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Cross-sectoral review of group-wide identification and management of risk concentrations

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Cross-sectoral review of group-wide identification and management of risk concentrations

I. Introduction

Overview and related Joint Forum work

This paper builds upon prior work conducted by Joint Forum working groups in the area of risk integration and aggregation¹ and aims to explore the progress that financial conglomerates have made in identifying, measuring, and managing risk concentrations on a firm-wide basis and across the major risks to which the firm is exposed.

In December 1999, the Joint Forum published its *Risk Concentrations Principles*,² which provided supervisors with principles for ensuring through the regulatory and supervisory process the prudent management and control of risk concentrations in financial conglomerates. In November 2001, the Joint Forum published *Risk Management Practices and Regulatory Capital: Cross-Sectoral Comparison*. This report noted a trend towards convergence of sectoral approaches to risk management and capital, while remaining neutral as to the extent to which such convergence would increase in the future. The Joint Forum's August 2003 publication, *Trends in risk integration and aggregation*, observed two important trends: (i) a greater emphasis on the management of risk on an integrated firm-wide basis; and (ii) related efforts to aggregate risks through mathematical risk models. However, the 2003 paper noted that firms varied considerably in the practical extent to which important risk management decisions were centralised and that risk aggregation methods were in the early stages of development.

This paper expands on the previous reports and explores the extent to which financial conglomerates active in two or more of the banking, securities, and insurance sectors currently identify and manage risk concentrations at the firm-wide level and how current and emerging risk techniques, including stress testing and scenario analyses, are employed to identify potential concentrations.

The Joint Forum conducted two different surveys during the course of its work: the first survey was for members of the working group³ and drew on views from 15 supervisory bodies across 10 countries. The responses to this survey provided an overview of the current supervisory guidance and requirements regarding risk concentrations. The survey also elicited the members' knowledge of the qualitative and quantitative approaches to the management of risk concentrations by financial conglomerates under their supervision. The second survey was directed at 18 financial conglomerates likely to have a firm-wide approach to identifying and managing risk concentrations. It was conducted through

¹ Previous Joint Forum documents have described an integrated risk management system as seeking "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." This is distinguished from risk aggregation, which broadly "refers to efforts by firms to develop quantitative risk measures that incorporate multiple types or sources of risk." Building upon these descriptions, we view risk aggregation as a point in time process - often additive - while we see risk integration as a dynamic process designed to capture interrelationships across risk factors both quantitatively and qualitatively.

² Joint Forum publications are available at <http://www.bis.org>.

³ See Annex on page **Error! Bookmark not defined.**

interviews with the selected firms during the last quarter of 2006 and first quarter of 2007, and focused on measurement, second order effects, risk mitigation, scenario analysis and stress testing.

Working definitions of risk concentrations

For the purposes of this report we define “risk concentrations” by reference to the following elements:

- Risk concentrations refer to exposures with the potential to produce: (i) losses large enough to threaten a financial institution’s health or ability to maintain its core operations; or (ii) a material change in an institution’s risk profile.
- Risk concentrations are viewed in the context of single or closely related drivers of risk that may have different impacts on a conglomerate that must then be integrated in assessing the overall risk exposure of the group.
- Risk concentrations may arise in a conglomerate’s assets, liabilities, off-balance sheet items, or through the execution or processing of transactions.

This working definition of “risk concentrations” is distinguishable from “concentration risk.” “Risk concentrations” refers to concentrated risk exposure(s) that may arise within or across different risk categories throughout the financial conglomerate. On the other hand, a “concentration risk” is narrower and refers to concentrated risk exposure(s) within a specific risk category. For instance, typical examples of concentration risk within credit risk are single name and industry concentration risk.

We have noted that few conglomerates have a single, firm-wide definition of a risk concentration. When asked to define a group-wide level risk concentration, most firms will instead discuss the benefits obtained from diversification.

II. Key observations

We note that risk concentrations at most financial conglomerates are still chiefly identified, measured and managed within separate risk categories and within business lines. For instance, credit exposures are considered within banking business units, catastrophe risk concentrations within an insurance business unit and so on. We characterise this as 'silo management'.

Despite this being the predominant practice, some financial conglomerates are striving for a more 'horizontal' (i.e., across risk category) view of risk concentrations as it becomes increasingly clear that risk concentrations may arise from interrelated exposures across risk categories. These groups have started to develop management tools to acquire relevant data across the group and present it to senior cross-group risk management committees.

The first step within groups taking this approach is typically the creation of a risk management structure with an overview and responsibility for the group as a whole. (Such a structure is illustrated on page 21.)

This step can yield immediate benefits with a modest investment in sophisticated risk measurement tools. For instance, we have seen an appreciation of the extent to which common exposures net out and then, in addition, an appreciation of the extent to which diversification increases across a broader group. For example, interest rate risk between banking and insurance operations naturally off-set one another whereas equity risks are positively correlated and benefit only from diversification effects.

One sophisticated method that many groups have embarked on is developing and embedding economic capital model frameworks across their enterprises. These approaches can improve the consistency of risk measurement, but can also lead groups to focus heavily on perceived diversification benefits rather than identification of concentrations per se.

Against this background of increasing group wide risk management organisation structures and the search for a common measurement methodology to support greater integration, we have seen a significant growth in risk transfer markets over the last few years which have made the effort even more complex.

Such developments give rise to 'new' exposures or risks such as:

- Exposure to adverse developments in market liquidity conditions
- Basis risks not previously recognised
- Pipeline or warehousing exposures
- Frequency or terms on which insurance or reinsurance contracts are altered
- Exposures to new (institutional) counterparties (e.g. hedge funds)
- Cash government collateral being replaced by other assets, in which concentrations might exist that are hard to capture and measure.

Even without such developments, there are many more traditional 'second order effects' that need to be considered in a comprehensive approach for identifying risk concentrations. By second order effects we mean indirect effects to a firm's exposure(s) caused by a change in economic or financial market conditions, from a shock or change in policy. This can be within a risk category or from contagion from one risk category to another risk category. An example of a second order effect would be the additional loss arising from the inability of a

group to liquidate some assets following a sharp decline the value of those assets. Another example would be the additional losses from declines in the value holdings of bonds issued by airlines companies due to an increase in oil prices. Another would be the additional losses incurred by the increase in lapse rates on insurance policies due to a change in interest rate movements. Finally, and important example is the consideration of how risk mitigation approaches play out under stressful market conditions.

It is impossible for us to compile a comprehensive list of such possible interactions, but we are strongly of the view that such hidden risk concentrations are best identified and managed through stress testing and scenario analysis. Hence a principal observation we make is that groups should invest as much time in contemplation of such extreme scenarios and exploring unlikely connections between risks as they do in perfecting the modelling of easier to identify risks.

As a counter-balance to the view we take above, we should note that some groups argue that economic capital models do capture such second order effects, albeit that this might only be done through making slightly more prudent correlation assumptions within a model, which may not reveal the risks of more extreme events in a scenario. Also, some groups point out that there can be a heavy cost to establishing group-wide scenario stress tests which are difficult to integrate into day to day management processes in a systematic manner.

We make two other broad observations: first, when compared with other risk types, the management of liquidity risk tends not to be as well integrated in a scheme of enterprise-wide risk management; and second, insurance-led conglomerates seem to be somewhat farther along in undertaking the stress and scenario analysis approaches described above, perhaps because the nature of insurance business risks, particularly in the property and casualty business, are less readily amenable to traditional quantitative measures.

Finally, we should note that the bulk of the work undertaken in compiling this report took place before the market turmoil that began in August 2007. While this report does not ignore these events (see in particular the box on page 14) it is not focused solely, or even primarily, on them, but rather on the management of risk concentrations more generally.

III. Silo risk management structures, using traditional approaches

The risk management at financial conglomerates tends to be structured in silos according to the risk category; the greatest degree of identification and management of risk concentrations, therefore, tends to occur within a given silo.

Risk category silo structures

Most conglomerates mainly define risk concentrations with reference to exposures resulting from their predominant business activities. The personnel, processes and systems used by financial conglomerates to identify, measure, and manage these major risks are largely grouped by the respective distinct risk categories, e.g. credit, market, insurance and liquidity risk. For example, firms seek to aggregate credit risk exposures arising from lending, financing, and derivatives activities; market risk exposures arising from securities and commodities trading; insurance risk exposures arising from policy underwriting; funding/liquidity risk exposures arising from how financing is sourced; and, to varying degrees, operational risk exposures arising from all business activities. This vertical structuring of risk management is referred to herein as the “silo approach.”

Measures of concentration risk within a risk category are typically aggregated at the top of the group either by model output (e.g. Value at Risk) or simple summation (e.g. adding up notional or nominal credit exposures). Financial conglomerates that seek to identify, measure, and manage risk concentrations as an additive to measuring concentration risk generally have focused on adding different exposures but within a single risk category. The most advanced techniques appear to be in measuring risk concentrations within the market risk category. Some firms have developed techniques for identifying risk concentrations involving exposures from two different silos, most commonly market and credit risk.

In general, the legal structure and distinct business units of the financial conglomerates are becoming less of an impediment to the broad risk concentration management. For example, many firms indicate that they are able to determine firm-wide measures of concentration risk within the credit and market risk categories by aggregating exposures across all their legal entities (regulated and non-regulated) and business units (banking, trading, and insurance units)⁴.

Traditional risk management approaches

Financial conglomerates manage risk exposures that arise within the various risk category silos using traditional approaches such as limit systems and internal reporting based on nominal exposure amounts. The trend is now for firms to analyse concentrated exposures more in terms of capital consumption, or marginal economic capital contribution; hence, reporting and limit systems are thus increasingly being expressed in terms of economic capital figures. Moreover, the more traditional reporting and limit techniques that historically focused on identifying, measuring, and managing concentration risk (i.e., risks within a single

⁴ Note, though, that there are jurisdictions where risk transfer between certain entities within a conglomerate is restricted to protect depositors and limit the benefits provided by deposit insurance and access to central bank funding. In these countries, disaggregated measures of risk provide important insight concerning where risk resides within organisations. Managing risk in companies where intra-company risk transfer is limited requires disaggregated measures of risk to accurately show the legal boundaries that have been established to limit risk transfer.

risk category) are now being adapted to manage risk concentrations, generally using more developed risk methods and metrics such as economic capital or earnings at risk.

Exposure limits are determined by management judgment as to the level of loss that could arise from an exposure (as shown by the several risk measures) and that is commensurate with the risk appetite of the firm. Generally (but not always), the tolerated loss level reflected in these limits is well below a level that would cause the firm's insolvency. Firms employing these measures implicitly recognise that earnings or reputational losses may have further magnifying effects (e.g. market reactions) that could further affect their solvency levels or liquidity positions. Certain management limits may also be established by using bottom-up approaches where business units set expected levels of activity for a reporting period and management determines limits relative to those anticipated amounts.

Firms often monitor exposures both against gross and net limits. The net limits provide management with a view of exposure levels after adjusting for risk mitigation efforts. Risk mitigation effects generally are recognised in risk exposure calculations, which results in measures that are reported on a net basis after giving credit to acceptable collateral, netting agreements, hedges, or reinsurance. However, *consideration of how risk mitigation approaches may play out under stressful market conditions (e.g. how holding less liquid instruments as collateral could lead to potential additional exposures) is not explicitly captured in most measures.*

Summary of risk concentration management practices per risk category

Credit risk

Credit risk exposures arising from lending activities generally are measured on the basis of notional amounts committed — either in absolute terms or relative to some other metric such as shareholders' equity — and/or using economic capital models. Credit risk exposures residing in trading operations are generally captured using a variety of 'issuer risk' measures (e.g. by rating category). *Some firms, depending on their management and reporting needs, may not be aggregating the credit risk of trading book exposures with banking book exposures on a firm-wide basis.*

Most of the surveyed firms reported that they manage credit risk concentrations through the use of various internal risk limits on exposures to particular obligor names, industry sectors and sub-sectors, geographic regions and countries, and product types.

- **Obligor name exposures:** Most groups look at single-name concentrations, by aggregating exposures to a borrower and family of related entities,⁵ especially for large counterparties. Obligor exposures generally are measured by name using notional amounts and mark-to-market values (usually net of offsetting positions and collateral). Insurance-led groups measure concentrations of credit risk to re-insurers by determining amounts recoverable relative to capital.

