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QIS 2: Modelling that is at odds with the prudential objectives of Solvency II

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Abstract / Résumé

In light of the changing face of risks and how they are perceived, the existing prudential rules are totally inadequate and the European Commission has established a vast project to overhaul the methods used to determine the solvency of insurance companies. An important stage has been reached with the completion of the Quantitative Impact Study (QIS 2), which lays out the main proposals for the basis of the standard solvency formula. In this paper, EDHEC focuses on certain aspects of the modelling suggested by the CEIOPS in the QIS 2. We demonstrate that the choice of certain concepts, measures and calibrations are hazardous and, in particular, may result in strategic management decisions being taken by insurance companies that would be totally at odds with the initial objectives of Solvency II, both in insurance terms (using the net combined ratio as the sole indicator of profitability goes against the hypothesis that cash-flows must be discounted) and financial terms (completely unrealistic treatment of hedges and a treatment of equity risk that makes it prohibitive to hold stocks).

Face à l'évolution des risques et à leurs perceptions, les règles prudentielles actuelles sont totalement inadéquates et la Commission européenne a mis en œuvre un vaste chantier de refonte du calcul de la solvabilité des sociétés d'assurance. Une étape importante vient d'être franchie avec l'élaboration du « Quantitative Impact Study 2 » (QIS 2) dressant les principales propositions pour les fondations de la formule standard de solvabilité. Dans cette présente note, l'EDHEC se focalise sur certains aspects de la modélisation suggérée par le CEIOPS à travers le QIS 2. Nous montrons que les choix des concepts, mesures et calibrations sont parfois non seulement hasardeux mais surtout pourraient engendrer des prises de décisions stratégiques de gestion des sociétés d'assurance totalement contradictoires avec les objectifs initiaux de Solvency II, tant en termes assurantiels (l'emploi du ratio combiné net comme seul indicateur de la rentabilité est en conflit avec l'hypothèse que les flux de trésorerie doivent être actualisés) que financiers (traitement des couvertures totalement irréaliste, traitement du risque actions rendant leur détention prohibitive).

About the Authors

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Introduction

In the last few years, the evolution in the complexity of risks has led to a genuine desire to adapt the prudential rules in order to provide a better perception of all companies with regard to the risks being run. The European Union has undertaken an ambitious project – Solvency II – in the current decade to completely overhaul the existing prudential rules. Solvency II should constitute a significant change in the management of insurance companies and we feel that we are therefore on the verge of a major change with far-reaching implications for asset management and asset-liability management (ALM) practices in this sector[1]. With Solvency II, the EU wishes to "establish solvency requirements that are better adapted to the risks that are actually taken on by insurance firms and encourage the latter to better evaluate and control their risks."

An important stage has been reached in the development of Solvency II with the publication by the CEIOPS[2] of the second Quantitative Impact Study (QIS 2), which aims to use the responses given by insurance professionals to provide a quantitative estimate of the global impact of the new solvency system.

In order to provide as much clarity as possible as to the structure of Solvency II, we will first outline the major improvements expected from this new framework, as well as the Solvency II targets, and then focus on certain aspects of the modelling[3] suggested by the CEIOPS through the QIS 2. We demonstrate that certain decisions in relation to concepts, measures and calibration are hazardous, and that there is a serious risk that if not improved, the current approach would lead to an outcome of the standard formula that is inconsistent with the initial target of Solvency II, notably in terms of the management of insurance companies.

In particular, we provide an outline of the methods used in QIS 2 for the calculation of individual risk charges[4], as well as general rules for assessing which method to apply in which case. This will enable us to demonstrate clearly where the CEIOPS may have shown lack of judgement in the methods proposed in the QIS 2. We will also emphasise the importance of an adequate calibration of the formula, as inadequate calibration – in particular in the case of market risks – unfortunately results in incentives for mismanagement rather than sound management of risks.

1 - In a recent study, EDHEC provides details of the impact of the new IFRS accounting standards and the proposed new prudential regulations, Solvency II, on risk management requirements and practices, both in terms of asset management and asset-liability management in insurance companies (The Impact of IFRS and Solvency II on Asset-Liability Management and Asset Management in Insurance Companies, Noël Amenc, Philippe Foulquier, Lionel Martellini and Samuel Sender, EDHEC Publications, November, 2006).
2 - Committee of European Insurance and Occupational Pensions Supervisors.
3 - It is not the aim of this paper to provide exhaustive information.
4 - Capital required against a specific risk factor.

I. The Aims and Issues of Solvency II

European regulations require insurance companies to be solvent, i.e. sufficiently solid financially to respect their commitments to policyholders and other creditors. The foundations of the current solvency system date from the 1970s (notably European directives 73/239 for general insurance and 79/267 for life insurance). Since then they have been updated during the work on Solvency I, which began in 1997 and led to publication in 2002. However, while they enabled the power of the insurance companies' regulatory authorities to be extended, they barely modified the existing system.

Hence, all the actors in the insurance industry (both the insurance companies themselves and the supervisors) willingly recognise that the simplicity of the Solvency I rules is no longer suitable in light of the changes seen in the sector and the risks being run. This explains the need for reform. Apart from this obsolescence, we feel that Solvency I hampers both the development and adaptation of asset management and ALM techniques. Even though the ends are different, the means implemented by the IFRS, Solvency II, Basel II, the new rules for financial conglomerates and the EEV (European Embedded Value, developed by a group of financial directors – CFO – and risk management directors – CRO – from leading European insurance companies) all converge towards the goal of providing an improved perception of companies.

