

PDF hosted at the Radboud Repository of the Radboud University Nijmegen

The following full text is a publisher's version.

For additional information about this publication click this link.

<http://hdl.handle.net/2066/46269>

Please be advised that this information was generated on 2020-09-27 and may be subject to change.

A supervisory view on economic capital models

Report of the Working group on Economic Capital Models *

The Working Group has been set up by *de Raad van Financiële Toezichthouders, de Nederlandse Vereniging van Banken* and *het Verbond van Verzekeraars*

- FINAL -

for fico-congress 12 May 2005

* Prepared by M. Gelderman (DNB; chair), H. Liersch (ING; secretary), P. Klaassen (ABN AMRO), I. van Lelyveld (DNB), G. Siegelaer (DNB), H. Wanders (DNB), O. Jones (Fortis), A. Pouw (Fortis), H. Everts (ING), H. van Broekhoven (ING), M. Boughanmi (RABO), and R. Monnik (RABO).

SUMMARY & CONCLUSIONS

The papers of the Working Group to date have been primarily concerned with the technical issues of how to measure and aggregate risks, and subsequently how to determine capital need(s), followed by a survey of the state-of-play of economic capital modelling at Dutch financial conglomerates. Now we will discuss an application of economic capital models that has –as yet– to gain widespread acceptance, namely regulatory use. Developments in industry and in the supervisory arena have made the discussion about the use of economic capital models for regulatory use timely and useful as economic capital models could deliver useful information for all stakeholders.

A prerequisite for regulatory use of economic capital models would seem to be that institutions put sufficient faith in these internal models. Are these models, or seen more broadly, is risk management adequately embedded in the organisation? This implies that the ultimate responsibility for the model used, lies with the institution. Moreover, that senior management understands and approves the overall approach chosen (i.e. determines the risk preference). It also implies a clear and documented delineation of responsibilities. A true acid test is whether the institution incorporates model outcomes in other processes like pricing or performance related pay.

Supervisors will, in addition to the appropriate embedding within the institution, have to be attentive to a number of issues. The most important of these are the effects of recognising economic capital model use on competitive equality, the behaviour of the models in times of stress, and, finally, the home-host aspect of model and model outcome recognition. These and other issues will be discussed in more detail in this paper.

Notwithstanding the abovementioned and other concerns, introducing economic capital models in the supervisory framework does provide a positive stimulant to improving risk awareness, measurement and management. By itself this development will not immediately solve all the imperfections in risk management we see today but given time it will certainly improve risk management.

Table of contents

1.	Introduction	3
2.	Regulatory Developments	4
2.1.	The Financial Conglomerates Directive	5
2.2.	Capital Requirements Directive and Solvency II	6
2.3.	Institutional structure of supervision	7
3.	Principles for economic capital models	8
3.1.	Introduction	8
3.2.	High level principles: further detail.....	9
4.	Supervisory issues.....	13
4.1.	Objectives	13
4.2.	Competitive equality	14
4.3.	The confidence level to be evaluated	15
4.4.	Going concern and times of stress.....	15
4.5.	Appropriate risk measures: VaR vs Tail VaR	16
4.6.	The systemic impact of model convergence and limited data availability.....	16
4.7.	Partial use	18
4.8.	Definition of capital.....	18
4.9.	Home-host issues in economic capital modelling	19
5.	Concluding remarks	20

1. INTRODUCTION

1. The papers preceding the present one give a comprehensive overview of both best and current practice in risk management practice within Dutch financial conglomerates. The first paper presented a risk typology that was useful in structuring the subsequent discussion of measurement and aggregation. After the description of the possible approaches, the Working Group surveyed the state-of-play in current implementation of economic capital models.
2. The economic capital models we have studied, promise to deliver different things to different stakeholders:
 - For the institutions implementing the models, they promise to deliver a view on the risk profile and the associated capital needed. Given that capital need, the model is then used to allocate capital across business units.
 - For supervisors these models could help improve understanding of the true capital needed rather than exclusively focussing on more mechanically determined regulatory minimum capital requirements.
 - For capital market participants, economic capital numbers would give a more accurate picture of the true risk profile of an institution as well.
3. Given the insights gained in the drafting of the papers to date, it is now time to turn our attention to one use economic capital models generally have not been yet put to: supervisory use. The interest to use internal models is increasing among regulators and supervisors. In banking, institutions may use (upon qualifying) some of the same parameters in computing regulatory minimum capital requirements as in internal capital determination under the first pillar in the new Basel Capital Adequacy Framework. Moreover, in the second pillar of the Basel Framework economic capital models will form the core of the required Internal Capital Adequacy Assessment Process (ICAAP), at least in the Netherlands. Similarly, on the insurance side, the Solvency II regulatory framework also contains three pillars and has room for internal models (even in the first pillar). A conceptual difference between Solvency II and Basel II that we will discuss more thoroughly later on is that in the former approach all risks are expected to be covered in the first pillar while in the Basel II approach some of the risks are specifically placed in the second pillar.
4. Supervisors might use these models to come to a view on the risk profile and associated capital, or more precisely, determine regulatory capital. This would herald a shift from the traditional accounting based approach to capital to an economic value based approach. In the former approach the buffer capital is defined in accounting terms, generally against historical prices, while in the latter approach

buffer capital is the difference in economic value between assets and liabilities against market or, alternatively, fair values. During the transition from accounting to value based approaches tensions will emerge and these should be dealt with if and when they arise.

