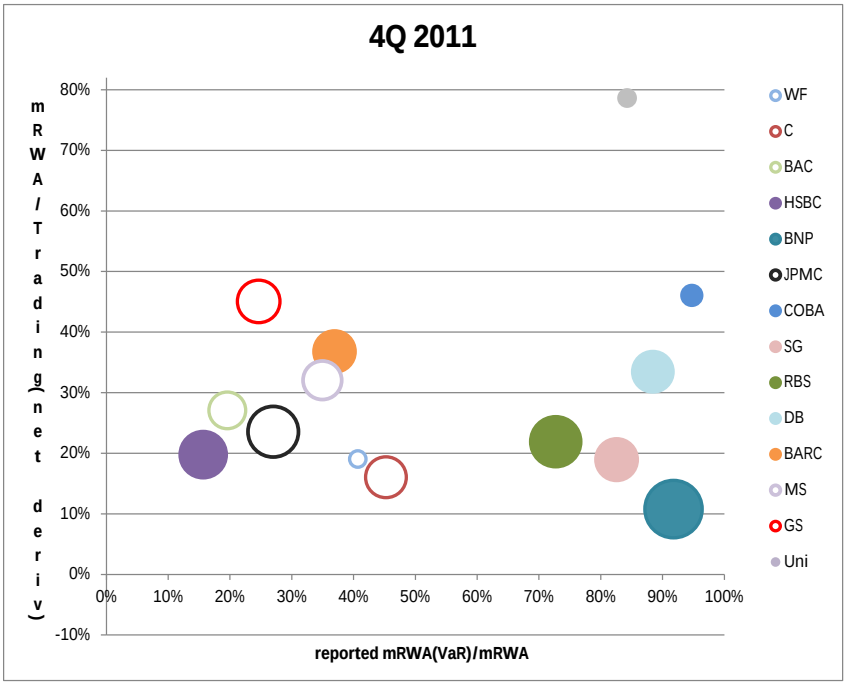
The bottom figure is based on data from end-2011 and shows the results for the same group of banks. A difference with the data from 2010 is that the correlation appears to be changing. The introduction of Basel 2.5 has resulted in an increase in market risk capital charges specifically for banks that use internal model approaches. The figure suggests that the advent of Basel 2.5 has somewhat altered the balance between the internal models approach and the standardised approach, reducing the gap between the standardised approach and the internal models approach.[19] While indicative, it is however too early to draw conclusions, as Basel 2.5 was not implemented in all jurisdictions in the period under review.

[18] For this analysis the same definition of trading assets is used as in Figure 2. Most banks break out the components of their mRWAs in annual financial reports and Pillar 3 reports where applicable (Europe, and Japan) with information on the amount from IMA and Standardised Approach. US banks are required to report the amount due to specific risk and this analysis estimates the amount from VaR by subtracting from total mRWAs. This does take out some part due to the VaR model, the specific risk surcharge; however, this is the best representation possible given available public information.

[19] The Basel Trading Book Group is currently doing a fundamental review of the trading book with particular attention to the scope of internal models and published in May 2012 a consultative document. One aim of the fundamental review is to strengthen the relationship between the models-based and standardised approaches by establishing a closer link between the calibrations of the two methods.

Figure 5: Relationship between mRWAs and reliance on internal models[20]





Note: the vertical axis shows the ratio of mRWA over total trading assets. The horizontal axis shows the ratio of mRWA based on the bank's internal VaR model over total mRWA. The latter ratio is a crude proxy for reliance on internal models for calculating mRWA. Banks that are subject to Basel 2.5 are indicated with closed circles, while banks that are not subject to Basel 2.5 are indicated with open circles. The size of the circles reflects the nominal size of the bank's trading book, adjusted for accounting differences.

[20] Amounts due to internal VaR models were available only for 14 banks (for one bank proxy data is used from 2011Q2).

Modelling choices

As illustrated in Figure 5, even when banks have a similar degree of reliance on internal models, there remains a considerable degree of variation in the average mRWA per trading asset. This variation may be caused by differences in modelling methodology and inputs for market risk models used for regulatory capital calculations. The impact of differing modelling choices cannot be investigated via public disclosures (see instead the test portfolio exercise results), however from public reports it is clear that some model changes do impact mRWAs. For example, banks reported the following that changed the measurement of VaR in the last years:

- Reducing the historical period to a shorter time period;
- Changing the weighting scheme to give more emphasis to more recent market data and volatility;
- Using an expected shortfall calculation rather than a VaR quantile measure;
- Increasing the granularity of the internal models to better capture basis risk.

Another common theme in discussions of VaR is extending the models to include more risk types, for example, dividend risk and various credit basis risks. Several banks mentioned improving their modelling of securitisation exposures as well as monitoring risks not currently in VaR for materiality. Those changes could increase or decrease mRWAs depending on the situation and all such changes are subject to regulatory review and approval.

Differences in accounting requirements and practices

Another contributing factor behind variations in reported mRWAs may be differences in accounting regime applied by banks in different jurisdictions. The analysis presented in this paper corrects for the impact of differences in the netting of assets across different accounting regimes. However, accounting regimes may also lead to differences in the classification of assets in the trading book or the banking book. Depending on the jurisdiction, for example, the treatment of securities financing and loans can be different and may contribute to differences observed in public disclosure of mRWAs when compared to trading assets.

Chapter 2: Hypothetical test portfolio exercise

An important element of the Committee's work is a series of international hypothetical test portfolio exercises which aim to investigate the level of variability in mRWAs that are calculated from market risk internal models in the trading book. These exercises can overcome the limitations encountered when attempting to use public and supervisory data to investigate variability of mRWAs, and allow for a more in depth analysis of the level of variability of mRWAs and its key drivers.

The purpose of the recently completed hypothetical portfolio exercise is to provide a broad, baseline understanding of banks' market risk models focusing on relatively simple products. A subsequent hypothetical test portfolio under consideration would be intended to explore specific methodological issues related to more complex products.

In summer 2012, the current hypothetical test portfolio exercise was completed. The scope of the exercise included three market risk internal models used by banks to calculate at least part of their overall market risk capital requirements:[21] Value at Risk (VaR); stressed Value at Risk (sVaR); and the Incremental Risk Charge model (IRC).

Importantly, the sample of banks that participated in the hypothetical test portfolio exercise is not the same as that used for the survey of publicly available data. Therefore, no attempt should be made to draw conclusions about the identity of the banks that participated in the hypothetical test portfolio exercise.

This chapter presents the results, and is organised as follows. Section 2.1 provides a summary of the exercise and its key findings. Section 2.2 discusses the scope of the exercise and the sample of banks that were involved. Section 2.3 presents the detailed results that underpin the key findings of the exercise.

[21] The market risk framework includes a fourth model, the Comprehensive Risk Measure (CRM). This model is used for certain securitisation positions and for most banks drives a relatively small element of their mRWAs when compared to other models. This model will be included in the next round of the hypothetical text portfolio exercise that is currently being prepared.

2.1 Overview and summary of key findings

2.1.1 Structure of the hypothetical test portfolio exercise and on-site visits

The participating banks were provided with a set of 26 hypothetical portfolios for which they were required to calculate a number of market risk internal model metrics (VaR, Stressed VaR (sVaR), and IRC) over 20 trading days. Portfolios covered all the major market risk factors (equity, interest rate, foreign exchange, commodities, and credit) and were comprised of mostly simple vanilla products.[22]

Following the receipt of results from participating banks and accompanying completed questionnaires on their modelling methodology, a sample were included in a series of on-site visits which were designed to ask more detailed, tailored questions about each bank's model in order to better understand the key drivers of differences in model results. On-site visits also helped to address residual data quality issues so as to ensure the reliability and comparability of the data used as the basis of the analysis. In addition to collecting bank results, simplified VaR and IRC models were developed to aid understanding of the impact of different modelling choices on results for each portfolio.

2.1.2 Key findings on the level of variability of mRWAs

i. Cross-model comparison of variability

Based on the test portfolio results, there is more variability[23] in mRWAs from the IRC model than VaR and Stressed VaR. This would be expected as IRC calculates risk over a longer holding period than VaR and Stressed VaR and is calculated to a higher percentile than those models, resulting in more volatility in the risk metric. Additionally, IRC is a more recent concept originating from the Basel 2.5 package and therefore the practice around it is less mature than is the case for VaR and Stressed VaR. Finally, while VaR and Stressed VaR variability can come from valuation, time period and forecasting differences, IRC models are more complex and depend on additional less observable components (eg Probability of Default, Loss Given Default, correlations between obligors on migration and default, and varying liquidity horizons) and unlike the VaR model, the IRC measure cannot be easily back-tested to assess its performance.

ii. Variability in diversification benefit

The test portfolio exercise included two hypothetical portfolios (the "all-in" portfolios) that aggregated the individual instruments in the other hypothetical portfolios of the exercise to create diversified portfolios. These diversified portfolios were included so that the level of diversification benefit that banks assume within their market risk models, and its variability, could be analysed. Of these two portfolios, the largest, most diverse one was used to analyse diversification differences within internal models.

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[22] Details of the test portfolios are set out in Annex 3.

[23] Throughout this chapter variability is defined as the standard deviation divided by the mean result for a portfolio – this provides a comparable measure of variability across portfolios and models.

The variation in the level of diversification benefit across positions, together with variation in the modelling of each individual position of a portfolio, drives differences in capital requirements produced by market risk internal models and therefore understanding variability in this element is as important as variability in the modelling of the individual instruments. Consistent with the other results for the models in the exercise, IRC models showed a larger variability in the level of diversification benefit provided when compared with VaR and Stressed VaR. All models, notably, showed a significant range in diversification benefit with IRC ranging from 25% - 75% and VaR and sVaR ranging from 35% - 75% across the participating banks.

iii. Variability in multipliers applied to the model result

For the main diversified portfolio the multipliers[24] that each participating bank reported they use for regulatory capital calculation purposes were used to calculate an implied capital requirement for that bank from internal models. Performing this analysis allowed all of the drivers of variability to be combined to identify in a single result the implied variability of the capital requirement that different banks would report for that common portfolio. The multipliers themselves had significant variability, and this has a very direct impact on variability of reported capital requirements as they act directly on the output of the VaR and sVaR model to produce the capital figure. The multipliers for the participating banks in the exercise showed a range of 3 - 5.5.

iv. The combined impact of variability drivers on capital requirements

All of the above factors can have a significant impact on variability of capital requirements for a diversified portfolio. In the exercise, using the multipliers banks are required to use for their actual portfolios, the range of calculated capital requirements[25] calculated for participating banks for the main diversified portfolio was approximately EUR 13.5m to EUR 34m (see Table 1).

[24] For VaR and sVaR models, banks are required to multiply the output of the model by a number which is a minimum of 3 but can be higher at the discretion of the bank's supervisor. This multiplied output is then used as the basis of the regulatory capital requirement for market risk.

[25] The implied capital requirement was calculated using the average VaR, sVaR and IRC results for portfolio 25 of the exercise for each bank. The VaR and sVaR figures were multiplied by the multiplier used by those banks when calculating capital requirements in their trading book, and added to the IRC figure to give a capital requirement.

Table 1: Implied capital requirement for the main diversified test portfolio (portfolio 25)

	Implied capital requirement for diversified portfolio (Euros)
Min	13,414,208
Max	34,165,014
Median	17,781,481
Mean	20,521,469
Stdev	6,344,392
Stdev/Mean	31%

2.1.3 Key findings on the drivers of variability

The drivers of the observed variability can be classified into two categories:

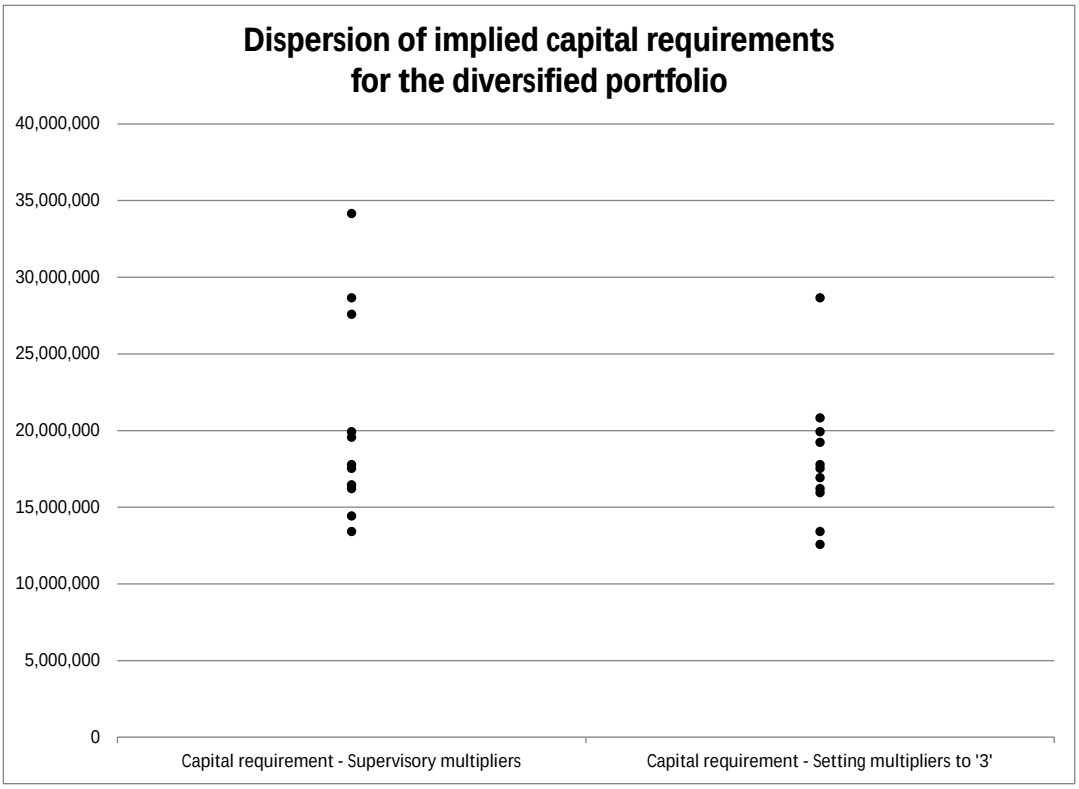
- those mainly under the control of supervisors (in particular, the multipliers applied to model results); and
- those mainly under the control of banks (modelling choices).