The objective of Solvency II is to determine the level of prudential capital required for each insurance company, based on an economic evaluation of the risks and no longer on a fixed-rate approach, as is the case today with Solvency I. This development should therefore lead to the following:

• Regulatory prudential requirements that are more consistent with the economic objectives. This should simplify the management of insurance companies, which are also subject to accounting (IFRS) and rating targets, and simplify asset management and ALM, following the necessary adaptation of the internal models to integrate this new environment.

• A more systematic and proactive approach to risk management, notably through ALM and asset management. By developing a more subtle and more severe evaluation of the risks (distribution, correlation, diversification, consideration of extreme risks, etc.) and by broadening their field of application (market, ALM, credit, underwriting and operational risks) beyond that defined by Solvency I and the IFRS, insurance companies will have to better capture, quantify and manage their risks, which will henceforth be identified sooner. This should lead to better market discipline.

• More efficient management of economic capital. The objective of Solvency II is to compel insurance companies not only to measure their risks better, but also to incite them to manage and control them better. The amount of capital required will depend on the capacity to achieve these objectives. The capital requirement exercises considerable pressure, because all mobilisation of capital has a cost, notably with regard to the optimisation of capital allocation by activity.

More specifically, Solvency I is today based on backward-looking financial statements, which leads to a decorrelation between the solvency margin and the future cash flows. This causes numerous paradoxes: the lower a company's reserves, the less capital it needs; the asymmetrical treatment of fixed-income gains or losses; the inclusion of gains on the asset side without restating the liabilities (artificial wealth), etc. Solvency II should adopt a more economic and forward-looking approach by establishing principles rather than directives, in order to encourage each company to set up more sophisticated internal risk analysis, management and control models.

Depending on the means available (the leaders in the sector are several years ahead of the other actors), the work to adapt or indeed to overhaul the internal models (asset allocation, ALM, provisioning, embedded value, and economic capital) is ongoing. Beyond the requirements of Solvency II, these models are at the heart of the management of every company. They should improve the competitiveness of their owners in an environment in which Solvency II, like Basel II, could redefine the confines of the insurance market (profitability that will henceforth integrate the risks being run) and financial strategies (asset allocation, hedging, more sophisticated ALM techniques, etc.).

In this sense, the trend towards the increasing 'financialisation' of ALM observed over the last few years should continue to grow. Solvency II should integrate the issue of asset-liability adequacy in the level of capital required, which should lead to more dynamic management of the differentials in duration and convexity between assets and liabilities, notably by turning to more structured and sophisticated interest rate products, (caps, floors, swaptions, CDS, etc.), and a transfer of some of the risks of mass insurance (securitisation of automobile and residential portfolios) and large insurance risks (natural catastrophe, mortality and life expectancy bonds) towards the financial markets.

II. The Ongoing Development of Solvency II through the QIS 2

As mentioned in the introduction, an important stage in the development of Solvency II has been reached with the release of the QIS 2 by the CEIOPS. The aim is to determine whether the initial proposals provide a sufficient balance between sensitivity to the primary risk factors faced by insurers and the complexity and soundness of the different approaches that were tested. The QIS 2 deals with:

1) the principles for evaluating assets and liabilities;

2) the SCR using a standard formula;

3) the SCR using the insurer's internal model and;

4) the MCR.

For further details, we invite the reader to refer to the appendix in order to better understand how the QIS 2 is articulated, as well as its content and key ideas.

This initial attempt to calibrate the MCR (Minimum Capital Requirement) and SCR (Solvency Capital Requirement) officially targets a level of prudence that corresponds to a VaR of 99.5%, this latter being used as a proxy for 99% Tail Var. However, the QIS 2 specifies not only that the factors and coefficients currently proposed must undergo tests by the CEIOPS, but also that the responses obtained by the QIS 2 will be invaluable in adapting these parameters.

The QIS 2 does offer the advantage of highlighting the risk concepts adopted and is sophisticated enough to handle the measurement and diversification of the risks but, as we will show in the next section, many choices of concepts, measures and calibration could result in management of insurance companies that contradicts and is inconsistent with the initial targets of Solvency II.

III. QIS 2 Risk-Modelling at Odds with Solvency II Targets

Although the model and the granularity of the standard formula proposed by the QIS 2 go some way towards meeting the objectives set by Solvency II (balance between sensitivity to primary risk factors and complexity), EDHEC, by outlining the methods used in QIS 2 for the calculation of individual risk charges, wishes to demonstrate in this paper that:

- the risk modelling is not always relevant and may lead to conflict with the initial targets of Solvency II (e.g. opportunistic regulatory capital arbitrage rather than efficient risk management);

- the calibration and stress scenarios proposed by the QIS 2 lead to demands on capital that are well in excess of those made by Solvency I (between two and four times depending on risk and activity, in particular with regard to companies that hold equities), while the regulatory authorities from each European country consider insurance companies to be well capitalised. This calibration, which the CEIOPS sees as a basis for negotiations, can therefore expect to see some key modifications.

III.1 Review of methods available for calculating individual risk charges and when they are appropriate

a) Factor-based

Factor-based calculations are the same as those involved in both the Risk Based Capital model (RBC) and the Solvency I approach. Each risk requires an amount of capital that is proportional to the size of the exposure. The latter is measured as market value in the case of RBC and generally as book value in the case of Solvency I.

This method is well suited where size does not bring any diversification benefits, and where the exposure to risk is proportional to the size of the business, i.e. where there are no mitigation techniques available.