5. Several options are open to supervisors in accepting models and model outcomes. On one hand of the spectrum, supervisors could take the model outcomes at face value and set regulatory capital requirements equal or proportional to economic capital. Another approach is that supervisors would critically assess the model and would only allow certain models or constrain parameter values to be within certain ranges. Yet another approach to using these models is that supervisors would incorporate economic capital outcomes as one of many pieces of information in coming to a proper assessment of the risk profile of an institution.
6. Notwithstanding the clear advantages of supervisory use of economic capital models there are a number of issues that make unconditional incorporation of model outcomes less straightforward. The most important of these considerations are the behaviour of the models in times of stress, the possibly less than complete coverage of the models, concerns about the organisational embedding of the risk management process, and, finally, the home-host aspect of model and model outcome recognition. These and other arguments will be discussed in subsequent sections. This paper will conclude that neither polar case is applicable but that economic capital models are well worth incorporating in the supervisory assessment process.
7. To give adequate attention to all these issues, the paper has the following structure. First, the developments within the regulatory arena are sketched as a background. It will be argued that recent changes have been conducive to the discussion of economic capital for regulatory purposes. Then we will pay attention to the general (organisational) framework of economic capital models. The way the models are embedded within organisations is important to supervisors because this supplies additional checks on and correct incentives in the model, if implemented appropriately. This is followed by setting out the broader objectives that supervisors are pursuing followed by a discussion of a number of issues that are of particular concern to supervisors. Finally, we conclude.

2. REGULATORY DEVELOPMENTS

8. So far, the subject of the papers of the Working Group has been the developments within the industry that might eventually lead to an industry standard. In the mean time a number of important developments have taken place in the regulatory arena as well. The focus of our discussion is the European developments as for most financial conglomerates in the Netherlands that is where most activities are located. Similarly to most countries elsewhere the legal basis for supervision of banks and insurers in European countries remains strictly sectoral. This sector-based regulatory environment is however changing rapidly. A first example is the implementation of the Financial Conglomerates

Directive in the EU member states. The Financial Conglomerates Directive allows for further information exchange among supervisors and emphasises the view on capital from the holding company's perspective. A second example is the convergence of approaches in both Capital Requirements Directive (CRD, the EU law implementing the Basel Capital Adequacy Framework) and the Solvency II process. In both these approaches for, respectively, the banking and the insurance sector, the general framework consists of three similar pillars. Moreover, both Solvency II and the CRD are likely to contain elements that would ease acceptance of economic capital. For instance, parameters used in economic capital models have found their way into the advanced approaches for credit risk in the CRD. Finally, a third example is the trend in many countries to concentrate supervisory agencies and where sectoral supervisors have merged, supervisory practices are likely to converge across sectors. Taken together these developments make the acceptance of economic capital models (somewhat) more likely and we will now consecutively each of these three developments –the conglomerates directive, the CRD and Solvency II, and supervisory institutional structure– in more detail.

2.1. The Financial Conglomerates Directive

9. One step in overcoming the tremendous difficulties of coming to a consistent regulatory framework, at least within Europe, was the implementation of the Financial Conglomerates Directive. This Directive was enacted in the European Economic Area (EEA) member states in autumn 2004 for application to financial years beginning on 1 January 2005. The Directive introduced supplementary supervision of financial conglomerates on a group-wide basis in order to address some of the concerns voiced. It operates in addition to both the prudential supervision of EEA regulated entities on a standalone basis and consolidated supervision on a sectoral basis.
10. The Directive applies to firms that qualify according to the following two steps: a group only qualifies as a financial conglomerate (a) if more than 50 percent of group activities are financial and (b) if the shares of the banking sector (including security activities) and the insurance sector in the total of the financial activities are each within the range 10–90 percent. In addition, if the minority share has a balance sheet larger than € billion, the group also qualifies as a financial conglomerate. If the group is headed by an unregulated entity, it is called a mixed financial holding. A procedure is given for identifying the co-ordinator, which is generally the regulator of the parent undertaking heading a financial conglomerate.¹

¹ If the financial conglomerate is not headed by a regulated entity, the co-ordinator is appointed on the basis of the relative size and jurisdiction of the regulated sectors or entities within the conglomerate. If the head office is outside the EEA, the third country regulator can be 'equivalent', in which case consultation is necessary, or if the regulator is not 'equivalent', the EEA supervisors can force their role as co-ordinator.

11. The co-ordinator has a number of methods at his disposal, the main ones being:
 - supplementary supervision of the conglomerate's capital adequacy, including requirements at the holding level;
 - requiring periodic reporting of significant risk concentrations at the holding level;
 - requiring periodic reporting of significant intra-group transactions (those above 5 per cent of the financial conglomerate's capital requirement are presumed significant).
12. In addition, the requirement for management to be of sufficiently good repute and experience is extended to the management of a financial holding company with at least one regulated EEA subsidiary.
13. One of the important aspects of the Financial Conglomerates Directive is that it will make exchange of information among parties with a legitimate interest easier. Once stakeholders have gained some experience in this process, the advantages of conducting this dialogue within a single consistent framework, i.e. economic capital, might be more easily recognised.