It is possible to split out the observed variability set out in Table 1 that derives from differing multipliers by recalculating capital requirements after setting the same multiplier for all banks. Performing this calculation indicates that approximately one-quarter of the total variability is due to differences in supervisory multipliers, subject to supervisory control (see Table 2 and Figure 6 where (for illustrative purposes) all bank multipliers have been set to "3").

Table 2: Implied capital requirements variability sources

	Implied capital requirement for diversified portfolio (Euros)	
	Using supervisory multiplier	**Setting multipliers to 3**
Min	13,414,208	12,567,926
Max	34,165,014	28,658,836
Median	17,781,481	17,540,171
Mean	20,521,469	18,095,667
Stdev	6,344,392	4,112,446
Stdev/Mean	31%	23%
Proportion of variability due to supervisory multiplier choice		27%

Figure 6: Dispersion of implied capital requirement for the main diversified test portfolio (portfolio 25)



Focusing on the variability that is under the control of banks, the details of model methodology and calibration provided by banks during the exercise, and follow-up discussions during on-site visits, allowed the identification of a number of the key modelling choices that were driving the variation in capital requirements across banks in the exercise. The exercise was necessarily however limited in its scope as the hypothetical test portfolios were of limited size and complexity. Therefore, to produce a more comprehensive list of drivers of variability, supervisory experience and simplified models developed for the exercise were used to identify a wider list of agreed drivers of variability that had been observed in practice within jurisdictions.

This section first sets out the key modelling choice drivers of variability identified directly from the test portfolio results. It then combines these with existing supervisory knowledge of other key modelling choice drivers that could not be tested by the portfolios in the exercise, to produce a table of key drivers of variability classified by their importance (strong, medium, or low impact drivers).

i. VaR and Stressed VaR variability drivers

The analysis of test portfolio results for VaR models showed that the choice of look-back period[26] and any weighting scheme applied to that period's data is the most important driver

[26] The look-back period is the historical period used to calibrate the market risk model, the Accord text requires that it has a minimum length of one year for VaR models but banks may choose longer periods if they wish.

of the variation in model results observed across banks. This choice can have a significant impact on model results, for example there are two banks which use a four- or five-year look-back period (which includes the stressed market variables during the 2008/09 period) whereas others use only a one-year historical period. Similarly, the choice of historical period for sVaR has a significant impact on the results of that model (although for the test portfolio exercise most participating banks chose a similar period and so the impact of this choice on variability could not be directly observed).

In the analysis of variability of VaR and sVaR (including when analysing the level of diversification benefit in the "all-in" portfolios), the choice of whether to use overlapping or non-overlapping periods[27] in calibrating stressed VaR also appeared to be an important source of variability.

Finally, the supervisory methodology for aggregating specific and general risks[28] differs across jurisdictions and has a strong impact on variability of results. Some participating banks calculated the specific risk charge as a standalone charge by using a different method than the one used to calculate the general risk (for example a Monte Carlo simulation is used to compute specific risk versus historical simulation for the general risk) whereas other banks used a single model that diversifies general and specific risk.

Other modelling choices were found to have lower level impacts on variability, such as: the level of approximation used when calculating the values of positions under new simulated market conditions; whether absolute or relative returns were used when simulating potential moves in risk factors; whether antithetic data[29] was used in the sVaR model; and whether historical simulation or Monte Carlo simulation models were used.

Figure 7 presents an assessment of all identified key drivers of variability and their relative impact. The modelling choices highlighted in bold are those which were assessed via the test portfolio exercise and identified as potential drivers of variability, the others are included to provide a more complete analysis and are based on supervisory experience gained from implementing and reviewing these models.

The conservatism of the choice of whether to use a longer or shorter period will vary over time – in a stressed environment a shorter historical period may be more conservative, whereas in a benign period the same choice can have the opposite impact.

27 The input assumptions for the sVaR model are based on a one year historical period. Banks can choose to either: consider each one day period during that year and calculate the losses their portfolio would have incurred over a one day period, then scale the result to an equivalent loss over 10 days; or they can consider a series of 10-day periods throughout the historical period and directly calculate the 10-day losses on their portfolio. If the second approach is used, in order to have enough data to calculate the loss that would not be exceeded 99% of the time, the 10-day periods used will overlap.

28 For equity and interest rate asset classes, the Accord differentiates between general risk (the risk due to market-wide changes in prices) and specific risk (the risk due to changes in prices that are linked to the specific instrument).

29 Antithetic in this context means that price movements are considered relevant irrespective of their direction. For example, if a time series included a significant upward spike, the model could apply significant movements both upwards and downwards.

Figure 7: Key model choice variability drivers, and their relative impact, for VaR and sVaR

The impact of modelling choices on variability of the VaR model result

Low impact	Moderate impact	Strong impact
Modelling approach (historical simulation versus Monte Carlo)	**Valuation approach (full revaluation or use of approximations)**	**Length of data period for calibration and the weighting scheme applied**
Calibration methodology (use of absolute versus relative returns)	**Risk factor granularity**	**Scaling approach to calculate 10-day measure / use of overlapping periods**
Data updating frequency		**Aggregation approach (aggregation across positions and aggregation of specific and general risk)**
Calculation of VaR percentile		

The impact of modelling choices on variability of the sVaR model result

Low impact	Moderate impact	Strong impact
	Use of antithetic data	**Scaling approach to calculate 10-day measure / use of overlapping periods**
		Approach to choose stress period, and the resulting stress period calibration

ii. IRC variability drivers

Based on the test portfolio results, transitional probabilities[30] appear to be the most important driver of variability in IRC across banks, together with correlation assumptions when more diversified portfolios are considered.[31] In the exercise, the variation in transition probabilities was particularly high for sovereign exposures where banks had different assumptions on default risk. The modelling approach used for the IRC, in particular whether transition matrix-based or spread-based models were used, also had a significant impact on variability. Based on the qualitative questionnaires that participating banks completed, it is also clear that choices related to liquidity horizons for products has a material impact on the result of the IRC model.

[30] Transitional probabilities are the probabilities assumed in the IRC model that a given entity will migrate from one credit rating to another.

[31] The importance of correlation assumptions was tested using the diversified portfolios and also tested and verified using a simplified IRC model developed to better understand how modelling choices can impact RWAs.

Figure 8 presents an assessment of the impact of various key drivers of variability and their relative impact. As with the figures related to VaR and sVaR drivers, the modelling choices highlighted in bold are those which were assessed in the test portfolio exercise and identified as potential drivers of variability, the others are included to provide a more complete analysis and are based on supervisory experience gained from implementing and reviewing these models.

Figure 8: Key model choice variability drivers, and their relative impact, for IRC

The impact of modelling choices on variability of the IRC model result

Low impact	Moderate impact	Strong impact
Modelling approach for basis risk when included in the model	**Single factor vs multi-factor model approach**	**Calibration of the transition matrix**
	Inclusion of basis risk in the model	**Correlations among obligors**
	Liquidity horizon assumptions	**Model approach (spread models vs transition matrix based model)**
	Recovery rate assumptions	
	Calculation of profit / loss on migration events	

2.1.4 Next steps

The analysis performed to date has focused on simple products and therefore did not include complex portfolios and the most complex market risk model – the Comprehensive Risk Measure (CRM). However the findings already highlight areas where policy action can be considered to reduce variability. The work has indicated that there is a direct relationship between complexity of risk metric/product and the associated variability of the metric across banks – with the relatively more complex IRC model displaying much more variability than VaR for example.

More complex products and models will be considered in a second phase of the exercise. Given that CRM and IRC share a number of characteristics (ie both are one-year metrics at the 99.9% confidence level) and the products involved in correlation trading are relatively more complex, it will be beneficial to include more complex products (including their inclusion in the CRM where relevant) in addition to re-running some of the Phase 1 portfolios.

2.2 Scope of exercise and sample of banks

2.2.1 Overview

The test portfolio exercise which forms the basis of the analysis in this chapter covered the following market risk models:

1. VaR;

2. Stressed VaR; and

3. IRC.

Participation in the exercise was voluntary, and was targeted at banks with significant trading books that have already implemented Basel 2.5 internal models (Stressed VaR and IRC, as well as CRM where applicable) for calculating regulatory capital requirements and/or will do so when those rules are implemented in their jurisdiction. As such, most participating banks were G-SIBs. However, some banks from countries with no G-SIBs were also included in the exercise on the basis of materiality of their trading activities relative to their domestic peers. Overall, the range of banks included in the exercise provided significant coverage of the jurisdictions in which banks with large trading books operate.

The number of banks participating from each country is set out in the table below.

Country	Number of banks participating
Belgium	1
Canada	1
France	2
Germany	2
Italy	1
Japan	1
Switzerland	2
United Kingdom	1
United States	4
Total	**15**

In addition to running their models on the test portfolios and submitting results, participating banks were requested to complete qualitative questionnaires. The questionnaires had the objective of providing qualitative information on the methodology applied in banks' VaR, stressed VaR and IRC models that could support the analysis of the quantitative results.

Following the receipt of completed questionnaires and test portfolio results, a sample of participating banks were selected to receive an on-site visit. The international on-site visit teams included typically five supervisory experts of participating member jurisdictions in addition to a host from the home supervisor. The on-site visits provided an opportunity to

gain a deeper understanding of the bank's submitted test portfolio results and associated qualitative questionnaire to help identify the key reasons for differences in results.

The test portfolio exercise ran over the period 18 June – 13 July 2012, with participating banks being requested to provide the results of their internal model for each test portfolio on each business day over that period. The follow-up on-site visits included nine banks and took place during September 2012.

2.2.2 Limitations of the exercise

In order to allow for the timely analysis of key drivers of variability in the market risk framework, the scope of the exercise was limited to the models mentioned above and test portfolios were limited to relatively simple products. The results in this report are therefore limited by not addressing the variability caused by the CRM model or the variability caused by more complex products.

These missing elements are likely to display greater variability than is observed in the current scope of products and models and may highlight different key drivers of that variability. For this reason, a second phase of work is planned to cover these more complex areas.

Additionally, given the limited number of banks in the exercise it is not possible to robustly (from a statistical perspective) infer the relative importance of key drivers, and these will in any case vary across asset classes. The identified key drivers and their importance will vary with portfolio composition.

2.3 Analysis of hypothetical test portfolio exercise results

This section provides detailed analyses by asset class of the level of variability observed in the test portfolio exercise and the identified drivers of that variability that support the key findings set out in section 2.1.

i. Analysis methodology

For analysis purposes the 20 day time series of test portfolio results were averaged. In general, stable time series and low volatilities in the series allow the use of such averages for analysis purposes to be a reliable approach, and this was the case for the results of this exercise.

In order to identify drivers of variability, bank results were ranked and these rankings were compared to modelling choices to understand to what extent specific modelling choices appeared to drive variation in results. This analysis was supported by simplified VaR and IRC models developed by Basel Committee members, which allowed investigation of how modelling choices impacted results.

Throughout this chapter results are presented as scatter plots, and unless otherwise stated results have been normalised so that the median result in each plot is 100%.

ii. Cross-portfolio comparison of variability across the exercise

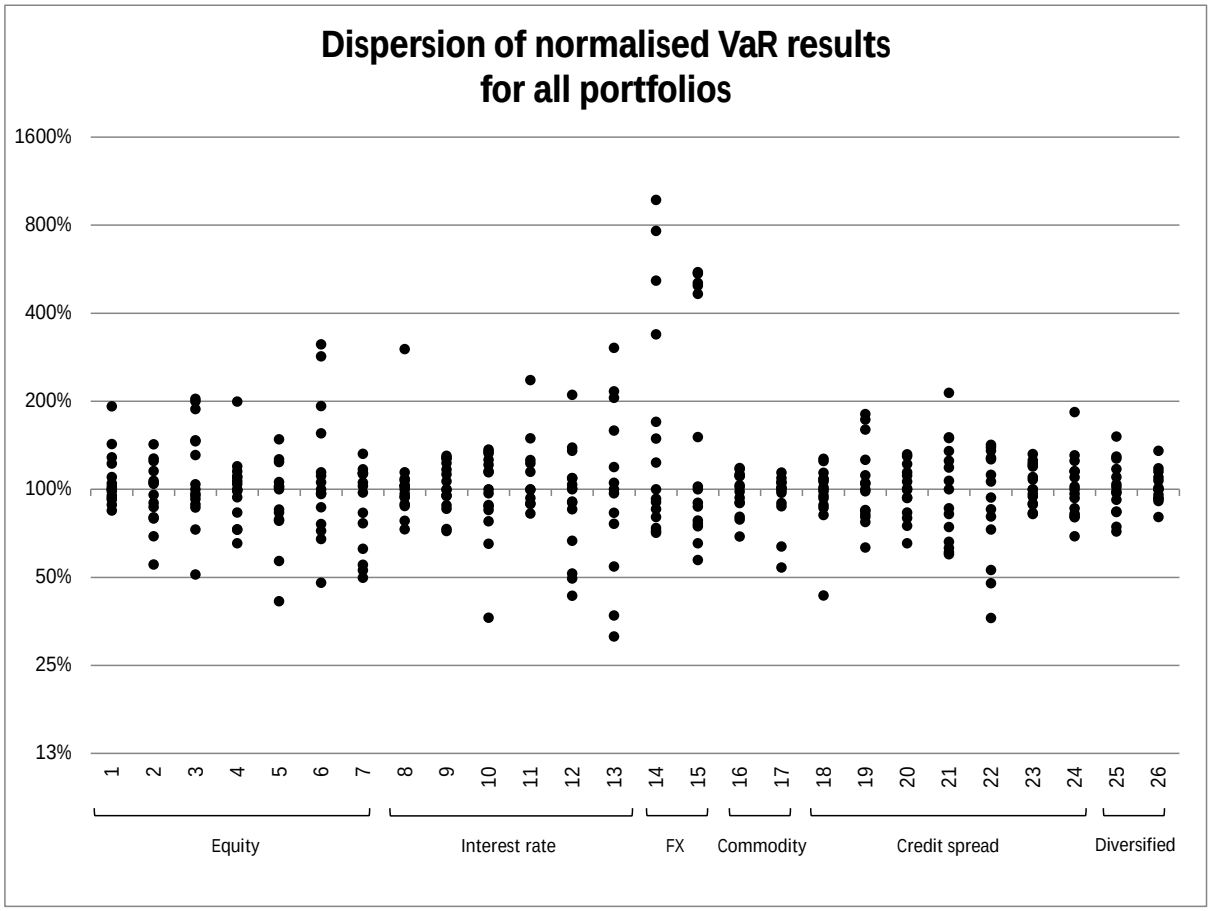
The level of dispersion of model results varied across asset classes, as can be seen in Figure 9, which shows the normalised dispersion of results for all models across all portfolios. Typically there was greater dispersion in FX portfolios (portfolios 14 and 15) than other asset classes,[32] with significant dispersion also evident in credit spread portfolios (portfolios 18 to 24).