This approach is used for example by the CEIOPS in the QIS 2 for real estate risk.

b) Factor-based, taking diversification benefits from size into account

For some risks, size brings diversification benefits. This is for instance the case when claims arise independently from different contracts. Here, risk is proportional to the square root of the number of contracts[5].

This method is well suited where size brings diversification benefits. In this model, it is supposed that risk exposure cannot be managed, but this exposure does not increase linearly with the size of the balance sheet.

For example, the CEIOPS used this approach for mortality risk (life underwriting), and more specifically for its volatility sub-component.

c) Scenario-based

The scenario-based approach consists in evaluating the effect of a particular scenario on the market-consistent value of either a set of liabilities, a set of assets or the balance sheet as a whole.

This method is well suited where there are risk factors for which volatility can be estimated by the regulator. For this approach to be relevant, these risk factors must impact all insurers according to their individual risk exposure and yet be beyond their control. In this model, it is supposed that risk exposure cannot be managed, but the company has no influence on these risk factors. Unlike the earlier models, once the net exposure (after financial hedging or reinsurance) is included, the impact of a scenario will change according to the company.

5 - When claims are independent, then the variance of the sum of the claims is equal to the sum of the variance of the claims. In this case, as variance grows linearly with the number of contracts, volatility grows linearly with the square root of the number of contracts.

This is particularly suited to market risks (e.g. for interest rate, equity, currency and real estate risks), at least in the standard approach, where the volatility of factors can be estimated by means of free historical data. It is also appropriate for the historical parameter estimate error of the mortality legal tables, as these are provided by the regulators.

This approach is used by the CEIOPS in the QIS 2 for interest rate and equity risks.

III.2 Hazardous choices of concepts, measures and calibration in the QIS 2 are inconsistent with targets of Solvency II

a) Market risks

Where there are market risks, it is the opinion of EDHEC that the scenario-based approach should be preferred. In the QIS 2, this is used for interest rate risk and equity risk but not for currency and property. It is important to mention that though interest rate risk is scenario-based, credit risk has been isolated from interest rate risk and even from market risks. The latter split is not natural because credit and interest rate exposures are not only highly dependent but also generally managed together when investing in corporate bonds. Indeed, the actual correlation between market and credit risks actually comes from the correlation between interest rate, equity and credit risks. This is not captured by the standard formula (for instance where market risks arise from FX and property) and leads to a bias in the estimate of required capital. For companies where credit and market risks have low correlation, the formula will require extra capital. We deal with credit risk in the next sub-section.

The scenario-based approach can be seen as encompassing the rudimentary factor-based approach without diversification benefits described previously, as it allows the calculation of risk charges (i.e. capital requirement for each risk described by the CEIOPS) when risk exposure is non-linear.

For currency risk, the current placeholder (mainstream) approach is a factor-based approach. However, as options are available to mitigate foreign exchange exposure, and are widely used, we think that this risk charge needs to be suppressed and replaced by the scenario-based approach, which would integrate the hedging items.

One wonders whether property risk has been defined as factor-based because the CEIOPS considers that property exposure is actually unhedgeable. While we admit that some of the idiosyncratic risk is unhedgeable due to poor liquidity and a lack of derivatives on unlisted buildings, future and derivatives are currently available to shed systematic risk. For example, Macro Securities Research, a company affiliated with Robert J. Shiller, reached an agreement in 2004 with the Chicago Mercantile Exchange to launch what are now the CME Housing Futures and Options, which have extended to the housing industry the same tools for risk management and investment that are available on more liquid and commoditised assets. As the lack of recognition of risk reduction techniques leads to the mismanagement of risks, EDHEC urges the CEIOPS to clarify its position on the subject.

Finally, it is also worth underlining that in terms of terminology, contrary to what the CEIOPS writes, we believe that equity risk should be referred to as being 'scenario-based' instead of 'factor-based', because the CEIOPS allows derivatives to be accounted for: "the immediate effect expected in the event of a 40% fall in all individual equities, also considering the effect on derivatives and short positions." In order to reduce the potential for confusion, we would expect the term 'scenario-based' to be used when referring to

market risk. We suggest that the term 'assets-only scenario-based' could also be used to avoid any confusion with the 'full balance sheet approach', which evaluates the impact of a given scenario on the net asset value. The lack of coherency in the calibration will be developed in a separate section of this document.

b) Credit risks

The current placeholder approach as described in the QIS 2 is a refined form of the factor-based approach (in it, risk charges are not solely a function of the market value and of the rating of bonds, but also of the maturity of the bonds).

However, we believe that credit is a field where the scenario-based approach would be most appropriate. By no means can a company influence the typical risk factors of the corporate debt market, spread risk and default risk, but it can manage its credit risk exposure either by dynamically rebalancing its portfolio or by purchasing credit derivatives (e.g. CDS).

Moreover, it becomes challenging to calibrate internal models to the assumptions of the factor-based approach, without assumptions being described in the form of a scenario. More precisely, the QIS 2 model does not offer the ability to deal with the spread risk and the default risk separately. The data concerning the credit market is not as rich as the data concerning the equity and governmental interest rate markets. But this is no reason to avoid the issue of setting up a market-consistent stress scenario.

We can also note that in the insurance business, credit risk exposure is generally built together with interest rate and equity exposure (aggregation of these three risks in order to integrate their dependence), rather than a two-step process imposed by the QIS 2, where the sub-components of market risk (equity risk, interest rate risk and others) are aggregated together before the resulting market risk is aggregated with credit risks. Here, the current two-stage aggregation of risks blurs the ability to comprehensively describe dependencies.

