Group Aspects of Regulatory Reform in the Insurance Sector

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This article discusses group aspects that may be expected to be important determinants of regulatory reform in the insurance sector. Basically, we deal with the question of whether the risk level of a group is higher or lower than the simple sum of risks of all institutions individually. The application of simple portfolio theory to explain overall group risks may be myopic. A holistic approach to assess group (concentration) risks also has to cover risks that portfolio theory does not take into account, for example, reputational effects, contagion, etc. In fact, the diversification gains from a large group portfolio may well be outweighed by the risks encountered at group level. In order to assess group risks, we advocate the use of copula-based economic capital models. We believe that this procedure allows a more adequate judgement on group risks than traditional methods, which are generally based on rather restrictive assumptions. Data constraints, however, may impair an early implementation of such models. An early start of data collection for adequate modelling and further research on copulas have to be understood as prerequisites to advanced solvency determination in groups.

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New Scope of Insurance Supervision

The aim of insurance supervision is – more than in banking supervision – the protection of the *individual* consumer. The system of risk sharing within a community, the with-profits concept of many insurance products and the (hidden or open) reserves of an individual insurer are – *inter alia* – the reason for the widely perceived lack in compatibility of the insurance business with a group-oriented supervisory system. This is the reason for an almost entire solo-entity orientation. However, financial group and conglomerate aspects have come to the fore of regulatory discussion several years ago and pose steadily increasing challenges to regulators and supervisory authorities alike: There are not only the questions of double gearing or excessive leveraging on a company's own funds, which are to be resolved (and to which legal frameworks were

* The views expressed in this paper are those of the authors and do not necessarily reflect the opinion of the institution they represent.

to be adapted¹), but also the cooperation between supervisors has to be explicitly defined² and solo supervision of companies possibly reconceived.³

The current Solvency II project, as it is being developed by the International Association of Insurance Supervisors (IAIS) and the Committee of European Insurance and Occupational Pension Supervisors (CEIOPS), will have to take account of this changed framework for a variety of reasons:

- Insurance groups – even if they are only small scale – have become a common structure in the market.
- A consolidated view does much better reveal the economic situation of the members of an insurance group.
- Modern group management foresees a flexible attribution of capital to different entities within a group, according to the economic facts in risk attribution and yield structure.
- Internal models will be brought forward mainly by larger groups and will have to accommodate their specific situation.
- Certain risks, such as contagion risk, have essentially emerged with the appearance of financial groups.
- On the other hand, simple portfolio theory suggests a certain potential for diversification effects, especially when the group consists of a wide variety of business lines. Insurance groups engaging in many different business lines or geographical areas should thus economize on large risk reductions due to diversification.

Ultimately, the question is whether the risk level of a group is higher or lower than the sum of that of all contained institutions individually. In other words, is a company, as part of a group, less or more exposed to risk than its stand-alone equivalent?

This question has far-reaching consequences not only for the company itself but also for the supervisor since the result may influence economic capital requirements and might therefore be expected to be mirrored in the future more risk-sensitive regulatory solvency regime.

However, an assessment still may be far from adequate, because it is subject to several deficiencies. The estimation of group risk, in particular the aggregation of individual company-level business-line risks to the group level, is still in its infancy. Moreover, usually the time series of the data necessary to model this effect are rather short (or even missing) and therefore deliver no significant results. Another problem lies in the difficulty to quantify those risks that are typically related to groups and which are therefore often hard to include, for example reputational risk and certain variations of other contagion risks.

¹ Cf. The EU Insurance Group Directive (98/78/EC) and the Financial Conglomerates Directive (2002/87/EC).

² The Helsinki Protocol defines cooperation of the supervisors of the entities of an insurance group. A CEIOPS Working Group is currently revising this cooperation.

³ Cf. EFR (2004).

The following section will shortly explain the causes and triggers for the emergence of large financial groups in Europe during the last decades. The next section will then assess potential consequences of this development for both the financial markets and the supervisors and regulators. In the penultimate section, potential methodologies for risk aggregation and their inherent shortcomings in taking account of all group-related risks and diversification potentials are described. The final section concludes by emphasizing the importance of spurring further research in group risks and makes suggestions for follow-up research on the concentration effects.

Emergence and rationale of financial groups and conglomerates

The emergence of financial groups and conglomerates can be traced back to a variety of arguments. Usually cited are expected cost synergies via economies of scale and scope (for instance, in the field of risk management) and the diversification effect. According to a Group of Ten study,⁴ the driving forces to consolidation have been improvements in information technology, financial deregulation, globalization and increased shareholder pressure for financial performance.

Levelling out the volatility of cash flows has a direct effect on the probability of financial distress and as such has an imminent importance in the reduction or avoidance of certain related costs. This effect is particularly true if the involved companies operate in different markets or countries, such that correlation of risks is rather low and diversification effects accordingly higher.

In a well-established and mature market, the possibility to increase market share is restricted to a certain level, that is, organic growth of financial institutions may be rather limited. The increase of market share would be accompanied by ruinous price competition. Under these circumstances, growth can only be achieved via acquisitions. Although these mergers and acquisitions remain predominantly national, several aspects support cross-border M&A activities of financial institutions. Legal, political, cultural or regulatory barriers still hamper direct access to markets and influence the structure of international groups. Hence, to grow internationally, institutions may have to take a stake in existing companies and to make use of well-established brands.

Another aspect of the establishment of large groups is agency reasons, as mentioned by Dierick.⁵ That is, managers may pursue personal goals (e.g. perquisites), which do not necessarily coincide with company or stakeholder (shareholders in particular) interests when engaging in mergers and acquisitions. One such goal can, for instance, be “empire building” since one can observe a strong correlation between compensation and status of managers and a company’s size. Often, this strategy is also pursued in order to delay the disclosure of certain deficiencies of the company and to profit from another institution’s business model (merger as a last exit strategy). Acquisitions may also serve as a means to head off hostile takeovers of the company since these are usually accompanied by a removal of the target company’s management.

⁴ Group of Ten (2001, p. 70ff).

⁵ Dierick (2004, p. 14).

Current developments in Europe to foster the integration of financial markets pave the way for the establishment of international groups and conglomerates. An important catalyst for internalization in Europe was definitely the introduction of a common currency in 12 European member states in 1999 or 2002, as it facilitated cross-border business and eliminated foreign exchange risk. Also, the Third Insurance Directives,⁶ containing as key elements the abolition of price and product control, the introduction of insurance licences and the principle of home country control, had a major impact on intensified competition and a changing market environment, and thus served as a trigger for consolidation across Europe. However, different tax regimes and policies and unequal contractual law still represent major obstacles to market integration and hence, primarily foster the establishment of subsidiaries instead of branches. Another barrier to consolidation – and a protectionist loophole – is the “public interest” clause, which in fact allows every member state to restrict market developments.⁷ The Financial Services Action Plan endorsed by the European Council in Lisbon 2000 has been another vehicle to relieve certain obstacles for international business. This action plan consists of a set of 42 measures intended to improve the Single Market in financial services, by filling gaps and removing remaining barriers to provide a legal and regulatory environment that supports the integration of financial markets across the European Union.

A Swiss Re study⁸ showed that large European insurers predominantly expanded via acquisitions at home or abroad. The European insurance landscape changed dramatically during the last decade and showed a tendency towards an intense market consolidation. The share of the Top 5 insurance groups grew particularly stronger resulting in a market share of up to 70 per cent for the analysed sample. In general, one can observe an inverse relation between the size of the market and the quotas of the biggest insurers.