There was also evidence that as the complexity of products increased there was more variability in results. For example, in the equity asset class portfolio 5 (which includes call options on baskets of equities hedged by individual call options) and portfolio 6 (variance swap) have greater variability than portfolios 1 and 2 which have simple futures or options contracts.

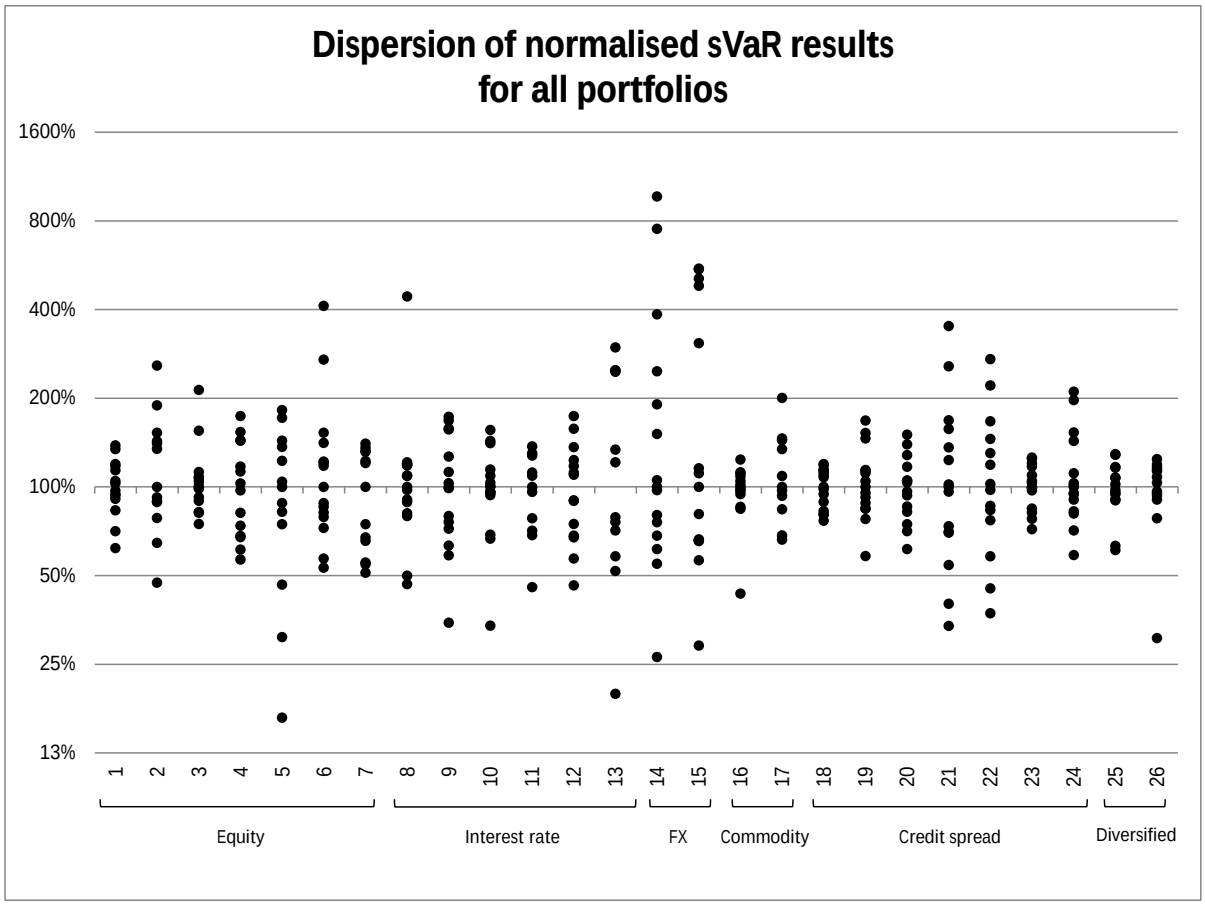
In general, the variability of the single asset class portfolios was much wider than that for the diversifed (and hence more realistic) portfolios. From a regulatory capital perspective, the result for the aggregate portfolio is the most important, as it is at the this level that regulatory capital requirements are generally determined.

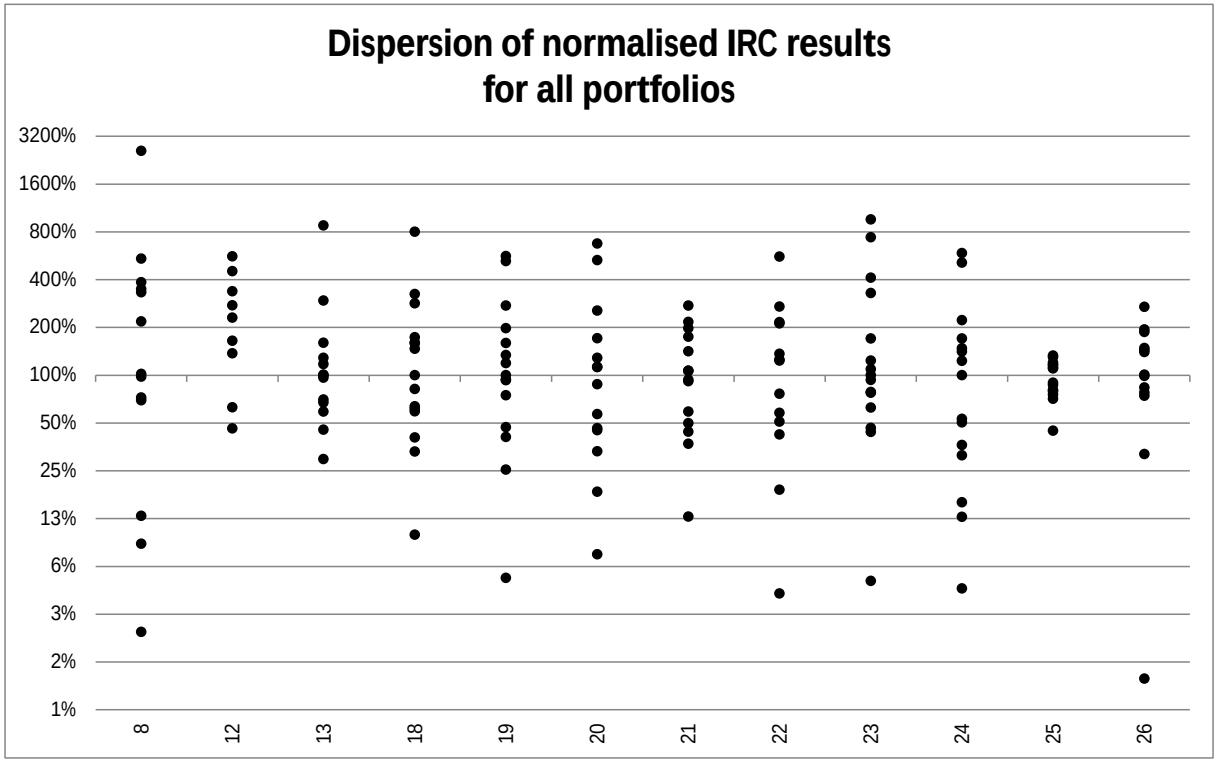
[32] For portfolio 15, this higher variability was partly due to two different modelling approaches being applied, leading to two clusters of results (see the detailed section on FX portfolios for further discussion of this issue).

Figure 9: Scatter plots for all portfolios[33] (NB: for portfolios 25 and 26 the diversification benefit is plotted rather than individual model results)



[33] In the figures, portfolios 1-7 relate to equity asset classes, portfolios 8-13 relate to interest rate asset classes, portfolios 14-15 are FX, portfolios 16-17 are commodities, 18-24 are credit spread portfolios, and portfolios 25-26 are diversified portfolios covering all asset classes.


Dispersion of normalised sVaR results for all portfolios
1600%
800%
400%
200%
100%
50%
25%
13%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Equity
Interest rate
FX
Commodity
Credit spread
Diversified


Dispersion of normalised IRC results for all portfolios
3200%
1600%
800%
400%
200%
100%
50%
25%
13%
6%
3%
2%
1%
8 12 13 18 19 20 21 22 23 24 25 26

iii. Cross-model comparison of variability

There was typically much greater variability in IRC results than VaR and sVaR. This is perhaps not surprising as IRC covers a longer holding period than VaR and SVaR (ie one year for IRC vs 10 days for VaR and SVaR) and it is also calculated a higher percentile than VaR and sVaR (ie 99.9% for IRC but only 99% for VaR and SVaR), resulting in more volatility in the risk metric. Furthermore, IRC is a more recent concept originated from the Basel 2.5 rules and therefore the practice around it is less mature than VaR and sVaR.[34]

2.3.1 Equity portfolios

Test portfolio description

There were seven test portfolios in the equity class:

Table 3: Description of the equity portfolios

Portfolio number	Description
1	Equity index futures on FTSE 100 (long delta)
2	Bullish leveraged trade on Google (long gamma and long vega)
3	Volatility trade #1: short short-term vega and long long-term vega on S&P 500
4	Volatility trades #2 (smile effect): long/short put on FTSE 100
5	Volatility trade #3 (correlation effect): long call on equity basket, short calls on component stocks (Unilever and Siemens)
6	Equity variance swaps on Eurostoxx 50
7	Barrier option on S&P 500

The vast majority of banks provided results for the seven equity portfolios, with the following exceptions:

- One bank did not compute the risk measures for portfolio 5 because it was not able to validate the results for the portfolio; and
- A second bank was not able to report sVaR figures for non-EUR equity portfolios as they could not separate the FX sVaR element to allow a consistent approach to be applied relative to VaR for each portfolio.

Additionally, it was decided to exclude a small number of other results from the analysis:

[34] Basel 2.5 introduced the IRC model (and CRM model) in order to reduce arbitrage incentives between the trading book and the banking book. IRC models (and CRM models) are generally of a more complex nature than the traditional VaR models because they combine elements from the regulatory banking book and trading book framework.

- The VaR and sVaR measures of one bank for each of portfolios 2, 5 and 7 were not taken into account because the banks did not have adequate models or data address these products.

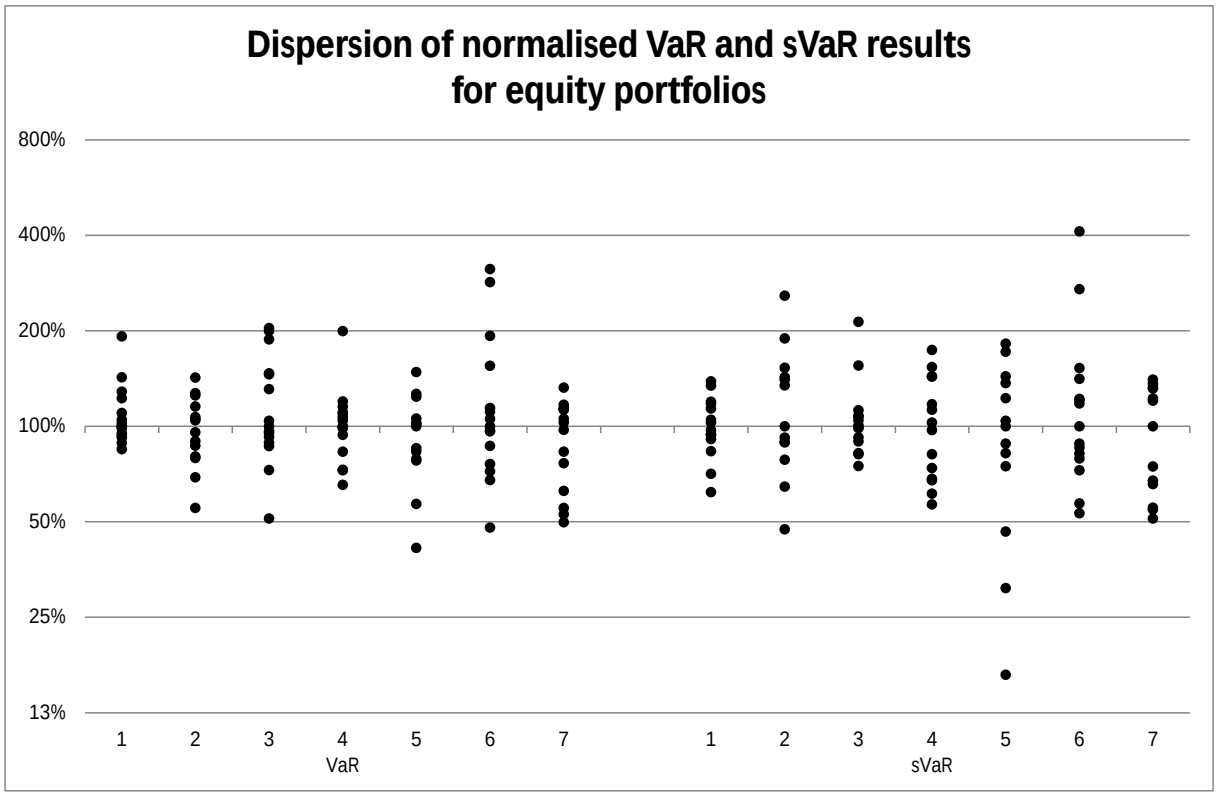
A number of banks were unable to model portfolio 5 as an American option. In this case however analysis showed that this did not have a material impact on results and therefore all results (except for the bank referred to above) were retained for the purpose of analysis.

Key findings

i. Cross-model analysis of variability

Figure 10 shows scatter plots of the results of VaR and sVaR for the equity portfolios. There was generally less variability in the VaR results than in those of sVaR. There is also a clear correlation between the variability of sVaR and VaR results across portfolios. The figures showed that VaR and sVaR was most variable for portfolios 3 and 6. It is also clear that the variability of VaR figures is correlated with the variability of sVaR figures: more variable VaR results for a portfolio typically correspond to more variable sVaR results.