2.2. Capital Requirements Directive and Solvency II

14. The Capital Requirements Directive is the EU legislation that will put the legally non-binding Basel agreement into law. The Directive will, in turn, be put into national law as of 2007. For the most part, the Directive is substantively equal to the Basel Capital Adequacy Framework. Solvency II is the European Commission's project to achieve harmonisation of risk-based capital requirements within the EU. Presently the details of Solvency II are being filled in.
15. An important similarity between Solvency II and Basel II is that a three-pillar structure seems to have been chosen in both frameworks; a first pillar with minimum requirements, a second pillar where describing the supervisory review process and, finally, a third 'disclosure' pillar for promoting market discipline.
16. Given this framework, the place of internal models is however somewhat different within the insurance and the banking sector's regulatory framework. Basel II has explicit minimum capital requirements for market-, credit-, and operational risk. Although the models used to determine regulatory minimum capital requirements do use some of the same inputs, they are not true internal models as supervisors partly determine their workings. In addition there is the second pillar where, on the one hand, institutions are required to hold sufficient capital for *all* risks and, on the other hand, supervisors will have to assess the adequacy of this capital adequacy process and its outcome in their Supervisory Review. The Basel second pillar clearly recognizes that some risks are not, or are not adequately, captured under the first pillar but should be incorporated in the internal model used in the second pillar. In contrast, in Solvency II the use of an internal model is already envisaged in the first

pillar and is thus used to determine the minimum capital requirements. The second pillar is then only reserved for the Supervisory Review, producing a supervisor's view on an institution's risk management, including the adequacy of capital.

17. The setup of the supervisory review also influences the appropriate supervisory response to more risk based capital adequacy approaches. Traditionally supervisors only set an absolute minimum capital requirement. In the supervisory review, as envisaged, supervisors could determine an additional capital requirement either because of additional institution-specific risk or because of systemic risk concerns. Dealing with the separate requirements following from the first and the second pillar merits further development. An important development in this respect is the introduction in Solvency II of the concepts of Minimum Capital Requirement and Solvency Capital Requirement. The former is the absolute minimum; an institution with capital below this threshold forfeits its license. The latter is the target solvency level which an institution should generally be able to maintain.

2.3. Institutional structure of supervision

18. The structure of financial sector supervision has seen some changes recently both on the national as well as on the international level. Internationally, at least in Europe, the further structure as given by the Lamfalussy structure has recently been introduced and details are currently being filled in. This structure was proposed by the "Committee of Wise Men on the Regulation of European Securities Markets", chaired by Baron Lamfalussy. The Committee was set up in July 2000 by the Economic and Finance Ministers of the EU (ECOFIN) with a mandate to assess the current conditions for the implementation of securities markets regulation in the EU and to propose improvements in order to ensure greater convergence and co-operation in day-to-day implementation of EU-wide regulation. A full description of these changes is unfeasible given the limitations of this paper but broadly speaking the proposals are based on a new, four-level regulatory approach, aiming to establish faster and more flexible decision-making procedures for securities market legislation and to ensure the uniform application of Community law. European Parliament endorsed the four-level approach, which was extended to the other financial sectors, the banking sector included (see Directive 2005/1/EC). The Committee of European Banking Supervisors (CEBS) and the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) are the main committees for EU supervisors aiming at further EU-wide convergence of supervisory practices in the banking and insurance sector respectively. The Lamfalussy approach doesn't change the existing institutional setting but clarifies the roles and responsibilities of the various players to give better advice to the legislative authorities.
19. On the national level, a number of countries have recently reorganised the institutional structure of supervision. A general trend that can be discerned is that in many countries cross sectoral regulatory agencies are being created. This tends to take two forms although variations exist: full integration of all supervisory authorities or a concentration by supervisory function. The first model, implemented in

for instance the United Kingdom amounts to merging all supervisory agencies together in one agency and leaving the central bank in charge of monetary policy, including the function of lender-of-last-resort. A variation is the solution chosen in Ireland where all supervisory functions have been merged within the central bank. The functional model, on the other hand, distinguishes between market conduct and prudential supervision. Prudential supervision is entrusted to one agency, possibly within the central bank and the responsibility for market-conduct supervision is given to a separate organisation. The latter model has recently been implemented in the Netherlands.

20. For our present analysis, the most important aspect of the reorganisation is the combination of (line-) supervision within a single supervisory agency. Just like in financial conglomerates, this forces supervisors in both sectors to align supervisory approaches. A first step here is to come to a single method of risk analysis. This method comprises a risk typology akin to the classification in the first Working Group paper. In addition, at De Nederlandsche Bank the risk analysis method leads to a risk profile for each institution. In this sense, it can be seen as a qualitative version of the economic capital models that we have been discussing so far. Once a unified risk analysis method has been implemented, it is easier to make supervisory approaches converge in both sectors. Nevertheless, even in institutions where the responsibilities for banking and insurance have been combined for quite some time, the supervisory approach does not have to be identical across sectors. This implies that the regulatory treatment of similar risks might differ over sectors.