Consequences and challenges to supervisors

Risks and opportunities

The establishment of large groups and conglomerates is connected with additional risks for the supervisor or the regulator, respectively. Those risks originate from diverse causes and are accentuated by a regulatory⁹ framework that almost exclusively focuses on the individual company, which in turn forms the basis of “add-on” consolidated supervision. Another challenge is the size of such financial groups, which facilitates morally hazardous behaviour based on confidence in a too-big-to-fail (TBTF)¹⁰ status. Size as such can also constitute a major challenge due to the increasing complexity and the lack of transparency of the organization or simply due

⁶ Third Insurance Directives (92/49/EEC, 92/96/EEC).

⁷ Cf. Swiss Re (1996, p. 10).

⁸ Swiss Re (2000, p. 22ff).

⁹ More precisely, regulatory and supervisory framework. However, regulation is usually used as a kind of umbrella term, and distinctions are only made when distinction is indispensable.

¹⁰ See below.

to increased economic power. A full understanding of all operations might be hampered for insiders, and even more for supervisors, who also face the market power of their opponent.

One of the most important and most often cited challenges to group stability is contagion. In this particular case, intra-group spillovers from one group entity to another are considered, a special case of those risks that are usually subsumed in regulatory literature under the term systemic risk. However, such risks are hardly quantifiable.

It has to be highlighted that most of the challenges for financial supervision mentioned are strongly inter-related and account for each other, which is particularly obvious for regulatory arbitrage and intra-group transactions, TBTF status and contagion, etc.

Multiple gearing or regulatory arbitrage

Regulatory inconsistencies both across countries and industry sectors invite institutions to overstate their capital by counting it twice (or several times), thereby satisfying all capital requirements. In other words, multiple gearing allows the regulatory capital from the upstream entity to support liabilities for both the upstream and the downstream entity. Hence, capital is used by several entities at the same time and, without raising additional capital, assets can be “multiplied”.¹¹ Labilloy¹² presents some illustrative examples of how insurance undertakings may easily circumvent the solvency rules, given the absence of supplementary supervision at group level.¹³

A prominent example for potential regulatory arbitrage is credit risk transfer, a transaction where insurers are actively selling credit protection, that is, when credit risk transfer serves as an underwriting product. However, as explained in IAIS,¹⁴ this form of regulatory arbitrage is currently not a prevalent issue, in particular when it serves the investment function. In this case, the main driver is the search for increased yields and diversification of portfolios.

*Intra-group transactions*¹⁵

Regulatory inconsistency provokes activity shifts between countries and institutions (e.g. from a banking corporation to an insurance firm within a conglomerate) in cases where requirements are lower there for the same risk. In other words, those operations can be used to circumvent the aims of regulatory requirements while still formally meeting them.

In addition to the circumvention of regulatory requirements, intra-group transactions may affect the risk of contagion, for example, via reinsurance contracts or economically similar constructions between insurance undertakings and their subsidiaries, via off balance sheet guarantees between themselves and their controlling holding company or subordinated loans to sister companies.¹⁶

¹¹ Jackson (2003, p. 5).

¹² Labilloy (2003, p. 207ff).

¹³ Compare with arguments on intra-group transaction.

¹⁴ IAIS (2003, p. 26).

¹⁵ For the various types of intra-group transactions and exposures, refer to Joint Forum (1999a).

¹⁶ Cf. Labilloy (2003, p. 208ff).

Excessive leverage

Another way of capitalizing on regulatory inconsistency is excessive leverage. In this case, the risk-bearing capacities of subsidiaries are financed through the issuance of debt instruments. Again, by making use of excessive leverage, the financial group's consolidated capital is less than the sum of the capital positions of the regulated subsidiaries.

TBTF status and economic power

The establishment of financial groups or conglomerates in general goes along with an increase in size. However, from an economic theory's point of view, the size of an institution contributes to morally hazardous behaviour by the institutions' decision-makers due to a TBTF perception. That is, managers will engage in more risky politics as they face no (or limited) downside risks due to confidence in a bailout by the government. But there still remain several arguments that let agents refrain from excessive risk taking. For instance, high-risk taking does not compensate for the potential loss of a valuable charter value, the present value of future business.

The establishment of financial groups leads to an increase in market concentration, which may ultimately hamper competition. Owing to their market power, those groups may become too big to discipline. Simultaneously, the lack of competition may lead to a decline in financial innovation, which is indispensable for the smoothing of risks.¹⁷ A reduction in competition may simply provide disincentives for firms to improve efficiency. A rise in market concentration also means an increase in the proportion of large firms in the industry. Hence, systemic risk is increased through a size effect. However, a smaller number of market participants may, on the other hand, improve peer monitoring, thereby reducing systemic risk potential.¹⁸

Lack of transparency

The size and structure of large financial groups and conglomerates are the main sources of their complexity and hence can severely limit the supervisors' ability to assess their risk profile. In fact, many of the arguments on group risks mentioned above can be derived from the opaqueness of the financial organizations. Mainly, this lack of transparency justifies the special consideration of groups by regulators and supervisors. The obligatory transition to IAS/IFRS rules¹⁹ for financial groups will contribute to a more accurate picture of the companies' condition. Fair valuation in many areas, fewer options, more detailed notes or insurance specific standards, to name but a few, will strongly enhance transparency and facilitate the recognition of certain risks to the firm.

¹⁷ This was also an argument in the U.S. for the strict separation between commercial banking and investment banking as laid down in the Glass-Steagall Act (1933) before an extensive deregulation in 1999.

¹⁸ De Nicoló *et al.* (2003, p. 32).

¹⁹ According to regulation 1606/2002/EC of the European Parliament and of the Council, listed companies will have to use International Accounting Standards by 2005.

*Agency conflicts*²⁰

Owing to the relative size and opacity of financial groups, the agency relationship between the management (agent) and the diverse stakeholders of the group (i.e. shareholders, supervisors, creditors, employees, policyholders, etc.) may intensify certain conflicts and generate costs provoked by the agent's utility-maximizing behaviour, which may stand in contrast to the interest of the principals. Truly asymmetric information may induce management to pursue private gains at the expense of the group's stakeholders.²¹

Laeven and Levine²² even demonstrate that the market may punish diversification (by building large conglomerates) via a discount on its value. These results are ascribed to the intensified agency problems between corporate insiders and small shareholders. In other words, it is assumed that agency problems dominate any economies of scope associated with diversification and the implementation of incentive-compatible contracts is impossible. Additionally, Myers and Majluf²³ showed that if investors are less well informed than current firm insiders about the value of the firm's assets, then equity may be mispriced by the market. The cost of capital is also related to the opacity of the business, which requires it. These facts may be particularly relevant in the case of large financial groups since financial institutions are counted among the most opaque businesses.

Contagion

Contagion can be described as a negative externality that spreads from one group entity to another, ultimately resulting in the risk of loss to that other legal entity. According to Freshfields Bruckhaus Deringer,²⁴ contagion will generally be the result of some legal or factual connexion between the two entities concerned, and may take many forms, depending on the nature and closeness of this connexion. In principle, one can distinguish between direct contagion and indirect contagion, that is, an event does not give rise to immediate loss or exposure but results in changes in third-parties' behaviour, which consequently causes loss or exposure.