Finally, the calibration of the credit risk charge is neither consistent with 'market prices' nor with historical events. The current factors give rise to a completely disproportionate capital increase between the rating classes: by a factor of 10, for example, between AA and A, which is not proportionate to their relative probabilities of default over any given horizon. Though one may imagine that the artificial penalization of low-rated bonds is a strong incentive to build internal models, the CEIOPS must prove its embedded assumptions in a more consistent manner, given the hedgeable nature of the credit market.

c) Life underwriting

Life underwriting risks can also be referred to as biometric risks. In this paper, we have decided to focus only on mortality risk.

Mortality risk is split into three sub-components: volatility risk, trend risk and catastrophe risk. As individual risks are neither fully dependent (everybody will not die at the same time) nor totally independent (overall mortality rates may be higher than expected), this approach is fairly sensible.

Volatility risk shows the fact that mortality is a random event by essence, and claims are modelled as independent in this case. More precisely, the QIS 2 suggests two approaches for volatility risk:

- The current placeholder approach, where the volatility risk is a factor-based approach that takes the diversification in the number of contracts into account. This approach can be seen as a good compromise between accuracy and simplicity in implementation.

• The alternative approach does not take diversification into account in the volatility part of the risk. We believe this is totally unrealistic regarding the influence of the size of the portfolio on mortality risk.

Trend risk arises from the fact that mortality tables may be wrong. It is an error to estimate that mortality rates would affect all individuals, as to do so would be to treat risks as overly dependent. However, we believe that the placeholder approach, which uses a fixed percentage of mortality reserves, is too arbitrary.

EDHEC believes that the scenario-based approach, which is currently the alternative approach, is more relevant because it reveals how a drift in mortality rates would impact outflows contingent to mortality risk. However this approach needs to be refined. More precisely, we recommend taking into account in the stress scenario the fact that uncertainty grows with time rather than age. We are more likely to be wrong on the average mortality rate twenty years from now. On the other hand, the relative shift to mortality rates input in this approach would suppose that the standard deviation of the estimate of the mortality rate is small for young people and high for old people, and yet this is not necessarily true.

d) Non-life underwriting

Like for life underwriting, modelling consists of three sub-components of non-life underwriting risks. These are reserve risk, premium risk and catastrophe risk.

EDHEC totally disagrees with the approach to the reserve risk suggested by the QIS 2 because companies are required to use market-wide estimates of volatilities instead of volatility measured on their own books. The embedded assumption behind the current choice of the CEIOPS is that insurers have no means by which to manage their exposure to insurance risk, either by their subscription policy or their reinsurance policy. Not only is this a poor reflection of the nature of the non-life business, but it is also completely at odds with the Solvency II objectives, since companies that are managed carefully with appropriate subscription and reinsurance policies have the same capital requirements in terms of the volatility of non-life underwriting as those that practice subscription without risk selection.

As far as premium risk is concerned, it captures the risk that new business brings losses (e.g. due to mispricing) rather than profits to the insurance company. The approach is retrospective and based on the volatility of the combined ratio (average between market-wide standard deviation and entity standard deviation).

We believe that in the case of premium risk, the reference to the market-wide standard deviation[6] is excessive but mostly that the historical volatility of the net combined ratio is not a good measure of the risks. Indeed, because profitability is the result of two components (underwriting and financial profit), there is no objective reason why the net combined ratio should be stable over time in a well managed insurance company. It is possible to have stable good profitability with a highly volatile net combined ratio that offsets the opposite moves of financial profit[7]. Fundamentally, computing the historical volatility of the net combined ratio over fifteen years brings little incentive to enhance risk management techniques. Due to this biased analysis, from a quantitative point of view, the requirements from the standard formula are probably too demanding (two to four times those of Solvency I), particularly when we consider that regulators currently consider insurance companies to be well capitalised.

6 - For premium risk the volatility used in the formula is the market-wide estimate if the number of available years is less than eleven, and the historical volatility of the net combined ratio if there are 15 years available. In between, it is a geometric average of the two.

7 - Even without any risk in the balance sheet, the volatility of the net combined ratio would equal that of the price of a bond that has the same characteristics as the liabilities. More precisely, for any subscription year:

Before Tax Profit = Profitability*Premium income = Premium income – Sum of discounted claims = Premium income – Price of Replicating Bond

And premium income *(1-Profitability) = Price of Replicating Bond

As Combined Ratio = Undiscounted Claims / Premium, we obtain:

Combined Ratio * Price of Replicating Bond = (1 – Profitability)*Undiscounted Expected Claims.

As far as catastrophe risk is concerned, the placeholder approach currently consists in a kind of factor-based approach (where each insurance company owns its market share of the catastrophe scenario currently defined by each national regulator), on top of which the benefits from reinsurance are taken into account. Though the alternative approach is scenario-based, guidelines are missing as to how protection from financial instruments such as Cat Bonds must be taken into account. More than anything, the fact that diversification is neither recognised between lines of business nor between countries is inconsistent with the nature of catastrophes.

It is of great importance that revisions of catastrophe risk acknowledge benefits that diversification across business lines and countries can bring. This could be done by means of correlation matrices, as is generally the case in other parts of the QIS 2. Naturally, guidelines should be provided to assess the efficiency of protection offered by financial products with insurance features such as Cat Bonds. Last but not least, if catastrophe scenarios continue to be defined by the national regulator, as is currently the case, they must be defined in a homogenous way so as to allow comparability between countries. The CEIOPS and the European Commission must provide the national regulators with public guidelines.

