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TRENDS IN RISK INTEGRATION AND AGGREGATION

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Executive Summary

1. This report summarises the findings of the Joint Forum's Working Group on Risk Assessment and Capital and builds on the previous efforts of the Working Group to better understand approaches to the management of major individual risks in the banking, insurance, and securities sectors. The Working Group has observed two important trends on the basis of a survey of 31 financial institutions in 12 jurisdictions – (1) greater emphasis on the management of risk on an integrated firm-wide basis, and (2) related efforts to “aggregate” risks through mathematical risk models. The Working Group believes that these trends stem from the interest of firms in understanding better the variety of risks that they face, thereby enabling them to determine more accurately the amount of capital they need to operate their businesses. The report is not designed to identify best practices or make recommendations but to act as a basis for a dialogue with industry in summarising current developments.

Integration of risk management

2. An integrated risk management system seeks to have in place management policies and procedures that are designed to help ensure an awareness of, and accountability for, the risks taken throughout the financial firm, and also to develop the tools needed to address those risks. A key objective is to ensure that the firm does not ignore any material source of risk. To help accomplish this, many firms have increased the share of firm resources devoted to risk management activities and/or created a dedicated risk management function. Common tasks for dedicated risk management functions include the development and enforcement of common definitions and metrics for risk throughout the firm, as well as the preparation of risk reports for senior management. Many firms have also invested considerably in centralised information systems to help keep track of risks within the firm.

3. From a decision-making perspective, integrated risk management typically involves the establishment of hierarchical limit systems and risk management committees to help determine how to set and allocate such limits. However, firms still vary considerably in the practical extent to which important risk management decisions are centralised.

Risk Aggregation

4. Broadly, risk aggregation refers to efforts by firms to develop quantitative risk measures that incorporate multiple types or sources of risk. The most common approach is to estimate the amount of “economic capital” that a firm believes is necessary to absorb potential losses associated with each of the included risks. This is typically accomplished via mathematical or statistical techniques designed to assess the likelihood of potential adverse outcomes, although the use of specific stress scenarios is also relatively common. More discussion of approaches to economic capital calculations is included in Annex 2 of the report. Based on the survey undertaken by the Working Group, it is clear that risk aggregation and economic capital methods are still in early stages of evolution.

5. Some firms remain sceptical of the value of these methods and techniques, particularly efforts to reduce all risks into a single number. Others believe that there is a need for a common metric that allows risk-return comparisons to be made systematically across business activities whose mix of risks may be quite different (e.g., insurance vs. trading). However, even among those firms that are at the forefront of exploring economic capital approaches, there is wide variation in the manner in which aggregated risk measures such as economic capital are used for risk management decision-making.

Supervisory Developments

6. Supervisory and regulatory practices have influenced and have been influenced by these trends. Oversight regimes in each of the banking, insurance, and securities sectors have themselves been evolving rapidly in recent years, as witnessed by such initiatives as the Gramm-Leach-Bliley Act (GLBA) in the United States, the Financial Conglomerates Directive (FCD) in the European Union, the emergence of pan-sectoral supervisory bodies such as the Financial Services Authority in the United Kingdom, as well as the Basel II and Solvency II projects in respect of capital adequacy.

Conclusions

7. The Working Group believes that the efforts that firms have been making to develop more systematic and integrated firm-wide approaches to risk management should continue to be strongly encouraged by the regulatory and supervisory community. Moreover, as firms become more reliant on integrated firm-wide risk management processes, it becomes ever more important for supervisors to understand those processes and to be able to have a meaningful dialogue with the firm about them.

8. The Working Group believes that supervisors and regulators should continue to monitor and support where appropriate firms' efforts to develop means of aggregating (to the degree possible) their risks. Supervisors and regulators should continue to improve their understanding of the nature and limitations of economic capital methodologies and how they are being used. At the same time, supervisors and regulators should recognise that these methodologies do not, by themselves, constitute a sound risk management framework and do not substitute for strong corporate governance and risk management capabilities generally.

9. There is also an interaction between the development of *economic* capital methods and the recognition of diversification benefits in *regulatory* capital calculations. Regulators, in setting capital requirements, do not fully recognise the degree of diversification benefits predicted by economic capital models. This is particularly the case with regard to diversification *across* risk types, such as market risk, credit risk, insurance risk, and operational risk. The Working Group believes that there are several reasons, including limitations on available data, why supervisors and regulators may be justified in pursuing a cautious approach. Many supervisors and regulators have indeed emphasised the importance of a strong and conservative regulatory capital framework in relation to the largest financial firms. However, for those firms in the financial sector that are doing economic capital calculations, the Working Group supports further work by them to develop an empirical basis for correlation estimates, particularly those between risk categories.

10. Continuing dialogue between the financial industry and the regulatory community reflects the complementary nature of existing trends in market and supervisory practices. The evolution in approaches to risk aggregation by firms not only reflects supervisory and regulatory initiatives, but also provides an impetus for continued advances in supervisory and regulatory approaches.

Trends in Risk Integration and Risk Aggregation

11. This report summarises the findings of the Joint Forum's Working Group on Risk Assessment and Capital in relation to trends in risk integration and risk aggregation. This work builds on the previous efforts of the Working Group to better understand approaches to the management of major individual risks in the banking, insurance, and securities sectors.¹ As a follow up to those efforts, the Joint Forum requested that the Working Group focus on issues associated with the emergence and development of integrated firm-wide risk management approaches as well as methodologies such as "economic capital" that are being used to develop aggregate measures of risk. The Working Group was requested to consider trends in market practices as well as related trends in supervisory approaches and the interaction between the two.

12. During 2002, the Working Group developed and conducted a survey of 31 market participants in 12 countries on these subjects. In some cases, the surveys were completed in writing. In other cases, members of the Working Group interviewed firms on the basis of the survey questionnaire. Based on these survey responses and ensuing discussions within the Working Group, this report provides a discussion of the trends in risk integration and risk aggregation.² The first portion of the report focuses on trends in market practices, while the second portion covers related supervisory trends. The third and concluding section of the report discusses additional potential implications for supervision and regulation of the trends discussed in the first two parts.

13. The report is supplemented with three annexes. The first annex provides a more detailed discussion of the results of the survey of market participants. The second annex contains a brief introduction to economic capital methodologies and provides a stylised example of a firm-wide economic capital calculation. The third annex provides further background information on some of the regulatory and supervisory developments mentioned in the report.

Trends in Market Practices

14. It is important to stress at the outset that risk management functions and approaches at major financial firms continue to evolve at a very rapid rate. It is therefore hazardous to generalise about the state of practice at any given moment, given the rate at which changes in those practices are occurring. The two most prominent trends discussed in this report – greater emphasis on integrated firm-wide risk management and related efforts to explore greater use of quantified measures of aggregate risk, such as economic capital – appear in varying degrees across all three financial sectors. Nevertheless, they are not by any means universal trends, nor are they identical. For example, some firms have embraced a more integrated approach to firm-wide risk management, but remain sceptical of the value of economic capital methods.

¹ The Joint Forum, *Risk Management Practices and Regulatory Capital: Cross-Sectoral Comparison* (November 2001), available at <http://www.bis.org>.

² The Working Group's findings in the insurance sector are supplemented by the results of an earlier study prepared by KMPG for the European Commission, *Study into the methodologies to assess the overall financial position of an insurance undertaking from the perspective of prudential supervision* (May 2002), and the survey of 12 insurance firms reported in Appendix 3.3 therein. The Group's findings in the securities sector are supplemented by the results of a survey of 19 firms in nine jurisdictions, undertaken by the Technical Committee of the International Organization of Securities Commissions (IOSCO) and published in its *Sound Practices for the Management of Liquidity Risk at Securities Firms* (May 2002).

15. Both of these trends, however, are responsive to the nature of the challenges that confront large complex financial firms today. Such firms typically engage in multiple financial activities in multiple geographic locations and multiple legal entities, while taking on multiple types of risks. At the same time, such firms are under increasing pressure to maximise risk-adjusted returns on capital. In addition, supervisory and regulatory initiatives have strongly encouraged firms to adopt risk management improvements, including in many cases more systematic approaches. These factors have over time led an increasing number of financial firms to adopt approaches that seek to provide a more integrated, firm-wide approach to the management of risks. At the same time, some firms have felt that the next step in improving their risk management approach should be the exploration of approaches to incorporate a common metric for expressing risk, such as economic capital.

16. One aspect of the greater emphasis on integrated risk management is an increase in the proportional share of firm resources devoted to risk management. Firms generally report having maintained or increased their internal emphasis on risk management in recent years, with some reporting significant increases in risk management-related expenditures. These increased resources have been seen as necessary to appropriately implement the risk management approaches that the firm is seeking to adopt.

Risk Integration

17. An integrated risk management system seeks to have in place management policies and procedures that are designed to help ensure an awareness of, and accountability for, the risks taken throughout the financial firm, and also to develop the tools needed to address those risks. That is, integrated approaches to risk management aim to ensure a comprehensive and systematic approach to risk-related decisions throughout the financial firm. For example, a clearly defined process helps to ensure accountability for decisions related to the management of risk, and reduces the possibility that some risks will not be appropriately assessed. In practice, the risk management process at a large complex financial firm encompasses a very large number of specific decisions and trade-offs being made at multiple levels within the firm, for example, which risks to take on, which to hedge, and what price to charge for bearing risks. Thus, it is no small task at a sizeable firm to develop a consistent and accountable approach to all its risk-related decision-making. Moreover, in many cases, knowledge of local market characteristics and nuances is essential to specific risk management decisions, so that a common process needs to remain sufficiently flexible to accommodate this local market knowledge.

18. Many firms have chosen to establish a dedicated risk management function. These units typically seek to promote more integrated and systematic approaches to risk management, although their specific roles vary widely across firms. A common function in many firms has been for the dedicated risk management function to develop and encourage the use of a common set of metrics for risk throughout the firm. This can involve establishing common firm-wide definitions of risk and having different parts of the firm apply such definitions more or less uniformly for risk reporting purposes.

19. Risk management functions are also typically responsible for preparing background material and data for senior-level discussions of risk, for example, firm-wide risk reports. The frequency of these discussions varies, as does the production of the various reports. Some types of reports (e.g., value-at-risk of trading positions) are often updated daily, while others (e.g., stress testing results) are updated less frequently. A common set of risk definitions and comprehensive reporting of risks by business units provides another critical benefit – better and more systematic identification of risk concentrations. For example, many firms have noted the advantage of having comprehensive reporting of aggregate exposures to individual counterparties that span the variety of different business activities in which such exposures may arise.

20. Naturally, the organisation of risk management functions varies across firms. In some firms, risk management is a highly centralised process where the dedicated risk management function exercises significant authority. In other firms, particularly in the insurance sector, local business units with a limited risk profile retain substantially greater autonomy over significant risk management decisions. Moreover, even in some firms with a bias toward centralised risk-management decision-making, the key decisions are made by a senior management committee, rather than by the risk management function itself. The organisational infrastructure of risk management decision-making varies considerably across firms, and it is difficult to conclude that any single approach is becoming dominant.

21. Where a firm stands in the spectrum from centralised to decentralised risk management structure is typically the result both of conscious decisions and of the firm's heritage and traditions. In practice, most firms tend to view centralised and decentralised risk management functionality as equally necessary, complementary and mutually re-enforcing.³ The manner in which the two levels of risk management are combined reflects the organisation's view on how to optimise overall risk management. Nonetheless, as an organisation grows and its technological infrastructure improves, there is oftentimes a tendency for centralised organisational units to emerge, evolve, and assert a greater role.

22. The broader trend toward more integrated and accountable risk management processes is also reflected in the significant expenditures that firms have been making to upgrade their information technology (IT) systems to better address the desire for up-to-date, consistent, firm-wide metrics of risk. IT systems are crucial: many firms report that the greatest practical challenge of developing a more integrated firm-wide view of their risks lies in the difficulty of ensuring compatible and efficient IT systems for data capture, data analysis, and data reporting that encompass the whole of their operations. In practice, even the most ardent supporters of firm-wide risk management are still some time away from having risk management IT systems that meet all of their desired specifications. As noted in Annex 1, the incompatibility of various older (legacy) information systems, particularly for firms with a significant acquisition history, is often an important obstacle in this regard.

Risk Aggregation

23. A second major trend in risk management is the exploration, and in some cases the development, of quantitative risk measures that incorporate multiple types or sources of risk. This encompasses the efforts that a number of firms are making to develop aggregate measures of risk exposure using common definitions of risk across the organisation. Additional detail on the issues associated with these developments can be found in Annex 1 of this report.