3. PRINCIPLES FOR ECONOMIC CAPITAL MODELS

3.1. Introduction

21. The discussion in the Working Group papers so far has mainly dealt with how the appropriate level of economic capital can be determined. The broader question as to what would constitute good first principles which would guarantee that the model is properly embedded has not yet been dealt with explicitly. As noted before, the economic capital model discussion shows great similarity to the discussion about the Internal Capital Adequacy Assessment Process presently taking place within CEBS. CEBS has recently released a number of High Level Principles that set out principles to which institutions should adhere in the development and maintenance of their ICAAP. Paraphrasing these principles in the context of economic capital models we have that:

1. The economic capital model is the institution's responsibility;
2. The economic capital model should be proportionate to the nature, size, risk profile and complexity of the institution;
3. The economic capital model should capture all of the material risks;
4. The economic capital model should be included in a formal and documented procedure, including the role of the management body;

5. The economic capital model should as far as possible form an integral part of the management process and decision-making culture of the institution; it should be properly embedded in the organisation;
 6. The economic capital model should be reviewed regularly, at least annually, by an independent party;
 7. The economic capital model should be comprehensive and representative;
 8. The economic capital model should as far as possible be forward-looking;
 9. The economic capital model should produce a reasonable outcome.
22. Not all of these Principles are equally relevant to our present discussion. Principle 2, for instance, is aimed at the many smaller financial institutions which would also be expected to have an ICAAP in place. However, these smaller institutions generally have a simple risk profile and this would thus lead supervisors to expect a less complicated model, in combination with measures to ensure that no undue risks are taken in areas that have been modelled in a less sophisticated way. Other principles are quite relevant, however, and we will therefore discuss each of them in the next section.

3.2. High level principles: further detail

23. *1. The economic capital model is the institution's responsibility.* Even if an economic capital model is used in setting regulatory capital, ownership should still be with the institution. The economic capital model should be a means of supporting the dialogue between the supervisory authority and the institution. Moreover, a continuous dialogue between the institution's senior management and the risk-management department is of great importance in this context. The dialogue touches the trade-off between "measuring" and "controlling". An adequate internal model that has been properly deployed by a risk-management department gives proper insight into the risks that the institution is running. It is then the responsibility of senior management, based on the work of the risk-management department, to shape the control of those risks by means of specific policy decisions.
24. *2. The economic capital model should be proportionate to the nature, size, risk profile and complexity of the institution.* Establishing whether the economic capital model in fact complies with this principle, should be established on a case-by-case basis. In this review, aspects such as the institution's legal form or its significance to financial stability may also play a role. As noted, however, this principle is more relevant in the general EU CRD discussion which is also applicable to a large number of small institutions.
25. *3. The economic capital model should capture all of the material risks.* The range of risks discerned has been discussed in the first paper of the Working Group. Naturally, the relative weights will differ for each individual institution. In addition to the risk types, the institution's risk preference should be incorporated in the assessment of the risks.

26. Furthermore, it is not just the risks that are easy to approach quantitatively that should be incorporated; risks requiring a more qualitative approach should ideally also have to be included. One way would be to use expert judgement, although how to go about this seems to be an unsettled question. In addition, the view that the final economic capital model only includes material risks does not absolve the institution from its obligation to demonstrate that the excluded risks are not material. This should preclude “cherry-picking” by only modelling those areas with relatively little risk.
27. In determining capital requirements, capital needs in stressed situations should explicitly be incorporated. Sensitivity to those situations, and the associated required capital, can be assessed using stress tests. Senior management or a dedicated committee must be actively involved in drawing up and evaluating the stress tests. If these stress test show that the institution is susceptible to certain risks, prompt action must follow to properly control the changed risk profile.
28. *4. The economic capital model should be included in a formal and documented procedure, including the role of the management body.* As an institution’s senior management has final responsibility for the economic capital model, senior management must approve its conceptual design (at least the objectives and scope of the model and, generally, the methodology). Further development can be carried out under the responsibility of the executive management. The methodology of, assumptions in and procedures surrounding the economic capital model need to be established and approved by the senior management. Management should also be responsible for integrating the economic capital model and its outcomes in the management culture. It is therefore important, as noted in the next Principle, that (the outcome of) the economic capital model is promoted within the organisation with sufficient commitment. The final outcome of the economic capital model should be reported periodically and regularly to senior management. The frequency of reporting depends on the speed at which the risk profile changes.
29. *5. The economic capital model should as far as possible form an integral part of the management process and decision-making culture of the institution.* In short, it should be properly embedded in the organisation. Similar to all models, the outcome of an economic capital model depends crucially on the information that is fed into the model. The quality of information, in turn, depends on the effort exerted to assure that this information accurately reflects current exposures and associated risk. The institution thus must have procedures to ensure the quality, promptness and completeness of data input. The integrity of the data process must be evaluated regularly. In addition to the processes in place, the effort expended will depend on the importance of the outcome of the model. If the model is merely a cosmetic exercise with no real consequences, the quality of the data will suffer accordingly. If, on the other hand, the model is used in several different and important decision processes, forces within the organisation will assure that the data quality is adequate.