We deplore the fact that the risk of inflation has not been isolated, even though inflation is treated as a hedgeable risk factor. As such, sound management of this risk should be matched by lower capital requirements. This improved management would involve a good ALM calibration and/or hedges via derivative instruments.

More precisely, just as there are interest rate-sensitive assets (bonds), there are inflation-linked assets (real bonds and inflation swaps). Equally, as discounted liabilities are sensitive to interest rates, exposure to inflation is built in to the non-life books as these companies provide protection against damage to goods and people. Damaged goods must be replaced or repaired for an amount which is subject to the price of goods; care and treatment has to be provided in the case of bodily injury for an amount subject to the price of health and services. And the sum of exposures to individual components of the consumer price index can be treated statistically as an overall exposure to the consumer price index, which is hedgeable.

III.3 Market consistency, calibration and risk management

We have already demonstrated the risks of inadequate modelling regarding the aims of Solvency II in terms of the management of an insurance company. In this section, our aim is to show that the QIS 2 also suggests some very dangerous calibrations. We believe that the scenarios must be calibrated to market data and that dynamic strategies must be recognised. Were the Solvency II standard not to respect this principle, this would unfortunately create incentives for the mismanagement of risks, as is shown below.

III.3.1 Lack of benefits from geographical diversification or beta management may generate mismanagement, thereby going against the initial targets of Solvency II

In the standard formula, no benefits from geographical diversification or from beta management can be accounted for. This tends to greatly penalise low beta equity-driven investment strategies, such as minimum variance portfolios – that is, unless the strategy has a long history. On the other hand, the current specification would considerably favour long-short strategies, as the "the immediate effect expected in the event of a

40% fall in all individual equities, also considering the effect on derivatives and short positions" would be approximately zero.

III.3.2 Lack of recognition of dynamic risk management strategies is totally inefficient and at odds with the Solvency targets

The lack of recognition of dynamic risk management strategies such as portfolio insurance is another source of concern at this stage. In the QIS 2, only current holdings of options that expire in a year or more are considered, together with those that are rolled over when explicitly stated in the investment policy. However, "no consideration should be given to management actions or active trading strategies."

The aim of Solvency II is to create incentives for insurance companies to measure and monitor their risks. EDHEC is thus confident that the significant difference in the risk position between a company that has dynamic hedging schemes (even a simple stop loss) and one that does not monitor its risk exposure will eventually be reflected in the calculation of required capital. This naturally implies the need for a revision of the methods and guidelines for the calculation of SCR.

III.3.3 An inadequate calibration of Solvency II for equity risk

The CEIOPS suggests measuring risk using a VaR of 99.5%, but sets the calibration of risk model factors at a level such that demands on capital appear to have no bearing on this reference figure. The factor volatility or stress scenarios are generally prohibitive. Again our aim is not to provide exhaustive details, but rather to use some examples to demonstrate the risks of an inadequate calibration, as in the QIS 2. This is done in the case of equity risk, where calibration is inadequate either with respect to bonds or with respect to market prices, as shown hereunder.

One of the most irrelevant stress scenarios, we feel, is the volatility of 40% on the stock market over one year, which would create such demands on capital as to completely discourage insurance companies from holding stocks[8]. Moreover, the ratio of equity volatility relative to bond volatility is very high. While 20% volatility for the stock market and a probability of 40% loss once in two hundred years seems in line with historical data, the shock applied to the yield curve is not[9]. In the light of historical Value at Risk, it seems that equity holdings are harshly penalised relative to bonds. The embedded stress correlation is also very high relative to the historical average. The reasoning is that correlation is higher in the tail than in the body of the distribution, making it somewhat illusory to rely on diversification[10]. This, together with the lack of recognition of alternative geographic locations and asset classes, raises concerns about how much the benefits from diversification are accounted for in the calculation of SCR.

EDHEC underlines that the current simplistic assumption that the stock market falls by 40% at the end of the reporting day would create strong incentives for the mismanagement of risks. Indeed, the embedded simplistic scenario has a probability that is so low, and measures risks in a way that is so different from most up-to-date methods, that the continuation of such techniques may lead to strong distortions in the form of regulatory capital arbitrage rather than good risk management.

To illustrate this idea, we propose the following simplistic example. We suppose that the cost of capital is 3% above the risk-free rate, i.e. that the return from core business is 6%, and that risk capital

8 - As we have seen with US life insurance companies regarding the risk-based capital Solvency approach.
9 - The bond shock is 40 basis points only for a zero coupon interest rate with maturity of six to twelve years. According to Shiller's data, the ten-year US bond yield rose by a maximum of 4% since both 1980 and 1871, while the S&P fell by a maximum of 30% (respectively 65%) since 1980 (respectively 1871).We have chosen the US data as an example, because the stress tests currently do not depend upon geographic location.
10 - While this has a sound theoretical basis, historical data show that at a one-year horizon, diversification between bonds and equities is a lot more efficient than when it is embedded in the market risk module. Since 1871, any equity loss over 30% has been accompanied by a rise in the ten-year bond yield of less than 1.1%, or by a fall of less than 25 basis points. Any rise in the ten-year bond yield of more than 2% has been accompanied by a loss in the S&P index of less than 12%, and any fall of more than 2% in the ten-year yield is accompanied by a rise in the stock market.

defined as a buffer earns the risk-free rate. IFRS reporting is done on an annual basis.