⁵ Single-name exposures for affiliates are usually defined based on legal and/or control relationships, with some groups also looking at closely-related borrowers such as companies that do a very high share of business with one another.

- **Industry sector exposures:** Obligors that offer similar products or provide similar services are grouped together.⁶ Some firms may establish limits on certain credit transactions for a particular industry such as project financing for shipping or energy companies.
- **Geographic region and country exposures:** Obligors are grouped based on country and geographic location.
- **Counterparty limits:** Similar to obligors, credit risk arising from trading counterparties may be grouped by family, industry or country and may be measured gross or net of collateral. Exposures to a specific counterparty may be measured in nominal amounts and through potential future exposure models.
- **Product type exposures:** Credit risk exposures may be grouped according to product type. For example, real estate exposures may be grouped by collateral type: apartments, single-family housing, office, industrial, retail, and hotels. Consumer loan exposures are often grouped on the basis of loan and borrower characteristics (e.g. subprime) or on loan-to-value (e.g. the amount of exposures with loan-to-value ratios in excess of 90 percent) or debt servicing requirements-to-income ratios.
- **Securitised exposures:** Credit risk exposures related to structured products are grouped by tranche and notional amount. Lower exposure limits are assigned to tranches with lower grades of credit ratings, e.g. on the S&P rating scale. A few firms attempt to use a “look-through” approach⁷ for structured transactions. However, the use of this approach is often hampered by a lack of information and/or system constraints.

Market risk

Market risk exposures are commonly measured using value at risk (VaR) models, based on potential loss, and other sensitivity measures. VaR calculations may be done both by asset class (e.g. fixed income, equities, commodities and currencies) and, within asset classes, by product type (e.g. corporate bonds, asset backed securities). Firms also use stress tests based on market movements to measure market risk concentrations at the group level of the firm. For some firms, these stress tests are conducted on a regular basis and the results made a part of their weekly, monthly or quarterly risk report. At other firms, they are conducted on an ad-hoc basis.

Interest rate sensitivity for fixed income products is commonly measured using techniques such as DV01⁸, or VaR, often combined with limits, and traditional gap analysis. For non-trading positions, interest rate risk concentrations are usually defined in terms of loss of economic capital, with materiality measured using firm-wide evaluations of earnings- and capital-at-risk under various interest rate scenarios. These could include parallel and non-parallel rate shocks, maximum volatility, and sudden crises simulations. For mortgage servicing rights, duration-based measures (such as net portfolio value of equity) are used to

⁶ As an example, industries in the United States are commonly defined by Standard Industrial Codes (SIC) or North American Industrial Classification System (NAICS).

⁷ A look through approach entails assessing credit risk for each of the underlying assets in the structure. Note that look through approaches are not confined to securitizations, but can be used in assessing some financial firms as well.

⁸ Average change in the dollar value of a position, given a one basis point change in price.

identify and control exposures to interest rate fluctuations by determining the sensitivity of asset and liability valuations to various interest rate scenarios.

Insurance risk

Insurance-led financial conglomerates group risk exposures for commercial insurance by customer name; personal insurance by product, geography, and type of coverage; and life insurance by amount of coverage. Interviewed firms report that they consider how natural or man-made events (e.g. a Katrina magnitude hurricane, tsunami, pandemic flu, or 9/11 event) would lead to large potential losses arising from exposures to re-insurers and also to increases in morbidity and mortality risks.

Insurance risk exposures are measured using basic and more advanced approaches, each of which compares the result to capital or income. The basic approaches take proxies for risk exposure⁹ and compare them to capital. Such exposure measures may be determined for a single risk or aggregated. The advanced approaches use sophisticated measures that model loss distributions to determine the expected amount that would be lost if a rare event (e.g. a 1:250 year earthquake) occurs. These modelled losses are also compared to capital.

Liquidity risk¹⁰

Broadly speaking, firms encounter the following three types of liquidity risk:

- Funding mismatch risk, or the risk that the firm will not have sufficient cash to meet obligations in the normal course of business, as a result of ineffective matching of cash inflows and outflows
- Market liquidity risk, or the risk that a firm will not be able to convert assets to cash or access market funding in an economical manner
- Contingent liquidity risk, or the risk that arises when a firm has insufficient funds to meet its obligations as a result of firm-specific or market-wide unexpected events

Funding liquidity risk concentrations can take the form of balance sheet concentrations, and concentration of funding providers, type of funding, and maturity of funding. These concentrations are measured in terms of notional value through the use of liquidity ratios, liquidity gap measures, and target unpledged liquid asset reserves. However, since these measures tend to be static, firms generally supplement these measures with more dynamic and forward-looking liquidity source analysis, pro forma cash flow analyses, cost of funds trend analyses, stress tests and contingency funding plans, taking into account contingent liquidity risks. The planned conversion of assets into cash is an important element of a firm's management of funding and contingent liquidity risks. Therefore, market constraints on achieving these asset conversions can exacerbate the severity of funding mismatches and contingent liquidity problems.

Firms generally conduct liquidity stress testing at both the individual firm and group levels. Firms that were interviewed in the course of preparing the 2005 and 2006 reports said that

⁹ Examples of proxies include: face amount insured; premium written volumes on a gross and net basis (before and after reinsurance); policy limits; number of policies in force; duration of liabilities; and maximum probable loss.

¹⁰ For a more in-depth discussion of the management practices of liquidity risk we refer to the Joint Forum report *The management of liquidity risk in financial groups* (2006).

they believed stress testing at both the firm and group levels allowed for better consideration of contagion effects. Stress tests include changes in credit ratings, deterioration in asset quality, operating losses, or negative press coverage and may include a variety of events, the various stages of an event, and levels of severity.

Contingency funding plans may involve the use of additional early warning signals, such as growing asset or liability concentrations, widening debt or credit default swap spreads, increasing collateral margin requirements, decreases in credit lines or difficulty accessing longer-term funding. Early warning signals may also include event triggers contained in the legal documentation governing public issuances of securities.

When compared with other risk types, management of liquidity risk tends not to be as well integrated in a scheme of enterprise-wide risk management. For example, liquidity risk stress testing often is not formally integrated into other group-wide stress testing activities. This was attributable to sectoral differences in business units (i.e., traditional business activities and balance sheets) and funding mix by the firms. Other reasons may also include a relative lack of data on liquidity risk and the difficulties inherent in capturing off-balance sheet liquidity risks (e.g. the difficulty in making assumptions about drawdowns of contingent obligations or the re-intermediation of risk in the 2007 market turmoil).

Operational risk

Relative to the other risk categories, the taxonomy for identifying, measuring, and managing operational risk exposures is less developed. For example, one interviewed firm when asked to identify an operational risk exposure cited the reputational risk that could result should independent financial advisors or broker-dealers sell the firm's products to unsuitable customers. In contrast, the "advanced approach" Basel II definition of operational risk excludes reputational risk.¹¹ Several, firms, though, see potential concentrated exposures that arise within operational risk; an example often given is the firm's dependence on one specific IT platform and its provider.

The development of models to measure operational risk is challenged by the lack of shared information available on the impact of operational risk exposures. To address the paucity of data, some financial conglomerates are participating in consortia that collect pooled data on operational risk events and losses. At least one firm with insurance activities has begun to adopt extreme value theory (EVT) to estimate operational risk by modelling the probability of rare losses in the tail of a distribution where few, if any, observed data points exist.¹²

Considerations

Risk exposures and risk concentrations are at most interviewed financial groups still chiefly identified, measured and managed within the broad risk categories (silo-type risk

¹¹ In the Basel Committee's June 2004 publication, *International Convergence of Capital Measurement and Capital Standards* (paragraph 644), operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events. The definition includes legal risk but excludes strategic and reputational risk. Legal risk includes, but is not limited to, exposure to fines, penalties, or punitive damages resulting from supervisory actions, as well as private settlements.

¹² EVT produces a capital-at-risk measure, which is identified as the minimum measurement - net of insurance cover - needed to cover the maximum potential loss with a confidence level of 99.95 percent.

management). However, it is clear that risk concentrations may arise from (interrelated) exposures across the risk categories, rendering a silo-based approach insufficient as potential concentrations across risk categories may not be captured. For example, consideration of how risk mitigation approaches may play out under stressful market conditions (e.g. how holding less liquid instruments as collateral could lead to potential additional exposures) is not explicitly captured in most measures.

As a result, several groups expressed a desire to develop more “horizontal” (i.e., across the risk categories) insight into potential risk concentrations and have started developing management tools to acquire a more integrated group-wide view of risk exposures and potential risk concentrations.

We also note that at some firms are not aggregating trading book exposures with banking book exposures on a firm-wide basis, and that the management of liquidity risk tends not to be as well integrated in a scheme of enterprise-wide risk management as other risks are.

IV Implications of the growth of risk transfer markets and the trend towards more active management of financial conglomerates' risk exposures

Among the key developments in the financial system since the 1999 Joint Forum report on *Risk Concentration Principals* are the development and tremendous growth of risk transfer markets, including not only credit risk transfer markets, but OTC derivatives markets more broadly, as well as continued growth in the participation of non-bank investors in credit markets. Credit risk transfer markets have seen exponential growth over the past 6-7 years, with the gross notional value of all OTC derivatives positions roughly quintupling over this period - exceeding \$500 trillion as of June 2007 - and market-based funding has continued to account for a large and/or increasing share of household and corporate debt over the past several years.

These developments have provided financial institutions increased opportunities to more actively manage the portfolios of risk exposures they hold, to attempt to tailor exposures to more closely fit their risk appetite and to generate revenues from trading, structuring and investing in a variety of increasingly complex products. The associated benefits of creating more tools to manage risks, allowing for more sophisticated risk management processes and facilitating a broader distribution of risks across the financial system, should not be understated.

However, the increased complexity that has come with this evolution in the markets has generated significant risk management challenges for financial conglomerates, perhaps most importantly as they pertain to capturing and measuring complex risk exposures and incorporating them into their risk concentration management processes. This difficulty is compounded by the possibility that different entities of the financial conglomerate may act as different players or have different purposes in the risk transfer markets, each generating their own risk exposures.

Areas of increasing importance for risk concentration identification and management

Financial conglomerates participate in risk transfer markets in a variety of ways and for a variety of purposes, including: to fund assets they originate; to manage their retained credit, market and insurance risk exposures through the hedging and acquisition of positions (in order to balance their portfolios); to invest in securitised products (for the purpose of diversifying their portfolio) and, to generate revenues from trading/market making as well as from packaging and distributing positions to and for clients. In each of these cases, participation in these markets generates significant risk exposures, even while being used to reduce others, and these exposures may be overlooked – particularly as the circumstances under which they can impact the firms are often viewed as highly unlikely scenarios -- and/or can be difficult to incorporate into traditional risk concentration measurement and management processes. *The complexity of the risk transfer markets and their products poses significant challenges to the measurement of the risk exposures from the positions in these risk transfer products or markets, thereby, posing additional uncertainties to the trading, hedging and investment strategies.*

Financial conglomerates (whether bank-led, insurance-led or trading focused) have been important investors in risk transfer products. However, the risk characteristics from investments in, for instance, CDO-squared's or CPDOs differ importantly compared to traditional assets such as ordinary bonds or stocks. Reliance on the traditional investment risk management tools such as credit rating management, sector diversification and basic duration analysis cannot be sufficiently robust to provide a meaningful view of the risks

inherent from the investment in these risk transfer products. In addition, capturing the risk characteristics in a portfolio of these products and the dependencies between the risk transfer products and the more traditional instruments of financial institution remains a challenge for many firms.

The increase of counterparty credit risk exposures is a prime example of the emergence of significant risk exposures from the growth of risk transfer markets, as the gross value of counterparty exposures has grown along with these markets. Often, the process of so-called risk transfer more closely resembles a transformation of a variety of risks into credit exposures to the counterparties to which they were transferred. *Consequently, the measurement of counterparty exposures and the incorporation of these exposures into firm-wide risk concentration management processes have become increasingly important.*

Yet, given the increasing complexity of products/positions, measurement of potential exposures from (OTC) derivatives contracts has become more challenging. Firms have broadly acknowledged the need for the increased use of stress testing to measure these potential exposures, practices at the firms are still being refined and stress testing as a measure of counterparty exposures continues to be an area for further developments.