30. If however the incentives produced by the model are perverse, individual personnel or managers might try to game the system. Such perverse behaviour, however, would generally lead to (opportunity) losses elsewhere in the organisation and management in those parts of the organisation would object. Only if risk is not adequately captured and would thus become “invisible” could such risk shifting occur undetected. It is in the interest of senior management to implement a system that uses adequate measurement and produces the appropriate incentives.
31. Given the incentives of senior management, the model should be implemented with care and should form an integral part of day-to-day risk management and thus of the process of planning, monitoring and controlling the institution’s risk profile. Furthermore, there should be a reporting line to the senior decision-making body on the actual risk profile compared with the risk standard. The systems and processes used in operations must be consistent with the economic capital model. The latter applies particularly to risk-management measures as incorporated in the economic capital model.
32. More sophisticated institutions in particular, can be expected to have integrated the economic capital model in the operating process. This may be done for example by using the economic capital model for allocating resources to business units, taking individual investment or disposal decisions or more generally for business decisions (such as expansion plans) and budgets. Less sophisticated or smaller institutions might decide to outsource part of economic capital modelling. Supervisors will however be particularly attentive because of the importance of ownership of the capital adequacy process.
33. *6. The economic capital model should be reviewed regularly, at least annually, by an independent party.* Such a review can ensure that all material risks are properly identified and measured and, therefore, that the economic capital model gives an accurate view of the institution’s risk profile. An institution should, therefore, have an independent risk-management function responsible for the design, implementation and maintenance of its internal model. Staff responsible for this function should be independent of the commercial activities, especially when the validity of the model is determined. They should report directly to the institution’s senior management and they should critically review whether the models used are sufficiently comprehensive, accurate and prudent. Furthermore, they should initiate improvements to the model as necessary. Finally, they should also ensure independent review of all material processes applicable to the model such as data collection, qualitative input, etc.
34. As became clear in the previous paper on the state of implementation, institutions have chosen different organisational forms to assure that model validation is insulated from undue (commercial) pressure. One issue that became clear is that the traditional auditor is less well equipped to assess an economic capital model. Thus, if the audit department is assigned a significant role in the validation process then audit departments will have to acquire new skill sets. Alternatively, if responsibility for validation is assigned to a unit within risk management then these risk managers will have to become

more or less independent; it might be difficult for risk managers to independently validate models if they were closely involved in developing these models. In the end, both organisational forms produce their own challenges.

35. The fact that some of the economic capital model outcomes are also published in, for instance, annual reporting implies that institutions will be inclined to put more effort in assuring its solidity. General reporting guidelines and regulations, like for instance given in the American Sarbanes-Oxley legislation, have made institutions more attentive to the quality of what is being reported. In this respect there is a permanent reporting quality drive.
36. *7. The economic capital model should be comprehensive and representative.* The administrative systems should be reviewed as to whether they provide the necessary information, and are reliable and representative of the institution itself. Attention also has to be given to the availability of general, external information and parameters. “Expert judgement” will have to be relied upon where these are not available.
37. The economic capital model will have to be updated if the assumptions and/or methodology prove to have changed substantially, for example, as a result of a different strategic focus, a revised business plan, a changed environment, etc. If new risks occur, they too should be incorporated immediately in the economic capital model. Keeping the economic capital model up to date is, therefore, an ongoing, iterative process.
38. It is vitally important that not only all material risks are incorporated, but also that they are measured reliably and consistently throughout the institution. Risks must be identified, quantified and managed transparently, consistently and prudently, partly through the economic capital model. When applying the economic capital model, an institution also has to consider its possible limitations. The institution must be able to assess the risks estimated with the model using the appropriate professional expertise. If necessary, internal specialists should adjust model outcomes on the basis of significant information which is not incorporated in the model. There must be a procedure for authorising and documenting these changes. It is useful to have clear guidance at hand especially for risks which are less easy to quantify.
39. *8. The economic capital model should as far as possible be forward-looking.* Most models are estimated using historical data and are, therefore, dependent on the past. It would be commendable if the economic capital model is as forward looking as possible, on the basis of the historical data and other information on the future risk profile (strategic plans, macro-economic forecasts), so that for instance proper projections can be made ‘through the cycle’. The remark that an economic capital model can be deployed more widely than merely for establishing just solvency levels fits in this context; examples are stress tests and supporting an integrated vision of the institution’s future development.

40. 9. *The economic capital model should produce a reasonable outcome.* The institution should have a proper process for validating the accuracy and consistency of the economic capital model. Regular back-testing is part of this. The economic capital model is validated on first use and if and when changes are made to the model, and preferably again some time after this. This validation exercise includes comparing the estimated risks against actual results. The internal and external data used should be up to date and representative. Moreover, the institution should document the validation results and use these to enhance the quality of the risk analysis. The institution should critically evaluate the performance of the models and aim for improvement, partly by regularly comparing the results from the model against new internal and external information on the modelled risks.
41. In the end, the outcome of the economic capital model must be approached with a degree of healthy scepticism. Every model is an abstraction of reality. It is, therefore, important that the outcomes of the economic capital model are approached in a structured way and discussed before they are allowed to influence policy. If the supervisory authority has additional information that puts the outcome of the economic capital model in a different light, this has to be included in the discussion and should lead to changes in the assessment of the buffer capital needed.

4. SUPERVISORY ISSUES

4.1. Objectives

42. Supervisors can pursue a wide range of objectives and the following list seems to capture a broad consensus:
1. Promote safety and soundness of the financial system, including safeguarding the economic interest of deposit- and policyholders.
 2. Enhance competitive equality
 3. Constitute a comprehensive approach to addressing risks
 4. Risk sensitive capital requirements
 5. Accommodate industry best practice
 6. Reduce the cost of implementation of new approaches and of supervision
43. Giving economic capital models a prominent role in determining capital requirements can help attaining a number of these objectives. A well rounded economic capital model is undoubtedly the most comprehensive model of an institution's risks available and would thus fulfil objective number three. Since the model would be risk sensitive, this would also cover objective four. Moreover, economic capital models are at the forefront of risk management technology (objective five), although for some elements, like the assessment of diversification, consensus on best practice still has to emerge. If supervisors increasingly rely on the outcomes of internal models for their assessments on

the risk profiles of institutions then institutions will have to report a great deal less (basic) data. In this case supervisors do not have to compute their own, simple models based on reported base data. This, in turn, would reduce reporting and compliance costs, making objective six easier to achieve. The first objective, promoting the safety and soundness of the financial system would seem to be easier to achieve if economic capital models increase a supervisor's (and institution's) understanding of risks. Moreover, more risk sensitive capital requirements help to ensure that capital is there where it is most needed.