Figure 10: Dispersion of normalised VaR and sVaR for the equity portfolios



ii. Key drivers of variability for VaR and stressed VaR

The following modelling choices were found to be key drivers of variability for VaR:

- **Length of the data period used to calculate the VaR**: for example, the two banks in the exercise that on average were the least conservative (in terms of average ranking on the equity portfolios) used a two-year look back with exponential weighting (so that the average weighted data period is equal to approximately six months).

- **Calculation of a 10-day VaR directly rather than scaling a one-day measure**: banks using this method appear to compute lower VaR than banks who computed an one day VaR and calculated the 10-day VaR by scaling up using the square root of time.

A number of other modelling choices were analysed but did not appear to drive significant variability of the results for these portfolios – in these cases however the result is impacted by the fact that only simple products were included in this phase of the exercise:

- **Valuation method**: there is no clear link between valuation methods and the VaR results.
- **Granularity of market risk factors**: there is a large variation in the number and diversity of the risk factors that are modelled by each bank. Some banks only simulate equity prices, ATM volatilities and interest rates where as some other simulate also skew/smile, term structure of implied volatilities, repo, dividends and correlations. However for these portfolios there was no clear correlation between the VaR results and the number and diversity of risk factors modelled in the VaR.
- **Method used to apply movement in returns (relative shifts versus absolute shifts):** all the banks use relative returns for equity prices, however for volatility returns different approaches were applied – these did not appear to have a direct impact on results.

For sVaR, generally there is a link between the average ranking for sVaR and the average ranking for VaR - banks that computed less conservative VaR figures also computed less conservative sVaR figures.

Here again the **use of 10-day overlapping returns rather than scaling a one day measure** appears to drive differences in sVaR results. This link is clearer for sVaR than for VaR.

The impact of other modelling choices such as the valuation method was analysed but was not conclusively shown to be a significant driver of variability in the exercise, again this is likely to also be impacted by the simplicity of the portfolios included in the exercise.

2.3.2 Interest rate portfolios

Test portfolio description

There were six portfolios in the interest rate class:

Table 4: Description of interest rate portfolios

Portfolio number	Description
8	Curve Flattener Trade (long long-term & short-term treasuries)
9	Interest rate swap
10	Two-year swaption on 10-year interest rate swap
11	Five-year swaption on 10-year interest rate swap
12	Negative basis trade (long corporate bond & long protection via CDS)
13	Relative value trade (long corporate bonds of same sector and rating)

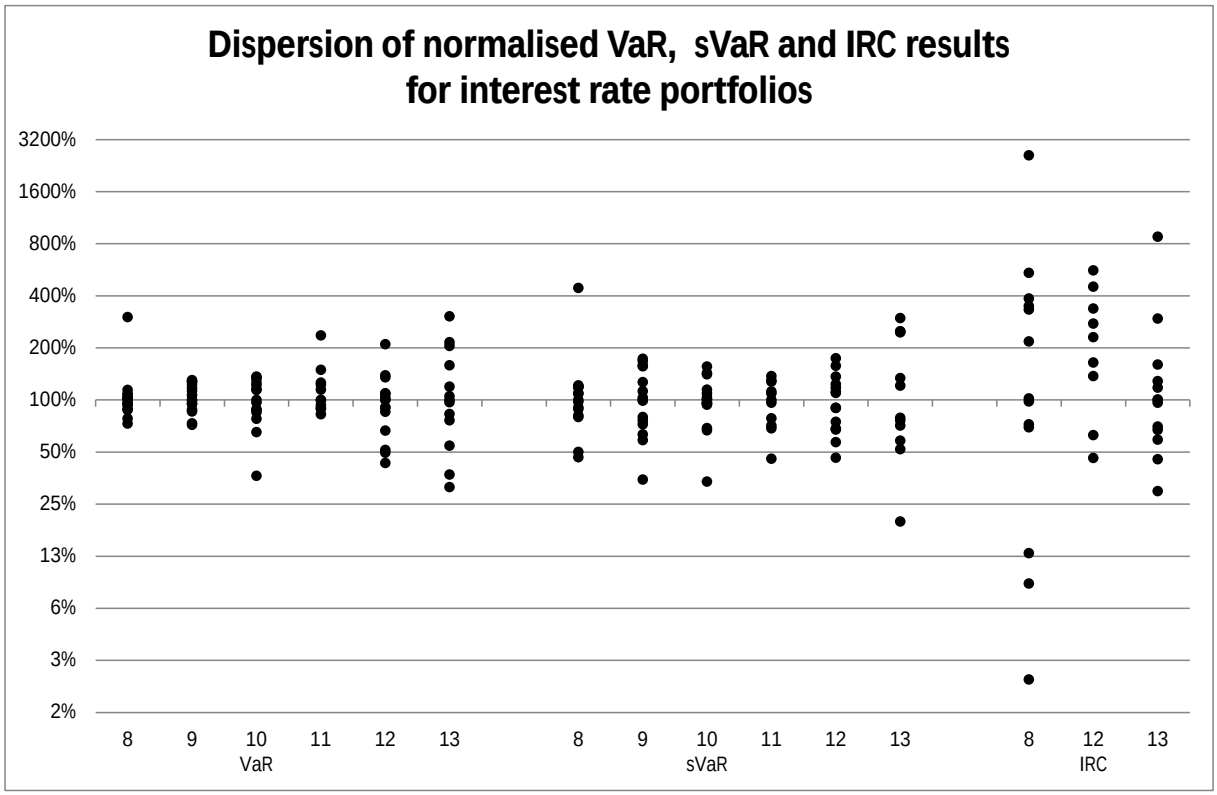
For portfolios 8 to 10 all banks were included in the analysis. For the remaining portfolios a small number of results (seven in total across the three portfolios) were excluded from the analysis due to issues which resulted in the figures not being comparable to those of other banks.

Key findings

i. Cross-model analysis of variability

Figure 11, below, shows boxplots for the interest rate portfolios for VaR, sVaR and IRC (IRC risk values were only required for portfolios 8, 12 and 13).

Figure 11: Dispersion of normalised VaR, sVaR and IRC for the interest rate portfolios



There is a comparable level of variability across VaR and sVaR, while the IRC shows higher variability. There is no clear correlation in variability across VaR and IRC, for example portfolio 13 shows the highest variability for VaR and sVaR, and in this case the IRC values are less variable.

ii. Key drivers of variability for VaR and sVaR

The following modelling choices were found to be key drivers of variability for VaR:

- The **use of 10-day overlapping returns rather than scaling a one day measure** is a significant driver of variability. Similarly for sVaR scaling shows a tendency to impact risk values;
- The **valuation approach** appears to impact risk values with approximation based approaches typically leading to higher VaR numbers in the exercise (however this will be portfolio dependent);

- The size of the VaR numbers appears to also correlate with the **length of the historical data period**. In particular in the exercise models based on a one year data period appear to have more conservative risk values.
- The **modelling approach** also potentially impacts results, with Monte Carlo methods being typically more conservative in the exercise in comparison to historical simulation (the same is also valid for sVaR) however this may be impacted by other modelling choices that are linked to the modelling approach rather than the choice of approach itself.

For sVaR, the modelling choices driving variation were less clear, however a potential driver was the use of **antithetic data** which appeared to result in lower risk values for the asset class (however the link was not strong).

iii. Key drivers of variability for IRC

The following modelling choices were found to be key drivers of variability of the IRC model:

- The use of different **liquidity horizons** (three, six and 12 months) appears to correlate with higher risk values compared to a constant position assumption. This may be due to the fact that positions are rebalanced at the beginning of the new horizons, so rating downturns and defaults can occur more frequently within the one year horizon than when a single one year horizon is used for all products. The importance of this choice is also supported by analysis using a simplified IRC model developed for the purpose of the exercise.
- The granularity of **risk factors** (in particular the capture of basis risk) appears to also have an impact on results. Five banks that did not fully capture basis risk were on average the most aggressive results for these portfolios.
- Models with less sophisticated one- or two-**factor structures** tended to produce more conservative results; however this was not a strong link.
- Finally, **migration matrices** and **PDs, correlation matrices** and **initial ratings** all play an important role for IRC.

2.3.3 FX and commodity portfolios

(a) FX portfolios

Test portfolio description

There were two test portfolios in the FX risk class:

Table 5: Description of FX portfolios

Portfolio number	Description
14	Long EUR/USD forward and short EUR/USD call option
15	Vanilla FX Swap: Lend USD and borrow EUR

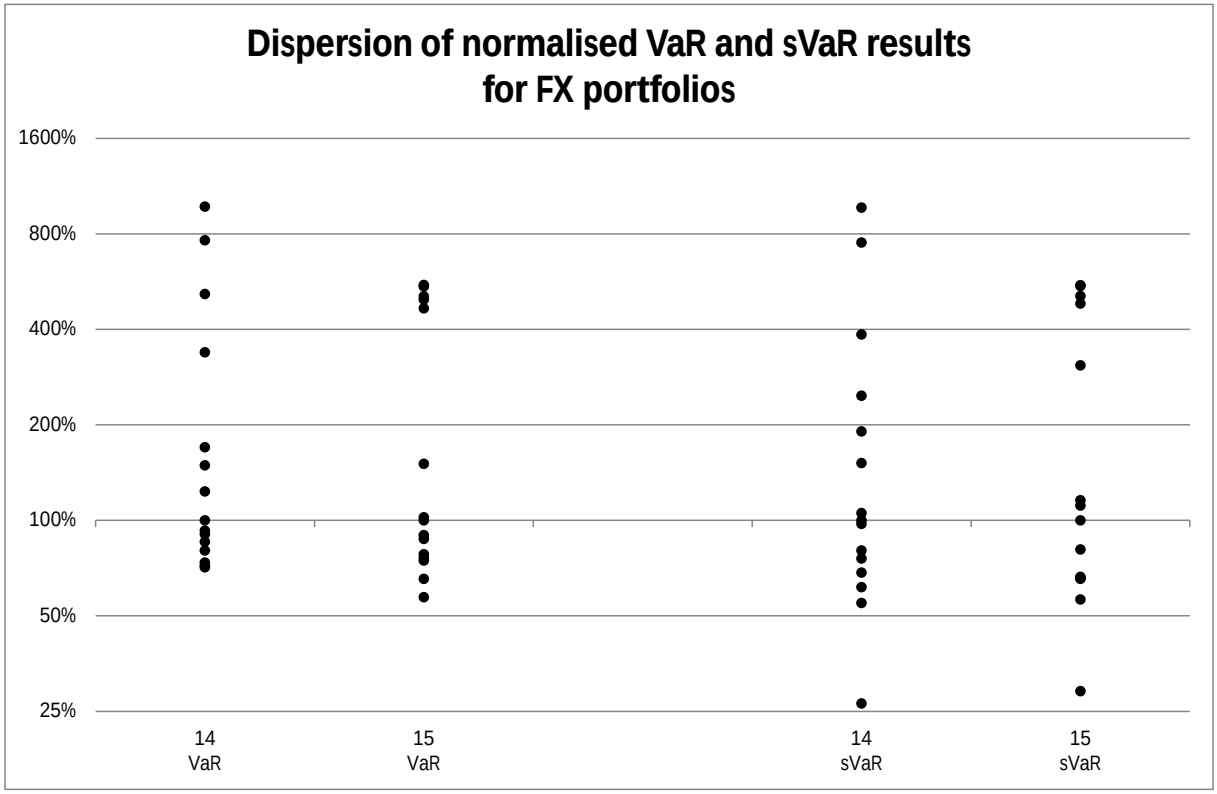
All of the participating banks submitted complete time series for these portfolios.

Key findings

i. Cross-model analysis of variability

Figure 12 below shows scatter plots of the results for these portfolios for VaR and sVaR. The figure shows that VaR and sVaR have a similar level of relative dispersion for each of the two FX portfolios.

Figure 12: Dispersion of normalised VaR and sVaR for the FX portfolios



There is significant variability across both the VaR and sVaR results reported by banks for portfolios 14 and 15. The magnitude of VaR and sVaR is consistent for each bank, in that a bank with a low/high VaR will have a corresponding low/high sVaR.

For portfolio 14 the distribution of VaR and SVaR appears to be bimodal with four banks being more conservative than the others. The differences however relate to the impact differing modelling choices rather than differing interpretations of the portfolio.

For portfolio 15 the distribution of risk measures also appears to be bimodal with five banks being more conservative than the others. The median for the higher mode is six times larger than the median for the lower mode. For this portfolio the difference relates to whether banks assumed the notional of the trade was exchanged at the inception of the trade. Where exchange of notional was assumed the additional interest rate risk resulted in the higher risk measure.

ii. Key drivers of variability for VaR and sVaR

The following modelling choices were found to be key drivers of variability for these portfolios:

- The use of unweighted data from longer historical periods for their VaR calculations appears to cause variability, in the case of portfolio 14 this appears to drive the bimodal nature of the distribution.
- The choice of whether to scale one day VaR to calculate 10-day VaR or not appeared to cause variability.
- Finally, the choice of stress period leads to lower sVaR when a period around 2011 was used.