24. The ultimate expression of the risk aggregation trend is the emergence of economic capital methodologies that seek to aggregate multiple types of risks into a single metric. Economic capital methods seek to assess the amount of capital needed to support a given set of risks. They are often based on statistical methods, for example the amount of capital needed to absorb losses up to a specified probability (e.g., 99.97%). But in many cases they also incorporate stress-test or scenario-based methods to measure the amount of economic

³ For example, even in a decentralised structure there has to be some element of or representative from a central control function to assure group management that the local unit is following the group's guidelines for the measurement of risk. Absent such assurance, the central unit might not fully understand the situation at the local unit.

capital that a firm could need to cover potential losses that would be associated with a given set of risks or activities.

25. Risk aggregation can occur at various levels within a large complex financial firm. It can occur across products and instruments for the same risk type, or across multiple risk types and across multiple business or legal entities. Across products, economic capital methods typically build on approaches developed for one or more of the individual risk types. For example, market risk economic capital is typically measured using a value-at-risk methodology, although some firms incorporate market risk stress testing into their economic capital calculation. In the insurance sector, there has obviously also been a strong tradition of risk quantification, but not all of it has been in the style of economic capital methods. A number of firms have been working to adapt existing approaches, such as dynamic financial analysis, to an economic capital context, a process that firms believe requires a significant amount of informed judgement.

26. There is especially wide variation across firms in regard to aggregation across risk types and business units. Some firms seek to provide all the core risk measurement inputs to a centralised risk management function so that it can perform the overall economic capital calculation. In concept, this allows all risks to be broken down into their individual variables, allowing a consistent approach to risk aggregation across risk types to be applied. In practice, many firms still produce economic capital measures for some legal and business entities separately (each spanning multiple risk types), so that a firm-wide calculation will need to make some assumptions about how to aggregate the risks of these multiple composite measures of risk. Annex 2 provides a brief introduction to economic capital methodologies and provides a stylised example of a firm-wide economic capital calculation.

27. The conceptual appeal of economic capital methodologies is the hope that they can provide a single metric along which all types of risks can be measured and traded off. If a reasonably accurate single metric could be found, it would provide an important mechanism for seeking to optimise the risk-return profile of the firm. Activities with poor risk-return tradeoffs – as measured by this metric -- could be reduced or eliminated, while those with appealing risk-return tradeoffs could be expanded. In reality, it is unlikely that any firm would allow key decisions to be made mechanically on the basis of a single metric. Nonetheless, there is a strong desire for a measure that could help provide a consistent discipline and input to risk-related decision-making.

28. There are a variety of views about the current state and usefulness of economic capital methodologies among large complex financial firms. In practice, as already suggested, the development of economic capital methodologies is clearly at an early stage, even for those firms that have focused on it most heavily. Moreover, some firms remain highly sceptical that complex risks can be meaningfully aggregated into a single metric, or that the current technologies for doing so are sufficiently accurate. Firms whose risks tend to be concentrated in a single type of activity seem to be more reluctant to adopt economic capital methodologies, on the grounds that traditional methodologies have worked well, are varied and robust, are carefully tailored to the risk at hand, and are well understood. Where the key risks are largely of the same type and where all decision-makers have a thorough background in that risk type, the traditional approach has obvious appeal.

29. For firms whose risk exposures are more variable, however, it is a difficult challenge for senior management to systematically apportion risk-taking authority across business units without a metric that allows them to compare the relative riskiness of those units. Thus, it is not surprising that those firms with the most variability in types of risk exposures have typically expended the most effort exploring economic capital methodologies that would allow them to make these comparisons. The resulting risk quantification and economic capital processes typically involve two components: (1) modelling the risks and (2) estimating the

key inputs to the models, including measures of exposure. Firms have generally found that each component requires significant attention.

30. Two important methodological issues arise as a firm seeks to develop a comprehensive firm-wide approach to economic capital. The first issue is the need to produce a complete measure of economic capital, covering all relevant legal entities and risks. There is a tendency for groups to seek to include all legal entities in their risk aggregation, excepting perhaps minor ones that do not have a significant amount of the particular risk assessed. Similarly, most firms that have adopted economic capital measures have felt it necessary to develop a comprehensive measure, since otherwise the measure of economic capital will fail to fulfil its role as a common risk metric. Development of a comprehensive measure, however, poses challenges. For example, it would require quantitative measures of risks that are inherently difficult to quantify, such as operational risk or business risk. Thus, the adoption of economic capital methods within firms has often been complementary to the efforts that a number of firms have been making to better understand and measure risks such as operational risk.

31. The second significant methodological issue associated with economic capital methods is the manner in which risks are aggregated across risk types (and less commonly across business or legal entities). Most commonly, this calculation involves the statistical concept of correlation. That is, a particular value for the correlation between the risks is selected, and standard statistical methods are then invoked to produce the aggregate risk measure. Empirically, correlations can be measured by observing the long-run relationship between two data series. In practice, there is a limited amount of relevant data currently available for measuring correlations across risk types.

32. There is little consistency across firms implementing economic capital methods, regarding the manner in which these critical correlation values are selected. Some firms attempt to measure correlations using data series that they believe provide reasonable proxies for the underlying economic relationships, while others believe that no empirical estimates would be reliable. For the latter firms, fixed correlation assumptions are employed. In some cases, these are clearly conservative, for example, the assumption of perfect correlation. Other firms adopt assumptions of lower correlations, implying the benefits of diversifying across the relevant risks. Even among firms that attempt to estimate correlations with data, conservative adjustments to these estimates are frequently applied.

33. To the degree that correlations across risks are imperfect, there is a “diversification benefit”. Generally speaking, the benefit is that the firm faces less risk, and would therefore require less capital to operate safely than would otherwise be the case. In other words, the aggregate risk is less than the sum of the individual risks that are being aggregated. The selection of correlations is the key variable influencing the scale of these diversification benefits, and this is why a great deal of attention is being given to estimating them.⁴

34. Another important aspect of this issue is the apportionment of any diversification benefit to business units below the firm-wide level. Most economic capital methods identify diversification benefits at one or more stages in the risk aggregation process. If the only purpose of making the economic capital calculation is to obtain a reasonable firm-wide risk estimate, then the question of how to apportion these diversification benefits is irrelevant. However, if the firm intends to assess business units by comparing their performance with

⁴ The stylised economic capital example in Annex 2 highlights the importance of these correlation assumptions numerically.

the amount of economic capital they are apportioned, then it is important to consider whether business-unit economic capital allocations should be calculated as if the business unit is a stand-alone entity (i.e., no allocated diversification benefit) or on the basis of a “marginal” contribution to aggregate economic capital.

35. Some firms are adamant that business unit economic capital should be calculated on a stand-alone basis (effectively allowing aggregation across risk types within the unit but not across other business units), with any diversification benefit accruing only at the firm-wide level. These firms contend that business unit decision-making could be distorted if activities are assumed to be low risk only because of the existence of diversification benefits with other business units. Moreover, the underlying relationships with activities in other business units could change significantly in a short period of time, particularly since these relationships are not typically under a common direction. Other firms, however, do apportion the diversification benefits down to individual business units, often on a pro rata basis. They believe that such measures provide a more accurate reflection of a unit’s marginal contribution to firm-wide risk and that concerns regarding inappropriate incentives can be addressed through the risk management process.

36. This issue is obviously connected with the wider question of how economic capital measures and methods are actually being used within firms currently. As noted, some firms remain quite sceptical about economic capital methods generally. Among those firms that perform some form of economic capital calculations, many use economic capital to help control risks and assess performance at individual business units. This frequently extends to assessing the return on economic capital of particular units. In some cases, firms base compensation decisions at least in part on the results of such assessments. Some of these firms also use the results of these assessments as important inputs into decisions about which business activities to expand and which to reduce.

37. Some firms use economic capital primarily at the firm-wide level to help guide broader decisions about whether the firm has sufficient actual capital overall and how to plan its aggregate capital needs over time. In most cases, the role of economic capital is only that of one input among several, while in a few others it has a greater influence. It is important to emphasise that the question of whether to use economic capital is not an “either/or” decision. Many firms and their managements recognise both the benefits and the limitations of the methodologies. That is, economic capital results are one factor among several used in making decisions on risk control, the adequacy of firm-wide capital, and the allocation of capital to the business units. Furthermore, in no case does economic capital supplant the firm’s existing risk management framework.

38. Nevertheless, some firms have observed that a comprehensive implementation of economic capital methods is the equivalent of a significant cultural change for many business units. As such, it requires strong support by the most senior levels of management, as well as a rigorous and disciplined investment of resources to bring about such changes. Again, some firms are strong supporters of such an approach as necessary to bring about the underlying benefits of economic capital assessment. Others, given existing weaknesses in economic capital methods, have no plans to move in this direction.

Trends in regulation and supervision

39. Developments in financial regulation and supervision have likely been at least partly responsible for some of the trends in risk management practices noted above. In turn, supervisory and regulatory practices have been influenced by these trends. Oversight regimes in each of the banking, insurance, and securities sectors have themselves been evolving rapidly in recent years, as witnessed by such initiatives as the Gramm-Leach-Bliley

Act (GLBA) in the United States, the Financial Conglomerates Directive (FCD) in the European Union, the emergence of pan-sectoral supervisory bodies such as the Financial Services Authority in the United Kingdom, as well as the Basel II and Solvency II projects in respect of capital adequacy.

40. Several of these initiatives have been spurred by the perceived need for financial oversight frameworks that better address the blurring of distinctions across the three sectors. In the US, the GLBA was intended to make clear in what forms and under what conditions financial firms may combine banking activities with other financial activities such as securities and insurance underwriting. Similarly, the development of the FCD in the EU has reflected the desire to start the building of a legal framework for the oversight of financial groups engaged in multiple types of financial activities.

41. In practice, supervisory implementation of both the GLBA and the FCD will involve supervisory engagement with firms regarding their overall assessments of the firm's exposure to risks and the risk management frameworks that are being applied on a firm-wide basis. Such engagement would result from the importance supervisors place on taking an integrated firm-wide perspective on risk assessment and management both for financial holding companies under the GLBA and for financial conglomerates under the FCD. Other key regulatory initiatives involve similar issues, even though the underlying legal frameworks may differ in important ways. For example, the US National Association of Insurance Commissioners has been studying the role of insurance supervisors in assessing the financial health of holding companies and their impact on regulated subsidiaries⁵, while the US Securities and Exchange Commission has been considering approaches to the development of an oversight regime for investment bank holding companies.

42. Several other important trends have been associated with these developments in financial regulation and supervision. First is the greater emphasis on risk management processes in general. Increasingly, regulators and supervisors in all three sectors recognise that a strong risk management process is a critical element in helping the firm avoid financial problems. This has led to a greater interest on the part of supervisors in the design and operation of these processes. In some cases, this interest is a formal part of the supervisory mandate, while in others it simply reflects a greater desire by the relevant supervisor to understand the approach that a firm is taking.

43. Second, there is an increasing need for supervisors to work together. Sharing information and insights is a crucial aspect of a closer working relationship. A large complex financial firm engaged in activities spanning multiple sectors in multiple geographic locations can easily attract the jurisdictional interest of dozens of distinct financial regulators, and in some cases over a hundred. This places a premium on developing a practical working approach to supervisory information sharing that addresses the underlying needs of the various supervisors as efficiently as possible.

44. Both the GLBA and the FCD envision a substantial amount of supervisory information sharing. In each case, there is a need to balance the legitimate information needs of individual supervisors with the desire to avoid overloading each individual supervisor with all of the information relevant to the global enterprise. In many cases, the relevant supervisors have worked out memorandums of understanding (MOUs) to help provide practical guidance on the circumstances and manner in which information will be

⁵ Further discussion of these initiatives is provided in Annex 3 of the report.

shared. Even in cases where a formal MOU does not exist, supervisors are generally successful at forging practical compromises that support their mutual objectives.

45. The trend in some countries toward the creation of multi- or pan-sectoral supervisory bodies is a related development. In recent years, a number of countries have reconsidered the structural and institutional aspects of financial supervision. In a number of instances, the result of these reviews has been the merger of supervisory functions addressing the banking, insurance, and securities sectors. Countries that decide to effect such mergers regard them as the best way to achieve a more common approach to activities in the different sectors, to enhance information sharing and co-ordination among the relevant supervisory functions, and to develop their ability to oversee groups that themselves take a more integrated approach to their activities across multiple sectors.