The company finds that its optimal equity holdings are €100m, with partial portfolio insurance. With the current guidelines, investing €100m of shareholder capital in equities increases risk capital by 40% of that amount, i.e. by €40m[11]. This investment is only worthwhile if the expected return on this asset is 3% above the risk-free rate, i.e. 6% or €2.4m. As portfolio insurance is implemented but not recognised as a protection by Solvency II, the company will seek to reduce its capital requirements by buying an option.

The cost of a one-year European put option with a nominal amount of €100m, with a strike of 90% of the current spot price[12], is €2.8m. A similar option of the Asian type (where the asset price is the average spot price over one year) is worth €0.7m. If the stock market falls by 40% at the end of the day, both options will be worth approximately €27m.

With current guidelines, buying an Asian option diminishes capital requirements by €26m, which is equivalent to a return of €1.5m, and it appears to be a good management decision to buy this option, which will provide very poor protection for the portfolio. Also, given that the portfolio is already protected by a dynamic strategy, buying a European option saves only €24.5m of capital, and has a higher cost. As such, it may be disregarded by management.

To give proper incentives to the development of internal models and high-performance risk management schemes, the standard approach must remain reasonably accurate in the description of the risk factors. However it is necessarily simpler and less precise than what could be expected from internal models.

The standard approach gives poor recognition of the fact that diversification and alternative investing can diminish volatility. The approach embedded in the QIS 2 is that the reduction of equity risk can only be achieved by means of derivatives[13]. If this is not changed in revisions of the Solvency II formula, the face value of risk reduction achieved by diversification, hedging strategies and state-of-the-art optimisation methods would be diminished. Companies would have considerable incentives to create significant exposure to long-short strategies and not to build an internal model for market risk. This is because if all equities fell by 40% today, as is assumed in the standard approach, the market value of a long-short fund would be unchanged. This means that holding such a fund does not require any capital.

This would create conflicts with the statement made by the CEIOPS: "partial internal model estimates would also be welcome – particularly in areas such as interest rate risk and equity risk where VaR approaches may be more familiar."

11 - This is overstated because the diversification benefits in the standard formula of the different risk capital amounts are aggregated thanks to a correlation matrix.

12 - The Hull pricer is used with an interest rate of 3%, volatility of 20% and a dividend yield of 0.

13 - "The 40% decline in equities is based on the average market decline for a 1-year horizon and a 99.5% confidence level. Individual shares may be less or more volatile than the average, but on average they behave according to the market. It is essential that a factor other than -40% can be supported with data over an acceptable time horizon. The investment background is of no relevance to the factor, since valuation is based on the market." (QIS 2 Q&A)

Conclusion

In this position paper, EDHEC has shown that the choice of the different methods available to calculate the capital required against a specific risk factor is crucial because it has a strong impact on the management of the insurance company. A method is suitable where its embedded hypotheses can be seen as a good description of the "real world" and in particular where the ability of insurers to manage their own risks is recognised. Unfortunately, there is in the QIS 2 a range of embarrassing mistakes, from miswording (in the case of equity risk) to major inconsistencies, both in terms of insurance practices (using the net combined ratio as the sole indicator of profitability goes against the hypothesis that cash-flows must be discounted) and financial practices (insufficient treatment of hedges and a treatment of equity risk that makes it prohibitive to hold stocks).

We have proven the importance of having realistic scenarios in the case of hedgeable risk factors by showing that inadequate calibration, as is currently the case for equity risk, would create incentives for opportunistic regulatory capital arbitrage rather than efficient risk management. And more generally, we have underlined the importance of recognising the tools available to mitigate risks, especially where the CEIOPS has failed to do so.

We believe therefore that the Solvency framework has huge consequences in terms of asset allocation. Indeed – and this is the objective of Solvency II – insurance companies will have to integrate the Solvency II regulatory framework into their decision-making process with regard to risk exposure and risk management. The amount of risk will generally depend on the amount of available capital: companies that are not very well capitalised will not bear large, open-risk positions. For instance, the size of the equity holdings will be larger for richer companies.

Any change in the financial markets will bring about a change in available capital (a rise in the stock market increases wealth) as well as in regulatory capital (equity risk changes with the market value of equity holdings), and this in turn will lead to a new optimal asset allocation. The search for an optimal use of capital will naturally lead to dynamic management of the balance sheet.

Because dynamic management is natural in the context of an economic framework for regulatory capital, it is regrettable that dynamic strategies are not recognised in the standard formula. This actually may lead to a step backward in the risk management of companies that already have modern processes. Moreover, as scenarios used for market risks have not been calibrated to include market volatilities, an unnatural and sub-optimal allocation of assets may be imposed upon insurance companies. The current choice of equity volatility that is excessively high relative to bond volatility will not lead to less risk in the balance sheet, but rather to excessive use of interest rate holdings relative to equity holdings, and to a sub-optimal portfolio of assets.

In conclusion, EDHEC regrets the approach chosen by the CEIOPS, as put forward in the QIS 2. Not only does it not correspond to the state of the art in optimal and overall risk and capital management for insurance companies, but, even more importantly, in cases such as options (FX, CDS, real estate) the explicit absence of consideration for dynamic allocation strategies or the treatment of equity risk is at odds with the objective to control financial risks, as set out in the Solvency II project.

Appendix: Presentation of the QIS 2

An important stage has been reached in the development of Solvency II with the publication by the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) of the second Quantitative Impact Study (QIS 2), which aims to use the responses given by insurance professionals to provide a quantitative estimate of the global impact of the new solvency system by the end of October 2006. The aim is to determine whether the initial proposals provide a sufficient balance between sensitivity to the primary risk factors faced by insurance companies and the complexity and soundness of the different approaches that were tested.