Particularly relevant for insurance groups are direct exposures such as an investment in or a loan to a primary entity, or an obligation to discharge or contribute to obligations of the primary entity.²⁵

An evident source of contagion within the insurance sector is reinsurance firms. This industry is highly concentrated and the reinsurance exposure of primary insurers has been growing.²⁶ Insuring the markets' peak exposures, reinsurers inherit all the risks that primary insurers cannot bear. Thus, a failing reinsurance firm might seriously harm already troubled insurers since they have to meet higher obligations than

²⁰ For an extensive survey on agency costs and asymmetric information in corporate firms, refer to Harris and Raviv (1991).

²¹ Cf. Jensen (1986) and Jensen and Meckling (1976).

²² Laeven and Levine (2004, p. 19ff).

²³ Myers and Majluf (1984).

²⁴ Freshfields Bruckhaus Deringer (2003, p. 19).

²⁵ Refer to Freshfields Bruckhaus Deringer (*Ibid.*) for several detailed examples.

²⁶ However, the increasing concentration in reinsurance has improved diversification (Swiss Re (2003, p. 13)).

expected in the event of a claim. Thus, reinsurance is a credit risk for primary insurers. Moreover, reinsurers are often the top trading company in a group structure and by this means can transmit shocks within and between sectors.²⁷ To sum up, bankruptcies of reinsurers, and therefore contagious risk, can primarily be triggered by the following three areas of operation: risk underwriting, retrocession and investment policy.²⁸ However, the aforementioned study has hardly found any evidence of systemic risk in reinsurance. The current market report on reinsurance firms by the IAIS²⁹ also attests a healthy state for the industry in 2003. Moreover, it finds no evidence of significant concentration of exposure to or by other sectors.

A direct exposure can also arise where courts are prepared to ignore corporate personality, resulting in the enforcement against one entity of liabilities of another. This so-called “piercing of the corporate veil” is particularly relevant in cases where the jurisdiction assumes excessive dominance of one entity upon the conduct of the business of another. That is, the various operating units of the group are compelled to bail each other out. Thus, risks can more easily spread from one entity to the other and in the worst case may provoke the insolvency of the entire group.

Indirect contagion is in part characterized by self-fulfilling prophecies and manifests itself, for instance, in reputational risk and funding liquidity risk. However, for the insurance industry, this kind of contagion risk is much less of an imminent problem compared to the banking sector since the cost for the withdrawal of capital is almost negligible: the redemption of an insurance policy is usually connected with a (heavy) loss for the insured due to the lower surrender values. Additionally, the process of redemption is relatively time consuming. However, for the insurance company, the loss in premia income is typically accompanied by a reduction in actuarial risk. In all, this kind of contagion risk is not negligible when markets do not distinguish between the solvent, regulated subsidiaries and the rest of the firm.

Non-regulated entities of the group

Non-regulated entities can be of particular concern since they are not subject to the supervisory scope, but still might affect regulated entities. For instance, the regulated entity might have to take on to a certain extent the risks associated with non-regulated companies’ activities if those were financed through “internal” loans or other forms of investment. Another argument is the indirect risk that a holding company’s activities might pose to regulated subsidiaries. As such, the results of a holding company’s businesses might provoke a change of the manner in which a subsidiary institution is operated.³⁰ Finally, difficulties in a non-regulated affiliate may also give rise to contagion risk for other entities within the conglomerate.

Outsourcing

Outsourcing – the use of a third party to perform activities on a continuing basis that would normally be undertaken by the regulated entity – is increasingly used as a

²⁷ Cf. Brouwer (2004, p. 4).

²⁸ Swiss Re (2003, p. 19).

²⁹ IAIS (2004, p. 3).

³⁰ Cf. Jackson (1997, p. 11).

means of both reducing costs and achieving strategic aims.³¹ Thus, in a setting where many businesses are strongly interwoven, supervision of financial service firms becomes a challenge. Furthermore, certain risks, such as reputation risk, strategic risk, contagion risk, etc. may evolve, which have not sufficiently been taken into consideration by the outsourcing entity.

An example for the broad variety of supervisory challenges is private trusts, as established in Austria. Those trusts are non-regulated entities and can legally not be considered as part of a financial group, while economically controlling relevant group business. They can be used to portion a stake in a subsidiary in an optimal way for meeting regulatory thresholds and for consolidation and hence may erode group solvency requirements.³²

International aspects

One aspect of moral hazard for financial groups originates from the organization and the structure of international supervision. Certain supervisory tasks are divided between host and home supervisors. Host supervisors may face incentive constraints to offer their service to foreign companies since the ultimate beneficiaries would be foreign shareholders and creditors, whereas the ultimate costs remain with the host country's residents.³³ Hence, they may be reluctant to fully cooperate with other authorities. Institutions aware of this situation have an incentive to engage in higher risk taking to improve company's profits. Operations may be organized across countries in a way that takes account of the diversity in supervision procedures.

Size

Another argument is the sheer size of some of these often rather opaque multinational financial groups, which might easily overstrain the capacity of supervisory authorities, even more so if these do not have (easy) access to all relevant data.³⁴

Group opportunities

Besides the numerous points that put emphasis on the risks originating from conglomeration and the building of large groups, several arguments support the view that certain risks can be easily diversified within financial groups.

The principal follows the diversification argument in portfolio theory, which stipulates that uncorrelated risks can level out each other and thereby limit the overall risk of the portfolio. A financial group should follow the same rule as a portfolio because often different products are offered, various markets are penetrated, a broad customer base is serviced, etc. Thus, idiosyncratic risks can be diversified away,

³¹ Joint Forum (2004, p. 4ff).

³² The incentive may even be higher for financial conglomerates as capital requirements are determined in a three-step approach, that is, at entity level, at (insurance) group level and ultimately at conglomerate level, which allows for more significant savings.

³³ Assumption: Owing to elasticity assumptions contributions of financial institutions to supervision can be transferred to clients, for instance, via higher costs of service. This can be an effect of reduced competition by virtue of the appearance of large groups with strong economic power.

³⁴ Cf. BCCI case.

provided that they are not fully correlated. Hence, the benefit obtainable will vary with the scope of activity³⁵ or, to be more precise, diversification benefits accrued depend on the number of risk positions (e.g. assets, liabilities, risk factors), the concentration of these positions and their correlation. On the other hand, firms may attempt to economize on their comparative advantage. Hence, affiliates will be related businesses or will continuously adjust to each other with the result of high positive correlations (and probably a high concentration) and rather low diversification effects.³⁶

However, the group structure may not only be a source of contagion but also a source of strength to member institutions. Although in most jurisdictions each legal entity of the group has a separate personality, due to the strong inter-relation distressed affiliated institutions are more likely to receive injections of capital – in the form of intra-group transactions – than stand-alone companies.³⁷ Legally, no entity is responsible for the liabilities of other (affiliated) institutions. However, holding companies may act as kind of a lender of last resort to its subsidiaries and thus reduce their risk of failure. Hence, this fact as well contributes to the safety of groups and has to be taken into account in the risk assessment of the group as a whole and its constituting institutions. It may also positively affect the rating of related institutions and ultimately their creditworthiness. As such, the mere presence of intra-group transfers is not a matter of supervisory concern. They can both be beneficial or harmful to the group as a whole.³⁸

Existing measures

Diversification effects (as assessed in later sections) are definitely a strong argument for the building of groups and conglomerates. However, certain deficiencies can emerge that consume parts of the achieved benefits of groups. Unfortunately, those risks are often difficult to measure. Proxies often only allow for weak approximations. However, the establishment of certain rules or firewalls can restrict certain aspects and impact company behaviour.