46. In other instances, countries that have reconsidered financial supervision in recent years have chosen not to merge supervisory functions into one regulator. These countries have determined that the banking, insurance, and securities sectors require different approaches to prudential regulation and consumer protection. They have therefore chosen to rely on “functional” regulators with different goals and expertise, bolstered by rules for sharing information among regulators. In some cases, these decisions have also been related to views about the role of the central bank in financial supervision. For example, some jurisdictions have felt it important to retain a role for the central bank in banking supervision, which if combined with a move toward complete consolidation of financial supervision, could result in the central bank taking on responsibilities (e.g., insurance regulation) that are not commonly performed by central banks.

47. A fourth important trend in financial regulation has been the effort to improve significantly approaches to risk-based capital adequacy regulations. This is reflected in both the Basel II effort to improve existing international capital adequacy standards for banks⁶ and in the EU’s Solvency II initiative for insurance companies.⁷ These initiatives seek to more closely align capital requirements to the risks faced by firms while maintaining a harmonised approach across a variety of jurisdictions within their respective sectors. This latter aspect limits the number of different capital adequacy regimes with which a geographically diverse firm needs to comply and provides supervisors with a common metric for assessing the capital adequacy of both their own firms and those from other jurisdictions. It may also lead to increased cross-border financial activity.

48. The trend toward increasing the sensitivity of capital adequacy rules to the risks being faced by firms reflects a desire for the regulatory framework to provide both a better assessment of the financial condition of regulated firms and incentives for the firms to undertake risk management improvements themselves. This latter point is a particularly important element of the Basel II initiative, which builds substantially on firms’ internal risk measurement practices. Indeed, the effort to better align internal risk management practices and regulatory capital assessment is itself a major theme of the Basel II project.

49. Similarly, the Solvency II project for insurance companies in the EU has been undertaken to help ensure both cohesion in the approaches to prudential supervision across the EU and appropriate prudential solvency requirements, as insurance company risks and

⁶ For a further information on the Basel Committee’s proposals, see Basel Committee on Banking Supervision, *The New Basel Capital Accord* (Consultative Document, April 2003) and *Overview of the New Basel Capital Accord* (Consultative Document, April 2003). Both papers are available at <http://www.bis.org>.

⁷ Further discussion of the Solvency II project is provided in Annex 3 of the report.

risk management techniques evolve. This effort, launched in 2000, is still very much in process. Important insurance-specific elements are clearly involved, including the role and measurement of technical provisions. Nevertheless, the core issues are not dissimilar from Basel II: namely, to what extent national approaches should be harmonised and how to measure risk and solvency appropriately within the framework.

50. Within both the Basel II and Solvency II projects, the question of how to measure relevant risks appropriately is obviously critical. These questions relate both to the techniques for measuring individual risks and for how these risks should be aggregated into a firm-wide measure of risk for capital adequacy purposes. There is thus a great deal of similarity between this problem and the problem that firms are attempting to solve via economic capital methodologies. It is not surprising therefore that regulators have taken a great interest in better understanding these methodologies, not only because some firms are trying to use them, but also to see which aspects can be adapted for capital adequacy calculations.

51. A basic difference between sectoral initiatives, such as Basel II and Solvency II, and pan-sectoral initiatives, such as the GLBA and the FCD, should not be overlooked. The sectoral initiatives promote increasingly complete risk management and capitalisation frameworks for the corporate entities within the respective sector. They do not address the issue of how the sector-based frameworks fit together to create a comprehensive view of the group as a whole. However, as discussed in prior work of the Joint Forum, it is important to note the desirability of sectoral capital regulations that have the flexibility to respond to the different needs of each sector, and that a meaningful trend toward greater sectoral harmonisation of capital regulations has not been observed.

52. A final supervisory trend is important to mention, even though it is not a primary focus of this report. This is the trend toward greater emphasis on public disclosures, particularly risk disclosures, as an important element in the regulatory and supervisory toolkit. Such disclosures are meant to help bring market discipline to bear as a complement to the regulatory and supervisory process. Disclosure of both qualitative and quantitative information about a firm's risks and risk management processes has been highlighted by various international groupings -- including the parent committees of the Joint Forum and the Committee on the Global Financial System -- as an important mechanism for encouraging continued attention to risk-related issues within firms. The Joint Forum is continuing to explore these issues through its Working Group on Enhanced Disclosure.

Implications and conclusions

53. The trends in market and supervisory practices identified above are to a great extent complementary and mutually reinforcing. Supervisory pressure has encouraged firms to devote greater resources to risk management. The efforts that firms have made in this area have led supervisors to focus more time and attention on the systems and processes that firms have built in response. They have also enabled supervisors to propose new approaches to risk-based capital adequacy regulations that build on these risk management approaches, which will in turn motivate firms to continue improving their systems. The mutually reinforcing nature of these trends appears broadly positive and should over time result in ongoing improvements in risk management capabilities.

54. The Working Group believes that the efforts that firms have been making to develop more systematic and integrated firm-wide approaches to risk management should continue to be strongly encouraged by the regulatory and supervisory community. Such approaches hold out the promise of more informed risk decision-making by firms, improved risk reporting to senior managements and boards of directors, greater accountability for risks, and better

identification of risk concentrations, among other potential benefits. At the same time, this does not imply a recommendation that all risk management processes must become highly centralised or that supervisors favour fully centralised firms. In many instances, it is critical that experienced staff knowledgeable about specific market practices remain heavily engaged in risk management decisions. That is, an integrated risk management process does not necessarily imply a centralised risk management structure. Rather, the key characteristic of the integrated risk management process is simply that it seeks to ensure that the firm appropriately considers and evaluates all material risks.

55. As firms rely more on integrated firm-wide risk management processes, it becomes ever more important for supervisors to understand those processes and to be able to have a meaningful dialogue with the firm about them. It is becoming increasingly difficult to assess the management capabilities of a large complex financial firm without understanding the key systems and processes that guide that firm's decision-making regarding risk. Detailed discussions and evaluations of these risk management systems also provide an opportunity for supervisors to compare the efforts and approaches of different firms, potentially enabling supervisors to suggest meaningful improvements in market practices. The Working Group believes it is also important to note that an understanding of a firm's integrated risk management approach should not necessarily be limited solely to the top-level or, where relevant, the holding company supervisor. There are circumstances when other supervisors and regulators with relevant jurisdiction would find such information useful to their responsibilities, thus highlighting the importance of efforts to enhance and sustain supervisory co-operation, including the sharing of relevant information.

56. Focusing more narrowly on the exploration and development of economic capital methodologies for aggregating risks, the Working Group believes that supervisors and regulators should welcome the efforts that firms have been making in this area. The methodologies that are coming into use are varied, and their continued development and refinement hold substantial promise. Nevertheless, these methods are neither sufficiently comparable nor well proven that it would be appropriate for the Working Group to recommend that supervisors encourage all firms to adopt such methods.

57. Supervisors and regulators should nevertheless continue to improve their understanding of the nature and limitations of economic capital methodologies and how they are being used. Such understanding would help support the supervisory evaluations of the strength of the firm's management processes and its capital position. In each evaluation, it will be important to examine the assumptions underlying the methodologies. Risk aggregation methodologies – and specifically economic capital methods – inherently include challenging methodological issues on which supervisors should focus particular attention, for instance, which risks are included in the calculation and which are excluded, the correlation assumptions underpinning the aggregation of risks, and the apportionment of any diversification benefits among the group's business units. In this context, the Working Group believes that stress testing should continue to play an important role in firms' evaluation of potential risks, particularly the risks associated with unique or extreme events. In addition, supervisors will need to remind firms making significant use of risk aggregation methodologies not to lose sight of the various regulatory restrictions that may exist on the movement of funds and capital among affiliates.

58. More generally, supervisors and regulators should keep in mind that while economic capital approaches may provide an additional tool that firms could find useful in helping to make risk-related decisions, they should not be seen as a substitute for strong corporate governance and risk management capabilities generally.

59. Supervisors and regulators should remain abreast of developments associated with economic capital methods to understand where improvements in their own risk-based capital

adequacy approaches may be warranted. The recognition of diversification benefits in regulatory capital calculations is a key issue in this regard. Many firms have argued that existing calculations fail to sufficiently take account of the economic benefits of such diversification. This is an issue of particular importance as firms engage more frequently in a broader array of financial activities.

60. Diversification benefits quantified via economic capital or other mathematical models are not recognised fully by regulators in setting capital requirements. There is, however, a spectrum of recognition. For example, in the treatment of market risks, nearly all frameworks allow some degree of diversification benefits across instruments, with those frameworks based on value-at-risk providing essentially full recognition within this risk category. Similarly, the Basel II approach is built around assumptions of substantial diversification within loan portfolios, although it does not currently allow those assumptions to vary across banks. In other cases, such as the US risk-based-capital rules for insurers, substantial diversification across risk types is also recognised.

61. Nonetheless, recognised diversification benefits are often less than predicted by economic capital models, especially in regard to diversification across risk types, such as market risk, credit risk, insurance risk, and operational risk. The Working Group believes that there are several reasons why supervisors and regulators may be justified in pursuing a cautious approach in this regard. First, as noted above, the lack of consistency in market practices in this area reflects the lack of available data and suggests further experience may be desirable before assuming a particular implicit degree of correlation (less than one) between various risks. Second, correlations may change over time and according to many estimates seem prone to revert to one during episodes of stress. The events of September 11 provide an example of the potential for simultaneous effects in capital and insurance markets that would not normally have been expected to be highly correlated. Third, a substantial diversification benefit could create a strong incentive in favour of ever-larger financial firms. It can also be argued that to avoid the consequently larger potential social costs of failure, larger firms should be held to a higher prudential standard, thus in concept offsetting the benefits of diversification. Fourth, even without recognition of diversification benefits within the regulatory capital framework, in many cases firms will have the opportunity to convince rating agencies and other market participants of the potential value of these benefits. In principle, this would allow such firms to operate with a smaller cushion between actual capital and regulatory capital than firms that could not demonstrate such diversification benefits. Thus, the cost to firms of a framework that takes a cautious approach to recognition of cross-risk diversification may be somewhat mitigated as a result.

62. To the extent that financial firms are using economic capital, the Working Group believes that further work by such firms on the empirical basis for correlation estimates, particularly those between risk categories, is warranted. As noted, the recognition of correlation effects and the associated diversification benefits in regulatory capital frameworks is an issue for which a spectrum of responses is possible. Over time regulators and supervisors should be prepared to revisit their approaches as more experience and data are accumulated. Further research and dialogue on these topics is desirable.

63. On the other hand, the Working Group notes that many supervisors and regulators have emphasised the importance of a strong and conservative regulatory capital framework in relation to the largest financial firms. The Working Group believes that it would be incumbent on the financial industry to demonstrate that the benefits associated with increased recognition of diversification – including potential incentives for ever-larger financial firms – would outweigh the costs.

64. Continuing dialogue between the financial industry and the regulatory community reflects the complementary nature of existing trends in market and supervisory practices.

The evolution in approaches to risk integration and risk aggregation by firms not only reflects supervisory and regulatory initiatives, but also provides an impetus for continued advances in supervisory and regulatory approaches. In this regard, it can be hoped that firms continue to place a strong emphasis on the dynamic evolution of their risk management practices.

Annex 1

Description of Survey Results

This annex provides a more detailed discussion of the results of the survey of market practices conducted by the Working Group. As noted, 31 firms from 12 countries participated in the survey. These firms vary in the range of activities they undertake. Some are true financial conglomerates, active in each of the banking, insurance, and securities sectors. Others operate primarily in a single sector.

Organisation of risk management functions

The surveyed organisations vary significantly in how they are structured to manage risks. Three schematic approaches are illustrative of this diversity:

- Operating units have primary day-to-day responsibility for risk management, subject to policies set by, and oversight from, senior management and/or a group-level committee.
- Operating units have primary day-to-day responsibility for risk management, subject to general policies formulated by a centralised risk management function, as well as routine monitoring by that function. The centralised unit in most (but not all) cases would work in association with risk management committees and report to a senior executive of the firm.
- A centralised risk management function assumes primary responsibility for risk management. It establishes strict guidelines for the risks that the operating units may take. Again, the central unit may work in association with risk management committees and would also report to a senior executive of the firm.

In practice, few firms fit neatly into any of these three structures. Approximations of each schematic approach were found among the firms in the survey.