44. The only objective where it is not entirely clear whether economic capital models are unequivocally beneficial might be objective number two: increased competitive equality. We will turn to this issue in the next section. Furthermore, we will then in subsequent sections raise a number of other issues specific to the use of economic capital models by or for supervisors. These issues are supplementing the explanation of the CEBS' High Level Principles for ICAAP given in the previous section and are, in no particular order, the appropriate confidence level in evaluating the model, going concern and times of stress, the appropriateness of VaR measures, model convergence and limited data availability, partial use, definition of capital and, last but not least, home-host issues.

4.2. Competitive equality

45. As noted in the previous section, objective number two –increased competitive equality– might not benefit unequivocally upon accepting economic capital models for supervisory use. More specifically, two angles can be discerned: competitive equality among (1) large, internationally active financial institutions and, (2) between large and small institutions. We will discuss both of these angles in turn.
46. Economic capital models are at first likely to be primarily implemented by large, internationally active financial institutions. Furthermore, if supervisors decide to place relatively more weight on the outcomes of economic capital models then the level playing field across jurisdictions becomes increasingly more important. To warrant the level playing field in this regard and increase model understanding, supervisors with a legitimate interest are likely to discuss economic capital models amongst themselves. Thus, without impinging on the home country control principle, some sort of peer review might be useful in increasing supervisors' understanding of economic capital models.
47. A second angle is that the significant (fixed) costs of economic capital models might drive smaller institutions out of the market and raise entrance barriers for new entrants. Especially for smaller all-round banks this can become a problem. A mitigating factor for smaller niche players might be that a more narrow focus also greatly reduces the complexity of the economic capital model. As an example, one could think of a credit card bank. For such a bank, the economic capital model could be rather simple; i.e. adequate modelling of a single portfolio (credit cards) and a model of operational risk. Another mitigating factor might be the possibility that part of the economic capital modelling might be

outsourced. Supervisors are however likely to be very attentive of the exact form chosen and make sure that ownership of the capital adequacy process lies with management and outsourcing does not lead to a loss of control or understanding.

4.3. The confidence level to be evaluated

48. The implicit confidence level underlying regulatory frameworks like Basel II and Solvency II roughly translates to an investment grade rating. Many institutions however aim for a rather higher level of confidence. These institutions target for instance a double or triple A rating. An issue in the Supervisory Review is whether supervisors should evaluate an institution's risk profile and associated desired capital level at the minimal investment grade confidence level or at the generally higher internal level of confidence. One argument is that supervisors should be able to understand the risk profile including all risks and that for instance business risk and funding risk are an integral part of this profile. The targeted rating is an important part of an institutions business model and failing to achieve or, possibly even more damaging, getting a downgrade will severely impact upon an institution's risk profile. One result could for instance be that funding for rating-sensitive business like swaps dries up. A counterargument, however, is that even though in the second pillar the supervisor should evaluate the whole risk profile, consistency with the first pillar should also be maintained. And since under the first pillar investment grade is sufficient supervisors should not be overly zealous.

4.4. Going concern and times of stress

49. An issue of particular interest to supervisors is the amount of capital needed in case of stress levels exceeding the levels used to calculate capital adequacy. The question is then to what extent the model can be relied upon in times of crisis. To put it differently, does the model still reflect the actual risk profile in a severely stressed market? It has been argued for instance that in such circumstances correlations between risk drivers, that in normal times exhibit low correlation, would increase significantly, possibly approaching a value of one. This would in turn mean that any diversification benefits would be lost when they are especially needed.
50. One way to approach this issue is devise and implement sensitivity and stress tests. Although such tests are to a degree arbitrary, given the lucky circumstance that institutions only have limited historical information on truly stressful periods, stress tests do provide some insights into the effects of for instance increasing correlations between risks.
51. Another reaction to this issue is the argument that institutions already buffer for exceptional circumstances by choosing high levels of confidence. A confidence level of 99.95%, for instance, translates into an expectation of a once in 2000 scenarios. Such an expectation goes beyond what is feasible for most market participants to contemplate and thus this argument has some merit. The

problem here is that the accuracy of the likelihood of default might be severely affected by changes in correlations, especially if return distributions are fat-tailed or skewed. The relevance of this particular issue would depend on the portfolio of the particular institution.