Both the Third Non-Life Directive and the Third Life Directive³⁹ limit the scope of supervision over an insurance company to the financial situation of that individual insurance company as such. To account for specific risks of insurance groups, in particular for the financial situation of an insurance company, Directive 98/78/EC⁴⁰ was adopted and later interpreted by the Conference of Insurance Supervisory Authorities in their Helsinki Protocol.⁴¹ The necessity for the creation of group-wide risk management tools and the consolidation of solvency was particularly underpinned.

³⁵ Cf. Oliver, Wyman & Co. (2001) and Kuritzkes *et al.* (2002).

³⁶ Cf. Santomero and Eckles (2000, p. 15). Also, contagious risk might increase given rather similar business models.

³⁷ Cf. Ashcraft (2004).

³⁸ Cf. Joint Forum (1999a).

³⁹ European Community (1992a, b).

⁴⁰ European Community (1998).

⁴¹ Conference of Insurance Supervisory Authorities of European Member States (2000).

Directive 98/78/EC requires the supervisory authorities to supplementarily consider the relevant financial affiliations between the insurance company and other parts of the insurance group, without, however, undertaking supervision of the group itself as a whole.⁴² In other words, the prudential supervision of insurance groups completes but does not replace the prudential supervision of their entities. The main specifications of this directive concern the coordination of supplementary supervision between the relevant authorities and the supervision of intra-group transactions. In the Helsinki Protocol, the mode of cooperation between competent authorities is specified. It requires that supervisory authorities form a coordination committee, in which they exercise their supervisory tasks in a collegial manner. Those committees can appoint one or more members as key coordinator for the supervision of insurance groups.

The supervision on intra-group transactions and positions⁴³ shall reveal any perils to the solvency of an insurance undertaking, such that appropriate measures at the level of that company can be taken by the responsible authority. Intra-group transactions may cause supervisory concerns when they: (1) result in capital or income being inappropriately transferred from the regulated entity; (2) are on terms or under circumstances which parties operating at arm's length would not allow and may be disadvantageous to a regulated entity; (3) can adversely affect the solvency, the liquidity and the profitability of individual entities within a group; or (4) are used as a means of supervisory arbitrage.⁴⁴ However, the supervisory concerns have to be balanced against the improvements to risk management, that is, more effective control of capital and funding and cost efficiencies, which are the goals of many groups using intra-group transactions.⁴⁵

The Insurance Groups Directive in particular addresses the organization of supervision and intra-group transactions as potential sources of group risk. As a measure to limit contagion already at the individual insurance level, both the First Life Directive and the First Non-Life Directive⁴⁶ restrict the type of business conducted by excluding all other commercial business.

All these measures are definitely valuable means to mitigate group-specific risks. However, they may not suffice to guarantee an (complete) extinction of additional group risks since many of them are of an indirect nature and often difficult to quantify. The aforementioned obligatory implementation of IAS standards in 2005 for publicly listed EU companies, and thus the enhanced transparency of accounting, will certainly be conducive to the early discovery of potential group risks. A more holistic supervisory approach regarding the group as an entity instead of solo-plus supervision may also better disclose certain risks that are particularly related to the group as such but do not appear at the stand-alone company level.

⁴² That is why it is also called solo-plus supervision.

⁴³ While the Directive refers to transactions between the insurance undertaking and the other parties involved, the Helsinki Protocol states the necessity to include intra-group positions as well in order to realize changes in positions.

⁴⁴ Gruson (2004, p. 22ff).

⁴⁵ Joint Forum (1999a, p. 6).

⁴⁶ European Community (1978, 1973).

This may, however, be inconsistent with the policyholder protection goal mentioned above.

Gap between measures and challenges

The aforementioned measures to limit the risks of an insurance group primarily focus on direct contagion issues. Moreover, European group regulation rather addresses the international coordination of solo supervision than that of group supervision proper. Thus, certain risks remain or are not fully addressed.

Solo-plus supervision does not sufficiently take account of idiosyncrasies of groups since it basically represents an add-on to the individual insurer supervision only. As a matter of fact, this approach leads to inconsistencies. Different treatment of similar risk types in life and non-life insurers may provoke regulatory arbitrage by the insurance group, that is, the business is booked in those subsidiaries that face the lightest regulation, irrespective of their ability to manage the level of risk.⁴⁷ Moreover, it suffers from the ignorance of non-regulated entities in the assessment of group risk, although those may account for a non-negligible part of the overall risk. Contrary to the banking group directive,⁴⁸ no rules on large exposures apply. Although intra-group transactions are subject to supervision, the possibilities of interference are limited. Authorities are only required to take action when the solvency position of the insurance company is threatened.

As Kuritzkes *et al.*⁴⁹ explain, there is a danger that institutions will increasingly view risk and capital reporting as a game to be arbitrated, rather than as an opportunity to communicate their financial strength to the outside world. Since financial groups are prone to such opportunistic behaviour, it is even more indispensable to reduce any loopholes in group supervision that emerge due to their perceived and apparent opacity. Merely supplementary supervision of groups may not be sufficient.

Any moral hazardous behaviour that concerns the attempt of the financial group to subvert capital requirements has to be prevented. Supervision of intra-group transactions and positions as proposed in the insurance group directive is a necessary measure. However, there still remain possibilities for multiple gearing and excessive leverage in the absence of supervision of the group itself and the restriction to a solo-plus approach.

The enormous size and the vast portfolio of (international) insurance groups enable extensive diversification, but they are usually accompanied by reduced transparency and the general perception of being TBTF. Uniform accounting standards across countries, clear share of tasks between supervisors, cross-border coordination committees, etc., may enhance transparency and thus facilitate the supervision of large and complex groups.⁵⁰ First steps in this direction are directive 98/78/EC and its

⁴⁷ Kuritzkes *et al.* (2002, p. 7ff).

⁴⁸ European Community (2000).

⁴⁹ Kuritzkes *et al.* (2002, p. 9).

⁵⁰ A report on insights into first practical experience of cooperation on cross-border supervision is to be provided by the Insurance Group Supervision Committee in early 2005.

specifications in the Helsinki Protocol, and the compulsory implementation of IAS standards that guarantees uniform accounting procedures across Europe.

As already mentioned, according to EU legislation, supervision of the group itself is not undertaken. This stands in contrast to directive 2002/87/EC on financial conglomerate supervision,⁵¹ which also regards the conglomerate as a whole. An aggregated view provides several advantages over a solo-plus approach. On one hand, concentration of risks becomes more evident. On the other hand, diversification potentials, due to the larger portfolio and various only weakly dependent businesses, can also be taken into account more easily.

Assessment of group risk

Primary concerns

Conceptual difficulties for a consolidated view

When assessing the risks of a group, the following three conceptual difficulties for a consolidated view have to be taken into account: the time horizon of the various risk models, the confidence level applied and the aggregation of those risks over the whole group.

First, time horizons for the different company risks may considerably vary. For instance, in order to measure potential credit losses, most credit risk measurement models focus on a 1-year time horizon. Market risk, on the other hand, is usually covered by Value at Risk (VaR) models focusing on a one- or 10-day time horizon or even multi-year horizons for particular insurance activities, for instance, life insurance.⁵² In fact, the horizon over which market risk is measured should reflect the underlying business activity and decision horizon.