(b) Commodities

Test portfolio description

There were two test portfolios in the Commodities risk class:

Table 6: Description of commodity portfolios

Portfolio number	Description
16	Long short-term Gold forwards and short long-term Gold forwards
17	Long Oil put options

A small number of results were not included in the analysis of results for these portfolios:

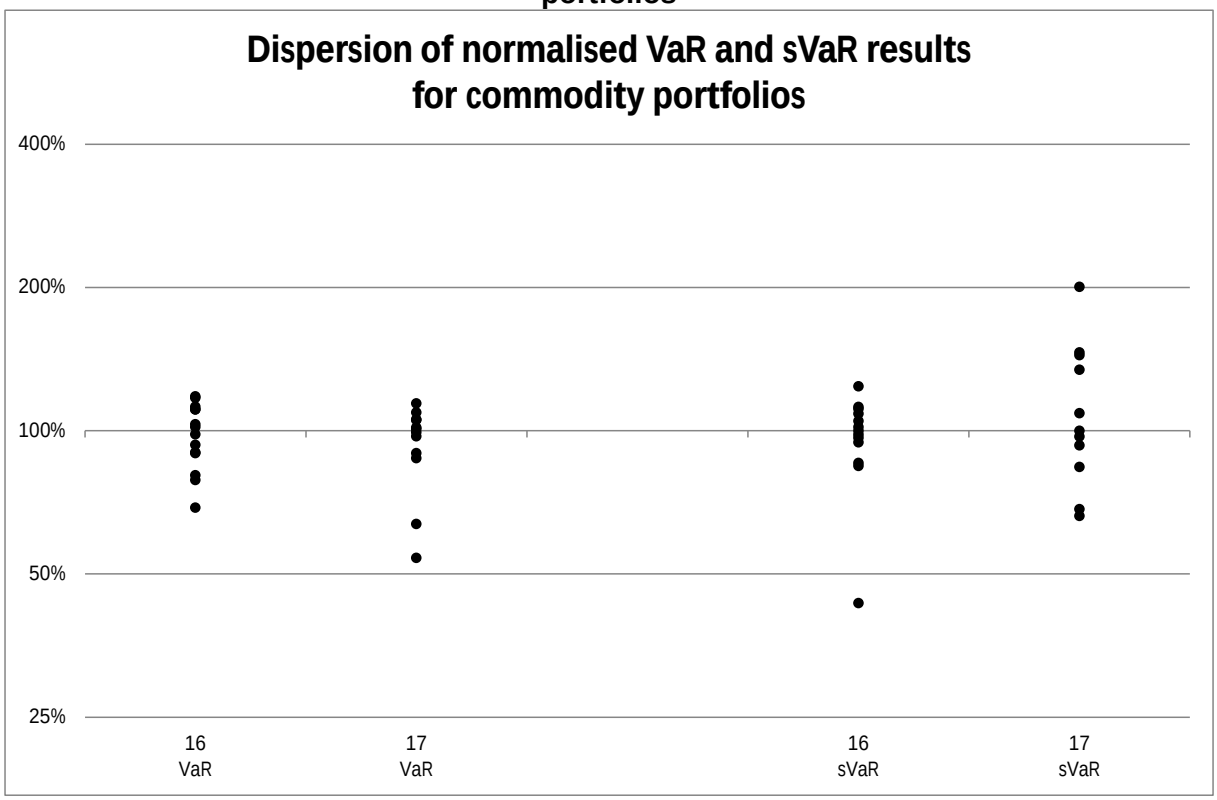
- One of the banks did not report VaR and sVaR for either of the commodity portfolios, since this asset class is not one for which they have permission to use an internal model. A second bank did not submit VaR and sVaR data for portfolio 17 for the same reason.
- One bank modelled portfolio 17 as an Asian option instead of American option, and as this had a material impact on results these were excluded from the analysis.
- Finally, one bank was not able to report sVaR in the correct currency, since the required currency differed from their home currency for both of the portfolios.

Key findings

i. Cross-model analysis of variability

Figure 13 below shows scatter plots of the results for these portfolios for VaR and sVaR.

Figure 13: Dispersion of normalised VaR and SVaR for the Commodity portfolios



For portfolio 16 and 17, there is relatively low variability in VaR and sVaR reported by the banks.

ii. Key drivers of variability for VaR and sVaR

The following modelling choices were found to be key drivers of variability for these portfolios:

- For portfolio 16, the highest VaR results come from models with a historical period of four and five years, indicating that the **length of the historical period** is a key driver.
- For portfolio 17, banks which used **10-day overlapping factor returns**, and priced based on that, seem to be less conservative relative to banks that use one day returns to price and scale the one-day VaR up to 10 days using the square root of time.

2.3.4 Credit spread portfolios

Test portfolio description

There were seven portfolios in the credit spread asset class:

Table 7: Description of credit spread portfolios

Portfolio number	Description
18	Diversified Index Portfolio (long protection via iTraxx index)
19	Diversified Corporate Portfolio (long protection via 10 corporates)
20	Sovereign CDS Portfolio (long protection via CDS on five countries)
21	Sovereign Bond Portfolio (long bonds on five countries)
22	Sovereign Bond/CDS Portfolio (long bonds and long protection for five countries)
23	Sector Concentration Portfolio (long protection via CDS on 10 financials)
24	Name Concentration Portfolio (long protection via CDS on Met Life)

Fourteen of the participating banks submitted complete results for the credit spread portfolios. One bank did not submit any results for portfolios 20 and 22.

Key findings

i. Cross-model analysis of variability

Figure 14 and Figure 15 below show scatter plots of the results for these portfolios for VaR, sVaR and IRC.

Figure 14: Dispersion of normalised VaR and SVaR for the credit spread portfolios

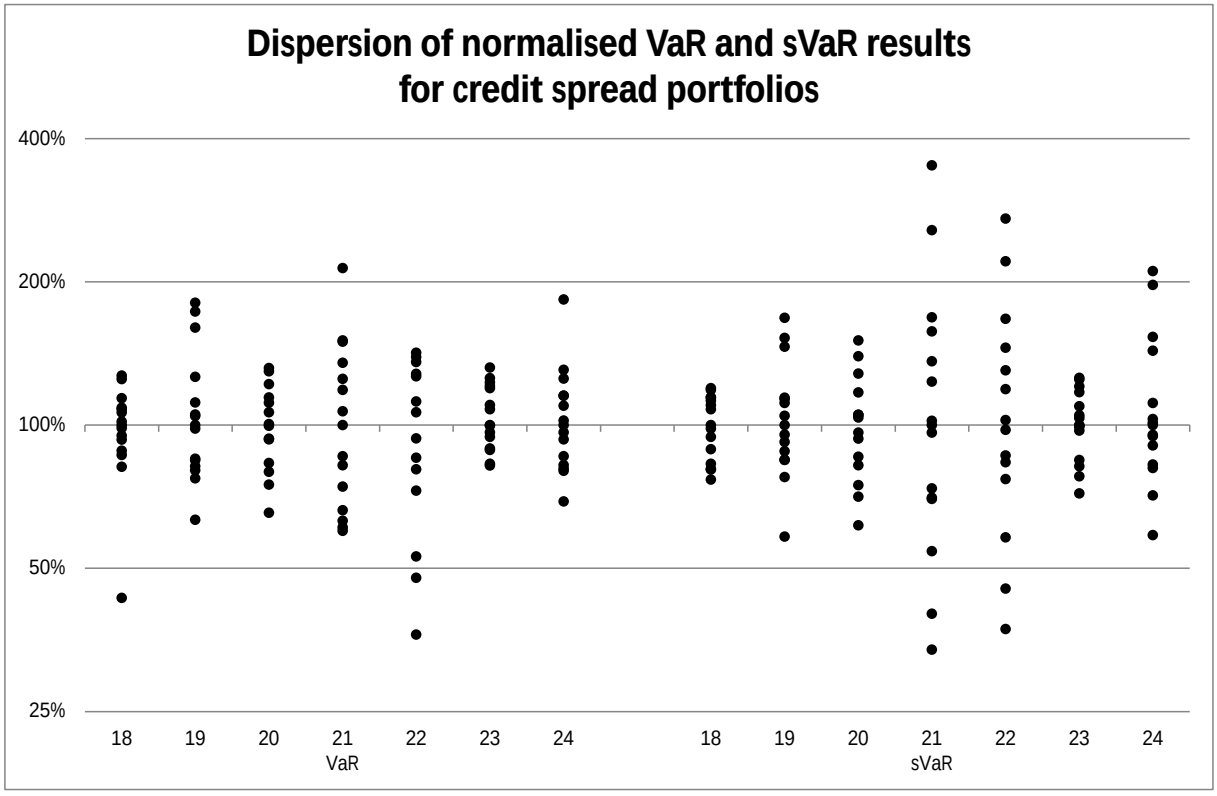
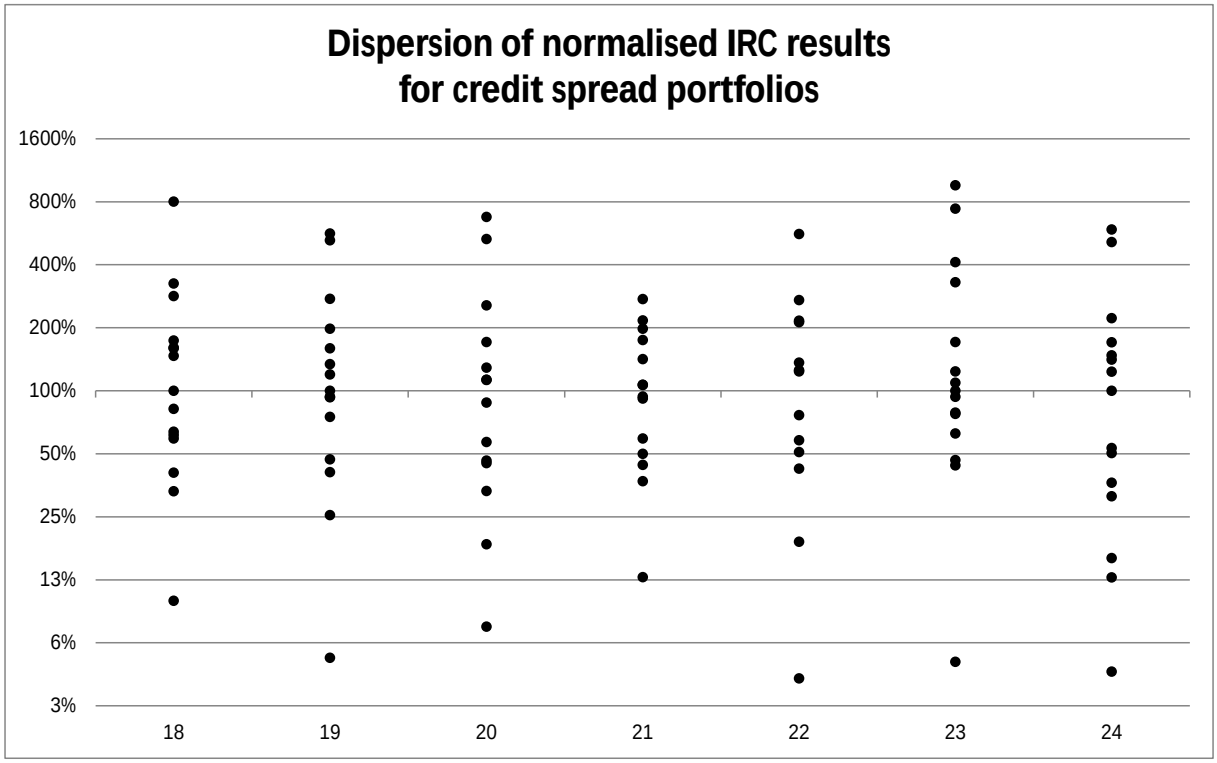


Figure 15: Dispersion of normalised IRC for the credit spread portfolios



The figures show that there is less dispersion in the results for VaR and stressed VaR in comparison to IRC across banks. The pattern of increasing variability from VaR, stressed VaR to IRC is generally consistent across all portfolios.

ii. Key drivers of variability for VaR and sVaR

The variability in VaR was the lowest out of the risk metrics for the credit spread portfolios. Nonetheless, analysis of the banks with the highest and lowest VaR results in the exercise suggests that the **length of the look-back period and weighting scheme** used to calculate VaR is a key driver of the variation observed across banks. The bank with the highest mean results uses a four-year look-back period that still captures data from the 2008/09 period.

Generally, greater variability was observed for sVaR results in comparison to VaR. This was the case even though most banks' VaR and sVaR methodologies are the same with the exception of using a 12-month continuous stressed period for VaR calibration. For most portfolios, stressed data appears to magnify the impact of differences in methodology across banks and no additional drivers were identified.

iii. Key drivers of variability for IRC

Based on the test portfolio results, two banks in the exercise consistently had higher IRC results than other banks. One of these two banks was unusual in comparison to most other banks whose data was considered in the analysis of credit spread portfolios in that it did not use transition matrices and instead uses a spread-based model to model price risk arising from credit migrations and general market risk. The use of this spread-based model produced IRC values that were higher than most other banks.

All other banks (except one) use transitional matrices in their IRC models in determining migration effects, and for these banks **transitional probabilities** appear to be an important

driver of variability in IRC. In turn, differences in the migration and default probabilities are ultimately driven by differences in the initial credit ratings that banks assign to different names. This observation is consistent across all the credit spread portfolios.

For portfolio 18 (diversified index), the high IRC outlier bank reported an average Probability of Default (PD) of 60 bps while the banks with the two lowest IRC values reported average PDs of 4 and 17 bps respectively and this is largely a result of the differences in the granularity of credit ratings.

The two banks with the lowest IRC across the credit spread portfolios had less granular credit rating structures in their models than others. The same observation can be made for portfolio 23 (financial sector concentration). The average PDs for the two low outlier banks are 3 bps and 7 bps respectively, while the PD for the high outlier bank is 49bps.

For all sovereign portfolios (20, 21, 22), differences in the aggressiveness of **migration and default probabilities in the sovereign transition matrix** are considered to be the key driver of differences between the banks' results.

The choice of **external agency rating or internal spread implied rating** was also a source of variability and in the exercise could lead to more or less conservative IRC figures depending on the portfolio being analysed.

Other potential drivers of variability such as liquidity horizon, recovery rate and correlation assumptions did not appear to drive significant variation observed across banks.

2.3.5 Diversified portfolios

Test portfolio description

In order to investigate the variability in diversification benefit, and to see the overall variability in model results for a wider portfolio, two diversified portfolios were included in the exercise which combined the individual portfolios discussed above.

Table 8: Description of diversified test portfolios

Portfolio number	Description
25	All-in portfolio – long a composite portfolio consisting of the simple sum of portfolios 1 – 24 inclusive
26	Sub all-in portfolio – long a composite portfolio consisting of the simple sum of 9 portfolios (#1, #2, #3, #8, #9, #10, #15, #16, #18)

For these portfolios, a number of banks had not been able to model all underlying portfolios. For portfolio 25, where only two underlying portfolios were not modelled or not fully modelled this did not have a material impact on the overall results, however where more than two portfolios were not included or had not been accurately modelled it was considered to be potentially material. As a result, to maintain the robustness of the analysis the VaR, sVaR and IRC results for four banks were excluded from the analysis.

For the purpose of analysing the variation in diversification benefit, however, only one bank was excluded from the analysis[35] (since in this case the statistic being analysed was still broadly consistent across the banks).