Unlike Solvency I, the QIS 2 of Solvency II is based on:

- the market consistent value of assets and liabilities;
- a wider balance sheet approach which notably includes the prudential nature of the cash flow policy;
- a broadening of the concept of risk (definition and scope);
- a recognition of the benefits offered by different forms of diversification.

This initial attempt to calibrate the MCR (Minimum Capital Requirement) and SCR (Solvency Capital Requirement) officially targets a level of prudence that corresponds to a VaR of 99.5%, with the latter being used as a proxy for 99% Tail Var. However, the QIS 2 specifies not only that the factors and coefficients currently proposed must undergo tests by the CEIOPS, but also that the responses obtained by the QIS 2 will be invaluable in adapting these parameters. In other words, it would appear that according to a number of insurers, these parameters have not been fully set to match a VaR of 99.5%. They are therefore no more than proposals that can be fully negotiated and also fully modified by the CEIOPS.

In particular, the QIS 2 deals with the following:

- principles for evaluating assets and liabilities;
- the SCR using a standard formula;
- the SCR using the insurer's internal model;
- the MCR.

1. Principles for evaluating assets and liabilities with a view to determining the standard MCR and SCR

Indications in relation to assets are relatively basic: they must be evaluated according to market value. If this value is not available, alternative approaches in respect of relevant market data may be employed.

The reference valuation method for technical provisions, which must be presented as a gross and net figure after reinsurance, depends on the type of risk:

- for risks that can be easily hedged (such as financial risk), the valuation must correlate to the market value;
- for other risks, or if there is a doubt about the market value or the 'hedgeable' nature of the risk, a best estimate approach is used, together with a margin of error, making it possible to reach the 75th quantile.

The best estimate must be shown independently of the 75th quantile. The probable present value of future cash flows must be determined using the laws of probability for each risk factor based on the experience of the insurer or of the market (where

data is insufficient or not credible), must make an allowance for the possibility of future inflation and management fees (not including economies of scale that are planned but not yet realised) and must reflect anticipated demographic, legal, medical, technological, social or economic developments. The discount rates are risk-neutral for the duration under consideration (the term structure of international rates is provided by the CEIOPS). A general insurance estimate must also be provided for technical provisions at a discount rate of 0%.

The margin added to the best estimate covers the risks linked to liabilities for the whole of their life cycle; it may be determined either by the difference between the best estimate and the 75th quantile of the underlying distribution up to extended commitments, or on the basis of the cost of mobilising the SCR up to extended commitments. Additional studies must be carried out by the CEIOPS in order to determine the advantages and disadvantages of these two approaches.

It is worth noting, however, that these two approaches are the subject of intense debate between the proponents of what we might call the actuarial approach (quantile) and the more financial approach (cost of capital). The European Insurance Committee has been in clear opposition for several months to the quantile approach, highlighting that it depends on the very subjective risk distribution hypotheses held by each insurer and that the link between the 75th quantile and the market consistent value of liabilities is not at all clear.

However, the QIS 2 does offer the advantage of highlighting the risk concepts adopted and is sophisticated enough to handle the measurement and diversification of the risks. Indeed, Solvency I fails to take into account the risk intensity per insurance activity (same required capital for a motor policy as a liability contract). This is dealt with by Solvency II, mainly by the suggestion that the valuation of provisions depends on a breakdown based on activity and risk:

- 11 categories of activity in non-life insurance (accident and health, third party liability motor insurance, other classes of motor insurance, MAT[14], fire and other property damage, third party liability, credit and suretyship, legal expenses, assistance, miscellaneous non-life insurance and reinsurance);

- 4 categories in life assurance (contracts with discretionary participation features, unit-linked contracts, other contracts without discretionary participation features and reinsurance);

- 6 risk factors in life assurance (mortality, morbidity, longevity, lapse rate, option take-up rates and expenses assumption). Volatility and correlation hypotheses must be included particularly for the first three risks;

- 2 independent tests in non-life insurance. One relates to reserves for outstanding losses and the other to premium reserves (for premiums not yet received or for current risks). All factors that might have an impact on future payouts (recourse to run-off triangles) must be considered.

Furthermore, unlike Solvency I, it is explicitly stated that guarantees and financial options must be valued and included in the balance sheet at risk-neutral discount rates. As with European Embedded Value, the time value (value of the option – strike price of the option – the current underlying value) must also be taken into account.

14 - Maritime, Aviation, Transport

2. Standard SCR Formula

As we mentioned earlier, the QIS 2 is no more than an initial test by the CEIOPS aimed at calibrating the parameters and assumptions and also at determining the methodological and conceptual problems involved in the development of the SCR. The factors and hypotheses concerning insurance shocks are theoretically based on an occurrence once every 200 years. However, many insurers believe that the values actually used do not correspond to this estimate and are in fact much more demanding in terms of capital needs.

The overall Solvency Capital Requirement is defined by the basic SCR (BSCR) adjusted to account for RPS, the capacity of future profit-sharing to absorb risks and for NL_PL, the anticipated profit or loss resulting from the following year's activities[15]:

$$SCR = BSCR - RPS - NL\_PL$$

2.1. Determining the basic SCR (BSCR)

In this section, we review in greater detail the technical description of the risk charges developed previously in Sections III.1 and III.2. The BSCR is the basic SCR, that is, the SCR prior to adjustment for future dividends and anticipated earnings from non-life activities in the following year.