Central vs. local functions

A clearly defined risk management process ensures accountability and reduces the possibility that some risks will escape detection and control. Among the surveyed firms, group-level oversight is most frequently performed by dedicated risk management committees comprised principally of senior officers.⁸ A slightly smaller proportion of the surveyed firms have also established a risk management department and designated its head as the “chief risk officer” or some equivalent title. Firms with such a centralised risk management unit differ in that unit’s structure and purposes. Often, the unit takes an active role in the management of risks, for example, by developing common risk policies,

⁸ Sometimes the board of directors has a sub-committee dedicated to risk management, but more often board oversight is charged to a group with wider responsibilities, such as the audit committee.

establishing uniform risk measurement definitions and procedures, and promoting the use of consistent methodologies across business units and risk types. In some instances, the central unit may also participate in setting risk limits and in monitoring compliance, either with or without the involvement of risk management personnel at a lower, business unit or business line level. The risk management department nearly always assists the top-level risk management committees by preparing background material and firm-wide risk reports. In the centralised paradigm, the chief risk officer most often reports to the chief executive officer or an executive committee, unlike the chief auditor, who might report to a board-level audit committee.

Other groups favour a more decentralised structure, where risk management responsibilities are specifically assigned to business units. Staff in these units are considered to be the best placed to assess and select the risks that the group assumes. This paradigm recognises that the business manager constitutes one of the first-line defences against risk. A group-level committee would typically establish parameters within which the business unit may operate, but otherwise would grant significant authority to local management. If there were a central risk management unit, its role would be focused on ensuring consistency in reporting at the group level, with limited direct involvement in risk-related business decisions by operating units. At some institutions, the role of the central risk management department varies across risk types. This department may predominate in the management of some types of risk, while local units retain sway over other types.

Separation of risk management and risk taking

It is common for firms in all three sectors to establish hierarchical limit systems. The highest level in the hierarchy determines the firm's total appetite for risk. Sub-limits under the high-level limits are parcelled out to broad business units or business lines. This process continues to lower and lower levels in the hierarchy and ensures that the taking-on of larger risks requires the approval of more senior levels within the firm.

A key factor influencing the assignment of responsibility for risk management is how easy it is to quantify all the dimensions of the risk. For example, valuation of publicly tradable market instruments can be obtained through market prices, which are available on a daily basis to risk controllers independent of the trading units. Assessments of loan valuations and insurance technical provisions, on the other hand, often requires experienced judgment and is more dependent on key assumptions.⁹ The separation between risk-taking and risk evaluation therefore tends to be less clear-cut in areas such as credit risk and insurance risk than in regard to trading functions.

There is a strong culture in the securities sector of segregating risk takers and risk controllers, enforced by regulations in all jurisdictions. This separation seeks to ensure that the originator of a given position cannot also be in charge of the risk's evaluation and performance measurement. It is intended to prevent price manipulations arising from conflicts of interest, especially when the compensation of staff is directly linked to the performance of the positions taken, and thereby protect both the firm and the investment community.

⁹ This comparison should not be taken too far. The valuation of some market instruments (e.g., swaps or private equity holdings) can vary significantly, depending on the measurement methods used. For both tradable market exposures and non-traded instruments, the valuation of positions is also influenced by accounting rules.

On the other hand, bank credit officers often have a role both in approving a loan in the first place, as well as in evaluating its condition over time, although the loan approval process has both business and risk management elements. Likewise, insurance underwriting and ongoing monitoring require detailed knowledge and expertise that effectively serve both business and risk management objectives. There therefore tends to be a somewhat greater emphasis within the banking and insurance sectors on the role of local business professionals as key parts of the risk management and assessment process.

Centralisation of information systems

Nearly all surveyed firms, even those choosing a decentralised paradigm, seek to develop a group-wide view on risk through the data that are reported to group management. The data reports need not be on integrated electronic feeds. Indeed, about half of the firms surveyed do not currently possess a group-wide, centralised information system. Instead, these firms would create an aggregate view by manually entering data into a spreadsheet. More precisely, some types of data may be captured by group systems, and other types not. Market data are most likely to be thus aggregated because of the availability of widely accepted methodologies and the need to react rapidly to changes in the market. Operational risk data are least likely to be aggregated at the group level. If a conglomerate has insurance operations, the insurance areas would likely have developed their own systems, without central office involvement. Nonetheless, as groups spanning multiple sectors progress toward taking a group-wide view on risk, they find ways to integrate the investment portfolios of the insurance subsidiaries into the group risk reports.

One finding from the Working Group's survey is that a centralised information system is often an adjunct to centralised risk management controls. However, a centralised system is not a prerequisite for the development of an aggregated view of risks, nor does the existence of a centralised information system imply that the firm has developed an aggregated view.

Firms that have grown rapidly through acquisition are likely to possess a number of legacy information systems and to be confronted with challenges in their integration. Incompatibility among these systems was mentioned as one of the main obstacles to central group management of risk. Even when firms have not undertaken mergers, connecting disparate systems used to manage different types of risk – or even the same type in different business units – is a major practical challenge in risk aggregation.¹⁰

Anticipated future evolution

Most of the firms with an extensive presence in the banking sector anticipate further centralisation in their risk measurement and management structure. For example, many banking organisations, in part spurred by the Basel II initiative, expect to develop further their frameworks for managing credit and operational risks in order to optimise their regulatory capital posture, as well as their own risk management capabilities.

Financial conglomerates with insurance affiliates are continuing their efforts to integrate technical risks into the group risk profile. The aggregation of technical risks with market and

¹⁰ Where insurance affiliates are involved, asset risks may well be aggregated through a centralised information system, while liability information is handled by decentralised systems.

credit risks poses special challenges related to the disparity in relevant timeframes and the uniqueness of various insurance products, as discussed further below.

Based on the survey results, those organisations that are active mainly in insurance feel less need to increase the degree of centralisation that they have already attained. This is partly because the non-technical risks are less important at these firms and the corresponding need for risk aggregation is less. The predominantly insurance groups also tend to prefer a more decentralised business model that recognises the need to respect jurisdictional boundaries.

One of the stand-alone securities firms in the survey also envisions some additional centralisation, mainly for the reporting and monitoring of risk exposures.

Advances in the central management's understanding of the risks being taken by business units would not necessarily translate into greater central control of risk origination. There will always be a need for risk control mechanisms at the local or business unit level. As indicated earlier, some firms would view the improved central capabilities as an adjunct to providing better support for business unit management of risks.

Approaches to risk aggregation

With respect to creating a single measure for all risks, there seem to be two basic approaches. The majority of surveyed firms tend to first aggregate across entities (or business lines) by risk type and subsequently aggregate risk types at the group level. A few do it the other way around: first across risk types by entity and subsequently across entities. Obviously, data consistency is a pre-requisite for robust aggregation. The degree of integration of the information feeds was cited as a crucial determinant in how the aggregation is performed.

Some institutions report that the risk measurement and assessment techniques at the business-unit level are more refined than the common metric used to aggregate risks group-wide. In many such cases, this is due to the business units' possessing special information about the customers (or other risk sources) that is not readily modelled. In other cases, it might indicate that some simplifying assumptions are built into the risk integration methodologies in order to allow a less complex, more readily available aggregation to take place on a group-wide basis, even if it should be less precise than aggregations made at lower levels. Naturally, there may also be specialised techniques that apply primarily to a single sector.

Risk types

Based on the survey responses, the following types of risk are often considered within firms' efforts to aggregate risks, although the ability to include specific types of risk within the aggregation methodology varies considerably.

- Credit risk
- Market risk (often including asset/liability risk and investment risk)
- Operational risk (possibly including legal risk)
- Liquidity risk
- Property and casualty risk (subdivided into premium risk and reserve risk)

- Life risk (subdivided into mortality and calamity risk)
- Other risks (sometimes business or reputational risk)

One important point to note here is the extent to which insurance firms face significant challenges in aggregating the multiple types of risks that they face, even if they have no significant banking or securities affiliates to consider. That is, insurance firms often face not only multiple types of insurance risks, but also market risks relating to their investment portfolios, credit risk relating to reinsurance agreements, as well as operational and potentially liquidity risks.

Organisational scope

Most groups that aggregate risks include all entities in their risk aggregation, excepting perhaps minor ones that do not have a significant amount of the particular risks assessed. One possible exception involves the combination of insurance risks with those emanating from other sectors. While some groups aggregate the asset risks of insurance units with similar risks of banking and securities units, others keep them separate, consistent with legal and regulatory boundaries. The firms' choice depends in part on how the risks are viewed and managed. Within the insurance entity, policy premiums are invested in assets managed by units separate from the units that take on the technical risk. Conceptually, it should be possible to aggregate the asset risks taken by the various asset management units in the group. In many cases, the insurance firm views asset risk as linked with technical provisions and thus manages the two risks in conjunction, where it must consider the related asset/liability risk as well as amount of the technical provisions. Firms that do not fully aggregate asset risks are also unlikely to include technical risks in their group-level aggregated risk measures.

Another key determinant is whether capital can be readily transferred among the affiliates in the group, e.g., between the banking and insurance units. If capital cannot be transferred, there is less incentive to aggregate risks between the units.

Firms that create special purpose entities (SPEs) indicate that they include related risks within their group-wide risk assessments based on an economic analysis of residual risks to the firm, rather than on the basis of legal or accounting separation.¹¹

Challenges in the development of an aggregated view of risks

While financial firms have been working to overcome many challenges in developing an aggregate and reasonably accurate perspective on risks, a number of significant ones remain and are currently the focus of intensive efforts. The remaining key challenges may be grouped in four categories: information technology systems, data, consistency in methodologies, and cultural differences. The first two were each cited by over one-third of the firms in the Working Group's survey. They are frequently linked; without suitable systems in place, data cannot be collected, processed and delivered in suitable formats. Those firms

¹¹ SPEs are commonly legally distinct and thus bankruptcy-remote vehicles created to facilitate fund-raising and trading by obtaining high ratings from external credit rating agencies in the context of the country's accounting and legal frameworks. They are used for asset securitisations, as commercial paper conduits, to serve as counterparties for derivatives, in reinsurance, and to issue certain complex capital instruments.

that have undertaken recent mergers or acquisitions may find their challenges in each of the four categories heightened.

There are at least two reasons for overcoming the systems challenge. The first is to increase convenience, efficiency and, ultimately, profitability. It is not necessary to have a centralised information system in order to develop an aggregated view of risks. Nonetheless, a centralised system clearly helps, as it minimises manual re-entry of data from separate systems. The results might then be timelier; reports that are currently produced quarterly or annually could be produced daily. Further, robust information systems would enable data that is collected for risk management purposes to be reconciled with data collected for accounting purposes, thereby enhancing data quality.

A second major reason for improving information systems is to facilitate the collection of the huge volumes of data required to assess model parameters and for estimating diversification benefits when risk types are combined. Collecting this data is itself a key challenge in developing an aggregated view of risk. Models for credit risk, for example, require data covering many thousand transactions over a multiple-year time span (preferably a full economic cycle). Stress testing and scenario analysis also are likely to make heavy demands on computing power.

Firms are making significant expenditures on information systems in order to overcome these challenges. Despite the considerable efforts to date, however, even the firms most committed to group-wide risk management are still some time away from having the technology systems that meet all their desired specifications.

The size of the third key challenge, methodological consistency, depends on which risk types are involved. Methodologies for measuring and assessing market and credit risks, while numerous, tend to be sufficiently consistent throughout the organisation as not to raise particular concern. Consistency in these risk types has been attained by a long developmental history, widespread industry acceptance, and promotion by central risk management groups or committees.

Efforts are now underway at a number of firms to improve the consistency of data on operational risk, without diminishing the relevance of such data to specific business lines. Banking groups, spurred by the Basel II initiative, have made notable progress here, although some firms in other sectors have also been working on broadly similar initiatives. For all sectors, qualitative indicators remain particularly important in the operational risk area. For example, securities firms not affiliated with banks have been taking significant steps to address operational risk and have invested heavily in technology and systems to more efficiently gather and process information regarding operational risks in order to supplement existing policies and procedures. While these securities firms believe that this information can be used to provide consistent measures of operational performance and to identify areas where enhanced controls are warranted, they remain sceptical of the ability to truly quantify operational risk because of the sensitivity of such estimates to assumptions regarding loss distributions and the uncertainty of extreme loss estimates based on a small number of loss observations.

With respect to technical risks in insurance, some firms note that the impact of any particular risk will be different for each product, thereby complicating the aggregation of data. Some insurance companies also report a challenge in determining the group-wide tolerance for different risks.

Cultural differences sometimes arise when an institution makes an acquisition or attempts to reconcile the accounting, supervisory or business practices in the various countries in which it operates. While these gaps may be bridged over time, cultural differences can be enduring

in some instances. This appears to be particularly important in trying to reconcile businesses with a heritage of mostly autonomous risk control into an organisation with a more centralised risk management approach.