In the analysis below, the results described are based on portfolio 25 (this is because the impact of a single missing portfolio has a material impact in portfolio 26, meaning the sample of banks that could be compared for portfolio 26 was too small to draw strong conclusions).

Analysis performed

For the diversified portfolios, three separate analyses were performed:

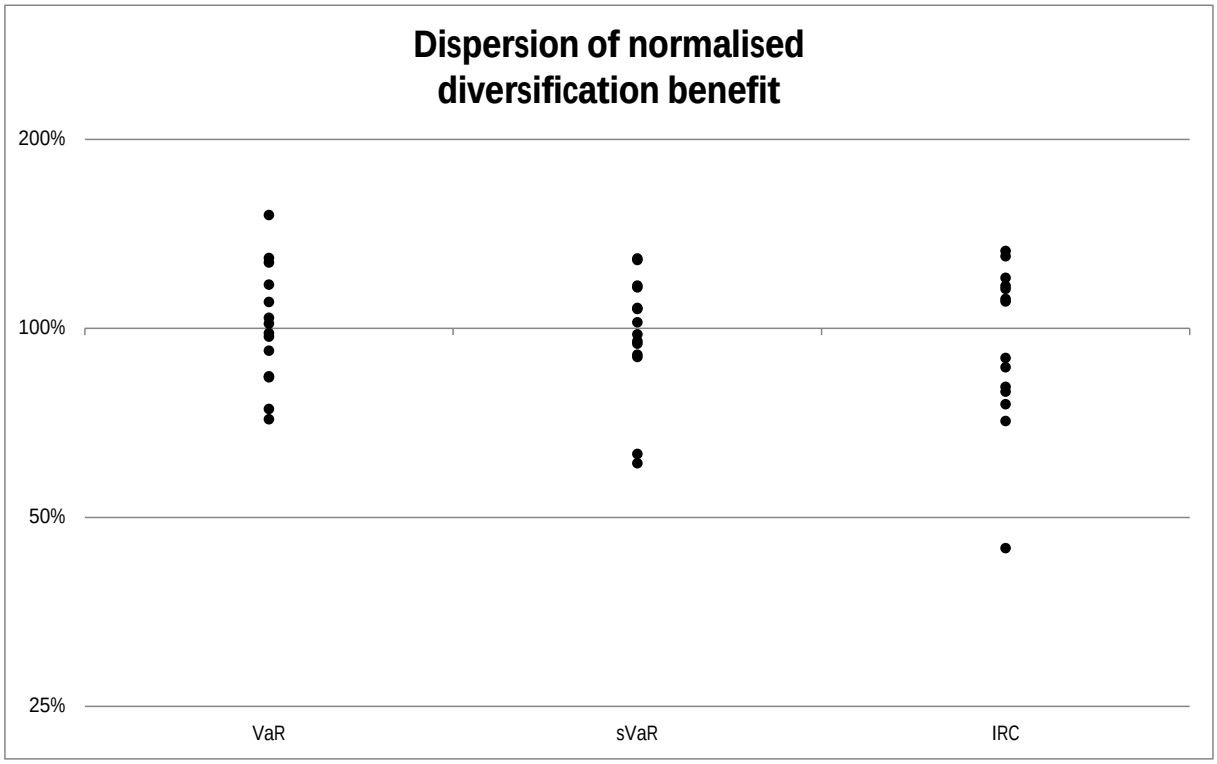
- The **variability in the level of diversification benefit** (calculated as the percentage difference between the sum of the model results for the underlying portfolios and the model result for the combined portfolio) was compared across models and participating banks.
- At the level of the diversified portfolio, banks were also requested, where possible, to use their standard approach to determine the relevant stressed period for their sVaR calculation. Five banks in the sample were able to do this and reported results. For these banks, **variability in the sVaR / VaR ratio and choice of stressed period** was also analysed.
- Finally, at the diversified portfolio level it is possible to use the VaR and sVaR multipliers reported by the participating banks to construct an implied capital requirement. **The variability in the implied overall capital requirement** was also analysed.

i. Cross-model analysis of variability in diversification benefit

Figure 16 below shows the level of variability of the diversification benefit for each model and the dispersion around the mean of the distribution.

[35] For one bank, a large proportion of the IRC results were excluded and therefore this bank was not incorporated in the analysis of the diversified portfolios.

Figure 16: Dispersion of diversification benefit for portfolio 25



The average level of diversification benefit is relatively consistent across models, with VaR models on average providing the lowest diversification benefit and IRC and stressed VaR models giving a similar level of benefit. There is, however, more variability in the level of diversification benefit achieved via the IRC model when compared to VaR or stressed VaR models.

The level of diversification benefit achieved by banks across all models was analysed to understand if in general banks with a conservative VaR or sVaR model also had conservative IRC models with respect to diversification benefit. In general there was no clear pattern in terms of banks having consistently high or low diversification benefit across models. The banks ranked second and third lowest for diversification benefit of VaR and sVaR, for example, have above average ranking for IRC (see Table 9).

Table 9: Comparison of ranking of diversification benefit for each bank by model type (rank 1 = lowest diversification benefit)

VaR diversification benefit rank	1	2	3	4	5	6	8	9	10	11	12	13	14	15
sVaR diversification benefit rank	1	3	4	5	6	8	9	12	2	11	10	13	14	15
IRC diversification benefit rank	15	2	6	13	10	1	14	8	12	5	11	4	3	9

ii. Key drivers of VaR and sVaR diversification benefit variability

The average level of diversification benefit achieved via VaR models in the exercise was typically less than that of sVaR models; however, the overall variability of the sVaR diversification benefit was lower than for VaR. The lower variability is likely to be partly due to the choice of historical period for sVaR calibration being relatively consistent across the participating banks.

From the VaR and sVaR results for these portfolios and accompanying questionnaire data, there appears to be one significant model choice which drives the variation in diversification benefit:

- **The use of longer historical periods** to calibrate VaR in the sample of banks leads to higher diversification benefit, consistent with the fact that sVaR is giving greater diversification benefit overall (longer historical period implies more chance of VaR including at least part of the sVaR period).

Variation was also observed in other modelling choices, for example the use of historical simulation compared to Monte Carlo simulation, however these choices appeared to have a low impact on diversification benefit. Similarly, the choice of whether to use relative or absolute returns when calculating price moves had no clear impact on diversification benefit.

For sVaR, the use of **overlapping periods**[36] seems to have an impact on the level of diversification benefit, however it does not appear to be a strong link.

iii. Key drivers of IRC diversification benefit variability

The level of variability of the diversification benefit of IRC was higher than that of the other models included in the exercise, mirroring results on variability in each of the underlying asset classes.

There was no clear single driver for the variability of diversification benefit for IRC. The level of benefit for this model will be driven by the correlations assumed across obligors, and so the factor structure of the model, and potentially other choices such as rating levels, will have an impact.

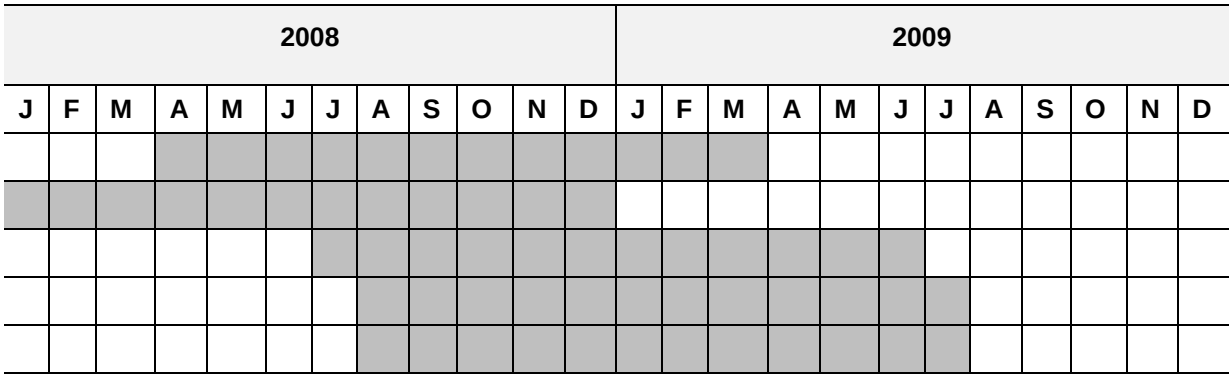
iv. Variability in selection of stressed period and sVaR/VaR ratio

Banks participating in the exercise were asked, if possible, to use their standard approach for determining a stressed period to find a relevant stressed period for the diversified portfolios.

[36] For stressed VaR, banks either calculate a one-day measure based on the one-year historical period or can use overlapping sets of 10 days within the historical period to directly calculate a 10-day measure of risk.

Five banks included in the analysis of results were able to perform this process. For those five banks, the chosen period was broadly consistent typically including the final five months of 2008 as shown in Figure 17:

Figure 17: Selected stressed VaR period for portfolio 25



v. Implied capital requirement variability

Finally, at the diversified portfolio level it was also possible to use the VaR and sVaR multipliers that each participating bank would be required to use by its supervisor to imply the capital requirement for the portfolio. The variability observed in the overall capital requirement incorporates all of the variability discussed in previous sections, and the variability in the diversification benefit.

The multiplier itself is also a source of variability as it can be raised above the minimum level of 3 by the bank's supervisor; however, the variability caused by this measure is not directly under the control of the banks.

Table 10 and Figure 18 below show the range, standard deviation and level of variability (measured as the standard deviation divided by the mean) of the implied capital requirement for portfolio 25 and the dispersion around the mean of the distribution. The results are shown both using the supervisory required multiplier than banks would actually use to calculate capital requirements, and using a multiplier of 3 (which shows only the variation in capital requirement due to modelling choices by controlling for the variation in the multiplier).

Figure 18: Dispersion of implied capital requirement for portfolio 25

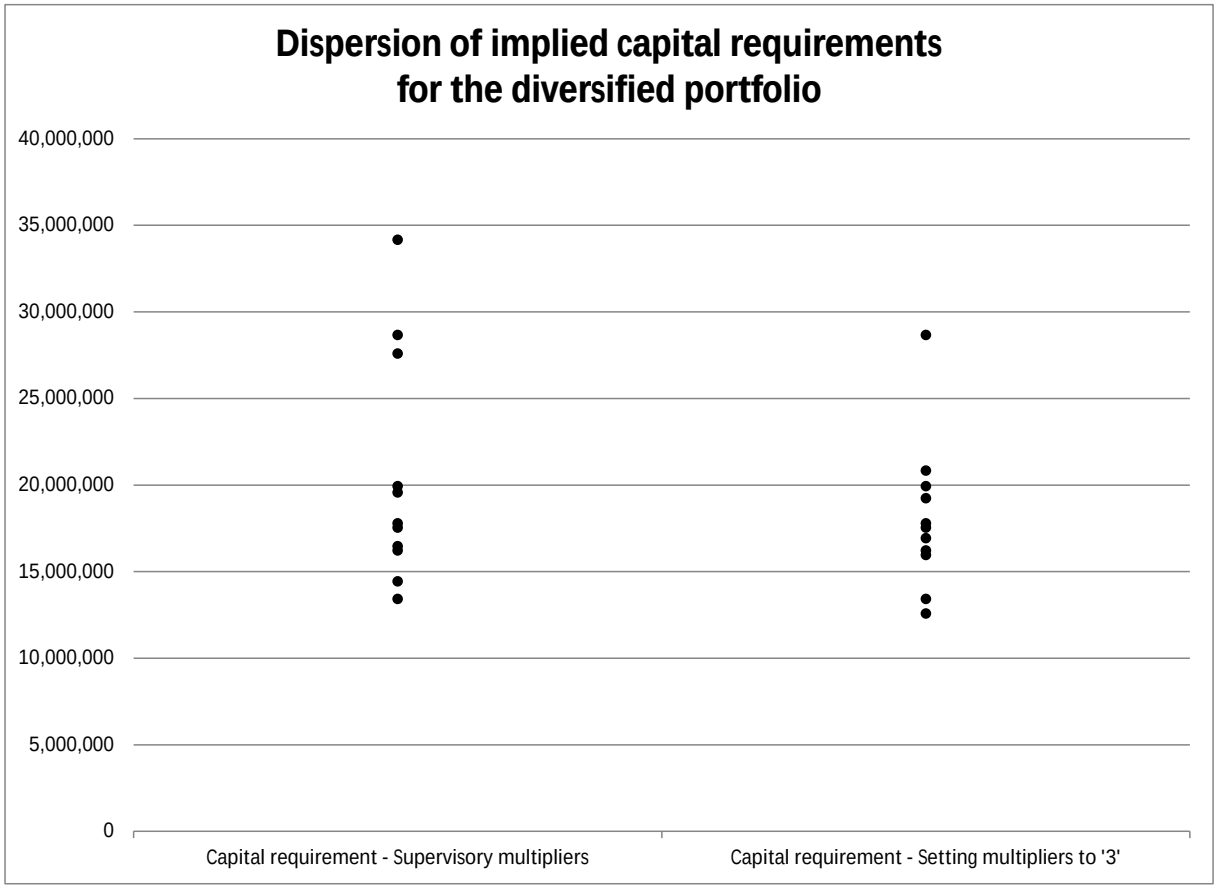


Table 10: Statistics on implied capital requirement for portfolio 25

	Implied capital requirement for diversified portfolio (Euros)	
	Using supervisory multiplier	**Setting multipliers to 3**
Min	13,414,208	12,567,926
Max	34,165,014	28,658,836
Median	17,781,481	17,540,171
Mean	20,521,469	18,095,667
Stdev	6,344,392	4,112,446
Stdev/Mean	31%	23%

The overall level of variability of the implied capital requirements is lower than the typical variability of the model result for each portfolio, due to the diversification benefits dampening the impact of individual modelling choices at each instrument level, and the fact that IRC

(which is the most variable model) has a smaller impact on capital requirements than that of VaR and sVaR. However, the use of differing levels of multipliers by supervisors increases the variability of the capital requirements, as there was a wide range of multipliers applied to banks who participated in the exercise (multipliers ranged from the minimum level of 3 to 5.5 for the participating banks) – these differences accounted for approximately one quarter of the observed variability.