Hence, it appears doubtful whether those risks can be sensibly aggregated. The attempt to use a common time horizon for the various risks will lead to an undue modification of the VaR models and the assessment of the inherent risks. Scaling using the root-t rule, that is, multiplying the (daily) standard deviation by the square root of the time horizon, which is a standard approach, is inappropriate for non-i.i.d. data and may overestimate volatility at longer horizons.⁵³ However, since usually i.i.d. normal returns are implicitly assumed, the root-t rule can be applied to scale volatilities and risk. In most cases, this might be a rather innocuous assumption.⁵⁴

Second, harmonization of the confidence level across risks can be obtained by rescaling the risk to the desired percentile using a fixed scaling factor as if the distribution were Gaussian.⁵⁵ Naturally, the assumption of normality may possibly

⁵¹ European Community (2002).

⁵² Cf. Joint Forum (2001).

⁵³ Although not reflecting a fully accurate picture of the respective VaR, this is still a rather conservative approach due to overestimation of volatility and hence may still be valuable for a risk averse risk management.

⁵⁴ Cf. Danielsson and Zigrand (2003, p. 16).

⁵⁵ Cf. Saita (2004, p. 14).

not reflect the real situation or may simply be false in practice, but it hopefully still enables a rough approximation.

Lastly, the simple add-on approach for the assessment of overall company risk may not sufficiently take account of possible diversification effects and particular group risks, for instance, reputational risk or other forms of contagious risk. Only under the premise that contagious risks and diversification effects level each other out, this concept reflects an accurate picture of the group's riskiness. However, generally this aggregation method does not recognize actual circumstances. Used as a supervisory tool to assess group risks and ultimately to define capital requirements, this method might punish companies with a large portfolio and a strong diversification potential that contributes to risk mitigation.

Coherent risk measure

To provide a more adequate picture of a group's consolidated risks, we have to find a coherent risk measure that allows an appropriate evaluation and consolidation of such risks, in particular concerning the degree of magnitude of the severity of a potential loss. A further property of this risk measure is its ability to accurately and consistently compare the severity of different risk portfolios.⁵⁶ According to Artzner *et al.*,⁵⁷ such a coherent risk measure has to fulfil the following requirements:

- (a) *Monotonicity*: $X \leq Y \Rightarrow \rho(X) \leq \rho(Y)$; that is, greater returns come with greater risk.
- (b) *Positive homogeneity*: $\rho(\lambda X) = \lambda \rho(X)$ for all $\lambda \geq 0$; that is, larger positions bring equal risk to many (λ) smaller positions.
- (c) *Translation invariance*: $\rho(X + c) = \rho(X) - c$ for all $c \in \mathbb{R}$; that is, by adding a sure return c to a position X , the risk $\rho(X)$ decreases by c .
- (d) *Subadditivity*: $\rho(X + Y) \leq \rho(X) + \rho(Y)$.

However, the requirement of subadditivity poses some difficulties in the assessment of consolidated risks of a financial group. It states that the total risk should at maximum equal the sum of the individual risks. As standard portfolio theory suggests, whenever correlation is less than perfect, this circumstance should allow for diversification. That is, the idiosyncratic part of risk can be diversified away, such that the risk of the whole becomes lower than that of the sum of the individual entities. According to supervisory view, this coherence is not necessarily given when examining consolidated risks of a group, as the group as such bears certain risks not inherent in the stand-alone company.

Hence, coherent risk measures were extended to convex risk measures or weakly coherent risk measures by relaxing the constraints of subadditivity and positive homogeneity and instead requiring a weaker condition:⁵⁸

- (e) *Convexity*: $\rho(\lambda X + (1 - \lambda)Y) \leq \lambda \rho(X) + (1 - \lambda)\rho(Y)$ for all $\lambda \in [0, 1]$.

⁵⁶ For instance, VaR faces the shortcomings to ignore diversification effects and the severity of events.

⁵⁷ Artzner *et al.* (1999, p. 5ff).

⁵⁸ Cf. Cheng *et al.* (2004, p. 4ff).

Causes for misestimating group risks

Indeed, there are several arguments that even support the view that the inequality of the subadditivity requirement, a major “pillar” of portfolio theory, may not hold. Indeed, taking into account reputational effects, that is, the idea that problems in one part of a group may affect confidence in other parts, the risk of the whole might well be greater than that of the sum of its parts. Following this line of argumentation, the Joint Forum⁵⁹ comes to the conclusion that in the absence of consolidated risk management, significant risks could be overlooked or underestimated.

Another explanation, besides the argument of reputational risk, for this divergence from the conclusion in portfolio theory lies in the fact that risks are determined by many factors that can vary over time and are interdependent. Hence, any outcome also depends on decisions of other players. That is, the volatility of one unit’s profitability may be affected by the actions of another unit within the financial group or conglomerate. Consequently, the aggregate position of the firm can be riskier than that of the sum of the assumed individual risks of the various business units.⁶⁰

The challenge is now to find an appropriate risk measure that reproduces as well as possible the consolidated risk of a group. Potential diversification effects have to be taken into account along with the possibility of additional group risks not considered at individual business units’ level.

A further challenge is the fact that the convenient use of linear correlation to detect interdependencies between risks may not be a useful method. First, the inclusion of non-linear derivative products invalidates many of the assumptions underlying the use of correlation. Furthermore, insurance claims data are typically skewed and heavily tailed. However, correlation is a measure in the world of multivariate normal distributions. An identical correlation does not necessarily tell us anything about the dependence structures of different distributions. Linear correlation also fails to capture all the dependence structures that exist between losses of multiple business lines, which is particularly relevant in the assessment of group risk. It might miss the fact that certain areas of the loss distribution are highly correlated, while others are less correlated or independent. As seen from extreme events like 11 September 2001, dependency usually increases in the tails. That is, whereas in “normal” circumstances, various lines of business may look almost independent, they become correlated in extreme events. Hence, dependence can be a valuable aspect for the management of the group or its supervisors. They are interested in whether extreme events have a tendency to occur together,⁶¹ that is, whether the distribution has tail dependence, and certain loss distributions show dependence only in the extreme tail. An often-cited example is the earthquake causing widespread damage to commercial property and triggering other catastrophes leading to further losses.

Economic capital and copula models

Economic capital models are current state of the art methods to assess minimum capital needed to guarantee smooth operations. Unfortunately, the concept of

⁵⁹ Joint Forum (1999b, p. 4).

⁶⁰ For detailed examples, see Cumming and Hirtle (2001, p. 44ff).

⁶¹ Cf. Embrechts *et al.* (2002).

economic capital,⁶² which can be defined as sufficient surplus to cover potential losses at a given tolerance level over a specified time horizon,⁶³ usually assumes independence of claim costs from one business to the other within the group. That is, financial institutions do normally abstract from potential mutual impact between the various business areas and risks although the dependence structure may have a substantial impact on the economic capital of that firm. Therefore, this aspect has to be included in the concept of economic capital if it shall be recognized as a cushion against all unexpected losses resulting from insurance losses or asset returns that fall below the levels expected, at the company's level of comfort. The concept as such, if adapted, is rather convincing since it provides the company, and to some extent also the supervisor, with a single number that reflects the aggregate risk of the company risk portfolio.