4.5. Appropriate risk measures: VaR vs Tail VaR

52. Economic capital modelling boils down to estimating a loss distribution and determining the buffer capital needed, given a pre-specified confidence level. This approach is tailored to equity stakeholders as this group is primarily interested in the loss-profile until the point that the firm is insolvent. A first objective of supervisors is pre-empting default and the point of departure is thus substantively similar to that of equity-owners. In addition, however, supervisors are, as delegated monitors of policy- and deposit holders, also interested in the distribution of losses once insolvency is triggered. They generally have to assure that in the resolution phase, after an institution is declared bankrupt, policy- and deposit holders' interests are properly taken care of. This will be less costly if a bankruptcy has been caused by a marginal loss (above equity) compared to a situation where almost all the assets are worthless.
53. To reflect supervisors' concern about extreme losses, a risk measure like Tail VaR naturally comes to mind. This measure is the average value of losses, given that the confidence level is breached and would thus much better suit supervisors' needs. Tail VaR results however have not yet gained the widespread acceptance VaR numbers have. This is for instance also reflected in the present supervisory approaches which have yet to adopt Tail VaR methods in any broad sense.² In addition, it becomes technically increasingly difficult to accurately estimate Tail VaR numbers as the confidence level is increased. This reflects the difficulty in estimating the tail of the distribution.

4.6. The systemic impact of model convergence and limited data availability

54. A concern that has been raised is that if institutions all use the same models, their reaction to a common shock will also become more similar. An often cited example, especially in the aftermath of the 1987 stock market crash, was that model based automated stop loss programmes were to blame for the severity of the market movements, although present consensus seems to be that substantive evidence for this allegation has failed to materialise.
55. Moreover, supervisors' use of mechanical rules in calculating capital adequacy does in practice introduce the same model across all institutions. Especially if these mechanical rules "bite" for a significant part of the population of supervised institutions and are applied with excessive vigour this

² Except for Canadian financial regulation, where Tail VaR computations are prescribed by the OSFI for dynamic solvency capital assessments.

could lead to a joint reaction with systemic implications. The present move towards firm specific internal models thus increases the diversity in models used.

56. However, in the survey of the state-of-play we concluded that the economic capital models have substantial similarity. This would indicate that institutions would indeed become more similar in their reactions to shocks, given a similar risk profile. This concern would seem to be premature as the diversity of opinion across institutions about the effects of specific shocks still builds in a buffer against herd behaviour. Two aspects can be discerned in this respect. First, economic capital modelling could lead to a shift in the composition of the activities institutions undertake and hence to a change in the exposures that institutions have on their books. This shift should be driven by the correct pricing of risks. In the short run, this might lead some or all institutions to discover previously undervalued area(s), where margins are higher. Institutions would then all like to expand their business in these profitable areas and institutions would thus become more similar. In the longer run, however, this dynamic should not necessarily lead to more similar risk profiles. Each institution could take on any exposure as long as the price charged covers the risk but these exposures however do not necessarily have to be the same.
57. A second aspect leading to similar responses is that economic capital models are (1) more risk sensitive and (2) built on the same principles or by the same suppliers. The former issue, increased risk sensitivity, can especially from a prudential point of view only been seen as an improvement. Risks that were previously present but went undetected are now being brought to the surface.
58. The latter issue, model convergence, could lead to supervisory concerns. The use of similar models will not so much be a problem if models are built in-house or, to a lesser extent, are truly custom-built by external suppliers. In this case, fitting the model to the characteristics of a firm is likely to introduce sufficient model variation across firms. If however modelling is outsourced to external parties with a significant market share who apply an off-the shelf approach, individual firms' reactions might indeed become more similar. What should especially worry supervisors is that these models could all error in the same direction.
59. A variation to this argument emerges if data are scarce. Since many banks lack sufficient data to accurately estimate key parameters, especially in the early phase of implementation, external data is used. This is accepted practice in for instance the area of credit and operational risk. These shared data could however be biased in some way. If this error is pervasive, the use of similar external data will lead to similar erroneous reactions of individual institutions to shared external shocks and thus financial stability in the aggregate might be strained.³

³ Note, however, that even with abundant data and clearly defined product characteristics, pricing is not straightforward, as for instance discussed by Walwyn and Byers (1997). In a survey by the Bank of England market participants disagreed quite markedly on the pricing of a completely standard foreign-exchange option. For a European-style

4.7. Partial use

60. Institutions generally start to model the risks that are most important in their business and are relatively easy to model. Building on these first models, other risk types that are either less important or more difficult to model are tackled. Thus although some economic capital models might not give a complete picture of all aspects of an institution's risk profile, for some parts of the risk profile there might nevertheless be valuable information in the model's result. The question emerges as to how to best use this information.
61. A starting point could be the overview of the reliability of modelling in the various risk types given in the Working Group's survey of the state-of-play in economic capital models. The overview showed that on the whole the following hierarchy holds for both sectors: market-, credit-, insurance- (if applicable), operational-, and business risk. Furthermore, institutions were nearly unanimous about the reliability of models on the banking side while on the insurance side views sometimes differed considerably. It is therefore conceivably that supervisors will develop methods and procedures for model acceptance in line with the discerned hierarchy. These methods and procedures will focus on the reliability of the models and whether the models genuinely improve risk management in the institution. One approach could for instance be to apply multiplication factors linked to the robustness of the models. Another approach has been used in the Advanced Measurement Approach for operational risk included in the Basel Framework. Here regulators have chosen to aim for a standard closer to best practice rather than industry standard. This has the advantage that the regulatory standard is quite advanced. The downside however is that for many institutions the operational risk management framework still needs significant development.

4.8. Definition of capital

62. One point that would most likely require some effort to reconcile is the definition of capital for internal and supervisory use. As noted in the introduction, the move from the traditional accounting based approaches to capital to an economic value based approach will at times be strenuous. Economic capital models deliver target levels of capital to which available capital should converge. In this context, available capital instruments are those funds that have loss absorbing capacity. In the accounting based regulatory definition of capital, the definition of capital also includes subordinated debt, under some restrictions.