Importantly, growth of OTC derivatives markets, and the increased use of secured financing arrangements -- in addition to greater participation by lower-rated/unrated entities, most importantly hedge funds -- have led to a significant increase in the use and range of collateral to mitigate these large gross counterparty credit exposures. As collateral allows firms to increase their capacity to enter into trades with these firms, gross counterparty credit exposures have increased substantially, while exposures net of collateral have not grown nearly as rapidly. *This significant increase in range of collateral poses challenges to the management of firm's funding liquidity risk, particularly in stressed environments. Moreover, the collateral requirement brings the funding risk of a firm together with its credit, market or insurance risk, necessitating the integration of the liquidity risk management with the management of the other risk types.*

As the financial condition of the counterparty is most likely to be deteriorating when the exposure is growing the increased use of collateral to minimize gross exposures to lower-rated counterparties has become particularly important and has increased the need for firms to be able to look through their pools of collateral and measure the impact of potential exposures in that collateral on their firm-wide risk concentrations. For example, collateral held against derivatives-related exposures and/or positions financed for clients that are the same as, or similar to, those held in banks' own portfolios are most likely to end up being owned by the bank – in the event of a counterparty default – at the same time they are declining in value or deteriorating in creditworthiness.

The more active use of risk transfer markets and dynamic risk management techniques has also generated increased vulnerability to a rapid and/or protracted decline in asset market liquidity. The dynamic hedging used by market makers or traders in risk transfer market for hedging their exposures could lead to potential concentrated exposures when they are not able alter their hedging positions or to take additional or offsetting positions if there is a significant reduction in market liquidity. In addition, the active management of the credit portfolio via, for instance, standardized indices may again lead to an unexpected build-up of concentrated exposures if the liquidity in these markets dries up. An additional important aspect stemming from these hedging strategies is the (remaining) basis risk, which is significantly determined by the adequacy of the risk measurement methods.

For their active management of the credit portfolio, financial conglomerates in recent years also increased their use of securitisation to off-load concentrated exposures. In addition, certain firms developed a strategy to originate assets explicitly for sale into the markets. The dependence on securitisation increases the vulnerability of firms to declines in asset market liquidity, as declining demand for assets may lead to unexpected increases in the size and riskiness of exposures, as market liquidity is most likely to dry up at the same time as prices are declining.

While firms do have processes in place to limit the size of exposures warehoused in advance of packaging and distribution, these exposures are not always included in considerations of firm-wide concentrated exposures as there is generally an assumption that they will only be held for a short time or that they can be hedged fairly easily. This assumption does not necessarily hold in a stressed financial market environment.

In addition, while considerations of market risk are often used for warehouse positions – e.g., running scenarios based on potential changes in market values or setting limits around the dollar value of a pre-described spread widening – *incorporation into credit risk concentration management practices does not appear widespread*. In broad, credit and market risk clearly come together here and require an integrated risk approach. Indeed, portfolio management processes, which are a key element of credit risk concentration management, are often focused on 'retained' corporate credit exposures, which includes the expected positions banks will keep after assuming a significant share will be either syndicated or sold into secondary markets, and, importantly, generally do not incorporate household/consumer exposures at all.

The use of off-balance-sheet vehicles to fund assets in advance of distribution and/or to fund residual positions generated by the packaging and sale of assets is another practice that can obscure a firm's total exposures, as agreements between the firm and the off-balance-sheet entity may only be triggered in adverse environments, thereby linking the asset liquidity of a particular market with a firm's funding liquidity.

The market events of the second half of 2007 and the rise of risk concentrations

In this box, we focus on the emergence of risk concentrations within financial conglomerates as the market turmoil developed, and the challenges or difficulties this posed to firms' management processes.

The risk measurement methods and valuation approaches that are key to the credit risk transfer markets were called into question in the later half of 2007. For OTC derivatives and securitization products the valuation process is fundamental to understanding the risks of these positions. Firm's reliance on liquid markets to value their positions may have led some firms to neglect more fundamental analysis of the risk of such positions. Consequently, the subsequent valuation difficulties affected some financial conglomerates' assessments of potential exposures in businesses across trading book activities, investment portfolios, warehousing and counterparty exposures.

The risk characteristics of credit risk transfer products (e.g. ABS CDO's) differ from those of single-name bonds or loans, and through investments in these products the risk characteristics of firms' credit portfolios can be affected. There are a number of factors to consider in assessing these effects. First, by the pooling of collateral, (higher grade) securitisation notes can represent significant exposures to systematic risk even while reducing specific risk. Second, if defaults become more correlated (which is the case for a

systematic credit event), the probability that the losses will affect the higher-rated tranches increases. Third, a risk feature called negative convexity can be present in credit structured products. This implies that a widening of credit spreads has a stronger impact on prices than a narrowing and that prices decline at an increasing rate the more spreads widen. The correlation and negative convexity features reinforce one another, in that, as the number of defaults increase the decline in prices of ABS gain in speed, and as negative convexity exacerbates the price decline. Fourth, often the securitisation products and the investment strategies incorporate additional leverage. In general, these features increase the “extent” and the “speed” of a systemic event materialising during a period of price declines. In addition, a feature that comes into play in a portfolio context is the dependency between securitisation notes. In general, compared to common single name bonds and loans, the dependencies between the securitisation notes are relatively stronger. It is clear that these characteristics of relatively higher exposure to systematic risk, stronger correlated exposures, significant negative convexity and high leverage may quickly lead to concentrated exposures to systematic factors. Risk management approaches that did not fully recognise these risk characteristics were not able to capture the potential risk concentrations within the firm stemming from their credit securitisation exposures.

A systematic credit event, which first showed up in the US subprime mortgage market, quickly spread through other markets, affecting many different business lines within financial conglomerates:

- The sharp rise in default rates of US subprime mortgages, coupled with tremendous uncertainty surrounding the valuation and risk measurement approaches for ABS and a loss of confidence in credit rating agency ratings, led to a drop in investor demand (as investors could not confidently quantify the risks of these products and as CDO's, CLO's, SIVs and conduits were experiencing difficulties). These developments, in turn, led to the almost complete absence of market liquidity for asset backed commercial paper. Several originating companies encountered difficulty funding their mortgage loans, and started to draw down the back-up lines of credit provided by their respective banks. In addition, for the firms originating the assets and structuring the ABS, these events led to an *unexpected build-up of concentrated exposures from assets in the warehouse pipeline*, since the assets could not be transferred and had to be taken on the books at the same time that liquidity support for similar assets was being drawn down.¹³
- As noted above, the lack of confidence in market participants' ability to determine the quality of some assets and the increased risk aversion among investors led to significant deterioration in the market liquidity of the ABCP markets. This in turn led to soaring rates on ABCP and the restructuring of CP funding with overnight or very short term debt (generally one week and under). *The shortening of ABCP funding maturities increased the funding concentrations of firms in short-term maturities, making them increasingly exposed to sudden liquidity events.*
- The funding difficulties (i.e., the difficulty of rolling over commercial paper) required some issuers to sell a portion of their assets to their liquidity providers or sponsors, while others drew on their back-up lines of credit or tried to exercise the option of extending the maturity of their CP or medium term notes. In sum, the market events severely affected the off-balance sheet banking conduits, including SIVs. For the sponsoring firms or the

¹³ Also the common repackaging of the involuntary build-up of non-investment grade residual risks, inherent to the CRT market making activities, could not be performed as the market's risk appetite decreased strongly, leaving the firms with concentrated exposures to these risks.

banks providing liquidity facility lines *this systematically led to a further build-up of exposures to (structured) credit assets and put pressure on their liquidity positions.*

- The credit event, coupled with the deterioration in market liquidity and the subsequent rise in risk aversion, led to large declines in the value of ABS and the underlying assets. Under these circumstances the degree of risk mitigation provided by initial margins and collateral may have been less than firms anticipated, due to the dynamics of the initial price shocks, the consequent increases in haircuts and the further price declines due to the sale of collateral in illiquid markets. The additional collateral requirements led to a further deterioration in the liquidity situation of several firms.
- The hedging of credit risk exposures was also limited by the market events and proved difficult to manage. Even the effectiveness of some of the more common hedges for structured credit products, such as traded reference indices or particular credit tranches, came into question. For instance, the hedging of subprime mortgage exposures via the ABX index proved to be quite difficult. Nevertheless, in some cases reference indices were the only hedging instruments that maintained their liquidity, forcing firms to alter their hedges from the instruments that lost their liquidity towards these reference indices. This often led to significant increases in basis risk. Additionally, the stress events also showed that some model-based valuations methods may not have fully captured the entire risk profile of the exposure under these market conditions, giving rise to additional unexpected basis risk. *As some hedging strategies proved inadequate or had to be altered in the midst of a market liquidity squeeze, some firms were exposed to unexpected concentrated risk exposures and basis risk.*
- The liquidity squeeze, combined with the higher sensitivity to credit risk and elevated concerns about financial institutions' exposure to structured credit products and liquidity facilities, spread to the interbank markets. Firms that were still relatively liquid were not willing to supply funds in the interbank market, due to their own contingent exposures or due to the uncertainty regarding the financial health of their interbank counterparties. These uncertainties resulted in steep increases in short-term interest rates for some firms, making interbank term funding extremely expensive or even impossible in some cases. This again forced certain firms' funding towards short-term (often overnight) maturities, augmenting their sensitivity to unexpected liquidity events. In addition, firms that *increased their reliance on the interbank markets to meet the additional liquidity demand (and thus may have been concentrated in these markets) saw an ultimate liquidity source being constrained.*
- The extensive downgrading of ABS also put enormous pressure on monoline insurance companies, as some financial guarantors have guaranteed large amounts of AAA rated (and super-senior) CDO tranches. This pressure has the potential to affect the entire ABS spectrum, bringing further price declines in particular to the already weakened higher-grade notes. The deterioration in the credit ratings for the ABS could have second order implications as, for instance, institutional investors that are only allowed to hold highly rated paper could be forced to sell in the event of a downgrade, leading to additional price pressure. *Thus, firms (and the ABS market) might have unexpected, second order concentrated exposures to certain monoline insurance companies, either directly or as a result of agreements to fund or buy back certain positions in the event of multi-notch downgrades of assets.*

While the credit risk transfer markets have provided financial institutions with increased opportunities to more actively manage the portfolios of risks that they hold, the recent market turmoil also demonstrates that these activities can also lead to additional and sometimes

difficult to measure and manage risk exposures. As recent events indicate, the greater a firm's reliance on the risk transfer markets – whether for an originate-to-distribute business, for the securitization of assets, as an alternative funding source, or for the hedging of risk exposures and the extended use of collateral to manage counterparty risk – the more dependent is the firm on the existence of liquid markets. Additionally, risk transfer markets can deepen the link between market liquidity and funding liquidity risk and may create significant exposures across risk categories (i.e., market, credit and liquidity risk). Recent events also show that different business activities across a financial conglomerate may be affected at the same time, possibly compounding the exposures at the different businesses (and increasing the potential of contagion to unaffected activities). The interactions between risk exposures can give rise to the rapid growth of 'unexpected' risk positions at the same time that they become increasingly difficult to measure and manage.

Considerations:

From the above discussion it is clear that a more active management of firms exposures, especially important for those firms with a stronger reliance on the risk transfer markets, requires an integrated risk concentration management approach across risk categories (credit risk, market risk, insurance risk and liquidity risk).

The participation of different entities of a financial conglomerate in the risk transfer markets, each with their specific activities or objectives, can also benefit from strong integrated risk concentration management across the different business units. All business lines and relationships need to be evaluated and a firm-wide view of exposures is necessary to capture potential concentrations. This does not have to, and probably should not, lead to a single number for measuring the potential exposure – as this is both impractical and can cause a false sense of security – but it should result in an assessment of whether a number of business lines are at risk of being affected by a single scenario or risk factor and the possible scope and scale of that impact across the firm.

The complexity of the risk transfer markets and their products can also pose significant challenges to the measurement of risk exposures from positions in these risk transfer products or markets, thereby potentially posing significant difficulty in the risk management of trading, hedging and investment strategies.

We note the importance of the measurement of counterparty exposures and the incorporation of these exposures into firm-wide risk concentration management processes has become increasingly important. In addition, the significant increase in the range of collateral (for the management of the counterparty exposures) poses important challenges to the management of the firm's funding liquidity risk.