Aggregation of individual risk elements

When risks of different types are aggregated, the methodology most commonly cited by the surveyed firms is economic capital. Economic capital is a measure of the amount of capital that a firm believes is needed to support its business activities or set of risks and is further discussed in Annex 2.

When used by financial firms, economic capital typically aggregates, at a minimum, market, credit and operational risks. These risks have in common that an unexpected loss of net asset value is possible, against which economic capital would safeguard. About half of the interviewed firms that use economic capital methodologies also include business (or strategic) risk as a separate major category in this framework. Market and credit risks were often the first to be combined, with operational risk added at a later stage. In the insurance sector, the main risk involves unfavourable and unexpected variation in cash flows (whether arising from the asset or liability side of the balance sheet) that impact the insurance firm's ability to meet its obligations to policyholders. Therefore, in many cases, economic capital in the insurance sector may be based on models of the potential deviation between actual and estimated cash flows (reflected by the amount of technical provisions). Among the firms that have insurance operations, about three-quarters that use economic capital methodologies include technical risks in economic capital. A few surveyed firms include asset/liability risk separately from market risk. Occasionally other categories of particular concern to the institution are singled out.¹²

Annex 2 includes a brief discussion of the primary methods used to estimate economic capital for each of the major risk types. For example, VAR methods, often supplemented by stress testing, are the predominant approach used to estimate economic capital for market risk. Most firms also include asset/liability risk within the market risk category, although a few groups treat asset/liability risk as distinct from market risk (and on a par with credit, operational and technical risks). For credit risk, banks have increasingly applied VAR-based methods to estimate required economic capital, although there is substantial diversity across banks in their approaches. Virtually all firms that take a group-level view of risk also aggregate credit risk exposures in other ways, for example by tracking aggregate gross and/or net exposure by borrower or by performing credit stress tests.

The treatment of operational risk within economic capital frameworks is evolving rapidly. Definitions of operational risk vary across firms, although among banks there is a tendency to use the definition in the proposed New Basel Capital Accord. That definition does not include business, strategic, or reputational risk. Those banks that include business risk in their economic capital frameworks would therefore define it as a separate risk type. Insurance entities also tend to treat business risk separately from operational risk. While insurance companies have always focused intensively on managing process-related operational risks that could result in additional claims, recently some insurers have been expending more effort on developing approaches to operational risk as a risk distinct from insurance risk.

¹² Funding liquidity risk is generally not included in the economic capital framework as a separate category. However, some firms take account of how adverse developments involving other risk types (e.g., a large trading or loan loss or an insured disaster) may impact liquidity.

The survey suggests that a number of financial firms, particularly banks spurred by the Basel II proposals, have begun efforts to collect the data needed to support more statistical approaches to operational risk over time. External data are also used, particularly in helping to calibrate “top-down” approaches to operational risk that focus first on the potential scale of operational risk losses that the overall firm might be exposed to, before allocating these amounts down to individual business lines. Some firms, however, remain sceptical of the value of external operational risk data, because they believe it would not provide an appropriate proxy for their firm. Additionally, some firms continue to doubt that operational risk can ever be reasonably quantified, although nearly all firms agree that it is a meaningful risk.

The aggregation of technical risks in insurance poses significant challenges. Insurance organisations view many of their product lines as involving distinct risks (property and casualty risk, life risk, or parts of these risk types such as morbidity, mortality, longevity, lapse, with many policy variations in each depending on the specific product). These make for a very large number of distinct risk profiles, some of which are difficult to describe analytically, let alone to combine. Modelling the effect of the transfer of technical risks via reinsurance poses an additional challenge. In particular, reinsurance coverage is typically based on the reinsurer absorbing a proportional share of the losses or a limited fixed amount once losses exceed a certain absolute threshold. The insurance business has also some risks of a non-financial nature that are not readily quantifiable. These include factors that enter after a policy claim is submitted, e.g., changes in the legal, regulatory, and economic environments during the period between the occurrence of a loss event and the settlement of the claim. In addition, insurance companies may face distinctive regulatory and accounting regimes in the various jurisdictions in which they operate.

Faced with these challenges, the tendency in the insurance sector (including insurance affiliates of financial conglomerates), as noted earlier, is for local management to take on a greater share of the risk management functions, particularly where the potential risk profile is limited. Nevertheless, some insurers have begun to address the challenges of aggregating technical risks through the use of stochastic modelling and other types of dynamic financial analysis (DFA).¹³ This modelling, in effect, simulates outcomes under numerous scenarios, which are assigned probabilities and combined to create an economic capital framework. However, because of the complexity of the modelling required, many of these efforts to explore economic capital approaches to insurance risks remain in the early stages of development. A few banking-insurance groups use required capital (the higher of regulatory and rating agency requirements) for insurance units as a proxy, pending the development of improved measurements of insurance risks.

Only a few institutions include reputational risk in their economic capital methodology. Most firms exclude it because it is difficult to quantify and it is not perceived as a separate risk; rather, it results from the occurrence of other risk events. Moreover, several firms suggested that capital alone is unlikely to provide an adequate safeguard against the damage to the franchise that might result from an event that impairs the firm’s reputation.

¹³ DFA is the name given to a variety of simulation techniques. These techniques may be based either on a model that assumes that there is only one possible outcome (deterministic models) or on a model that assumes that a range of outcomes is possible (probabilistic models). While the prevailing models in the life insurance area still tend to be deterministic, there is a trend toward greater use of probabilistic models throughout the insurance sector.

Concentrations

Aggregate measures of risk by risk type using a common metric (i.e., economic capital) allow firm management to assess the extent to which their risks are concentrated by broad risk type. In addition, many surveyed firms also develop measures of other risk concentrations. For example, these might include more detailed assessments of whether market risk is concentrated in particular areas, such as foreign exchange or equities. With regard to credit risk, banks typically seek to assess concentrations to individual borrowers as well as to broad industry or geographic groupings. The development of common group-wide IT systems is seen as enhancing the ease with which such measures of concentration can be developed, since otherwise it can require a great deal of manual effort. Surveyed firms all recognised the importance of seeking to understand where their risks might be concentrated, although few had sought to supplement their economic capital methodologies with “add-ons” to reflect the concentrations that might not naturally be picked up in their economic capital approaches.

Tensions between methodologies

The survey results suggest that tensions often arise in seeking to aggregate measures of risk for different risk types due to methodological differences in the approaches used for different risk types. Most significant tensions arise from the different profiles of the various risk types and the different time horizons used in their management.

With respect to time horizons, market risks are typically evaluated over a short timeframe (once or several times a day or every ten days), credit risks over an intermediate timeframe (a few months to a few years) and insurance risks over a long timeframe (many years). Firms usually compromise on one year as a common time horizon for assessing firm-wide economic capital. For many firms, a one-year horizon represents a period over which they believe they can liquidate or mitigate many types of risk (such as asset-based market risks) and access the market for additional capital, if necessary. Banks also commonly use the one-year timeframe to assess economic capital for credit risk. For insurance companies, many property-casualty and term life policies are re-priced annually upon renewal and thus the evaluation of the adequacy of technical provisions would appear to fit with a one-year horizon, even though the contracts’ maturity may be significantly longer. On the other hand, a one-year horizon may be insufficient for many property and casualty insurance liabilities to fully emerge and does not correspond to the period of cash build-up in whole life insurance policies.¹⁴

The probability distributions for different risk types – market, credit, operational and technical – have distinctly different shapes. It is not always possible to aggregate the distributions analytically, but only through simulations. When economic capital is allocated to the group’s various business units, each with a different mix of risks, the common confidence level chosen can strongly affect the allocation.¹⁵

Tensions also sometimes arise from the need to choose a common confidence level. Market risks, for example, are typically evaluated using a 99% confidence level. Group-wide capital need, on the other hand, is evaluated using a level that corresponds to the credit rating that

¹⁴ Of course, the selection of a one-year horizon for economic capital purposes does not prevent the firm from using other horizons for different purposes, such as risk monitoring, credit provisioning, hedging of positions, and product pricing.

¹⁵ For an illustration of these issues, see Christopher Hall, “Economic capital: towards an integrated risk framework,” *Risk* (October 2002), pp. 33-38.

the group seeks to attain (often 99.97%, associated with an “AA” rating, although lower figures are also used).

While there are some commonalities among the models used by the banking sector and the insurance sector, the actual models are likely to have a number of significant differences. Two differences relate to the time horizons and the nature of the respective loss distributions, as noted above. A more fundamental difference derives from the approach that firms in each sector take toward modelling. Banks tend to look at market, credit and operational risks separately, only aggregating them at the last stage of modelling. For insurers, however, market and credit risks are not always easily separated from technical risks. Therefore, the various risk types would have to be integrated in the models from the start. The tensions between the two approaches would be most visible at those conglomerates that combine significant banking and insurance operations.¹⁶

Correlations and diversification benefits

One of the frontier issues with economic capital methods involves the extent to which different risks are correlated and the benefits that might be obtained from diversification¹⁷. All risk-taking firms assume there is value to diversification as a safeguard against potentially calamitous risk. Accordingly, financial firms diversify over large numbers of separate loans extended, insurance policies underwritten, or securities owned, depending on their business. To gain the benefits of diversification, companies try to avoid undue concentrations of related risks.

There is a certain amount of correlation both within and among the primary risks (credit, market, technical, operational) that financial firms face. These correlations derive from common factors that affect the risks. Yet correlations are rarely perfect, unless all of the characteristics of the exposures being correlated are essentially the same. The amount of capital needed to operate safely would reflect the imperfection of correlation or, expressed differently, the benefits of diversification. The surveyed firms are therefore giving a great deal of attention to these correlations. However, correlations, whether within a single risk type or between risk types, are not necessarily stable numbers. They likely fluctuate over time, reflecting, in part, the prevailing business and market conditions. During periods of stress, evidence suggests that they may increase significantly. Nevertheless, firms typically focus on a single set of correlation estimates that are assumed to be stable over the risk assessment horizon.

Correlation between risk types

While it is well accepted that diversification within a risk type brings at least some benefits, estimating their magnitude with a desirable degree of precision can be difficult. Estimating the size of the benefits from the imperfect correlation between risk types is much harder, if

¹⁶ This paragraph draws heavily on KPMG, *op. cit.*, p. 51.

¹⁷ A structured way to think about risk diversification issues is developed in a recent paper by A. Kuritzkes, T. Schuermann and S. M. Wiener: *Risk Measurement, Risk Management and Capital Adequacy in Financial Conglomerates*, Wharton Financial Institutions Working Paper (03-02). The authors distinguish benefits obtainable from diversifying among (a) instruments bearing a particular risk type, (b) risk types and (c) entities under a corporate umbrella. The paper discusses the possible benefit levels from the latter two forms of diversification. The paper's structured framework is similar to the economic capital frameworks adopted by a subset of the institutions in the Working Group's survey.

only because it involves building into the methodology several layers of assumptions and simplifications. Firms differ not only in their ability to estimate correlations between risk types, but also in their degree of comfort with the results obtained. Virtually no surveyed firm felt that it had adequate data on which to base estimates of inter-risk correlation. To resolve the problems caused by the perceived insufficiency of data, some firms use external indices (e.g., equity prices) as proxies for empirical data on the behaviour of particular risks.

The Working Group found little consistency in the methods used by the surveyed firms to calculate correlations and diversification benefits. At one extreme, some firms estimate correlations among all risk types using data or synthetic indices. At the other extreme, some firms do not attempt to estimate correlations at the present time because they do not think that their estimates are accurate enough to be useful. In between, there are firms that:

- Use standard correlation factors (e.g., 0%, 50%, and 100%) between risk type-business unit segments;
- Use data to estimate correlation factors, but then average the results with 100% (perfect correlation) in the interest of conservatism;
- Assume that market and credit risks are perfectly correlated with one another through common factors such as economic activity and country, but operational risk is only weakly correlated with these (partly because it mainly involves business activities other than proprietary trading and lending); do the analysis on a group-wide basis;
- Assume that market and credit risks are imperfectly correlated with one another, but operational risk is perfectly correlated with these because it is defined as the operational aspects of trading and lending operations; do the analysis on a group-wide basis;
- Perform the correlation analysis within the banking and insurance divisions separately and only in a later stage estimate correlations between these divisions;
- Perform the correlation analysis within the banking and insurance divisions separately, but assume that aggregated risks in the two divisions are perfectly correlated.