Annex 1: Summary of the market risk capital framework

The capital charges according to the market risk framework comprise capital charges for interest rate related instruments and equities in the trading book as well as for foreign exchange risk and commodities risk irrespective of whether the position is held in the banking or in the trading book. Interest rate related instruments and equities are subject to both general and specific market risk capital charges.

In measuring their market risks, banks are allowed to make a choice between two methodologies: a standardised approach and, subject to the approval of supervisory national authorities, an internal models approach.

To the extent a banks' internal model does not cover specific risk, the specific risk capital charges of the standardised measurement method apply. Under the **revised market risk framework**, the capital requirements for market risk are calculated as the sum of the following elements:

- The capital charge according to the standardised measurement method to the extent a bank does not use internal models, covering
  - general and specific interest rate risk;
  - general and specific equity position risk;
  - foreign exchange risk;
  - commodities risk;
- The capital charge according to the internal models approach, which is the sum of
  - The higher of (i) its previous day's VaR number; and (ii) an average of the daily VaR measures on each of the preceding 60 business days, multiplied by a multiplication factor; plus
  - The higher of (i) its latest available stressed-VaR number; and (ii) an average of the stressed VaR numbers over the preceding 60 business days, multiplied by a multiplication factor; plus
  - The incremental risk charge (IRC) where applicable; plus
  - The comprehensive risk measure (CRM) capital charge, where applicable.

The approaches available to calculate the capital charges for specific risk under the new market risk framework are outlined in the table below.

New treatment of specific risk

Instrument type	Standardised measurement method	Internal models approach
Unsecuritised credit products which are not included in the correlation trading portfolio	Specific risk capital charges according to the standardised measurement method (unchanged).	99%/10-day VaR specific risk measure times three* **plus** 99%/10-day stressed VaR specific risk measure times three* **plus** IRC charge including default and migration risks at a 99.9% confidence level and a one-year capital horizon.
Securitisation products as defined in paragraphs 538 to 542 of the Basel II Framework which are not included in the correlation trading portfolio	New capital charges for securitised products under the standardised measurement approach, independent of whether a bank otherwise uses the standardised measurement method or the internal models approach.	
Products which are included in the correlation trading portfolio (paragraph 689(iv))	New capital charges for securitised products under the standardised measurement approach, calculated as the maximum of (i) the total specific risk capital charges that would apply just to the net long positions from the net long correlation trading exposures combined, and (ii) the total specific risk capital charges that would apply just to the net short positions from the net short correlation trading exposures combined (paragraph 709(ii)).	99%/10-day VaR specific risk measure times three* **plus** 99%/10-day stressed VaR specific risk measure times three* **plus** Comprehensive risk capital charge including default and migration risks at a 99.9% confidence level and a one-year capital horizon.**
Equity products	Current specific risk capital charges according to the standardised measurement method. The reduced specific risk capital charge of 4% for equities in liquid and well-diversified portfolios set out in paragraph 718(xxii) has been eliminated, ie an 8% specific risk capital charge applies.	99%/10-day VaR specific risk measure times three* **plus** 99%/10-day stressed VaR specific risk measure times three.

* The multiplier may be adjusted up to 4 based on backtesting results. Banks may use one VaR model jointly modelling general and specific risk. ** The Basel Committee has introduced a floor to the comprehensive risk capital charge expressed as 8% of the charge applicable under the standardised measurement method.

Market Risk Models by Risk and Product Type

(Assuming all relevant model approvals)

		Product Types				
					Securitisation	
		FX and Commodities	Interest Rates and Credit	Equity	Non-CTP	Correlation Trading
Risk Types	General Market Risk	VaR + SVaR	VaR + SVaR	VaR + SVaR	Securitisation Framework SA or IRB	VaR + SVaR
	Specific Risk	Not relevant *	VaR + SVaR	VaR + SVaR		
	Incremental default and migration risk	Not relevant *	IRC	IRC optional **		CRM***

* For FX and Commodities all price risks are captured by Var + SVaR

** Banks have the choice to include Equities in IRC

*** Comprehensive Risk Measure (CRM) includes specific risk and should capture not only default and migration risk but also other price risks where relevant such as cumulative risk arising from multiple defaults , credit spread risk , volatility of implied correlations, basis risk, recovery rate volatility, and the risk of hedge slippage and the potential costs of rebalancing such hedges.

Value at Risk (VaR): VaR is a technique used to measure a portfolio's market risk. It measures the most that a portfolio is expected to lose over a given time period (eg 10 days) in all but X percent (eg 1%) of the time. The 1996 Market Risk Amendment introduced the 99% (100-X), 10-day VaR requirement for banks using the internal models based approach into the regulatory framework.

Incremental risk charge (IRC): In recognition of the fact that the 10-day VaR metric does not sufficiently capture banks' exposures to credit risk, the 2009 amendments introduced an additional capital charge intended to capture both default risk and credit rating migration risk. The IRC is estimated based on a one-year capital horizon at a 99.9% confidence level, consistent with the treatment of credit exposures in the banking book. But it also takes into account the liquidity horizons of individual positions or sets of positions. And – unlike the banking book treatment of credit risk – it takes a firm-specific portfolio view of risk, allowing firms to estimate their own correlation parameters.

Stressed VaR: the 2009 amendments require banks to calculate a "stressed VaR" measure. This is intended to replicate a VaR calculation that would be generated on the bank's current portfolio if the relevant market factors were experiencing a period of stress. It should be based on the 10-day, 99th percentile, one-tailed confidence interval VaR measure of the current portfolio, with model inputs calibrated to historical data from a continuous 12-month period of significant financial stress. The introduction of stressed VaR is intended, in part, to dampen the pro-cyclicality of the VaR measure and to mitigate the problem of market stresses falling out of the data period used to calibrate the VaR over time**.**

Comprehensive Risk Measure (CRM): As of July 2009, the Committee agreed to apply the standardised capital charges based on the banking book risk weights to securitised products. However, the Committee agreed on a limited exception for certain correlation trading activities, where banks are allowed by their supervisor to calculate capital charges based on a so-called Comprehensive Risk Measure (CRM). This new model is subject to a strict set of minimum requirements, including the regular application of specific, predetermined stress scenarios and a floor expressed as a percentage of the charge applicable under the standardised approach.

Annex 2: Overview of publicly available information

This annex provides an overview of publicly available data sources for information on market risk exposures of banks.

Financial reports

Banks provide annual reports of their financial condition, income and balance sheet statements along with supporting notes, following standards put forward by accounting standards boards, FASB in the US and IFRS globally. Typically these are supplemented by quarterly or other intra-year reports (see below for a discussion of related FASB accounting standards).

IFRS standards outline minimum disclosure requirements regarding information to present in the notes to the financial statements in order for them to convey a fair picture of the reporting entity and help users understanding the significance of financial instruments for the entity's financial position and performance, the risks arising from these instruments, and any amount figuring in financial statements. Especially, IFRS 7 specifies that minimum information to disclose regarding market risk shall consist of a sensitivity analysis by types of risks (ie the effect on profit and loss of a variation of the different risks). This analysis can take the form of VaR disclosures. In this case, the methods and the main parameters and assumptions of the model have to be disclosed, as well as an explanation of the objectives and limitations of the model. This involves disclosing the type of model used and an explanation of how it works, and of the main characteristics (confidence level, holding period, options, volatilities and correlations, Monte Carlo simulations).

These standards are updated as conditions change. For example, as IFRS incorporated new provisions to allow for reclassification of assets from trading, disclosure requirements evolved, too. IFRS 7 imposes requirements to disclose the fair value and the carrying amount at the reclassification date and, for each reporting period following reclassification, a comparison between the gains or losses recorded on reclassified assets and those that would have been incurred had the assets not been reclassified.

Basel 2 – Pillar 3

Pillar 3 reports were established by the Basel 2 framework with the aim to provide the public with qualitative and quantitative information on the risk exposures of a bank. Minimum disclosure must include the top level components of total RWAs by risk type. These disclosures have to be provided separately for the standard approach and the internal models approach. In addition, most disclose by type of risk, for the period under review, their average, minimum and maximum VaR, as well as the VaR value at the last day of the period under review (these are new Basel 2.5 disclosure requirements).

Pillar 3 requirements are intended as a basic set of transparency requirements, leaving banks free to provide additional detail which some do. Extensive commentary on components of RWAs often accompanies mandatory disclosures on capital requirements. Pillar 3 reports must be published at least annually but banks have the ability (or may be compelled by their supervisor) to provide more frequent disclosures. In contrast to the focus

of notes to financial statements on market risk as defined by the banks, Pillar 3 reports are devoted to mRWAs with regulatory VaR, defined consistently across banks, an important but not sole determinant.

Public regulatory reports (only for United States)

Federal Reserve

The Federal Reserve mandates disclosures of financial data on a common template for all US bank holding companies. Along with the income and balance sheet data seen in Annual Reports, the FR Y-9C includes a variety of other information that provide additional detail on components of income and the various categories of assets and liabilities. For example, banks report trading income by asset class, as well as net, gross, and asset class of trading derivatives. Information on market Risk Weighted Assets (mRWA) is limited to two items: (i) Market Risk Equivalent (MRE, total mRWA); and (ii) Amount due to specific risk. Banks are not asked to report the regulatory Value at Risk (VaR), the 10-day, 99% measure of market risk that produces the VaR-based measure part of mRWA. FR Y-9C is exclusively a report of numbers; there is no commentary by the filing bank.

Securities and Exchange Commission (SEC)

US Banks subject to SEC reporting requirements file annual and quarterly reports with the SEC on Form 10-K and 10-Q, respectively. Foreign banks that are subject to the SEC reporting requirements file their annual reports on Form 20-F. These financial reports include financial statements prepared in accordance with GAAP (ie US GAAP for US registrants; foreign private issuers may use US GAAP, IFRS as issued by the IASB, or home country GAAP with reconciliation to US GAAP). There is some overlap between SEC reports and the FR Y-9C when the reporting legal entity is the same, although SEC reports do not generally include data on mRWAs or the composition of total RWAs. Along with financial statements, these reports require additional disclosures including commentary on various items, for example, regulatory capital.

Included in the SEC required disclosures are qualitative and quantitative information about a bank's market risk for trading and non-trading activities consistent with SEC Regulation 229.305, which provides for VaR as one disclosure alternative. Banks that elect to disclose VaR are required to disclose details about their VaR calculation and the model assumptions, including average, low and high value, confidence level, holding period, length of the historical database on which the model is built, risk that stay out of the scope, backtesting, explanation of differences between VaR and daily profits and losses with qualitative explanations that can be split between exposures and accompanied by graphs.

FASB Accounting Standards Codification paragraph 825-10-50-23 encourages but does not require the disclosure of quantitative information about the market risks of financial instruments covering details on positions and perhaps activity during the period; the hypothetical effects on comprehensive income, net assets, or annual income of possible changes in market prices; and VaR from derivatives and other positions for period end and average during the period. The paragraph also suggests other potential encouraged disclosures such as a gap analysis of interest rate re-pricing or maturity dates, duration of financial instruments, along with other ways to disclose quantitative information about market risk in trading and non-trading activities. There is no mention of the associated RWAs related to market risks. Some banks report TRWA as part of the disclosures provided consistent with FASB Accounting Standards Codification section 942-505-50.

Further, regulatory requirements include banks having to disclose information about their exposures that are linked with the crisis started in 2007 (for instance their exposure to subprime, CDOs, other ABS, and monolines). A significant part of these exposures have been held in the trading book. These ad-hoc disclosures can be provided in the financial statements, in the Pillar 3 report or elsewhere (for instance in the management report). They are released every quarter and in some jurisdictions they follow a standardised format. They provide an insight on exposure classes (like securitisation positions) that are not otherwise identified as such in financial statements of banks.

Annex 3: Hypothetical test portfolio structure

The following instructions and test portfolio descriptions were sent to participating banks and formed the basis of the exercise.

1. Key instructions and assumptions for the exercise

In order to ensure the accurate and consistent execution of the exercise across all participating institutions, banks are asked to familiarise themselves with the following instructions and assumptions:

(a) The duration of the exercise will be the 20 trading days over the four week period beginning on **Monday, June 18, 2012** and ending on **Friday, July 13, 2012**.

(b) All VaR, Stressed VaR, and IRC results should be documented using the Excel template accompanying this document.

(c) In the case that the exercise requires a Bank to provide results for a model that has not been approved for use in regulatory capital calculations, the Bank must provide results using the model currently being used for internal management purposes. Please clearly specify the regulatory approval status of the models employed for each portfolio in the third tab of the results submission template accompanying this document.

(d) Banks should assume they enter all positions on the first day of the exercise, with initial valuations for instruments being based upon end of day prices observed on Monday, June 18, 2012. Unless explicitly stated otherwise in the specifications for a particular portfolio, strike prices for options positions should be determined relative to prices for the underlying as observed at market close on Monday, June 18, 2012.

(e) Assume that once positions have been entered as specified in this document on day 1 of the exercise, each portfolio ages for the duration of the exercise. Furthermore, assume the Bank does not take any action to manage the portfolio in any way during the entire 20-day exercise period.

(f) Assume that there is neither any margining agreements nor collateralisation of positions associated with the trades entered in the exercise.

(g) Banks should calculate 10-day 99% VaR on a daily basis. If a participating bank also calculates VaR by risk factor, it may elect to separately provide an additional breakdown of total VaR, GMR (General Market Risk) VaR, DSR (Debt Specific Risk) VaR, and ESR (Equity Specific Risk) VaR for each portfolio as applicable.

(h) Stressed VaR and IRC are to be calculated on a weekly basis. We would prefer that calculate Stressed VaR and IRC based on end of day prices for each Friday in the time window for the exercise (ie **June 22, June 29, July 6,** and **July 13)**. However, flexibility will be granted to banks preferring to use results from another day of the week if required.

(i) For each portfolio, banks are asked to provide results in two currencies; one in the Bank's home currency and one in the base currency of the portfolio as provided in

the table below. Two separate tabs in the accompanying Excel file are provided to facilitate the submission of both home and base currency results.

(j) In addition to VaR, stressed VaR and IRC risk metrics, banks should also provide the initial market value of each portfolio, and indicate the stress period used in the calculation of portfolios 1 to 26. For the selection of the stress period, the following applies:

- In order to facilitate a quantitative assessment of the impact of different choices for stress periods across banks, stressed VaR for portfolios 1 to 24 will be calculated using the top-of-the-house stressed period currently used by each bank for its actual trading portfolio.
- For the "all-in portfolio" and "sub-all-in portfolio" enumerated as portfolio 25 and respectively 26, each bank is asked to use its own internal process for stress period selection to identify the appropriate stress period. The stress period selected by a given bank should then be used in its calculation of stressed VaR for portfolio 25 and 26 respectively.