The increased use of dynamic or active risk management techniques, including dynamically hedging both market and credit risk exposures and securitisation, implies a greater reliance on strong ongoing market liquidity. Firms do not appear to be explicitly assessing the impact of a severe and extended decline in asset market liquidity as part of their risk concentration management processes, though this has become an increasingly important factor with respect to the generation of concentrated positions.

The increased link between asset market liquidity and funding liquidity at dealers/banks that has been generated by the growth of risk transfer markets, and credit markets more broadly,

does not appear to be well captured in firms' funding liquidity stress testing/scenario analyses practices.

V. The integration and corporate governance process

A key step in developing a process to identify, measure, and manage risk concentrations is the integration of risk management across a financial conglomerate. The 2003 Joint Forum report describes an integrated risk management system as one *“that seeks to have in place management policies and procedures that are designed to help ensure awareness of, and accountability for, the risks taken throughout the financial firm, and also to develop the tools needed to address those risks”*. The objective is to establish a system that is designed to ensure that the firm is made aware of the material sources of risk to which it is exposed and that it does not ignore them.

The 2003 report made a number of findings, including that a key aspect of integrated risk management is the establishment of a dedicated risk management function responsible for developing common firm-wide definitions of risk and metrics for measuring risk. This is necessary to harmonise risk reporting and promote a more systematic identification of risk concentrations. The report also noted that efforts to centralise risk management in such a dedicated function varied widely across firms. Moreover, industry participants interviewed for the 2003 report expressed the view that a centralised and decentralised risk management function are “equally necessary, complementary and mutually re-enforcing.” Further, the report noted that IT systems are vital for successfully integrating risk management and that difficulties lie in “ensuring compatible and efficient IT systems for data capture, data analysis and data reporting that encompass the whole of the operations.”

Continuing trend towards closer integrated risk management

The trend towards closer integrated risk management is found in different ‘layers’ of the financial groups. First, there is the trend towards closer integration across the (‘sectoral’) business units of the group, second, there is the closer integration across the broad risk categories, and third, there is the closer integration between the different risk management systems and the interplay with the conglomerate’s management practices. Together with this integration trend continues the evolution of risk aggregation frameworks of economic capital models and stress testing methods.

Regarding the integration across sectoral business units, there is a tendency among the interviewed conglomerates to replace their separate sectoral management entities by more group-wide management teams that cover the several businesses of the firms. However, the extent that firms are integrated across their different business units differs widely. In this respect, integration across banking and securities units appears to be more advanced than across banking and insurance units. Financial conglomerates with insurance and banking business reported that integration across these sectors is complex¹⁴. One reported example is the complexity in developing a model of interest rate risk that combines banking and insurance activities, given the netting effects arising from the opposing interest rate sensitivities in the banking and insurance sectors. In general, though, these conglomerates show that for certain risk categories, such as credit risk, liquidity risk and business risk, it is possible to develop or use integrated management structures that cover the different sectoral units. In particular, some of these firms with banking and insurance business have

¹⁴ This separation of the business units may also be for strategic reasons.

established a full integration of the risk management structures across the sectoral business units.

As documented in Section I, financial conglomerates still primarily manage and measure risk exposures according to the broad distinct risk categories to which the exposures are categorised (i.e., silo-type or vertical management structures). However, some firms are in the process of developing and implementing risk practices to capture exposures across the broad risk categories, in order to acquire a horizontal view of the risk exposures of the group. For instance, some firms establish specific committees that have as their sole objective the acquisition of a horizontal view of risk exposures across the group. Related to this, some conglomerates are developing more integrated risk measurement methods that capture risk exposures across the risk categories: as reported a preferred tool to measure exposures across the risk categories is stress testing. Note, though, that some interviewed firms reported that having robust vertical practices is a first priority and once the vertical approaches are sufficiently developed and implemented, management can move towards the development of the horizontal systems. Additionally, for reasons related to their business, and hence the nature of their risks and their relatively more top-down approach towards risk management, insurance-led groups appear to have risk management and measurement practices that are much more integrated across risk categories.

Some financial groups seem to be in the early stages of formalising the interplay between the group's overall management strategies and practices on the one hand and the different systems or tools for risk management on the other hand. This interplay closely intertwines the different systems and results in a revolving management process.¹⁵ In broad lines the "revolving" management process consists of:

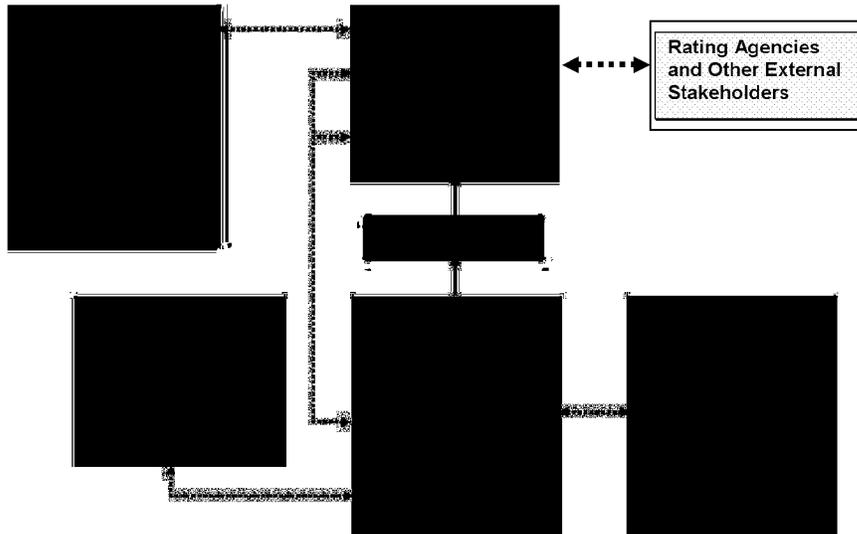
- (1) Determination of the firm's strategy and risk appetite by the top-management (firm-wide),
- (2) Capital planning and allocation of capital,
- (3) Monitoring of risk exposures via limits,
- (4) Risk mitigating initiatives if exposures (risks) and performance is out-of-line with the intended management strategies and goals.

This allocation of the measured risks (or capital) to the various business units and measurement of performance confronts the different business units with their risks (i.e., capital consumption) and profits from their business, thereby incorporating both aspects in their business-making process. The basic frameworks underpinning this "revolving management process" are the economic capital models and stress testing methods. The economic capital model is used for the aggregation of risks (calculation of capital) and the allocation of capital to the various business units. Capital planning is increasingly based on stress testing (and contingent measures for the stressed scenario can be determined). Limit systems may be calibrated and the monitoring of risk exposures may be derived from figures calculated by the firm's economic capital model or stress testing exercises. The risk mitigating initiatives depend on a wide array of risk/return considerations and their risk mitigating effects may be introduced in the economic capital models and stress testing exercises. Both tools are also employed for the pricing of risk exposures.

¹⁵ Thereby, reflecting the general trend towards more active and dynamic management of the firm's portfolios.

Corporate governance aspects of the integration

The corporate governance structure of the financial conglomerates varies depending upon the size, structure, complexity, and primary business activities of a given firm. However, the survey responses indicate that the typical governance structure for a large organisation is generally consistent with the following chart.



In most financial conglomerates there is a centralised group responsible for approving high-level policies that establish the firm's risk appetite and risk tolerance. At some firms, this group is a committee of the board¹⁶ and at others it is a committee of senior managers. These global risk committees communicate risk appetites to the business units primarily through limits but also through balance sheet (and, in particular, capital) allocation. Board level risk committees may empower other committees or senior managers to address specific risks. Increasingly, conglomerates are appointing chief risk officers (CROs), who report directly to the board-level group risk committee.

These global risk committees are usually responsible for reviewing risk reports that evaluate risk concentration sources and business unit adherence to limits. At some conglomerates, a risk division operating at the senior management level contains an independent unit devoted to integrated risk management and internal control. Some conglomerates have group-wide credit portfolio management teams that optimise the firm's risk-return profile from credit-related activities and engage in specific activities (e.g. entering into derivatives transactions) to reduce credit concentrations. The internal audit function generally plays a significant role in assessing the adequacy of controls around measuring and monitoring risk exposures and in complying with policies and procedures for managing exposures. It also may have specific responsibility for quantitative validation of internal risk models and rating systems, validation of other internal processes and data maintenance systems, and monitoring and control of firm-wide operational risk.

¹⁶ In several firms, the board level committee communicates to the business units the areas where limits may need to be calibrated. As an example, one group performs an annual review of risk concentration on a per-industry basis, combining industry and risk portfolio review with a review of the largest counterparties in each industry. This review is then used to set the following year's strategy.

In addition to firm-wide risk committees, conglomerates establish risk committees by risk category (e.g. market, credit, liquidity, and operational risk) and business unit. These risk committees often conduct more detailed monitoring and generate more comprehensive reports than the firm-wide committee. These risk committees may also conduct stress testing and scenario analysis, which is reported up to the firm-wide risk committee. Business unit periodically report their counterparty exposures to the CRO or other senior managers and immediately inform these officers of limit breaches.

At securities-led conglomerates, the risk reports that are received by the firm-wide risk committees contain metrics for market risk, credit risk and liquidity risk exposures. These include probabilistic (e.g., VaR, positive future exposure, notional credit exposures grouped by name, industry, country, and credit rating) and non-probabilistic (e.g., stress and scenario results) measures. At banking-led groups, common risk concentration reports include: exposure reports by single names (large borrowers), high-risk products, industry sectors and countries; VaR reports for trading book exposures; earnings-at-risk reports under various interest rate scenarios; and portfolio stress testing results.

Challenges to integrated risk management

Firms reported a multitude of difficulties that challenge their process to acquire an integrated view on risk concentrations. The most common challenges reported are the following.

Regarding the integration across 'sectoral' business units, some firms reported significant differences across entire risk systems (e.g., risk typology, risk metrics, mathematical and statistical risk measures, historical IT systems, etc.) as important impediments for the integration process and the separate management of risks at the business unit level¹⁷. General impediments to the risk integration process exist when firms lack a common IT system platform across business units. Some groups also mentioned the absence of a group-wide database, a lack of uniformity and timeliness in collected data, and data access and quality issues (e.g., in mortality rates) as other hindrances to identifying and consolidating exposures across risks and business units. In worldwide groups and conglomerates, data consistency is the cornerstone of risk exposures' identification: risk and capital models can help to create consistent methodology for exposures measurement, management and reporting. Finally, we also note the impact of data protection legislation, which may prevent the transfer of data across a group.

The integration across risk categories is also challenged by the silo-line risk culture in some groups, and the use of different methodologies to measure the exposures within the different risk categories¹⁸. For instance, the risk measures may use different time horizons (e.g., a 10 day VaR in market risk versus a one-year default horizon for credit risk economic capital), hindering the aggregation of the risk exposures. Conceptual issues also arise in measuring and quantifying exposures from different types of products (e.g., loans and loan commitments versus equity tranches of synthetic CDOs). A significant challenge reported is identifying risk concentrations within structured transactions, across multiple trading desks and business unit, as well as in the collateral that firms hold against counterparty exposures.

¹⁷ Some of these difficulties also hold (but generally to a lesser extent) within different sectoral business units.

¹⁸ See also section 4 of this report and the discussion of the tensions between methodologies provided by the Joint Forum 2003 report.

Considerations

Most interviewed groups reported that obtaining a group-wide view of their risks is a priority for their risk concentration management. However, some firms do not consider this a priority or do not believe that attaining an integrated group-level view is necessarily a meaningful objective. The extent of integration between the interviewed groups differs importantly; in general, though, there remains significant scope for further integration.

The measurement and management of risk concentrations across risk categories is limited at many firms. In this respect note that, given their business and the risks run, there is a general tendency for insurance-led groups to be further integrated than the other interviewed groups. In addition, the tendency towards a more active or dynamic management of the firm's portfolios necessitates the interplay of the strategic management with the risk management practices, thereby stimulating the further integration process. This integration will, however, importantly depend on the advancements made in risk (aggregation) models and stress testing exercises.

VI. Economic capital and stress testing as management tools

As noted in Chapter 3, financial conglomerates primarily identify, measure and manage risk exposures according to the risk category to which the exposures are categorised. However, as is discussed in the previous chapter, there is a trend among the interviewed firms to pursue a more firm-wide view of risk exposures. To do this, some firms are developing techniques that strive to aggregate different exposures within and across risk categories and that seek to introduce how dependencies could play out. The primary tools in this regard are economic capital models, and stress testing and scenario analysis.