Allocation of diversification benefits

A critical issue raised by most firms that employ economic capital methodologies (and by some that do more modest risk aggregation calculations) is the question of whether and how to allocate the benefits of risk diversification. Particularly for firms that evaluate business lines on the basis of return on economic capital, it can make an important difference whether or how the diversification benefits are allocated to specific business units. Many risk managers indicated that problems could arise when firms allow particular units to be perceived as low-risk largely because their particular risk exposures are offset by other risk exposures elsewhere in the firm, when the risk would be viewed as high on a stand-alone basis.

The survey results suggest that there are two views prevalent among firms. Firms holding the first view believe that these benefits should not be passed down to the business units. Rather, each unit is expected to operate on a stand-alone basis. Firms with the second view believe that an “optimal” level of group risk-taking can be achieved only when diversification benefits are allocated to at least the major business units. That is, such firms believe that it is preferable for each business unit to be assigned an economic capital allocation closer to its marginal contribution to the total economic capital amount, as opposed to what its economic

capital requirement would be on a stand-alone basis. Because of the nature of economic capital methods, it can be difficult to define what is meant by the marginal contribution to economic capital. Indeed, if each business unit is simply assigned the difference between the firm-wide economic capital calculated with and without the business unit included, it will turn out that the sum of individual business unit allocations will typically fall short of the firm-wide economic capital amount. The survey confirmed that the allocation of economic capital amounts to business units is therefore an issue that is receiving significant attention.

Intra-group risk transfers

One important issue in risk aggregation is the extent to which capital and risk may flow from one business area to another. If intra-group transfers of risk and capital are not possible, the utility of an aggregate measure of risk may be more limited. With regard to intra-group transfers of capital, all firms indicated the presence of policies to help ensure that regulatory and legal restrictions on such transfers are observed, although few firms indicated that they made any specific adjustments to risk aggregation methodologies as result of such restrictions.

The survey suggested that about half of the surveyed firms engage in internal risk-transfers between different entities within the group to some extent, while the rest either had a policy against making internal transfers or did not have a reason to do so. The predominant rationale for making internal transfers within a financial conglomerate is the view that the risks can be better managed by the unit that is best suited to managing them. For example, if a banking unit is deemed to be more capable of managing certain market exposures, those risks might be transferred to it from an insurance affiliate. In another case, a banking affiliate might transfer equity position risk to a securities affiliate or might receive interest rate or foreign exchange risk from such an affiliate. Other groups contend that such internal transfers would not alter the group's overall risk profile and therefore mandate that all risk transfers be made to outside parties. One surveyed firm noted that accounting rules, such as FAS 133 in the US and IAS 39, could have an impact on the extent to which firms might undertake internal hedging transactions.

Impact on decision-making

The survey results suggest that firms that have developed economic capital methodologies typically use them in various ways, including:

- Risk control. The amount of economic capital allocated to a business unit constrains the risks that it takes. At present, this is most commonly seen in the market risk area, where the economic capital and VAR methodologies are closely related. In the credit area, many firms still rely on other methodologies to place limits on their exposures, but the economic capital methodology is sometimes an important supplement.
- Assessment of solvency. By design, the economic capital methodology provides a measure of a firm's overall capital position, given its chosen combination of capital and risk.
- Performance measurement. Economic capital is a component of well-known measures like risk-adjusted return on capital (RAROC) and return on risk-adjusted capital (RORAC). These are used to evaluate performance across the group's various business lines.
- Capital allocation. Knowing where the economic risks lie enables firms to allocate capital to the divisions that need it as protection against risks already assumed.

- Adjustment of the group's risk posture. The amount of economic capital allocated to a business unit can be varied over time either to promote or discourage certain activities, for example, when the business cycle shifts. Some firms allocate more capital to the units with high RAROC, so that those units may expand their activities and thereby increase the group's total profitability.
- Staff compensation. By tying compensation to RAROC, firms reinforce desirable behaviours.
- Acquisition and divestiture decisions. An economic capital analysis gives firms a better sense of the contribution an existing operation makes, or a potential activity would make, to group-wide profitability.
- New product design. A few firms use the methodology in designing and pricing products to earn a fair return on them.

The firms employing economic capital methods tended to view the process of obtaining an aggregate perspective on risks as a valuable one. These firms indicated that senior management appreciated (a) the opportunity to conduct a thorough review of all risks facing the firm, (b) the ability to get a handle on the group's total risk, and (c) the resultant sense of how the group's various risks compare to one another.

Several surveyed firms acknowledged that they have not yet fully developed and implemented their planned economic capital approach. A number of firms noted that they were continually seeking to improve their data and refine their methodologies. One firm indicated that its methodology was too dependent on historical data and does not take into account how its risk portfolio may change over the time horizon used in the analysis.

The survey results indicated some cross-sectoral differences in the attitudes toward the practical use of economic capital methods for the purposes listed above.

- The banking groups surveyed tended to have a favourable view of the concept of economic capital. In recent years, many of them have begun to employ this concept for various purposes within their organisations. Banking groups are working to refine their present methodologies to make them more relevant to all activities in which they participate.
- Although not yet widely used, insurance companies are becoming increasingly receptive to economic capital, although as noted above, the concept requires further development to make it suitable for technical risks.
- Securities firms not affiliated with banks appear to be more wary of the value of overall economic capital calculations. Instead, these firms tend to focus on risk calculations that are more centred on individual risks and business lines. Some of these firms have stated that risk measurement could not be meaningfully compressed into a single metric.

Nonetheless, the Working Group perceives that there is a long-term trend across firms in all sectors to explore further the economic capital concept.

Annex 2

Approaches to Economic Capital

This annex provides a discussion and some examples of the various approaches that financial institutions take to establishing an economic capital framework. It is not intended as a comprehensive survey.

Definition and use of economic capital

At the broadest level, economic capital methods attempt to assess the amount of capital needed to support a given set of business activities or risks. As discussed further below, this frequently entails a statistical or probabilistic assessment of the potential for losses associated with those activities. Based on such an assessment, it would be common to assess economic capital as the amount of capital necessary to cover losses up to a specified probability. For example, economic capital might be defined as the amount of capital needed to absorb losses in 999 out of 1000 possible scenarios within a one-year period.

Firms use economic capital concepts and calculations in different ways, as discussed in Annex 1 of this report. In some cases, firms seek to compare the amount of economic capital that they assess as necessary to support a given set of risks with the actual amount of capital that they have available for that purpose. Firms may also use different definitions of actual capital (tangible equity, equity plus long-term debt, etc.) when performing such comparisons.

Another common use of economic capital is to calculate a return on economic capital, where the economic return on a given set of activities is compared to the economic capital assessed for those activities. This is intended to provide a “risk-adjusted” measure of the performance of those business activities.

Components of the framework

While economic capital can be measured in a variety of ways, probably the most common methodology involves the development of a statistical distribution of potential losses associated with a given set of risks. This distribution can be used to produce an estimate of the probability that a particular loss threshold will be exceeded for a pre-determined percentage of the time (the confidence level).

There are several basic ways in which a statistical distribution of potential losses can be generated, including:

- Analytical method, where historical data are fitted to a mathematical distribution formula and that formula is used in the analysis,
- Historical data method, where actual outcomes are ordered by size and a desired percentile of the result is selected, and

- Simulation method, where a large number of simulations are performed, the results are rank-ordered, and a percentile of the result is utilised.

Each method has its advantages and disadvantages, relating to accuracy, relevance, data availability, the need to fill in gaps in the data, computational ease and resources required. These three methods can be used for any of the major risk types. In practice, firms might mix and combine methods as determined by their management objectives, resources and data availability.

In addition to these statistically oriented approaches, many firms also make use of stress tests as an important part of their economic capital methodology. The most common form of stress testing involves the development of one or more specific adverse scenarios which were judged to fall within the chosen confidence level. These may or may not be based on actual historical events (e.g., the 1987 stock market crash). The stress test approach to economic capital focuses on the losses that would occur under the specific scenarios. How these potential stress test loss amounts might be translated into an economic capital assessment is a question that requires a judgmental assessment of the various stress scenarios and will differ across firms.

In devising an economic capital framework, the time horizon and definition of loss are important considerations. Trading activities tend to involve short time horizons (a few hours to a few days); credit activities, intermediate horizons (a few months to a few years); and operational risk and insurance activities, a long horizon (a number of years). Also, accounting rules, regulatory guidance and management policy combine to determine when a loss will be recognised. Loss recognition is straightforward in some instances, e.g., for trading securities that are marked-to-market regularly or operational losses that are recognised when they occur. In these instances, there is usually little question as to the function of economic capital. Management has more leeway in other instances. For example, as regards credit exposures, management may choose to measure economic capital against only loan defaults or against both defaults and deterioration in credit quality. The choices of time horizon and loss definition can be linked.¹⁸

Thus the economic capital approaches most commonly used for the various risk types can be significantly different.

- For the market risk associated with trading portfolios, it is common to use value-at-risk (VaR) methodologies for economic capital purposes. VaR is essentially the statistical approach that was described above, where the objective is to answer the question: What level of loss will be exceeded only x% of the time, where x is typically 1% or even smaller. Firms tend to employ short time horizons (e.g., days or weeks) when making such assessments, because of the changing composition of the trading portfolio, although this can sometimes miss the non-linear risks associated with options positions. However, firms also frequently consider the potential for losses over longer periods by scaling up one-day VaR results.

In addition, many firms supplement their VaR methodologies with stress testing. Each firm makes its own decision on the relative weight to give to VaR and stress testing results in estimating the amount of economic capital it needs to safeguard against market risk.

¹⁸ Consider credit risk in lending. If capital is held against defaults only, it makes sense that the horizon should be the entire life of the loan. If capital is held against deterioration in value, then some time period would be selected, independent of the life of the underlying loans.

- Many financial firms face interest rate risk, also known as asset/liability risk, in relation to non-trading positions. One approach to such risk is to estimate the present value impact of a specified set of interest-rate change stress scenarios, although some firms seek to measure economic capital for interest rate risk using a more VaR-like approach.
- In regard to credit risk, the last decade has witnessed the substantial development of so-called credit VaR models that are built around the construction of a statistical distribution of potential credit losses. These models typically involve a variety of components, including estimates of the probability of default, the loss given default, and the exposure at default for individual credit exposures. Assumptions about the relationships between exposures (i.e., the correlations between them) are also key drivers within these models. Credit VaR models often assume a one-year horizon for assessing the potential for losses, although longer horizons are also sometimes employed.
- P&C insurance companies tend to look at the complement of the confidence level associated with economic capital. That is, they ask what amount of capital is needed to reduce the probability of “ruin” (i.e., inability to meet policyholder claims) to a target level. Where the risk profile does not involve high probability high impact events (i.e. a “fat tail”), the insurance models are conceptually similar to the VAR model. Where significant risk is found in the tails (especially when low probability, high impact events are involved, that is, “fat tails”), the model is modified to take into account the policyholder obligations that appear in the tail beyond the confidence level specified. The two most common versions of this methodology are known as the “economic cost of ruin,” used primarily by non-life companies, and the “tail value at risk,” used by both life and non-life companies. There are also modifications to each of these.

These models include as components other statistically based methodologies. For example, in life insurance there are statistical distributions for the various risk factors (technical, credit, market, and operational risks). In catastrophe insurance, an “exceedence probability curve” focuses on the possible claims resulting from low-probability events. In other non-life insurance lines, frequency severity modelling combines separate (usually analytical) distributions for the frequency of a claim and the severity of the claim.

- For operational risk, sufficient internal data to support a probabilistic model are less likely to be available than for other risk types. Accordingly, internal data are frequently supplemented (or replaced) by external data, expert opinion, scorecards, and benchmarking. The use of scorecards and benchmarking is particularly common as a means of allocating economic capital across business lines within a firm. The development of economic capital approaches for operational risk is a rapidly evolving area, and a significant amount of judgement is involved in any specific implementation.
- Although by no means universal, some firms estimate the need for economic capital to cover other risks not otherwise mentioned, such as business risk or reputational risk. These types of risk are perhaps the most difficult to quantify, and those firms that seek to incorporate them into their economic capital framework have tended to adopt either judgmental or scale-based measures to do so.

Aggregation and correlations

Aggregating economic capital measures is challenging for several reasons. First, most businesses within a financial firm bear more than one type of risk. For example, a trading business bears both market and credit risk. Second, there are many different business activities within a financial firm. Third, in most cases, the risk (economic capital) of two activities is not generally equal to the simple sum of the risks (economic capital) associated with each activity on a stand-alone basis. This is true both within the same risk type as well as across different risk types.