(k) For transactions that include long positions in CDS, assume an immediate up-front fee is paid to enter the position as per the market conventions as indicated by Markit Partners (100bps for investment grade, 500bps for high yield).

(l) Assume that the maturity date for all CDS in the exercise follow conventional quarterly termination dates, often referred to as "IMM dates".

(m) Additional specifications required in order to compute pricing calculations required for CDS positions should be done in a way that is consistent with commonly used market standards.

(n) Use the maturity date (ie, some options expire on third Saturday of the month, etc) that ensures the deal is closest to the term-to-maturity specified. For any material details of the product specification that are not explicitly stated in this document, please provide the assumptions you have used along with the results (ie, day count convention, etc).

(o) Assume that one options contract represents 100 shares of the underlying security.

(p) The acronyms ATM, OTM and ITM refer to an option's moneyness: ATM stands for "at the money", OTM stands for "out of the money", and ITM means "in the money".

(q) Assume that all options are traded over-the-counter unless explicitly specified in the portfolios

(r) Assume that the timing convention for options is as follows: The time to maturity for a *n*-month option entered on the first day of the exercise is in *n* months. For example, a 3-month OTC option entered on June 18, 2012 expires on September 18, 2012. If options expire on a non-trading day, adjust the expiration date as per business day conventions consistent with common practices. Also provide explicit details on the nature of the adjustment made.

(s) Assume that the exercise style for all OTC options specified in the Phase 1 portfolios is as follows:

- **American** for single name equities (Portfolios 2,5), and commodities (Portfolio 17), and,

- o **European** for equity indices (Portfolios 1,3,4,6, and 7), foreign exchange (Portfolio 14) and Swaptions (Portfolios 10 and 11).

(t) In the case that a bank is required to make additional assumptions beyond those specified above that it believes are relevant to the interpretation of its exercise results (eg close of business timing, coupon rolls, mapping against indices, etc.), it should submit a description of those specifications in a separate document accompanying its return template.

2. Specification of Phase 1 Portfolios

The portfolios provided to banks are representative of common trading strategies implemented using primarily vanilla products. The following table specifies the details about each hypothetical portfolio and which risk metrics should be calculated for each:

Phase 1 Portfolios – Common Trading Strategies and Transactions

Equity Portfolios					
Portfolio # Risk Factor	**Strategy**	**Base Currency**	**VaR**	**Stressed VaR**	**IRC**
1 Equity	**Equity Index Futures** ***Long delta*** -Long 10 contracts ATM 3-month FTSE 100 index futures ** Futures price is based on the index level at NYSE Liffe London market close on Monday, June 18, 2012.*	GBP	×	×	
2 Equity	**Bullish Leveraged Trade** ***Long gamma & long vega*** -Long 500 contracts OTC Google (GOOG) OTM 3-month call options (1 contract = 100 shares underlying) ** Strike price is out-of-the-money by 10% relative to the stock price at market close on Monday, June 18, 2012.*	USD	×	×	
3 Equity	**Volatility Trade #1** ***Short short-term vega & long long-term vega*** -Short straddle 3-month ATM S&P 500 Index OTC options (10 contracts) -Long straddle 2-year ATM S&P 500 Index OTC options (10 contracts)	USD	×	×	
4 Equity	**Volatility Trade #2 (Smile effect)** ***Long/short puts on FTSE 100*** - Long 10 contracts of 3-month put options on FTSE 100 index (*with a strike price that is 10% OTM based on the end-of-day index value*) - Short 10 contracts of 3-month put options on FTSE 100 index (*with a strike price that is 10% ITM based on the end-of-day index value*) ** Strike price is based on the index level at NYSE Liffe London market close on Monday, June 18, 2012.*	GBP	×	×	

5 *Equity*	**Volatility Trade #3 (Correlation effect)** ***Long call on equity basket, short calls on component stocks*** - Long 1-year ATM OTC call options* on a basket of two equities composed of Siemens AG (SIE, DE0007236101) & Unilever (UNA , NL0000009355) - Short 1-year ATM call options on Siemens (SIE) * - Short 1-year ATM call options on Unilever (UNA)* ** Number of contracts should be computed so that total market capitalisation of the basket is €10MM and the market capitalisation of each underlying equity is €5 MM (please specify the number of contracts in the results). Market capitalisation should be based on share prices at end of day June 18, 2012.*	EUR	×	×	
6 *Equity*	**Equity Variance Swaps on Eurostoxx 50 (SX5E)** - Long ATM variance swap on Eurostoxx 50 with a maturity of 2 years, notional amount of €10MM. The payoff is based on the following realised variance formula: $\frac{252}{n-2}\sum_{i=1}^{n-1}[\ln(\frac{S_{i+1}}{S_i})]^2$, where n= number of days until maturity	EUR	×	×	
7 *Equity*	**Barrier Option** - Long 10 contracts of 3-month ATM S&P 500 down-and-in put options with a barrier level that is 10% OTM and continuous monitoring frequency.	USD	×	×	
Interest Rate Portfolios					
Portfolio # Risk Factor	**Strategy**	**Base Currency**	**VaR**	**Stressed VaR**	**IRC**
8 *Interest Rate*	**Curve Flattener Trade** ***Long long-term & short short-term treasuries*** -Long €10MM 10-year German Treasury bond (Coupon: 2.0, Expiry: 1/4/22, ISIN: DE0001135465) -Short €40MM 2-year German Treasury note (Coupon: 0.25, Expiry: 12/13/13, ISIN: DE0001137362.)	EUR	×	×	×
9 *Interest Rate*	**Interest rate swap** - Receive fixed rate and pay floating rate - Fixed leg: Based on par rate, pay annually - Floating leg: 3-month Euribor rate, pay quarterly - Notional: €10mm, Maturity: 10 years	EUR	×	×	
10 *Interest Rate*	**2-year swaption on 10-year interest rate swap** An OTC ATM receiver swaption with maturity of two years on the interest rate swap described in #9.	EUR	×	×	
11 *Interest Rate*	**5-year swaption on 10-year interest rate swap** An OTC ATM receiver swaption with maturity of 5 years on the following interest rate swap (ie receive fixed leg and pay floating leg as per the definition of a receiver swaption) : - Fixed leg: 5% semi-annual rate - Floating leg: EUR CMS rate 10Y, semi-annual - Notional: €10mm, Maturity: 10 years	EUR	×	×	
12 *Credit Spread*	**Negative Basis Trade** ***Long Corporate Bond & Long Protection via CDS*** -Long US$10MM Microsoft senior unsecured debt (MSFT 2.5 2/18/16 series, CUSIP # 594918AK0) -Long US$10MM notional single-name 5 year CDS on Microsoft (RED Code: 5EDDA9)	USD	×	×	×

13 *Credit Spread*	**Relative Value Trade** ***Long Corporate Bonds of same sector and rating*** -Long €12MM GlaxoSmithKline debt (GSK 3 7/8 7/6/15 series, ISIN:XS0438140526) -Short £10MM Roche Holdings debt (ROSW 5 ½ 3/4/15 series, ISIN: XS0415625283) ** based on a constant foreign exchange rate of £1=€1.2*	GBP	×	×	×
Foreign Exchange Portfolios					
Portfolio # Risk Factor	**Strategy**	**Base Currency**	**VaR**	**Stressed VaR**	**IRC**
14 *F/X*	**Covered F/X Call** ***Long EUR/USD and short EUR/USD call option*** - Long 3-month EUR/USD forward contracts (ie long USD against EUR) with US$10MM notional purchased at a rate of US$1 = €0.76 - Short US$10MM 3-month OTC EUR/USD call option (ie short USD against EUR)with strike price of €0.76	EUR	×	×	
15 *F/X*	**Vanilla Currency Swap** ***Fixed-for-fixed; Lend USD and borrow EUR*** - 2-year fixed for fixed F/X swap - Lend US$10MM at 1% with semi-annual coupons and borrow €7.8MM at 1.5% with annual coupons	EUR	×	×	
Commodities Portfolios					
Portfolio # Risk Factor	**Strategy**	**Base Currency**	**VaR**	**Stressed VaR**	**IRC**
16 *Commodity*	**Curve Play from Contango to Backwardation** ***Long short-term and Short long-term contracts*** - Long 350,000 3-month ATM OTC London Gold Forwards contracts (1 contract = 0.001 troy ounces, notional: 350 troy ounces) - Short 430,000 1-year ATM OTC London Gold Forwards contracts (Notional: 430 troy ounces)	USD	×	×	
17 *Commodity*	**Long oil put options** -Long 100 contracts of 3-month OTC WTI Crude Oil puts with strike = 6-month end-of-day forward price on June 18, 2012 (1 contract = 1000 barrels, total notional 100,000 barrels)	USD	×	×	
Credit Spread Portfolios					
Portfolio # Risk Factor	**Strategy**	**Base Currency**	**VaR**	**Stressed VaR**	**IRC**
18 *Credit Spread*	**Diversified Index Portfolio** ***Long protection via CDS index*** - Long €10MM notional iTraxx 5-year Europe index Series 17, Version 1 – Maturity 6/20/2017 (RED Pair Code: 2I666VAX3)	EUR	×	×	×

<table>
<tr>
<td>19
Credit
Spread</td>
<td>Diversified Corporate Portfolio
Long Protection via CDS on 10 A- to AA- corporates
- Equivalent of Long €1MM notional per single-name 5 year CDS (total €10MM notional) on the following companies:
<table>
<tr><th>Name</th><th>RED Code</th></tr>
<tr><td>P&G</td><td>7B6989</td></tr>
<tr><td>Home Depot</td><td>47A77D</td></tr>
<tr><td>Siemens</td><td>8A87AG</td></tr>
<tr><td>Royal Dutch Shell</td><td>GNDF9A</td></tr>
<tr><td>IBM</td><td>49EB20</td></tr>
<tr><td>Met Life</td><td>5EA6BX</td></tr>
<tr><td>Southern Co</td><td>8C67DF</td></tr>
<tr><td>Vodafone</td><td>9BADC3</td></tr>
<tr><td>BHP</td><td>08GE66</td></tr>
<tr><td>Roche</td><td>7E□2AF</td></tr>
</table></td>
<td>EUR</td><td>×</td><td>×</td><td>×</td>
</tr>
<tr>
<td>20
Credit
Spread</td>
<td>Sovereign CDS Portfolio
Long Protection via CDS on 5 countries
- Long €2MM per single-name 5 year CDS (total 10MM notional) on the following countries:
<table>
<tr><th>Country</th><th>RED Code</th></tr>
<tr><td>Italy</td><td>4AB951</td></tr>
<tr><td>UK</td><td>9A17DE</td></tr>
<tr><td>Germany</td><td>3AB549</td></tr>
<tr><td>France</td><td>3I68EE</td></tr>
<tr><td>US</td><td>9A3AAA</td></tr>
</table></td>
<td>EUR</td><td>×</td><td>×</td><td>×</td>
</tr>
<tr>
<td>21
Credit
Spread</td>
<td>Sovereign Bond Portfolio
Long Bonds on 5 countries
- Long €2MM per single-name 5 year bonds(total 10MM notional) on the following countries: Italy, UK, Germany, France, US
<table>
<tr><th>Identifier</th><th>Description</th></tr>
<tr><td>IT0004164775</td><td>BTP 4% 2017</td></tr>
<tr><td>GB00B0V3WQ75</td><td>UK Treasury Gilt 1.25% 2017</td></tr>
<tr><td>DE0001135317</td><td>Bund 3.75% 2017</td></tr>
<tr><td>FR0010415331</td><td>OAT 3.75% 2017</td></tr>
<tr><td>US912828NA41</td><td>US Treasury 3.125% 2017</td></tr>
</table></td>
<td>EUR</td><td>×</td><td>×</td><td>×</td>
</tr>
<tr>
<td>22
Credit
Spread</td>
<td>Sovereign Bond/CDS Portfolio
Long Protection via CDS on 5 countries
- Long €2MM per single-name 5 year CDS (total 10MM notional) on the following countries: Italy, UK, Germany, France, US as in portfolio #20 and 21.
- Long €2MM per single-name 5 year bonds (total 10MM notional) on the following countries: Italy, UK, Germany, France, US as in portfolio #21.</td>
<td>EUR</td><td>×</td><td>×</td><td>×</td>
</tr>
<tr>
<td>23
Credit
Spread</td>
<td>Sector Concentration Portfolio
Long Protection via CDS on 10 financials
- Equivalent of Long €1MM notional per single-name 5 year CDS (total €10MM notional) on the following 10 companies:
<table>
<tr><th>Name</th><th>RED Code</th></tr>
<tr><td>Met Life</td><td>5EA6BX</td></tr>
<tr><td>Allianz</td><td>DD359M</td></tr>
<tr><td>Prudential</td><td>7B878P</td></tr>
<tr><td>AXA</td><td>FF667M</td></tr>
<tr><td>ING</td><td>49BEBA</td></tr>
<tr><td>Aegon</td><td>007GB6</td></tr>
<tr><td>Aviva</td><td>GG6EBT</td></tr>
<tr><td>Swiss Re</td><td>HOB65N</td></tr>
<tr><td>Principal Financial Group</td><td>7B676W</td></tr>
<tr><td>Suncorp Group</td><td>8ED955</td></tr>
</table></td>
<td>EUR</td><td>×</td><td>×</td><td>×</td>
</tr>
</table>

24 *Credit Spread*	**Name Concentration (Long Protection via CDS on 1 name)** - Equivalent of Long €10MM notional on 5 year CDS for Met Life	EUR	×	×	×
Diversified Portfolio					
Portfolio #	**Strategy**	**Base Currency**	**VaR**	**Stressed VaR**	**IRC**
25	**All-in Portfolio** - Long a composite portfolio consisting of the simple sum of all preceding portfolios (#1 through #24 inclusively)	EUR	×	×	x
26	**Sub-All-in Portfolio** - Long a composite portfolio consisting of the simple sum of 9 portfolios (ie portfolios #1, #2, #3, #8, #9, #10, #15, #16, #18)	EUR	×	×	×