A concept that combines all the aforementioned properties – for example, coherent risk measure, consideration of dependencies, etc. – is the copula function. As the name already implies, the copula couples the marginal distributions together to form a joint distribution. This function embodies all the information about the dependence structure between the components of a random vector and, hence, allows the modelling of these dependence structures considering different distributions. Copulas are a means to obtain a joint return distribution of a portfolio when the percentiles of the portfolio differ from the percentiles of the marginals, whereas in usual portfolio VaR approximations, the equality is taken for granted. Additionally, those models face the deficiencies of certain restrictions, for instance, perfect correlation or restrictions of percentiles (e.g. to come from a normal density). These assumptions limit the dependence on the data available.⁶⁴ To this extent, the inclusion of copula theory into the economic capital approach makes sense as it allows an appropriate risk aggregation considering potential diversification effects.

Although this extended concept of economic capital including the use of copulas is an appealing methodology, as it provides a single metric to measure a firm's risk, it still bears certain deficiencies. Certain risks, such as operational risk, business or reputational risk are not easily quantifiable and consequently urge the use of proxies (e.g. equity prices), which, by definition, can only offer an approximation. The Joint Forum's Working Group on Risk Assessment and Capital⁶⁵ emphasizes some additional aspects of why supervisors may be justified in pursuing a rather cautious approach by neglecting diversification across company risks, that is, the assumption of perfect inter-risk correlation. One argument is the lack of data available to allow the justification of the calculations. Moreover, correlation may fluctuate over time and

⁶² Mind the distinction from regulatory capital. Economic capital is based on the calculations that are specific to the company's risks, while regulatory capital is based on industry averages and does not account for company specificities and relative risk attitudes. Its purpose is to balance the trade-off between the solvency and the profitability objective. Economic capital is a measure of the amount of capital that a financial institution should have at the minimum, to be able to withstand both expected and unexpected future losses.

⁶³ There exist many alternative definitions for economic capital.

⁶⁴ Cf. Rosenberg and Schuermann (2004, p. 13).

⁶⁵ Joint Forum (2003, p. 12ff).

according to several estimates seems prone to revert to one during episodes of stress. As a consequence, the extent of diversification strongly diminishes. The events of September 11 provide an example of the potential for simultaneous effects in capital and insurance markets that would not normally have been expected to be highly correlated. In order to confront the solvency of a company with such unfavourable scenarios, Faivre⁶⁶ proposes the use of Gumbel copulas, a representative of Archimedian copulas, for stress testing, where major events tend to be linked while the most common claims remain independent. One, however, has to be aware that they can only model independence or positive dependence structures, and as they depend on a single parameter they have no allowance for special treatment of some components.

Additional concerns from a supervisor's point of view

Another argument that may make supervisors unwilling to fully take account of diversification to elicit capital requirements derives from the fact that a substantial diversification benefit might encourage the establishment of large financial firms. However, those large institutions are also associated with higher potential social costs of failure.⁶⁷ Moreover, there may be a strong tension between the objective to exploit synergy potentials, which necessitates the reduction of strict firewalls between the different business areas, and the risk of contagion.⁶⁸ Those risks are usually not accounted for in management's calculations for the group. Correspondingly, higher prudential standards can in such a case be a counterbalance to these developments.

Insurer risks

Literature provides a large variety of approaches for risk classifications. In this paper, we follow the approach proposed by the working party for the IAA Insurance Regulation Committee⁶⁹ because it provides a clear illustration of major insurance risks while being largely accordant with the Basel II risk categorization for banking. Insurer risks are partitioned into six major risk groups, each consisting of several risk elements:

- underwriting,
- credit,
- market,
- operational,
- liquidity,
- event.

Clearly, liquidity risk and event risk could as well be subsumed under market risk or operational risk, respectively. However, the emphasis on these particular aspects of potential insurer risks first shows their importance to the business, and second, it shall

⁶⁶ Faivre (2003, p. 6ff).

⁶⁷ Mind in particular the problem related to the TBTF property.

⁶⁸ Freshfields Bruckhaus Deringer (2003, p. 65).

⁶⁹ IAA Insurance Regulation Committee (2002) and International Actuarial Association (2004).

enable a distinction between internal risks over which the company has control and event risks that are external to the firm. Besides underwriting risk, which is specific to the insurance business, all the other risks are generally present in other financial institutions as well.⁷⁰ As a matter of fact, risk of financial loss to an insurance firm might therefore be driven by many of the same influences affecting a bank.

In principle, all the aforementioned risk elements have to take account of the three following key risk components: volatility risk; uncertainty risk, which is a non-diversifiable component of the risk; and extreme event risk.

Underwriting risk

It is the umbrella term for a multiplicity of risks covering both the perils from the specific line of insurance and the specific processes associated with the conduct of the insurance business. It relates to the risk that an insurance company will suffer losses because the economic situation or the occurring rate of incidents have changed contrary to the forecast made at the time when a premium rate was set. Typical examples of underwriting risk that apply to all lines of insurance are underwriting process risk, pricing risk, claims risk, economic environment risk, etc.

Credit risk

It is the risk of default and change in the credit quality of issues of securities, counterparties and intermediaries, to which the company has an exposure. Being traditionally associated with assets, credit risk can exist with respect to any set of projected future cash flows and can therefore contribute to the assessment of outsourced risks. This kind of risk has increased in importance due to the migration of credit risks from the banks to the insurance and reinsurance sectors, that is, risk arbitrage across sectors. Still, the most significant component of credit risk, in particular for general insurers, may be that associated with the failure of reinsurers to meet their obligations when due. Moreover, it is present in the extensive bond portfolios held by the companies. Credit risk can be reflected in the present value of a set of cash flows either implicitly via a credit risk spread incorporated in the discount rate or via explicit modelling of the cash flows themselves. In the European Union, many jurisdictions restrict the exposure to credit risk by prescribed investment rules that limit the types and amounts of assets that insurance firms may hold.⁷¹

Market risk

In principle, market risk arises from the level of volatility of market prices of assets, that is, it describes the risks from variations in financial markets such as changes in interest rates, in equity indices, etc. It involves the exposure to movements in the level of financial variables such as stock prices, interest rates, exchange rates or commodity prices. A shift in market prices may exacerbate the generation of income and the achievement of a liquidation value of invested premia to meet the firm's liabilities.

⁷⁰ Hence, the strong accordance of insurance risk presentation with the Basel II approach for banking risks (see, among others, Creedon *et al.*, 2003, p. 21ff).

⁷¹ Joint Forum (2001, p. 17).

Market risk can only be measured appropriately if the market value of assets and liabilities is measured adequately. Owing to the lack of a real market for insurance liabilities, the market value of insurance liabilities can be approximated through evolving fair value techniques. The risk measurement time horizon⁷² for the insurance industry is considerably longer than that for banks since it shall reflect the underlying business activity and decision horizon. Hence, it is more appropriately defined in terms of years (instead of days or hours).

Operational risk

Following the new Basel Capital Accord, operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems (or from external events). Capital management focuses significantly on those operational risk events which are infrequent but of high severity since more frequent but smaller events are assumed to be easily mitigated by the quality of internal controls. A typical operational risk occurring in life insurance is, for instance, failure in unit pricing, although this kind of risk is usually categorized as high-frequency–low impact. Besides the difficulties to evaluate these kinds of risks, there is the immediate problem of double counting. For instance, a certain misconduct of an employee (i.e. operational risk) may only become material after adverse developments in the markets. The measurement of operational risks is particularly difficult since they must, to a large extent, be based on qualitative data and in general those data have not been collected so far.