In practice, firms have to make choices about how to aggregate risks and economic capital. Probably the most common approach focuses on aggregation across risk type. Under this approach, each business activity is assessed for its sensitivity to the core risk factors for each risk type. The appeal of this approach is that these risk factor inputs can be added up across business lines.

For example, each business line might be assessed on the basis of its sensitivity to changes in the dollar/euro exchange rate. These sensitivities can be summed to provide a firm-wide assessment of the aggregate firm sensitivity to this exchange rate. At both the business unit level and at the aggregate level, such sensitivities could be fed into a VaR or stress test model to determine the amount of economic capital corresponding to this exposure. Importantly, if some business units are positively exposed to increases in the value of the dollar, while others are negatively exposed, the aggregate economic capital for this risk will be less than the sum of the individual business unit calculations.

Following through on this type of approach would typically result in each business activity being assigned a set of risk factor inputs, some of which will relate to market risk, some to credit risk, some to operational risk, and so on. These can then be added up across the firm and economic capital methods applied. In principle, all risk factor inputs could then be included in a single over-arching conceptual economic capital framework, but at present this tends to be more of an aspiration than a reality. In practice, what usually occurs is that the risk factor inputs for market risk are input into a market risk economic capital model, the risk factor inputs for credit risk are plugged into a credit risk economic capital model, and so on.

The result is a firm-wide measure of economic capital for market risk, a firm-wide measure of economic capital for credit risk, etc. Similar calculations can also be repeated at the individual business unit level, but again the result will be separate measures of economic capital by risk type. The final step in the aggregation problem is therefore the question of how to aggregate measures of economic capital across risk types.

This is where the role of correlations is critical. Most firms, faced with this problem, address the issue by treating the separate economic capital estimates as measures of volatility and consider the statistical question of what the aggregate volatility across all risk types is under certain assumptions about the correlations between the risk types. This is a straightforward statistical calculation, albeit one that is critically influenced by the assumptions about correlation that are made.

Correlations have been discussed in general terms in Annex 2, and the wide variety of methods used to estimate them was noted. A brute-force method to estimating correlations involves mathematical calculations from historical data. This method tends to be resource-intensive and limited to narrow exposure categories, e.g., within a particular risk type.

Alternatively, risk exposures might be linked to a proxy (such as an index in the case of market risk or an industry grouping in the case of credit risk); and relationships between exposures are determined by reference to correlations between proxies.¹⁹ Across broad risk type categories, however, the lack of historical data tends to result in the use of correlation assumptions, and judgment looms large in their selection.

A hypothetical example

To illustrate the general methodology and, particularly, the potential diversification benefits, let us assume that a hypothetical bank decides to create an economic capital model based on the following concepts.

The bank separately estimates its economic capital requirements for its market, credit and operational risks. Because it wishes to earn a “AA” rating from the external credit rating agencies, the bank chooses a common one-year time horizon and the 99.97 percent level of confidence.²⁰

The firm calculates its VaR for market risk every business day. Its trading department uses an analytical model to estimate VaR over a one-day horizon at a 99 percent confidence level. The amount of capital needed over a one-day horizon is converted to that needed over a full year by using a multiplicative factor.²¹ It is possible to convert the 99 percent confidence level to 99.97 percent by using another multiplicative factor.²² Using these factors introduces assumptions that may or may not correspond to actual experience. For example, use of the time conversion factor, with no adjustments, implies that no account will be taken of any optionality effects. Also, the selection of a 99.97 percent confidence level means that a loss greater than the estimated amount would occur 0.03 percent of the time, or once in 3,333 years. The reliability of the resulting estimate would obviously be difficult to verify empirically.²³

For simplicity, let us assume that the bank’s estimate of economic capital for market risk incorporates all interest rate or asset/liability risk. Moreover, as this estimate is derived from a VaR framework, it will implicitly take into account diversification effects across all of the major types of market risk factors, including interest rates, foreign exchange rates, equity prices, etc. Assume that the net result is a market risk economic capital estimate of \$1 billion.

¹⁹ This is sometimes called the econometric or factor approach to estimating correlations.

²⁰ This is the confidence level associated with the one-year AA default probability.

²¹ If the distribution is normal, the multiplicative factor is the square root of the number of trading days in the year, e.g., about 15.5.

²² If the probability distribution takes a normal shape, then VaR is simply the standard deviation times a constant that depends on the confidence level chosen. VaR at the 99.97 percent level of confidence is about 1.5 times VaR at the 99 percent level.

²³ Although it conducts stress testing, the hypothetical bank chooses not to include the results in its economic capital framework. Other financial institutions may use only stress test results and not VaR. Still other institutions may use a weighted combination of the amounts of economic capital implied by VaR and stress testing. Even when economic capital is estimated at a 99.97 percent confidence level, not all the components would necessarily be estimated at this level. For example, market risk VaR may be measured at a 99 percent level, with stress test results increasing the level of confidence to 99.97 percent.

Next, assume that the bank has developed a statistical model for credit risk. This model is built around internal ratings of the bank's borrowers that provide estimates of the likelihood that the borrowers will default, how much the bank can recover in the event of default, and the likelihood that lines of credit will be drawn down in the event of default. Further, the model incorporates assumptions on the inter-relationships between variables. For example, the model calculates the correlation between default rates for loans to various commercial sectors.

The bank is likely to have one methodology for its larger commercial loans and a different methodology for its retail credits. In general, a bank may have any number of methodologies for numerous loan segments. If lending areas are modelled separately, then the amounts of economic capital estimated for each area need to be combined. In making the combination, the bank either implicitly or explicitly incorporates various correlation assumptions.

Assume that the bank's total estimate of economic capital for credit risk is \$3 billion.

Finally, assume that the bank has developed an estimate of economic capital for operational risk by considering the frequency of large losses for firms active in similar businesses, with some allowance for differences in management controls and procedures. This estimate of economic capital for operational risk is \$2 billion.

Now that the bank has estimated the economic capital needed for each of market, credit and operational risks, the separate requirements must be combined into a total figure. The hypothetical bank uses the standard statistical approach to aggregating these figures on the basis of correlation assumptions. We now consider the effect of various correlation assumptions.

In one scenario, the bank assumes conservatively that its market, credit and operational risks are perfectly correlated. If it needs \$1 billion in economic capital for market risk, \$3 billion for credit risk, and \$2 billion for operational risk, then its total economic capital requirement is the sum of these, or \$6 billion.

Alternatively, the bank might assume that the three risks are completely uncorrelated, so that the correlations between each pair of risks are zero. Under this assumption, the aggregate economic capital estimate is only \$3.74 billion. This represents a decline of nearly 40 percent relative to the \$6 billion estimate under the perfect correlation assumption.

In a third scenario, the bank estimates a 0.8 correlation between market and credit risk, a 0.4 correlation between market and operational risk, and a 0.4 correlation between credit and operational risk.²⁴ Under these assumptions, the bank estimates its total economic capital requirement as \$5.02 billion. Thus, even with these higher correlation assumptions, the recognition of diversification benefits would result in a 16 percent capital saving – a significant sum.

The example serves to illustrate the practical significance of the cross-risk correlation assumptions. This point is further reinforced by considering the differences in the calculated return on economic capital that would result from these different assumptions.

²⁴ These illustrative figures are taken from Oliver Wyman & Company, *Study on the Risk Profile and Capital Adequacy of Financial Conglomerates* (February 2001), p. 22.

Annex 3

Initiatives in Insurance Sector Regulation

This annex provides additional detail on two of the regulatory and supervisory developments mentioned in the report, both of which relate to the oversight of insurance firms. These are (1) the EU's Solvency II project and (2) initiatives by insurance regulators in the US regarding insurance holding companies.

The Solvency II project

National authorities in Europe generally set prudential rules to ensure that an insurance company is financially sound. These rules typically provide for adequate technical provisions against policy liabilities, appropriate assets backing the liabilities, and minimum capital to cover the remaining risks that the insurance company may face. While the various national rules have worked well over the years, the European Commission came to realise that a single market, as exists within the EU, calls for a coherent system for prudential supervision. This system would need to meet the challenges posed by increasing competition, continued integration of the capital markets, and the emergence of financial conglomerates. There is also a need to help ensure that prudential solvency requirements remain appropriate as insurance company risks evolve with new product offerings and risk management techniques.

Accordingly, in 2000 the European Commission initiated a comprehensive review of the prudential rules designed to ensure the solvency of insurance firms in the EU. This review, called the Solvency II project, followed an earlier study (Solvency I) that looked more narrowly at the existing rules for the solvency margin. The Solvency II review is to be fundamental, wide-ranging and intended to lead to a major reform of the solvency system for European insurance companies.

Three general issues recur throughout the Solvency II project. The first issue is what shape the future solvency system should take. The second is how better to match prudential solvency requirements to the risks of an insurance company. The third is how and to what extent to increase harmonisation of regulatory systems across EU Member States.²⁵ In addition, as a secondary theme, the Solvency II project has considered the desirability of enhanced disclosures by insurance companies has been considered.

At the start of 2003, the European Commission's Insurance Committee (more particularly its Solvency Subcommittee) was still considering these issues. Consequently, this paper will

²⁵ These issues are highlighted in *Considerations on the design of a future prudential supervisory system*, a paper prepared by the European Commission for the Solvency Subcommittee of the Insurance Committee (MARKT/2535/02, issued 28 November 2002). The Joint Forum Working Group thinks that resolution of these issues will facilitate risk aggregation to the extent that they encourage insurance companies and their supervisors to take views of risk, risk quantification, and risk management that are more nearly consistent among jurisdictions.

focus on only a few of the issues: those pertinent to regulatory capital, harmonisation of rules and practices, and oversight of risk management.

Matching risks and regulatory capital

The Solvency Subcommittee explored the issue of the extent to which a solvency framework could be sensitive to the risks of each insurance company, including its asset risks. In doing so, the Subcommittee kept in mind that the objective of attaining a close matching between risks and the framework should be balanced against other objectives, including simplicity and maintaining a level playing field for competition.

After studying the risk-based capital systems in use in Australia, Canada and the US, the Subcommittee concluded that standard formulae for a capital requirement are by themselves insufficient to help ensure solvency. This is because the valuation of an insurance company's technical provisions, which is used in the risk-based capital systems, is a complex process that should not automatically lead to specific levels of prudential capital. This limits the extent to which capital levels can correspond to technical risk. Any measurement errors from the use of a standardised formula could not be estimated because they would vary with the characteristics of the company.

Further, the Subcommittee noted that existing solvency systems (whether inside or outside the EU) do not really serve to provide levels of capital sufficient to withstand business fluctuations. Rather, they either delineate a threshold for the imposition of supervisory restrictions on a company's activities (including, in the extreme, a take-over of the company) or provide an early warning of financial difficulties. Regulatory capital does not need to be calculated in a particularly risk-sensitive manner in order to serve these functions. That amount of capital needed to protect the company against the risk of insolvency, on the other hand, would be higher than the amount of regulatory capital. Methodologies used to estimate this amount would have an impact on the company's management and risk appetite.

The objective to be served by the capital requirement would be a determinant of the extent to which harmonisation between national systems and co-operation between supervisory authorities is needed. If required capital is set as a threshold for supervisory intervention, then a maximum degree of harmonisation of the rules would be desirable. If, on the other hand, an economic capital concept of solvency were employed, then the methodology would be specific to each company. In this case, harmonisation can be achieved only through a convergence of supervisory practices.

Use of internal models

The potential use of internal models for prudential purposes was explored.²⁶ First, not many insurance firms were found to possess working economic capital models that take into account all the group's major risks. Those in use have a short history. The Subcommittee thought that before a model could be accepted for prudential purposes, it must be actively used internally for the firm's risk management. Not many firms have such a high level of confidence in their models at present. Further, supervisory verification of the models would entail a large commitment of resources.

²⁶ European Commission, *Risk models of insurance companies or groups*, a note prepared for the Solvency Subcommittee (MARKT/2515/02, 17 May 2002).

Nonetheless, most members of the Subcommittee (and the European Commission more generally) would encourage insurance companies to continue developing internal models to provide greater understanding of the risks to which the company is exposed. As mentioned in the KPMG study, cited in Annex 2, permitting capital requirements to be based on internal methodologies might provide insurance companies with added incentives to improve their risk management methodologies because they might then enjoy lower capital requirements.²⁷

Nonetheless, there could be limited correspondence between standardised formulae and economic capital. One of the papers prepared for the Solvency II project stated:

As the overall risk models developed by the large insurance groups show, calculating an economic capital requirement which is consistent with a precise mathematical definition is an extremely complex process in which the choice of assumptions, company-specific parameters and aggregation methods has a decisive impact on the result.²⁸

Harmonisation of technical provisions

According to the Solvency Subcommittee, one of the weaknesses of the present European system of provisioning is that it does not enable a good comparison of technical provisions across insurance companies. Consequently, the Subcommittee ordered investigations into this issue.