We note that as economic capital models are developed, expanded, and more finely tuned to a firm's activities across sectors and risks, there is some blurring of the line between them and stress testing or scenario analysis. More specifically, risk management departments are developing more inclusive, scenario-based economic capital (and VaR) models in an effort to better capture and understand the firm-wide risks on an integrated basis. This trend is necessary and commensurate with the more dynamic management of risk exposures. Nonetheless, the trend seems to be in an early stage of development, and will require much work before such an inclusive model is operational. As a result, this report refers separately to economic capital models¹⁹ and stress testing.²⁰

Economic capital models

In addition to the traditional risk exposure measures reported in Chapter 3, economic capital or economic loss is a common measure of risk that is used or is being developed at many of the interviewed financial groups.²¹ Significant progress during recent years has been realised. However, the specific models used by the firms differ widely and there are no recognised best practices with respect to economic capital frameworks.

The appeal of the economic capital framework is that it seeks to report a common measure of risk across businesses and risk categories. Additionally, the framework enables the allocation of the measured risks to the business units, which promotes greater consideration of the risks by business units in their decisions-making. It also provides a system for consistent firm-wide risk/return evaluations. A further benefit is the establishment of a uniform risk language across the financial conglomerate.

At the same time, there are limitations to using economic capital models for risk management purposes. Several interviewed firms commented that they were actively considering ways to aggregate data within and across risk categories but that such aggregation is difficult due to the high degree of subjectivity involved, particularly in terms of aggregating exposures from different risk categories into a single measure of potential loss. Nonetheless, aggregation of different risk exposures (e.g. lending related credit exposures, settlement risk, and exposures

¹⁹ Joint Forum 2003 report notes "economic capital" is the amount 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

²⁰ The CGFS 2005 report on stress testing gives as a definition of "stress testing": is a risk management tool used to evaluate the potential impact on a firm of a specific event and/or movement in a set of financial variables.

²¹ Related measures are Capital-at-Risk (CaR, i.e., economic capital at a lower confidence interval, such as 90 percent) and Earnings-at-Risk (EaR, i.e., which gives an assessment of the potential fluctuations in profits due to certain risks materialise).

within structured credit products or insurance and banking exposures) is a priority at many interviewed firms.

Limitations of the economic capital models to capture risk concentrations

Some limitations were noted with respect to developing economic capital models for capturing and measuring risk concentrations across a firm. Firms commonly reported that their economic capital models fully incorporate certain concentration risks within the broad risk types²², however, the measurement and management of risk concentrations goes beyond these more standardised concentration issues. In this respect, if the economic capital model does not recognise certain exposures or specific material relationships between significant exposures there will be an underassessment of the risks run by the firm. For instance, basic models often do not capture the indirect credit exposure from collateral. Moreover, they generally fail to incorporate the relation between a direct credit exposure and an exposure through the collateral; thus, the model would miss the potential risk concentration that could arise from exposure to the counterparty and the collateral.

Similarly, 'second order effects' generally are not incorporated in economic capital models even though they may be deemed material by the firm. Some firms reported that they do not identify and establish limits for second order effects because measuring them in a systematic way involves a very high degree of subjectivity, potentially distorting the determination of the risk profile of the firm, the risk allocation or, in broad, the decision-making process of the group. Other interviewed firms stated that second order effects are implicitly taken into account by conservatively setting the correlations between risk factors, portfolios, business units, and risk categories. Some firms stated that their current economic capital models capture very specific second order effects; for instance, the effect of interest rates on lapse rates or the introduction of market liquidity risk (by increasing the required time to close a position).

When asked to define a risk concentration at the firm-wide level, most firms conceptualise the issue in terms of diversification; namely, risk concentrations are those risks that are not diversified away. This stems from the fact that risks typically are not perfectly correlated and thus the aggregated risk of a financial institution will be smaller than the sum of all the individual risks. This reduction is generally referred to as the diversification benefit and the extent of the effect chiefly depends on the strength of the dependencies between all the relevant risk drivers. Currently, the general economic capital framework of the firms assesses the sensitivity to the risk drivers within each risk category or business unit and aggregates these outcomes through summations based on (linear) correlations.

The modelling and measurement of the dependencies between risk factors, business units and broad risk categories are a continued area of focus. Several methodological issues make the measurement and incorporation of the dependencies in the basic economic capital models hard to come by. Consequently, there is a wide variation in practices between firms. For example, to derive the correlation matrices to aggregate across business units or risk categories, firms use correlation estimates on the basis of certain internal (firm specific) data or market data. Or they derive the correlation figures via simple deductions. This lack of quality data limits the estimation of these correlations: hence, the surveyed firms reported to

²² For instance, a common practice is the introduction of single name concentration risk and sector concentration risk in the credit-VaR model thereby recognising the granularity of the portfolio and the concentration towards specific industry sectors or countries/geographic areas.

having the greatest confidence in the robustness of the estimation of the correlations between the different risk factors in the market risk category.

Although the correlation matrices may provide a way to aggregate several risk figures into one final number, they may not capture the dependencies that exist or may arise between the relevant risk factors and, therefore, the business units and the broader risk categories. These dependencies vary as market or more general macroeconomic conditions change and may significantly alter during periods of stress.²³ Moreover, the potential reinforcing effects between the different risk factors will not be captured. Using a simple correlation between, for instance, market and credit risk to integrate both risk types misses the rich dependency structures between the risk factors that affect products subject to both credit and market risks (e.g., loans, credit derivatives, fixed income portfolios, etc). For example, an increase in interest rates may reduce the capacity of a borrower to service his debts. In addition, if the borrower defaults and the bank 'seizes' his assets (the collateral provided for the loan), it may find that the rising interest rates have decreased the collateral's value.²⁴ Hence, while the correlations introduced in the economic capital models may provide a way to aggregate risk exposures, they are less suited to measuring risk concentrations.

Moreover, in the aggregation process many firms use some average correlation that holds across the loss distributions. Stressed correlations generally are not employed as the value of such correlations may fluctuate depending on the type of stress event and the fact that the correlation data under stressed conditions are limited²⁵. This raises questions on the informational content of the actual aggregated risk figure and its reliability and robustness. Nonetheless, some firms explicitly mentioned the use of stressed correlations by estimating the correlations of the worst one in 10 or 20 year events. A limited number of firms model dependencies based on copula techniques to capture the tail dependencies. Several firms noted that given these difficulties in capturing the dependencies between the risk factors, economic capital models do not address them sufficiently. As a result, these firms sum up the measures derived from each category to arrive at an aggregated risk figure. These firms view the models primarily as a means to analyse capital and review business performance and not as a risk management tool.

Firms try to compensate for the deficiencies and uncertainties of the economic capital models through the use of conservative approaches (e.g., increasing the correlation values in the models from the values estimated), different risk metrics (such as the more traditional measures), traditional (nominal or gross) exposure limits and benchmarking techniques. One of these benchmarking techniques is stress testing, which many firms reported using to measure and understand potential risk concentrations that are not captured through traditional metrics and economic capital models.

Considerations

The economic capital framework provides a useful tool to introduce a common risk denominator for integrated firm-wide risk management: namely, a risk measure that is widely

²³ Thus, the diversification benefits may not come to fruition in a crisis when a financial institution needs them the most.

²⁴ Among the interviewed firms, banking and securities-led groups spend quite some effort to understand and model this interaction of market and credit risk.

²⁵ Even for long time series data, the correlation estimation may be hampered by structural changes in the economy.

understood across the firm, allocates the risks to the business units, and provides for consistent risk/return exercises across the firm.

However, in terms of measuring risk concentrations, economic capital models have limitations. In the above discussion, we mentioned the issues of 'hidden' risks, second order effects, and the methodological difficulties in capturing dependencies under stressed conditions. Consequently, several financial conglomerates reported the need to use economic capital models in concert with other techniques such as stress testing and scenario analysis²⁶. Additionally, the computation of benefits of diversification makes an implicit assumption that there are no 'hidden risks' or that the material relationships²⁷ are recognized. Hence, in their recognition of diversification benefits, firms should take a conservative stance towards this assumption.

Stress testing and scenario-analyses

While risk concentrations within a risk category are still often managed in a traditional way (e.g., regularly-performed, single-risk tests, including those required by supervisory authorities), stress testing and scenario analysis are emerging as techniques to measure and manage the impact of potential risk concentrations across a firm's business units and relevant risk categories.

The word stress testing covers a broad range of varying techniques whose purposes may differ. As noted by the CGFS 2005 report²⁸ on stress testing two main categories can be distinguished, namely scenario tests and sensitivity tests. Additionally the former category can be separated in hypothetical scenario stress tests and historical scenario stress tests. The latter stress tests employ real-life past experiences as scenarios, while the former build on more hypothetical (forward-looking) "could-be" events. However, this distinction is blurred inasmuch as the construction of hypothetical scenarios often involves a consideration of past events. Sensitivity tests specify risk parameters that will be shocked without identifying the specific source of the shock (e.g., a specified percentage change in interest rates or the market value of an underlying instrument). These techniques are often used to assess the variation in the statistical loss distribution when introducing shocks to certain parameters and, hence, to value the robustness of the risk models and their outputs. As this report analyses the management of risk concentrations, it mainly focuses on the scenario stress tests employed by the conglomerates²⁹.

²⁶ As has been suggested by the Joint Forum 2003 report (page 12) "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."

²⁷ For instance, not capturing a material relationship between important exposures implies zero correlation or, thus, an important diversification that actually is not present.

²⁸ Committee on the Global Financial System (CGFS), 2005, *Stress testing at major financial institutions: survey results and practices*, can be downloaded at the BIS-website.

²⁹ Note that, as the model assumptions are crucial for the measurement of risk, the (distributional) assumptions of the models underlying the stress test exercises are also crucially important for the identification of the risk concentrations. However, in this study we mainly have focused on the application of the exercises and the scenarios.

Advantages and disadvantages of stress testing and scenario-analysis

The interviewed conglomerates reported several advantages of stress testing and scenario-analysis over economic capital models. Several firms pointed out the flexibility of stress testing and their forward-looking feature. This feature makes them appropriate for the active management of risk exposures and risk concentrations. Hence, it provides a key tool for the general move towards more dynamic risk management techniques of conglomerates.

Stress testing and the use of scenarios are generally less opaque than economic capital models since, for instance, assumptions underlying the stress tests are more visible to the end-user. This makes the tools more intuitive, which helps communication of risks and risk concentrations to the senior management of the group. Firm-wide stress tests also provide insight into how different business units and entities within a conglomerate impact the overall risk profile of the firm.

The flexibility provides a way to introduce and visualise more clearly the exposures to and the dependencies between the risk factors across business units and risk categories. Therefore, it is the preferred tool to measure risks across risk categories and to implement as a risk concentration measure across the whole group. More generally, stress testing appears – due to its flexibility – to be better equipped to address the methodological challenges that economic capital models face. For instance, it can be a tool for capturing the non-linearities in complex products.

The process of identifying the relevant scenario's for the conglomerate requires the firm to monitor events that may harm it and provides an opportunity to look beyond the standard exposures, dependencies, or risks to which they are familiar. If this process is performed on a continuous basis it may enrich the decision-making by the management of the firm.

Extreme but plausible scenario events (i.e., those having severe financial or operational implications for the firm) drive the development of stress tests,³⁰ which are based on either historical or hypothetical event data. The criterion of 'extreme' scenario implies a sufficiently harmful event, taking into account the composition of the institution's portfolios, thereby introducing the firm-specific feature of the stress test. The second criterion is plausibility, as scenarios that are highly implausible reduce the credibility of the stress tests. At some groups, the event type is determined by a top-down process of finding the most significant events and determining the severity of the event by applying statistical techniques to available historical data or, absent historical data, by applying conservative probability and severity parameter estimates. At some firms, lower-level business units identify important stress events and report the results to senior management. This identification of the relevant scenarios is the most important challenge, as it entirely depends on the scenarios whether the stress test will provide the necessary or required information to the risk management personnel to allow them to understand the firm's risks and, if warranted, to adjust activities accordingly.