Liquidity risk

This risk is expressed by the exposure to loss in the event that insufficient liquid assets will be available from among the assets supporting the policy obligations to meet the cash flow requirements of policyholder obligations when they are due. The exposure to this particular risk increases significantly when the credit quality deteriorates because of policyholder withdrawals.⁷³ This particular risk is strongly related to market risk, in particular pricing risk, which can in many cases also be a trigger. Hence, we may experience the same mapping difficulties as for operational risk, although we have to notice that liquidity risk is less of a problem for insurances (for instance, in comparison to banks) owing to the reversed duration structure, with long-term liabilities and short-term assets.

Event risk

Event risks are all sorts of risks outside the control of the enterprise, which can have a significant impact, for example, disaster risk, legal and political risk, etc.

Obviously, due to their different structures, life and general insurers are harmed to a different degree by certain risk aspects. This fact makes a classification of risks for

⁷² Owing to the different structure compared to banks, the consequences of certain market changes (e.g. a short-term interest rate rise) are also different (cf. Bikker and Van Lelyveld, 2002, p. 15).

⁷³ This risk is typically mitigated by the inclusion of specific charges for early withdrawals.

insurances even more difficult and leads to the multiple and different classifications of risks. A European Commission study⁷⁴ (carried out by KPMG) tried to contrast the relevant risks for both the life and the non-life sector of the insurance industry.

Risk assessment

In order to assess all the risks of an insurance company or group, probability distributions are commonly used. They describe risks by giving the likelihood of all possible outcomes. Depending on the kind of risk and the business the insurance is in, those (marginal) distributions can significantly differ in their tail weight. Hence, it is even more important that the model underlies an appropriate distribution. However, we have to be aware that certain parameters are often difficult to estimate due to, for instance, data shortages, contamination of observations, etc., and that they might change over time.

Owing to certain infrequent but sizeable losses, many insurance risk distributions are skewed. Therefore, it is also indispensable to choose the right risk measure that also takes into account fat tails of a distribution, which is especially relevant in non-life (or general) insurance. For that reason, it is often argued in favour of the Tail-Value-at-Risk,⁷⁵ (TVaR) instead of the usually used VaR as it incorporates the quantile VaR plus the average exceedence of that quantile and is thus able to consider special events. Its main advantage is that it not only reflects the frequency of shortfall but also the expected value of shortfall. Moreover, it also fulfils the four requirements for a coherent risk measure as stated by Artzner *et al.*⁷⁶ A major drawback of TVaR is that it cannot properly adjust for extreme low-frequency and high-severity losses as it only accounts for the expected shortfall,⁷⁷ and hence only assesses the mean size of losses exceeding the VaR but ignores losses below the VaR.

An additional aspect in the assessment of risks is to which extent certain risks could be outsourced to reinsurers. Reinsurers have the effect that they can greatly reduce the extreme tail of the cedant's loss distribution. However, this comes at the cost of sacrificed earnings through premium payments to reinsurers. Additionally, credit risk for insurers might increase if the reinsurer is unable or unwilling to perform.

A major difficulty in the assessment of the risks of a group is the fact that the distributional behaviour of each risk can considerably differ among the business lines. Moreover, the different risks are not equally distributed either, for instance, the tail weight can be considerably different.

Aggregation of risks

Assuming perfect dependence between the losses of the different business lines, the calculation of group risk, using economic capital as a proxy, is straightforward. The

⁷⁴ European Commission (2002, p. 20ff).

⁷⁵ Almost synonymous expressions are Conditional Tail Expectation (CTE) or expected shortfall (ES). For differences, refer to Cheng *et al.* (2004, p. 9ff).

⁷⁶ Artzner *et al.* (1999, p. 5ff).

⁷⁷ Wang (2002, p. 61).

aggregated economic capital required will simply be the sum of the respective economic capital requirements for each business line.

However, risks are rarely perfectly dependent and there is substantial room for diversification, which requires a different approach to assess the overall risk of a financial group.

The following three issues have to be taken into account when aggregating different risk measures:⁷⁸ (a) the identification of components that have to be aggregated; (b) the choice of the relevant aggregation technique or algorithm; and (c) the calibration of parameters.

Aggregation of risks occurs at two levels. At the first level, given known marginal distributions, the respective risks in all business lines are aggregated within a single risk type.⁷⁹ In the end, this procedure should result in a joint distribution for each risk factor. The second level contains the aggregation of risks across risk types, that is, the different insurer risks are combined. Theoretically, the results should then provide us with the overall risk of the group.⁸⁰

The argument for this two-level approach lies in the fact that different sensitivities to the various risk types have to be assumed across the business lines of the respective groups. Hence, first, the particular risks have to be assessed from a group's viewpoint. Only in a second step, the aggregation across all risk types can then be conducted in order to evaluate the overall risk.

However, certain inconveniences complicate an accurate assessment of the amount of risk of the group and necessitate certain simplifying assumptions. This fact leads to a trade-off between the accuracy of the results and the number of premises that are necessary to enable or ease the calculations and their comprehensibility. Different risks are assumed to underlie different distributions due to different risk sensitivities. However, also within a certain risk category, different business lines may require different distributions. The assumption of equal distributions across business lines in insurance is particularly problematic as business in the life and non-life sector (or even within non-life insurance) is notably divergent. Especially in non-life insurance, one also has to keep reinsurance in consideration. Reinsurance particularly assumes risk in the tails, at the cost of potential additional credit risk.⁸¹ Additionally, across business lines, certain risk categories have to be borne to a different extent. For instance, life insurance has to bear relatively more market risk than non-life insurance, but considerably less operational risk. Thus, it appears that to make the right decision concerning generalization and assumptions becomes crucial.

Different aggregation algorithms and techniques have been proposed in the literature carrying both certain advantages and disadvantages.⁸² In this paper, we

⁷⁸ Cf. Saita (2004, p. 15).

⁷⁹ It is assumed that risks differ across business lines, for example, market risk may underlie different distributions in life and non-life insurance.

⁸⁰ An aggregation across risk types followed by an aggregation across business units should lead to the same final result.

⁸¹ For argument, refer to an earlier section.

⁸² See table in Saita (2004, p. 27).

focus on the copula method of aggregation since under the premise of access to sufficient data, it should provide the most realistic results.

To our knowledge, one of the first papers to estimate group risk of insurance groups⁸³ with real numbers by using copulas is that of Tang and Valdez.⁸⁴ The results suffer from several (necessary) assumptions, but it still provides us with sufficient insight into the assessment of overall group risks.

To keep their analysis tractable, the following limitations were added: the modelled multi-line insurer restricts its business to general insurance (i.e. non-life insurance). The authors then focus purely on one risk, that is, underwriting risk, while ignoring other sources of risk. The effect of reinsurance is also excluded from the analysis. For the sake of simplicity and tractability, the analysis is restricted to elliptical distributions as these distributions are amenable to standard risk management approaches. For instance, they support the use of VaR as a measure of risk.⁸⁵

The authors use a gross loss ratio, defined as the ratio of cross-incurred claims to earned premia, in order to enable a valid comparison between losses from business lines and with different loss exposure and to estimate their underwriting risk distribution. As the risks covered by each business line differ, the distributional behaviour must also differ. The selection of the marginal distributions has to take tail behaviour into account. For the five business lines, three appropriate marginal distributions were found.⁸⁶

The effect on (economic) capital requirements is then analysed by using copulas. Within the range of elliptical copulas three variants are presented: the Normal, the Student-*t* and the Cauchy copula. Normal copulas are a very popular choice in practice due to the common assumptions of normality in financial applications. Unfortunately, the Normal copula does not give sufficient extreme correlations and shows asymptotically zero correlation at the extreme tails.⁸⁷ Student-*t* copulas⁸⁸ might more adequately reflect losses in the insurance business due to their consideration of tail dependence. Capital requirements are then calculated using the VaR risk measure or the TVaR. The diversification benefit is then calculated as the difference between the capital requirement on the aggregate loss and the weighted sum of the capital requirements of each business line as if each were a stand-alone business.