As regards to non-life insurance, a wide variety of provisioning practices and equalisation mechanisms were in use in EU Member States. This reflected two main challenges. One is the lack of a common database for provisions on policy claims. Although most supervisory authorities possess some data, their quality and quantity tends to vary significantly. Second, determining prudential provisioning is a very complex matter. It depends strongly on the nature of the business written and the market. It has been suggested that the proper supervisory response to this diversity is to provide principles and guidance for sound claims management and provisioning in order to facilitate the eventual convergence of company practices. Furthermore, if equalisation provisions²⁹ were combined with capital in calculating the solvency margin requirement, additional harmonisation could be achieved.

As for life insurance, it was recognised that interest-rate and other market risks are inherent in several life products, including guaranteed interest rate contracts, annuities, profit-sharing clauses, unit-linked products and contracts containing embedded options. Among other things, the principles for risk management and supervisory review, being developed by the Basel Committee in its project to revise the Basel Capital Accord, would be useful in addressing these risks. Introducing minimum regulatory requirements and the use of prospective tools for asset-liability management would also improve practices in that sector.

²⁷ KPMG, *op. cit.*, p. 11, paragraph 2.1.17.

²⁸ *Considerations on the design of a future prudential supervisory system*, *op. cit.*, paragraph 72.

²⁹ Equalisation provisions are established to smooth fluctuations in the loss pattern.

Resolution of accounting issues

Solvency requirements and accounting issues are intertwined. Solvency requirements are based on financial information provided under accounting rules contained in the EU's Insurance Accounts Directive, issued in 1991. Nonetheless, there are numerous options that complicate a comparison of accounts among Member States. Hence, one of the objectives of the Solvency II project is to base the new solvency framework on common accounting policies in order to avoid the costs and complexity of multiple financial reporting systems.

The use of International Accounting Standards, mandated for publicly owned companies in the EU from 2005 onwards, will present an opportunity for harmonisation of accounts.³⁰ However, the present standards do not address insurance company contracts with policyholders, although the insurers' assets are covered. To fill in this gap, the International Accounting Standards Board is presently working on a new standard for insurance company accounting. Once the new standard is issued, an issue will arise as to whether that standard will be controlling for insurance companies in the EU or whether the EU's Insurance Accounts Directive will continue to apply. The EU is considering amending its directive to reflect the international standards.

The issues here are quite fundamental. For example, the overall accounting framework is being hotly debated. This framework could be based on either a "deferral and matching" model or an "asset-liability" approach. The former aims to match revenues and costs to relevant periods, while the latter utilises current values of assets and liabilities on the balance sheet. Many other decisions, including valuation principles, discounting of non-life technical provisions (policy reserves), equalisation reserves, and deferment of policy acquisition costs, hinge on the basic framework chosen. How insurance contracts are defined constitutes another fundamental issue, i.e., whether these are to be classified as financial instruments and subject to the applicable accounting rules for such instruments.

Supervisory oversight of risk management

The Solvency II process revealed a need to strengthen the supervisory review process beyond that laid out in existing EU directives, including the stronger process resulting from Solvency I. The need for an even stronger process was highlighted by a report prepared by the Conference of European Insurance Supervisory Authorities that noted the role of management in recent solvency problems.³¹ This report concluded that an effective prudential regime is not just about setting capital requirements and maintaining financial resilience, but also about anticipating and preventing potential problems through strong management, corporate governance, and internal controls. Consequently, it proposes a set of management principles for company management with regard to (a) organisation and governance, (b) strategy and decision-making processes, (c) risk monitoring and reporting, and (d) the taking of corrective action. Under a proposal before the Solvency Subcommittee, supervisors would investigate company compliance with these principles.

³⁰ International Financial Reporting Standards will gradually replace International Accounting Standards.

³¹ Conference of the Insurance Supervisory Services of the Member States of the European Union, *Prudential Supervision of Insurance Undertakings* (December 2002). This is popularly known as the "Sharma Report" after the chairman of the group that prepared it.

US insurance holding companies

US insurance supervision has historically focused on the financial health and dealings of insurance entities, since only the insurance business is subject to regulation. Consequently, companies that hold insurance entities generally go without supervision at the group level, aside from a small number that have elected to become Financial Holding Companies (FHCs) or themselves constitute insurance companies. Nonetheless, because the regulatory authorities recognised that financial difficulties at any company in an insurance group might spill over to affiliated insurers, efforts have been made to take a more group-wide perspective under the aegis of the National Association of Insurance Commissioners (NAIC), a non-supervisory group that includes representatives from all state insurance supervisory bodies.

Background

The insurance structure in the US is characterised by the existence of a regulatory body in each of the individual states, but no national body with authority to impose standards. Thus, insurance companies are supervised by the insurance supervisor of every state where they are licensed to do business. At one time, the laws and supervisory framework of the various states diverged because they were developed independently. As insurance companies expanded the geographical scope of their operations, this divergence increasingly became a burden to them. State supervisors were sympathetic and sought both to exercise better supervision and to attain greater uniformity by harmonising their regulations, and utilising the best supervisory practices.

In this vein, the NAIC has played an important role in fostering consistency among state legislation and supervisory practices. Among other things, the NAIC has developed model laws, which state legislatures could consider as the basis for their own laws. It has published papers on best practices for insurance supervisors and developed manuals on supervisory practices. It developed a regulatory financial reporting format that is now used in all states, thereby simplifying the financial reporting process for insurance companies whose operations span several states. In addition, the NAIC has developed an accreditation process for state supervisory authorities. For a state supervisory authority to become accredited, its state insurance laws must establish standards at least equal to those found in the NAIC model laws in certain critical areas, its supervisory practices must meet minimum criteria, and its company financial examination and analysis operations must meet NAIC standards. With a very small number of exceptions, all state authorities are accredited. As a result of the NAIC's efforts, there is now a high degree of consistency among the states, even while individual state authority is preserved.

Since many insurance companies conduct business across several states, the state supervisory authorities have established co-operative arrangements in order to economise on supervisory resources, while providing effective state supervision. These arrangements extend to insurance companies domiciled in one state that are subsidiaries of insurance companies domiciled in other states.

Historically, state insurance supervisors had no authority over any company that is not an insurance company. Frequently, insurance companies would be subsidiaries in a group, in which the parent itself is typically not an insurance company and thus is not subject to traditional state insurance legislation and oversight. To strengthen supervisors' authority in this situation, in 1969 the NAIC adopted its Insurance Holding Company System Regulatory Act (Holding Company Act, or simply "Act"). This model Act was subsequently enacted into the laws of virtually all states.

Holding Company Act

The Holding Company Act addressed a perception that insurance holding companies were being formed to circumvent state statutes on the formation, financing, investments, management, and required reporting of insurance companies. It reflects the view that protection of an insurance unit in a group and its policyholders can be achieved by regulatory approval of material transactions between the insurer and its affiliates, additional disclosures, and limited authority over the holding company in situations where the financial health of the insurer is at risk.

The Act requires all insurance companies that are members of a holding company system to register in its state of domicile. In the registration, which must be renewed annually, all relationships and agreements between the registrant and its affiliates must be disclosed. The Act sets standards for material transactions between the domestic insurance company and its affiliates and provides for supervisory approval in certain instances. The Act establishes rules for state supervisory approval of any acquisition of control of an insurance company. On an ongoing basis, every insurance company is required to produce to its state supervisor records and other information in the possession of the insurer or its affiliates that are reasonably necessary for the supervisor to ascertain the condition of the insurer. If the insurer does not comply, then the supervisor has the authority to examine the affiliates (even the non-insurance ones, if necessary) to obtain the needed information on the insurer.

However, unless it is an insurance company, there is no provision in the Act for examination of the holding company itself or for review of its capital adequacy or risk management systems. The focus of insurance regulation remains on the solvency of the individual insurance companies and protecting policyholders. Holding companies that are not themselves insurance companies – these constitute the large majority of topmost holding companies – continue to be unregulated by insurance supervisors.

Framework for information sharing and group analysis

The NAIC and the state supervisors realise that their analysis of individual insurers would not be complete without a fuller understanding of its group and the markets in which the group operates. While there is significant co-ordination between state supervisory authorities when an insurance company is experiencing difficulties, the supervisors see a need to be more pro-active in sharing information for insurance groups that do not necessarily have weaknesses. In addition, the GLBA encourages co-operation among supervisors in the banking, insurance and securities sectors. For these and other reasons, in March 2002 the NAIC issued a white paper, *Framework for Insurance Holding Company Analysis*, which provides guidance on how state authorities may obtain a better understanding of a holding company's structure and overall operations. The framework also provides for a co-ordinated approach to the review of holding company transactions that impact insurance subsidiaries domiciled in multiple jurisdictions.

The framework provides for a "lead state" to co-ordinate an analysis of an insurance group, including a review of the group's financial results and overall business strategy. As part of its analysis, the lead state supervisor would scrutinise transactions between affiliates. The lead supervisor would also establish lines of communication among all interested states and serve as the regulatory contact with the group's top management. With the GLBA in force, the lead state supervisor may serve as a central point of contact for interested banking and securities regulators, particularly with the Federal Reserve as the umbrella supervisor of FHCs.

The purpose of the lead state supervisor's analysis is to obtain a general understanding of the holding company, its insurance and non-insurance businesses, the risk inherent in those businesses, and the group's approach to risk management. In conducting its analysis, the

supervisor would gather information from the insurance supervisors of all states in which the group has an insurance affiliate and from federal and state banking and securities agencies. Publicly available reports would be an important source of information on risk and risk management at a consolidated group level, although some information might be gleaned from internal management reports. The results of the lead state's analysis would be shared with other interested supervisors, including those in the banking and securities sectors.

The scope and content of the lead supervisor's analysis is evolving. For example, a NAIC working group is considering how to enhance the current financial analysis and examination of insurance companies to focus better on the various risks of the group as a whole. The NAIC also plays an important role in the state authorities' evaluation of the condition of the holding company. For one thing, the NAIC develops an analysis of the regulatory capital positions of the various insurance entities in a group. Among other things, this analysis helps the supervisors preclude multi-gearing and double-leveraging among insurance entities. The NAIC's capital analysis does not extend to non-insurance affiliates, such as banks, securities firms or commercial entities, or to the non-insurer holding company itself, although an *ad hoc* estimate of a consolidated RBC amount for the insurance subsidiaries only may be prepared. There is no attempt to assess the capital adequacy of the consolidated holding company.

The framework reinforces the provisions of the Holding Company Act with regard to the obligation of individual insurance companies to provide information on transactions with affiliates, including parent holding companies. While the holding company is typically not itself supervised, the information obtained about its financial condition and operations is helpful to the state insurance authorities in their supervision of the insurance subsidiaries.

Annex 4

Members of the Working Group on Risk Assessment and Capital

**Co Chairmen: Darryll Hendricks, Federal Reserve Bank of New York
Roger Cole, Board of Governors of the Federal Reserve System**

Belgium	Mr Jos Meuleman	Commission Bancaire et Financière
Canada	Mr Denis Sicotte	Office of the Superintendent of Financial Institutions
France	Ms Nadege Jassaud Mr Roland Moquet	Commission Bancaire Ministère de l'Economie, des Finances et de l'Industrie
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Singapore	Ms Soo Hoon Hauw	Monetary Authority of Singapore
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Sweden	Mr Mats Stenhammar	Finansinspektionen
Switzerland	Mr Roland Goetschmann	Eidgenössischen Bankenkommission
United Kingdom	Ms Nadege Genetay	Financial Services Authority
United States	Ms Anna Lee Hewko Mr T Kirk Odegard Ms Elise Liebers Mr Richard Mead Mr Ernest L Johnson, III Mr Michael Macchiaroli Mr George Lavdas Mr Michael Yuenger	Board of Governors of the Federal Reserve System Federal Reserve Bank of New York Virginia Bureau of Insurance Securities and Exchange Commission Office of the Comptroller of the Currency
IAIS	Mr Yoshihiro Kawai Mrs Catherine Lezon	
EU Commission	Mr Peter Smith	
Secretariat	Mr Laurent Le Mouël	Secretariat of the Basel Committee on Banking Supervision