Sterling/Deutschmark straddle, 10-month forward option at-the-money, they found a 2.7 percent standard deviation in the value and even larger disagreements for the "Greeks". With more complex products disagreements naturally increases and this would increase the variability in reactions to similar shocks.

63. Although institutions in our sample differ in what instruments economic capital amounts are intended to cover, it is clear that the industry and the regulatory definition of capital are not equal. This might in turn lead to confusion in the Supervisory Review and thus supervisors will have to be particularly attentive to this issue. One possible solution, which would warrant consistency with the first pillar, would be to require institutions to provide a reconciliation of economic capital planning in terms of regulatory capital (own funds). The most important issue here is, however, that institutions develop economic capital models that deliver accurate target capital levels.

4.9. Home-host issues in economic capital modelling

64. All large institutions operate in more than one jurisdiction and this raises a number of important practical issues. The most important of these are, first, the regulatory approval of the economic capital model used and, second, the allocation of diversification benefits. We will discuss these two issues in turn. Before financial conglomerates are allowed to use their economic capital models for any regulatory use, supervisors in all the relevant jurisdictions should agree that the model provides an accurate picture of all the relevant risks. This will probably give rise to a procedure very similar to the procedure for validation of credit risk models. Supervisors will exchange information among themselves and possibly the home supervisor will take the lead. Once all supervisors of significant subsidiaries agree, institutions could start using the economic capital model for supervisory purposes. Alternatively, some subset of supervisors might allow the model's use before consensus is reached. All in all, this seems like a practical issue that interested parties should be able to find a solution to.

65. The second important issue in home host relations is the treatment of diversification benefits. As has been discussed in previous Working Group papers, these diversification benefits can be substantial and reflect risk reduction because (part of) the conglomerate is viewed as a whole. Once the diversification benefit has been determined and acknowledged the next step is the allocation of this benefit. In the context of our present discussion we abstract from allocative issues within jurisdictions and focus on the issues across jurisdictions. Here the diversification benefits as a result of the joint operation of two separate entities or business units will have to be allocated to one or both of these entities.

66. One possibility is that a host supervisor would insist on stand-alone capitalisation of a business unit in its jurisdiction? A legitimate argument for the host supervisor to require such a level of capitalisation is that in case the subsidiary runs into trouble, the necessary capital might fail to materialise in their jurisdiction because other supervisors might disallow capital transfers. The institution would in this case be forced by the host supervisor to hold more capital in its foreign subsidiary. Technically the institution could accommodate this within its economic capital model by recalculating (parts of) the model on a stand alone basis. A similar issue emerges within jurisdictions if institutions are legally required to hold sufficient capital on a solo basis.

67. If, in addition to the host supervisor's request for solo capitalisation, the home supervisor is then also led to annul the diversification benefit brought about by the foreign subsidiary, this implies that (part of) the diversification benefit would in practice not be acknowledged. The equally valid argument for the home supervisor would be that allowing host supervisors to insist on stand alone capitalisation and, at the same time, still recognising *all* diversification benefits would imply undercapitalisation in the home jurisdiction.

5. CONCLUDING REMARKS

68. Developments in the regulatory arena have paved the way for further consideration of economic capital models for supervisory use. Three developments stand out in particular. First, the implementation of the Financial Conglomerates Directive. This Directive has made communication between the various supervisors with legitimate interests and financial conglomerates easier. Second, both in the banking and the insurance industry new capital adequacy frameworks are being implemented in the (relatively near) future. Both these frameworks allow the use of internal models to a certain extent. Third, the institutional structure of supervision has seen material changes in a number of countries and in many cases this has brought together banking and insurance (line-) supervision within a single organisation. Taken together, these developments have made the discussion of economic capital models feasible and fruitful.

69. In the work of the Working Group to date the focus has been on risk measurement and not so much on how this measurement process should be embedded within the institution. Supervisors feel that the trust an institution itself puts in any model is a good indicator for the faith that the supervisor should have in the model. A precondition is that the model has sufficient impact internally. To warrant the proper overall implementation, we have discussed the high level principles that could guide supervisors and institutions in this respect in Section 3. Important aspects that can be stressed in this respect are that ultimate ownership of economic capital modelling should lie with the institutions, that such a model should be properly embedded in the organisation, and that both supervisors and management should be attentive that assessing the validity of the models is done with sufficient care.

70. Even though the arguments in favour of using economic capital models are persuasive there are also a number of concerns raised especially by supervisors. One concern discussed for instance was that the use of economic capital models for regulatory purposes could be detrimental to competition. Another concern is that model outcomes might not be robust to levels of stress exceeding those used to design the model. Do for instance the assumptions about correlations still hold in times of severe market stress? Finally, the home-host aspect of this discussion was touched upon. Since financial conglomerates operate in numerous jurisdictions, many supervisors have legitimate interests in model acceptance and model use. The issue of coordination of the flow of information and the assignment of responsibility should thus (remain to) receive sufficient attention.

71. Notwithstanding these and other concerns, introducing economic capital models in the supervisory framework does provide a positive stimulant to improving risk awareness, measurement and management. By itself this development will not immediately solve all the imperfections in risk management we see today but given time it will certainly improve risk management.