Conclusion

Certainly, both insurers and supervisory authorities agree that the current approach to estimate group risks is not the *ultima ratio*. It assumes perfect dependence between risks and does not account for potential additional risks resulting from the group as

⁸³ For a purely theoretical assessment of group risks and dependence, see Faivre (2003).

⁸⁴ Tang and Valdez (2004).

⁸⁵ Refer to Embrechts *et al.* (2001) and Embrechts *et al.* (2002) for the motivation to use elliptical distributions and their shortcomings.

⁸⁶ The three marginal distributions are Pareto, Log-normal and Gamma, with Pareto having the heaviest tail weight and Gamma the lowest.

⁸⁷ Embrechts *et al.* (2001, p. 26ff).

⁸⁸ Cauchy copulas are a special case of the Student-*t* copula with one degree of freedom.

such. Nor does it account for the risk mitigation properties inherent in groups like diversification effects or capital injections by a holding company to its subsidiaries. A wealth of more sophisticated methods has been proposed, but they all more or less suffer from the same shortcomings:

- Lack of data or very short time series with too few data points.
- Cost–benefit ratio in comparison to conventional calculations.
- Validity of the model.
- Dependencies may change over time and in extreme events.
- Non-quantifiable risks can have significant impact.
- Choice of adequate copula has paramount effect on:
 - (economic) capital requirements for the firm or the group,
 - diversification benefits.⁸⁹
- Diversification may not be a sufficient argument for a reduction in regulatory capital.

The best model is of no use when the relevant (amount of) data (is) are not available. Unfortunately, insurance data have not been collected to the same extent and for the same long time period as is the case in the banking industry. Thus, calculations may only give very crude approximations and do not provide detailed insights for both the group and its supervisor.

Another point is the relation between costs and benefits of such a model. The development and maintenance of such statistical models may be very cost intensive and the savings for the group in terms of diversification benefits are not that clear by now. Hence, it may only be reasonable for very large groups (companies) to develop respective models.

A very important aspect is the validity of the model. It is challenged in two respects: dependencies between risks may change over time. In extreme events, like earthquakes or terrorist attacks, dependency will certainly increase. Accordingly, the model has to take these facts into account and must be regularly adapted. Moreover, the model has to consider risks that are hardly quantifiable, like reputational risk, but have an imminent impact on the financial safety of the group. Possibly, one has to search for adequate proxies.

Finally, copula models are definitely cutting edge methods to estimate group risks. However, it is imperative to find a suitable model that best represents actual conditions.

Overall, from a supervisor's or regulator's point of view, there has to be clear support for these developments. In the industry, there is a strong tendency towards the development of respective models. Furthermore, such models may make the rationale for the supervisor's requirements more transparent. However, one has to be aware that risk aggregation at group level may reintroduce the problems, which firewalls were designed to address. That is, if one takes account of diversification effects at group level, one also has to be aware of the fact that the various subsidiaries of the group are then compelled to underwrite the risks of the other respective companies. This way, the

⁸⁹ Cf. Tang and Valdez (2004).

channel of direct contagion is reopened.⁹⁰ The counterargument from the industry may be that diversification contributes to a diminished volatility of aggregate returns, and thus to a reduction of systemic risk. Hence, from a supervisor's perspective, it is questionable whether diversification effects can be considered as an argument to reduce regulatory capital requirements. This argument stands in contrast to groups' economic capital calculations. The potential for cross-subsidization diminishes the danger that the firm will have to approach the capital market and so increases its value.⁹¹

Suggestions for further research

As mentioned above, it is worthwhile to put further effort in the research of particular dependencies between companies within a group in contrast to stand-alone companies. From theory, we know that there must be certain diversification effects. However, we also strongly agree that the structure of groups may be responsible for certain risks that do not emerge in individual companies. Hence, the question is which effects exceed and ultimately how regulation and supervision should be organized.

Given the challenges recognized in the assessment of group risks, the following concluding remarks may give some input for further research:

- Certain group risks like reputational risk are difficult to quantify and therefore are not taken into account in diverse risk aggregation models. Cross-correlations of share price developments due to certain events or ratings may function as a proxy. In fact, one may estimate the overreaction of the market to a related company in the course of a downgrade event. The results have to be contrasted with the dependence structure of independent companies or those that are perceived as independent.
- The group structure as shown by Ashcraft⁹² may also represent a source of strength to its affiliated companies and in this manner, somehow counterbalances the aforementioned argument. To evaluate this effect, the recovery from and the transition into financial distress of affiliated companies in comparison to stand-alone companies may be assessed.
- In Basel II, several methods are proposed to assess the capital requirements in the banking sector. The Australian supervisory authority follows a similar approach for the insurance sector and requires all insurers who do not use an internal model to determine their appropriate capital requirement to use the so-called Prescribed Method. The NAIC risk-based capital model for insurance companies may also constitute a simple approach that may be extendable to a group risk model. Comparably to the risk adjustment formula for the various insurance risks within an insurance company, a formula for risk aggregation across business lines may be developed. However, standardized methods usually suffer from the constraint that they may not adequately reflect the different business lines of an insurance group. It may be difficult to develop a "one size fits all" solution reflecting the idiosyncrasies

⁹⁰ Cf. Morrison (2003, p. 530).

⁹¹ *Ibid.*, p. 531.

⁹² Ashcraft (2004).

of all insurance types, and hence appropriate for insurance group assessments.

To develop a common standard approach that best reflects the insurance industry and its risks, the extent of add-ons for group risks has to be appropriately measured. A conservative approach that simply adds risks assumes perfectly correlated business, which is improbable. In fact, such an approach presumes that additional group risks completely outweigh diversification benefits, or vice versa.

- Internal models may better account for idiosyncrasies of the diverse insurance groups. However, to be permissible, they must reflect the actual circumstances. Since capital requirements should not only be a burden to the group but essentially work as a measure to guarantee the stability of the market and the company *per se*, the establishment of internal models has to be encouraged by supervisory authorities. This necessarily means that supervisors have to keep up with current developments in risk assessment and aggregation. Furthermore, they have to be aware of the assumptions underlying the various methods and their consequences. Several companies already experiment with copula models to assess and aggregate their total company or group risks, as these models represent the state of the art and, contrary to generalized models, may permit to emphasize company specificities. The principal challenges for the aggregation of risks and ultimately for the assessment of the safety of an insurance group are the different distributions of the various insurance risks. Furthermore, the underlying distribution for the same risks may differ across business lines. However, certain assumptions that leave the model manageable impose constraints on its accuracy. One has to be well aware that different (copula) models may result in different final outcomes, for example, depending on the focus on fat tails of risk distributions. Hence, it is advisable to compare calculations with different underlying copulas. Tang and Valdez⁹³ provide an interesting model as to how one may approach the assessment of group risks. However, they restrict their model to underwriting risk and to the class of elliptical copulas. Nevertheless, it provides a good starting point and leaves room for further research.

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⁹³ Tang and Valdez (2004).

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