In this respect, their development is importantly based on judgment or the 'expert based' opinion of the businesses and the risk management personnel. However, this level of subjectivity can raise questions as to whether the tests are capturing the relevant risks the firm runs. At the same time, several groups explicitly noted that statistical methods alone do

³⁰ Examples include: estimating how loan losses would rise if the housing bubble were to burst (earnings focus); the effect on trading asset prices of an avian flu outbreak (also an earnings focus); and the impact on funding requirements of a downgrade in the bank's debt ratings or a capital market disruption (earnings and contingency funding implications).

not provide a sufficient tool for the management of risks. The experience or judgment of (senior) management is crucial for the risk management, and stress tests offer a way to introduce this aspect into quantitative measures.

In addition, as flexibility may provide one of the strengths of the stress testing, it also has some significant limitations. Unlike the economic capital modelling, stress testing can be more difficult to implement on a consistent and regular basis through-out the group. This raises questions about the reliability of the (group-wide) stress test figures and their practical implementation.

On the stress tests performed

Stress testing and scenario analysis are not typically used to identify risk concentrations on a systematic basis. Rather, they give profile to an issue or quantify potential exposures that have already been identified. In this respect, firms use stress testing and scenario analysis primarily for informational purposes, and rarely implement 'hard decision-making' rules or limits based on the results of the stress tests.

Among the firms that we interviewed there was a wide variation of practices with respect to the use of scenario analysis and stress testing to measure risk concentrations. Stress tests can consider relatively simple scenarios such as unexpected movements in interest rates or the failure of a large counterparty. They can also consider more complex scenarios that involve variations in an array of different risk factors or entail certain ad hoc event scenarios such as an avian flu outbreak, a terrorist attack, or an unexpected change in climate. The practices between the interviewed groups also differ significantly. Some groups rely on historical events for all types of scenario tests, while others apply such scenarios only to "standard" stress tests. Others do not rely at all on historical events because they feel that such scenarios lose relevance as they are subject to evolution in the face of changes in financial instruments, the economic environment, and information technology. However, groups in general, and insurance led-groups in particular, appear to have significantly increased and enhanced their stress testing practices in recent years. Insurance-led groups appear to be more accustomed to using stress testing to identify and measure concentrations, which may be due to the event-driven nature of exposures in the insurance sector.

Over the past several years, insurer-led groups have increasingly taken a "total balance sheet" approach to stress testing and scenario analysis (i.e., looking at risk concentrations across the balance sheet and across risk types). For example, insurer-led groups may consider the correlations between asset risk and insurance risk in extreme tail event scenarios (e.g., how an earthquake would simultaneously impact the value and liquidity of the insurer's investments given that it may need to liquidate a significant amount of these investments to pay the insured claims, factoring in the lag time from the event occurring to the claims being filed/processed and then subsequently paid). In addition to scenario testing catastrophic industry events, company-specific events (such as a two-notch downgrade) are also considered when assessing the impact of risk concentrations. Moreover, since 9/11, insurance-led groups (and rating agencies) have expanded their scenario analyses to consider more extreme scenarios, such as the impact on capital of multiple catastrophic events occurring within a single timeframe.

Stress tests that integrate exposures across the broad risk categories and business units are generally lacking, except for some one-off attempts that build around specific scenarios or events, such as bird flu or 9/11. Some firms interviewed said that they employ various ad-hoc global macroeconomic scenarios; however, they vary widely in the extent to which they

integrate exposures across risk categories or cover the different business units of the group.³¹ Other firms, though, questioned the usefulness of these global stress tests and see the added value limited to the identification of potential risk drivers. A small number of firms focus on stress tests that capture the interrelationship of credit, market and liquidity risk exposures across the major business units, product exposures and portfolios. However, stress testing practices within risk categories and business units prove to be the most common and the most advanced. Of these, the stress tests for market risk are the furthest developed and most commonly used³². This may reflect the fact that market risk exposures generally lend themselves better to stress testing, since market observable prices give insights into potential losses based on risk factor movements.

A reported challenge is the difficulty in developing stress tests that effectively include business management actions, i.e., that are sensitive to changes in business strategy and management practices. In this regard, some groups in their stress testing design may assume that they can withdraw from a business activity as part of the strategy to manage through a crisis. In other words, a key assumption is that the firm simply stops generating new exposures and that positions remain static during the stress period. This may fail to take into account real-life reactions and constraints, and thereby effectively over-estimate the firm's capacity to take corrective measures. The boxes below set out some recent cases where exposures might have led to potential risk concentrations because a firm could not freely exit a business or did not appreciate the existence of the risk in sufficient time to be able to exit the business.

Reputational risk

Securities sector

Asset management generally is not viewed as a business activity that gives rise to concentrated exposures in the market, credit, and liquidity risk categories. Rather, the primary potential risk exposure generally is reputational in nature. However, the experience of one securities firm demonstrates how reputational exposures arising from asset management activities can migrate to traditional market and credit risk exposures that were not originally captured in the firm's systems for measuring and monitoring these exposures. Moreover, the migration can occur and the new risks remain even if the firm exits the business.

In this case, the firm managed two hedge funds that used leverage to invest heavily in CDOs that referenced sub-prime mortgages. The market dislocation for such CDOs beginning in February caused the value of the securities held by the hedge funds to drop substantially, giving rise to margin calls from banks that had financed the positions. The hedge funds ultimately could not meet the margin calls and became insolvent. Significantly, the securities firm whose affiliate was the asset manager had not financed the positions, nor had it invested more than small amounts in the hedge funds. In theory,

³¹ The macro-scenarios differed strongly and the impact of the scenario on the different risk exposures was mostly calculated per risk category and reported separately or aggregated to derive the total loss in revenue or capital.

³² Stress tests were reported to provide an important tool for the valuation and risk management of complex financial products and for backtesting the common VaR based market risk models. Some firms explicitly noted that the mark-to-market of the products necessitates the use of stress testing to identify risk concentrations. The interviewed firms commonly show to perform market risk stress tests across the group (capturing the most important business units) and firms reported that these tests provided a reasonably comprehensive view of major risks across all business lines. The stress tests are often based on specific periods of market turmoil, such as the stock price fall of May 2006.

the firm should have been able to let the hedge funds fail without incurring any direct market or credit risk exposure; though obviously the failures would – and did – result in significant reputational harm.

The securities firm, however, agreed to “take out” certain of the other bank creditors by replacing their secured financing with its own loans to one of the hedge funds. In the end, the hedge fund failed and the securities firm had to seize the collateral and, thus, was left owning the CDOs. The firm likely had several reasons for providing the substitute financing. First, the action may have avoided a precipitous liquidation of the assets by the other creditors that could have adversely impacted the already stressed CDO market. Second, the other creditors may have used “moral suasion” inasmuch as they had relied, in part, on the securities firm’s name and reputation in lending to the hedge funds it managed. Finally, the firm may have calculated that the further harm to its reputation resulting from its simply walking away could have ultimately been more harmful than the potential losses that may arise from taking over the financing. However, it should be pointed out that the second fund was, in fact, allowed to fail without the firm providing relief to the secured creditors.

Insurance sector

Some firms considered that under-pricing of a product will not have lasting results as re-pricing will limit potential losses to the existing subscription period, when in fact such an option is only theoretically available.

One insurance firm, while analysing a group contract for disabled people, realised medical evolutions had led to under-pricing of the life guarantees. The actuarial department proposed to increase premiums as a result. However, as civil rights associations took on the matter public outcry followed, and a serious blow to reputational risk was avoided only after the firm stated in a television broadcast that the proposed price increase would not take place.

Obviously this situation would not have been modelled for adequately.

Legal constraints

Laws in the main country of operation of one insurance group provides that in respect of individual health contracts, after a 2 year probationary period, an insurer is not allowed to take into account any new element in the policyholder’s health situation, directly or indirectly: Re-pricing must be done homogeneously across all similar contracts in the firm’s portfolio, and no unilateral cancellation may take place.

Such legal constraints may be inadequately taken into account in a scenario testing the ability to correct underwriting risk.

Private law changes

In one country surveyed, where over half of all life insurance policies are cancelled before maturity, insurance undertakings’ practices were to subtract large amounts from the accumulated value of life insurance contracts, arguing that their cancellation fees (which insurers derived from expenses for distribution, administration and early cancellation etc.) were simply very high.

In 2005 a court ruled that the standardised provisions in case of a surrender regarding fees resulting from distribution cost as well as cancellation fees were illegal due to lack of transparency. This ruling applied to policies sold in the years 1994 to 2001.

In consequence insurance undertakings had to build reserves for pending losses to prepare for a wave of lawsuits and deferred payouts.

Public policy law changes

In one country the health insurance market is split into two segments, statutory health insurance (SHI) and the private health insurance (PHI). 80% of the population is insured statutorily and pays state regulated premiums – these premiums are not cost-effective. Any gap is subsidised by the state.

For young people generating little health related cost the premiums in PHI are low but do gradually become higher resulting in high premiums at high ages. For SHI the cost is higher at first but covers children for free and therefore remains more stable as policyholders age.

Unlike PHI, SHI does not create reserves but rather relies on public funding when financing gaps emerge. As PHI is profitable, it was obliged to subsidise SHI with a large amount yearly. However insurance undertakings offering PHI undertake risk assessments before customers may receive coverage, SHI are obliged to take all applicants.

In the course of the latest reform of the health insurance sector, plans have emerged to force PHI to change their underwriting policy by having to offer basic coverage to everyone. Also intended changes to legislation enable insured persons to switch their provider (insurer) more easily and have accumulated reserves transferred to another provider.

As a result insurers current reserve policy will prove insufficient as their calculation to cover cost will then cover a higher risk population at low premiums.

Complex structures

In the last few years large primary insurers in one country have entered into arrangements to transfer large portions of their underwritten risk to special purpose vehicles abroad. There are often tax benefits related to these structures.

Unlike in banking the assets held by the SPV were of equal duration to the underlying risk (obligations). However these SPVs were vulnerable to market risk regarding the assets held (e.g., Argentinean bonds). To minimise this risk the SPVs would buy swaps from the same primary insurer to cover for this market risk.

As a consequence part of the risk originally actually transferred off the insurer's balance sheet was actually transferred back onto the balance sheet after issuing the swap and selling it to the SPV. The primary insurer therefore retained the risk associated with a fall in value of the assets intended to provide reinsurance protection in the case of a claim.

The net result was that no risk transfer had taken place and the insurer may have become liable for some liquidity demand resulting from market risk of an off-balance sheet vehicle. The existence of this risk was not apparent initially.

The measurement and management of exposures stemming from second-order effects is not usually incorporated into groups' current stress models. It is an emerging practice at some firms, however, with these risk managers believing that the most effective way to address these effects is through the use of stress tests identifying potential risk concentrations.

There is no consensus about how much further existing risk concentration measures and stress testing frameworks should be refined in this area. Some groups believe their risk concentration measurement methodologies already capture second-order effects, either implicitly (via conservative estimates for correlations relating different risk categories) or explicitly (via assumptions such as for client behaviour under certain market conditions). Other groups interviewed do not simulate second-order effects, believing that design difficulties preclude them from being fully captured in stress tests³³ or else that they are not material enough to make incorporating them a priority.³⁴

Market liquidity issues are described by many groups as a second-order effect. In contrast to most other approaches that are not typically adjusted to account for liquidity, stress tests can be designed to simulate a loss of market liquidity during a downturn period. Firms can superimpose on a stress scenario a set of adverse liquidity shocks, for example, lengthening the holding period for positions, not allowing rebalancing or hedging of portfolios, or assuming conditions that force severe haircuts on collateral. Regarding counterparty risk, some groups assume that credit protection would not be available in a liquidity crisis. One group mentioned that, where hedge funds are seen to provide liquidity to the market, a typical scenario would be to run a hedge fund stress test that incorporates margin call risk.

Firms report a wide variety of other second-order effect scenarios, for example: country risk scenarios that account for secondary effects of currency restrictions; an increase in interest rates and subsequent fall of real estate prices; and a credit downgrade of a large borrower that results in an increase in their funding costs and withdrawal of other creditors, with the firm then being more exposed to the borrower through its committed credit lines.

Again, it appears the insurance sector is generally more accustomed to recognising and incorporating second-order effects. For example, one specific scenarios reported by an insurance led-group included losses from an earthquake followed by theft and looting, with resulting business bankruptcies and a deteriorated economic climate affecting investment values and future underwriting income in addition to insurance losses;

In addition, several firms reported they incorporate the effects of risk mitigation techniques via stress testing in their assessments. Though, again there was no broad consensus on how effective stress testing is in gauging risk transfer effects. Some groups believe that, because they record and measure exposures created by risk transfer instruments, any scenarios that stress risk drivers across businesses and risk factors will naturally identify these risk transfer effects. Others stated that scenarios would have to be specifically designed and sufficiently severe to account for non-linearity and contingent triggers, such as deep out-of-the-money option exposures.

Several groups also reported challenges with conducting credit risk stress tests because of the uncertainty surrounding the measurement and estimation of the interrelationships among credit portfolios, the dependencies between credit defaults, the identification of the material risk drivers and their relation with the specific credit variables (PD, LGD, EAD), in general the

³³ One group mentioned that these scenarios are very judgmental and therefore subjective, and that believing second-order effects are implicitly captured in stress testing could lead to a false sense of risk awareness. Therefore it preferred to perform targeted analyses, as and when warranted by market conditions.

³⁴ Note, however, that some firms have modelled certain events where second-order effects account for 40% of aggregated losses.

lack of standard industry stress testing practices and back-testing techniques, and the lack of market indicators of credit performance for non-US countries.³⁵

Liquidity stress tests tend to be performed on a stand-alone basis, without formal integration of stress testing activities with other risk disciplines. In addition, the current focus of liquidity stress testing programs is generally on firm-specific liquidity events rather than on other types of crises like systematic/market-related events. A typical firm-specific liquidity scenario performed is the downgrade of a firm's credit ratings. Other stress tests reported include difficulties in accessing liquidity in short-term funding markets and difficulties in accessing liquid assets in regulated entities across international borders or in a particular entity.

Business risk, reputational risk, legal risk, country/transfer risk, and event risk are by some firms specifically analysed through ad hoc scenario analysis. Groups are in the early stages of analysing these risks in the context of risk concentrations, but consider these risks to be potential sources of severe losses for which a more quantitative approach would be helpful. In this respect, stress testing is not necessarily preferred to other techniques available for measuring and monitoring risk concentrations, and it is important to note that it is not used at all by at least one firm interviewed and on a limited basis by many other firms. Nevertheless, stress testing for many firms (particularly in the market risk area) has become routine and a matter of regular management reporting.

The market events of the second half of 2007 and integrated risk management approaches

Risk concentrations are determined by the extent of the exposure(s) and the interdependencies between these exposures. Recent market events showed that the magnitude of the risk exposures and their simultaneous realisation across much of the global financial system had not been fully anticipated. Previously we discussed how risk methods may have missed certain of the specific risk characteristics of the credit risk transfer products and thereby may have missed the potential concentrated exposures that can arise during systematic events. We also summarized how the credit event spread through the markets, affecting the different activities of financial conglomerates and leading to a number of risk concentrations. As described above economic capital models generally lack the flexibility to fully integrate the rich interdependency structures between exposures and tend not to incorporate the second order effects. Scenario stress testing is regarded as a more appropriate tool to capture the dependencies, the second order effects, and the simultaneous realisations due to contagion. However, in our interviews with firms majority indicated that they had not conducted stress tests and scenario analysis that had detected and prepared their institutions for the potential ramifications of this financial shock. In general stress tests, for instance, did not adequately capture (systemic) market shocks, had optimistic assumptions on asset marketability (via loan sales or securitization), underestimated or ignored the risks of extending liquidity support to conduits and SIVs, and ignored potential contingent risks from reputational issues.

³⁵ Some reported credit risk stress tests are: tests to measure credit exposures on a country-by-country basis in the trading book; tests to measure the sensitivity to the credit spread widening (both in banking and trading books), tests that shock the rating bands, unwinding of a housing bubble, and tests that account for general increases in the PDs, fall in collateral prices, and correlation changes within and between industries and countries.

In general, the scenario stress tests of the financial conglomerates do not consider systemic shocks or events; rather, they mainly look at name-specific events. Systemic shocks are often considered as, occurring with extremely low probability, and thus are usually considered to be too severe to be practical. Moreover, many firms question the feasibility of predicting the actual development of particular shocks. However, while standard distributions may allot an extremely low probability to these systemic shocks occurring, recent experience may give a different picture of their likelihood. It is correct that the precise timing, triggers and development of a systemic shock are hard to exactly predict; however, accurately predicting specific market events is not necessary to incorporate systemic risk in to a scenario. Thorough analysis and understanding of the economic and financial environment, coupled with predictions on further environmental evolution, the identification of how different risk factors could potentially play out, the identification of the drivers of potential market dislocations, the ways in which contagion may spread, and the firm's own behaviour during these events, will increase financial conglomerates preparedness and robustness to manage through these turmoil events.

The events in the latter half of 2007 clearly showed how positions can suddenly become concentrated because of the actions of other market participants; in reality market participants sometimes overreact to certain events (which may be due to information gaps and asymmetries), which can lead to a drying-up of market liquidity. Even so, the limited number of financial conglomerates that reported inclusion of market liquidity issues in their stress tests tended to see market liquidity risk only as a material issue only for certain 'narrow' markets (generally, markets dominated by a few dealers). Overall, these conglomerates saw the exposure of the entire group to these narrow markets to be rather limited. Recent market events, however, showed that the issue of market liquidity is not restricted to highly concentrated markets and that risk concentrations may quickly arise in the financial conglomerates when broader market liquidity dries up.

Firms should also consider how different market structures (that originally may be intended to protect individual positions) may lead to or reinforce a systemic event. For instance, the market triggers present in different CDOs reinforced the initial price declines of ABS. Common investment rules forced some market participants to simultaneously exit certain positions, with these asset sales leading to further price declines (leading to potential second order effects). The liquidity constrained SIVs were particularly prone to second-order effects; fire sales had the potential to trigger a domino effect spreading to other SIVs that were holding similar assets. This reduction in asset value could breach certain triggers, forcing the SIVs in turn to sell assets to meet their liquidity requirements. The market volatility also led to some firms' VaR models breaching their limits, which led to a reduction of the risk appetite. In general, besides a firm's own management actions, firms should also consider the potential reactions of the market participants to stress events in their scenarios. In particular, the self reinforcing behaviour due to certain market structures should be incorporated into scenario stress tests.

The 2007 market events also showed the importance of legal and reputational risk issues. Several financial conglomerates faced the threat of legal action by different sorts of investors for the losses suffered on their ABS investments. To avoid some of these legal actions and the associated reputational risk several firms bought back the ABS, bringing additional unexpected losses to these firms. Even some managers of money market funds had to reimburse their clients, after freezing withdrawals when clients started to redraw from the money market funds that invested in ABCP.

Considerations

Stress testing is a complementary risk measurement methodology for the management of risk concentrations across a financial group. It provides a tool for understanding how exposures arising from different business units and risk categories can interact at the firm-wide level. It therefore offers a framework that may circumvent the specific limitations of other techniques for risk concentration measurement. Additionally, stress testing is a key tool for the more active management of the group's portfolios and the management of complex financial products. However, it remains a complementary tool rather than a cure all, as stress tests require the development of an underlying risk model, based on specific and often qualitative assumptions, for the ultimate calculation of the risk figures. Hence, the quality of the risk information deducted from stress tests can only be as good as the reliability of the underlying risk model.

Although the survey responses indicate a tendency by certain firms to acquire a more horizontal view of risk concentrations and that stress testing is the preferred tool for achieving this, many firms remain sceptical of the ability of stress testing to provide a firm-wide view of risks. These firms question the cost-benefit trade-off of establishing firm-wide scenario-stress tests and the difficulty of integrate them into their risk management process in a systematic manner that leads to routine reporting and actionable information. Consequently, stress tests are often limited to certain one-off exercises conducted on an ad hoc basis, including events like general oil price shocks, an Avian flu pandemic and a 9/11-type terrorist event.

The 2007 market events showed the potential benefits of regular firm-wide integrated scenario stress tests. These tests should be based on a thorough analysis and understanding of the economic and financial environment, with predictions made on the potential evolution of the environment and the identification of how different risk factors could potentially play out, the identification of the drivers of potential market dislocations and how contagion may spread to the different markets. Areas for further refinements in stress test exercises include the introduction of more realistic assumptions on business management decisions,, potential reactions of third parties and the issue of market liquidity,, the incorporation of second-order effects, the impact of legal and reputational issues, and the effects of risk mitigation techniques.

Economic capital models and stress testing methodologies have both their advantages and disadvantages. Combining both methodologies appears to strengthen the risk concentration measurement and management of financial groups. This may explain the blurring line between risk modelling and stress testing. One trend noted is that, as the conglomerates gain experience in their risk modelling and stress testing, the basic risk models are being enriched as (previous) stress test features are introduced and standardised in the risk models.

Annex 1: Current regulatory requirements relating to risk concentrations

Quantitative Requirements

European Union

In Europe, large exposure requirements (relative to capital) for credit institutions and investment firms are now prescribed by Directive 2006/48/EC. This directive defines a "large exposure" as one whose value is or exceeds 10 percent of the institution's own funds. It sets three concentration limits: 1) a single exposure (or group of connected exposures) may not exceed 25 percent of funds; 2) the total of "large exposures" may not exceed 800 percent of funds; and 3) intra-group exposures may not exceed 20 percent of funds. According to a survey on large exposures recently conducted by the Committee of European Banking Supervisors (CEBS), all member states have adopted the first two limits. With regard to the third, a large majority has set a 20 percent limit, but this is usually waived if the exposures in question are included in the scope of their supervision on a consolidated basis.

According to the Capital Requirement Directive (CRD), concentration risk (apart from the large exposure requirements) is part of the Internal Capital Adequacy Assessment Process (ICAAP) and Supervisory Review and Evaluation Process (SREP). The approach for concentration risk is laid out in the second pillar principles in article 124 of the CRD and some general technical criteria set forth in the annexes to the CRD. National authorities have some flexibility in developing supervisory approaches, with several member states applying more stringent limits in areas. Apart from the regulatory regime, on-site bank inspection frameworks in certain countries may require additional actions to be taken, depending on the activities, features, and complexity of the bank.

The European Commission is currently conducting a review of how "large credit exposures" are managed by credit institutions as well as by their supervisors. Under the provisions of the new CRD, this review must be completed by the end of 2007.

For insurers, asset spread rules set regulatory limits on credit risk concentrations (i.e. investment in any one counterparty) or to credit and market risk concentrations (e.g. exposure to one type of investment or instrument may be capped). EU insurance regulators have issued guidelines on the diversification of portfolios, concentrations, and the stability and soundness of future cash flows.

Some supervisory authorities also require specific stress tests and scenarios to be performed annually or quarterly (including equity, market, catastrophe risks and some interplay between those factors).

The on-going Solvency II project provides for an Own Risk and Solvency Assessment and a supervisory-recognised use of internal models in the calculation of capital requirements. Risk concentrations and risk categories correlations will also be taken into account in the solvency capital required of all undertakings.

United States

Among U.S. banking institutions, exposures that exceed 25 percent of capital (eg tier 1 capital and the loan loss allowance) generally are noted and scrutinized more closely. This

threshold is contained in statute, agency regulations, and supervisory materials individually or jointly issued by the Federal Deposit Insurance Corporation (FDIC), the Board of Governors of the Federal Reserve System (Federal Reserve), the Office of the Comptroller of the Currency (OCC), and the Office of Thrift Supervision (OTS).

Moreover, a banking institution's loans to one borrower (LTOB) cannot exceed 15 percent of the bank's capital and surplus if unsecured, or 25 percent of the banking institution's capital and surplus if the additional 10 percent is fully secured by readily marketable collateral such as actively traded securities. Higher limits are authorized based on collateral. LTOB limits apply to state banks that are members of the Federal Reserve System. State banks may also be subject to additional lending limits imposed by the law of the chartering state; these limits typically are expressed in terms of notional amounts relative to capital. LTOB limits are legal maximums; safe and sound operation may give rise to a need for the institution to adhere to a lower limit.

For thrifts, while the new general limitation allows LTOB up to 15 percent of unimpaired capital and unimpaired surplus, the statute authorizes the Director of the OTS to increase this limit to 30 percent for qualified savings associations to develop domestic residential housing. The OTS Director may permit an institution to lend up to the lesser of \$30 million or 30 percent of its unimpaired capital and unimpaired surplus to one borrower for the development of domestic residential housing units subject to certain conditions, including that loans made under this Special Rule do not, in the aggregate, exceed 150 percent of the institution's unimpaired capital and unimpaired surplus.

U.S. banking institutions are subject to limits on the amount of real estate loans that exceed supervisory loan-to-value limits. Supervisory loan-to-value limits vary by property type, ranging from 65 percent for unimproved property to 85 percent for improved property. The aggregate of loans exceeding these limits may not exceed 100 percent of capital for banks, although as noted above, a higher limit may be approved for savings associations. Additionally, the aggregate value of non-residential or commercial real estate loans that exceed supervisory loan-to-value limits are restricted to no more than 30 percent of capital.

The Expanded Guidance for Subprime Lending Programs³⁶ requires U.S. banking supervisors to "intensify examination scrutiny" of U.S. banks where subprime lending programs have an aggregate credit exposure equal to or greater than 25 percent of tier 1 capital. Among other things, intensified scrutiny includes an expectation that banking institutions maintain higher capital against subprime assets relative to non-subprime assets, and an expectation that banks stress test under "conservative scenarios" to support capital adequacy determinations.

With respect to market risk, capital regulations require U.S. banking institutions to estimate VaR measures as part of their regulatory capital calculations. The quantitative aspects of VaR measures are defined by regulation, consistent with the Basel Committee's Market Risk Amendment adopted in 1996.

U.S. savings associations are subject to rules that require the board of directors to establish limits relating to interest rate risk tolerance levels. These limits must be expressed in terms of the minimum net portfolio value (NPV) ratio the board is willing to allow under current interest

³⁶ Subprime lending programs are those where lending activities are targeted to borrowers with weakened credit histories or reduced payment capacities as measured by relatively low credit scores, debt-to-income ratios, or other criteria.

rates and for immediate, permanent, and parallel up or down movements in the term structure of interest rates by 100, 200, and 300 basis points. The OTS collects information about the repricing characteristics of assets and liabilities through supervisory reports and uses this information to estimate post-shock NPV ratios. Larger savings associations are also expected to produce their own measures of interest rate risk to include NPV and earnings sensitivity under a variety of interest rate scenarios (including non-parallel movements in the term structure of interest rates).

At the conglomerate level, the OTS requires quarterly reports on risk concentrations from the top tier, plus any sub-tier, holding companies. Such reporting includes: data for all actual risk concentrations; type of risk concentration; and the total dollar or notional amount of any risk concentration type that exceeds 5 percent of equity. Aggregated risk concentrations that are at least 25 percent of capital are required to be identified. Reportable risk concentrations³⁷ assume that at least one of the subsidiaries involved in the transaction is a regulated entity, or that a regulated entity is affected by the risk concentration.

Insurance firms' asset side risk concentrations are similar to those of other financial firms (e.g. exposure to concentration of asset classes and counterparties). Insurers are highly regulated and State laws fashioned on the Model Laws and Regulations drafted by the National Association of Insurance Commissioners (NAIC) contain a number of limits as mentioned below. On the asset side, U.S. insurance laws and regulations impose restrictions on investments – typically limits on asset classes, single and connected names, countries and rating categories (expressed as a percentage of assets or capital). U.S. insurance firms tend to maintain total adjusted capital well above the minimum capital levels required in the NAIC's Risk-Based Capital Model Laws for life, property/casualty, and health insurers. Premiums may only be invested in government and rated corporate bonds; U.S. insurance firms may not invest in equities. Asset adequacy tests under specified interest rate stress scenarios are also required.

Risk concentrations on the liability side are exposures to what is being insured (e.g. natural or man-made catastrophic events) and may be to a particular region (e.g. underwriting homeowners insurance in Florida) and/or type of business line (e.g. business interruption and life insurance to firms concentrated in the Wall Street area). On the liability side, regulations impose limits on the size of single exposures (expressed as a percentage of capital); any single insurance risk exposure is limited to 10 percent of surplus.

Although there is no specific limitation to the number of reinsurers that must be used in a certain type of transaction or requirement limiting the amount of reinsurance a primary insurer may purchase, there are restrictions on what companies qualify for admitted treatment and what types of transactions are permitted in order to receive reinsurance accounting treatment. Regulators do use "early warning tests" that flag insurers that have a significant amount of reinsurance leverage and foreign reinsurers (known as "alien

³⁷ Reportable risk concentrations include, but are not limited to: financing and/or insurance concentrations with a counter-party involving investment, bond issuance, loan, foreign exchange contract, derivative contract, foreign exchange contract, interest rate swap, cross currency swap or collateralized swap agreement, financing and/or insurance concentrations within a group of counterparties that share a significant common characteristic, or combination of common characteristics; similar categorization and sub-categorization of concentrations among insurance products; financing and/or insurance concentrations of counterparties within geographical locations including domestic and foreign countries and geographical regions; concentrations within specific types of securitization that require either the implied or specific financial support of (top tier HC or sub tier financial HC); financing and/or insurance concentrations within specific industry sectors or across an identified group of industry sectors; concentrations within Property and Casualty Insurance lines that provide exposure to natural disasters or catastrophes; concentrations within a specific type of investment, or, a class of investments.

reinsurers) must post collateral. An issue for the subgroup to consider is whether the restrictions on what companies qualify as admitted treatment and the requirements to post collateral for Alien reinsurers have the effect of mitigating concentrations.

Concentration of exposure to reinsurance counterparties is a significant and unique (insurance sector) risk. The NAIC's Credit for Reinsurance Model Act requires alien to post collateral with US insurers ceding insurance to them. This serves as a mitigant to U.S. insurer reinsurance risk concentrations when non-U.S. counterparties are involved. Financial guarantee insurers, which are primarily located in New York and tend to be large companies, tend to have unique risk concentrations arising from the correlation of their investments and insurance risks. The majority of states require financial guarantee insurers to be monoline, thus there is no diversification with other business lines (a handful of states do not require such firms to be monoline). Health insurers, as guarantors, may have other types of unique risk concentrations.

In the United States, the SEC's net capital rule for broker-dealer subsidiaries contains several requirements addressing concentrated exposures. These include capital charges for proprietary positions where the size of the position exceeds a level of the entity's capital or four weeks of trading volume. At the group level, the SEC requires investment banks that are part of its consolidated supervised entity program to report certain information about market and credit risk exposures, e.g. 15 largest counterparty exposures (current and potential) and 10 largest country exposures.

Japan

In Japan, banking laws and a related government ordinance stipulate that the amount of credit extended by a bank to a single person (including related parties such as subsidiaries, a parent company, subsidiaries of the parent company, etc.) must not exceed an amount calculated by multiplying the amount of the bank's capital by 40 percent in a case where related parties are included or 25 percent where related parties are excluded.

Canada

OSFI's Guideline B-2, applicable to banks and insurance companies, generally stipulates that a bank or life insurer may not have a credit exposure to an entity or group of connected entities that exceeds 25 percent of its total capital. These limits may be set higher (up to 100% of total capital) for subsidiaries of a regulated Canadian bank or life insurer. For P&C companies, the credit exposure limit is equal to 5 percent of total assets. For both types of insurance companies, credit exposure to reinsurers incorporated outside Canada is limited through full collateralization requirements.

Insurers are subject to specific capital charges for concentrations arising from their liabilities. Under the MCCSR Guideline, life insurers must hold capital to cover mortality volatility risk; this charge varies inversely with the granularity of the death benefit amounts in an insurer's book. Both life and P&C insurers are required to hold capital to cover catastrophic risks.

Qualitative requirements

Qualitative requirements include examination manuals and handbooks that address issues such as concentrations of credits, internal controls, policies, risk assessments, and control systems, concentrations of risk factors, regional or country concentrations, and the criteria used to determine risk exposure limits. Certain regulatory regimes, such as the United States and the Netherlands, address the legal capacity of the group to freely transfer capital and liquidity between legal entities.

European Union

In the EU, the CRD leaves it to the national authorities to develop their approaches to supervise risk concentrations under Pillar 2. Currently, the EU supervisors are developing a second pillar approach to assessing credit concentration risk in line with the CEBS guidelines put forward in Consultation Paper 11.³⁸ The proposed approach mainly consists of a qualitative assessment of the management processes and internal reporting and the systems to identify, measure and manage concentration risks, as well as the manner in which the institution incorporates risk concentrations in its ICAAP. However, the proposed approach also would consist of a very crude estimation of the extent to which the institution's credit portfolio is concentrated or diversified over geographic regions and economic sectors.

The EU directive on financial conglomerates, 2002/87/EC, provides that regulated entities in a financial conglomerate should have: (i) a sound risk management process that includes good governance, periodical management reviews, capital adequacy policies, and procedures for ensuring well integrated risk monitoring systems; (ii) adequate internal control systems governing the firm's own funds; and (iii) sound reporting and accounting procedures.

Within the insurance sector, current rules vary across jurisdictions and may include reporting on internal controls and management's evaluation of the financial standing and prospects of groups. The Solvency II project aims at strengthening such a pillar II approach, and will consider intra-group transactions and support in determining a group and individual entity's capital and supervisory requirements.

United States

In the United States, financial and bank holding companies are supervised by the Federal Reserve and savings association holding companies are the supervisory responsibility of the Office of Thrift Supervision. Supervisory guidance for all three types of holding companies is broadly similar.³⁹ Holding companies should manage and control aggregate risk exposures on a consolidated basis, recognizing legal distinctions and possible obstacles to cash movements among subsidiaries in its non-trading activities and when managing interest rate risk. Other supervisory guidance states that global limits should be set for each major type of risk and should be integrated, to the fullest extent possible, with institution-wide limits on those risks as they arise in all other activities of the firm. The limit system should provide the capability to allocate limits down to individual business units.

³⁸ www.c-eps.org/Consultation_papers/consultationpapers.htm.

³⁹ In addition, the SEC provides supervision of qualifying consolidated supervised entities of broker/dealer firms.

With respect to the market risk of trading activities, US banking regulations provide that the measurement of market risk should take account of hedging and diversification effects. A well-constructed system of limits and policies on acceptable levels of risk exposure is a particularly important element of risk control in trading operations. Limits can be allocated to business units, product lines, or other appropriate organizational units. Through the examination process, regulators may recommend additional *ad hoc* scenarios for banks that are conducting stress testing and scenario analysis and for the integration of those analyses with business strategies and limits.

With respect to liquidity risk, supervisory manuals provide that MIS should be able to project cash flows under a variety of scenarios, including: (i) a “business-as-usual” approach; (ii) a firm-specific liquidity crisis; and (iii) a systemic liquidity crisis. Moreover, management is responsible for establishing and implementing a sound funding liquidity contingency plan.

Insurance regulation in the United States has historically focused on legal entity, rather than consolidated supervision (although the NAIC has recently begun to take some steps toward a consolidated view, particularly across the insurance entities in a group). The NAIC is implementing the lead state concept to improve coordination and communication among companies within the group.

It’s likely that only the largest insurance conglomerates have the ability to identify and measure risks (and thus risk concentrations) across all the entities in the group, and that this ability is at the early stages of development. Also, given that they are not supervised on a consolidated basis (and that their regulation focuses on solvency rather than risk management), they may lack the incentive for developing consolidated risk approaches.

Catastrophe models are continuously being updated and refined in light of new information (cat events) and more advanced measurement techniques. Models are available for natural and, more recently, man-made cat events. Also, post-9/11, companies are scenario testing a broader range of scenarios. Advancements in these cat models should provide insurers with increasingly better measurements of the extent of their insurance risk concentrations. Insurers are increasingly securitizing their catastrophe risks and selling it to the capital markets via cat bonds.

Japan

The Japan FSA’s guidelines describe the points considered in the agency’s evaluation of conglomerate supervision, including: (i) whether a management company⁴⁰ has established a system for identifying risk concentrations of the group and appropriately measures, monitors, and manages those concentrations; (ii) whether the directors of a management company are fully aware that concerns arising from risk concentrations can be alleviated through appropriate risk management and internal control policies and can be complemented by securing an adequate capital base; and (iii) whether the directors of a management company are fully aware of unquantifiable risks and new risk concentrations arising from cross-sector business integrations.

⁴⁰ “Management company” refers to a company that manages the operations of a financial conglomerate.

Annex 2: List of members of the WG on Risk Assessment and Capital