Unlike Solvency I, where capital needs were primarily necessary to face underwriting risks, Solvency II widens the scope of what constitutes risk. To achieve this, 6 primary categories of risk and associated capital needs are defined:

• Capital needs for the market risk (SCR_{mkt}). The market risk is measured by the impact of shifts in financial variables such as share prices, interest rates, property prices and exchange rates, each of which is referenced with financial needs determined according to different stress scenarios (alteration of the interest rate curve according to specific values per duration provided by the CEIOPS, 40% fall in the stock market, 20% in property and 25% in currency exchange rates, where the investment policy such as hedging mechanisms is included). The coefficients for the correlation matrix of these four risks are defined by the CEIOPS and have provoked intense debate over their excessive value (0.75 between the interest rates and stocks, 1 between stocks and property). One of the primary sources of debate is the rate of 40% for a fall in shares for the year. Not only is it judged extremely high in relation to the actual market volatility (2 standard deviations), but above all it may prove to be totally confiscatory, as in the United States: American life assurance companies hold too few listed shares because of the demands on capital that result from the country's prudential solvency regulations.

• Capital needs for the life assurance underwriting risk (SCR_{life}). This risk is now broken down into biometric risks (mortality, longevity, morbidity and incapacity), fallout risk and management fees. Each of these risks is referenced with capital needs determined on the basis of volatility and particularly detailed stress tests, especially for the biometric risks. A correlation matrix defined by the CEIOPS makes it possible to determine total capital needs for the life assurance underwriting risk. Once again, the volatility suggested by the CEIOPS is considered to be excessive (particularly for the redemption rate).

• Capital needs for the health underwriting risk (SCR_{health}). The health risk is broken down into three elements: 1) expenditure risk; 2) risk of excessive loss experience/mortality/cancellation; 3) risk of epidemic/accumulation.

• Capital needs for the non-life underwriting risk (SCR_{nl}). This risk is broken down as follows: 1) cash flow-related risk; 2) risk associated with premiums (premiums lower than expenses and

15 - When the non-life activity is profitable, the theoretical pursuit of the activity can result in a reduction of the SCR, as explained in section 2.3 in this appendix.

services provided); 3) catastrophe risk (extreme events). Premium risk and reserve risk of each line of business are aggregated by means of a correlation matrix. On the other hand, catastrophe risk is simply summed across the 11 non-life lines of business. The volatility factors make prohibitive demands on capital – two to four times as high as those used in Solvency I.

- Capital needs for the credit risk (SCR_{cred}). Controversy surrounds the factor values, which give rise to a completely disproportionate capital increase between the rating classes (by a factor of 10, for example, between AA and A, which is not proportionate to their relative probabilities of default over any given horizon).

- Capital needs for the operational risk (SCR_{op}). This corresponds to the risk of losses due to poorly adapted or malfunctioning internal processes, either because of human resources, operating systems or external events.

The reference capital needs for the individual SCR risks, according to the rows and columns of the correlation matrix (*CorrSCRrxc*), are written respectively as SCR_r and SCR_c.

Three levels of reference capital needs are defined for these six risk categories:

- correlation matrix provided by the QIS 2:

$$SCR_1 = \sqrt{\sum_{rxc} CorrSCR^{rxc} \bullet SCR_r \bullet SCR_c} = BSCR.$$

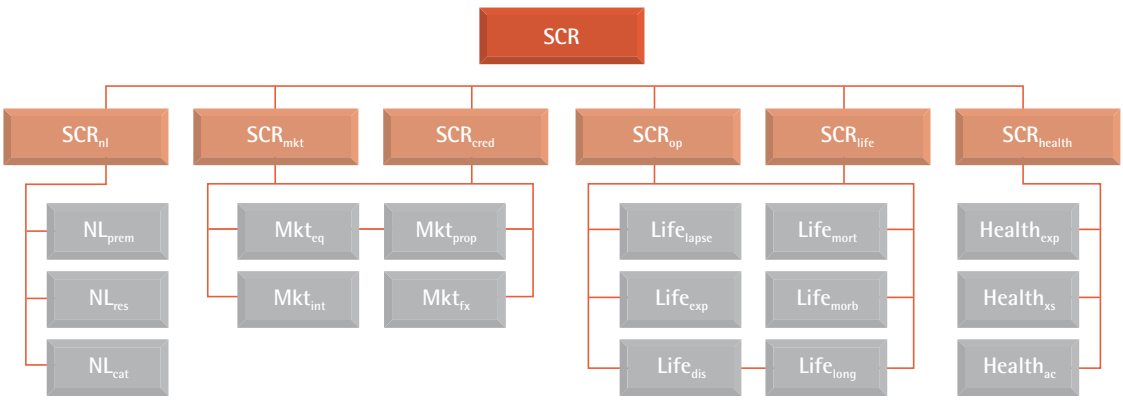
- total independence:

$$SCR_2 = \sqrt{SCR^2_{Mkt} + SCR^2_{Cred} + SCR^2_{Life} + SCR^2_{Health} + SCR^2_{nl} + SCR^2_{op}}$$

- without regard for the diversification effects:

$$SCR_3 = SCR_{Mkt} + SCR_{cred} + SCR_{life} + SCR_{health} + SCR_{nl} + SCR_{op}$$

The CEIOPS presents the standard formula for the different risk categories as follows:



2.2. Calculation of the Reduction for Profit Sharing (RPS)

In section 1 of this appendix, which dealt with determining technical provisions, discretionary dividends were included. However, they can be used to tackle risks with often significant measures of success. The CEIOPS therefore suggests calculating capital needs in three stages:

• Initially, the capital needs for each individual risk are calculated prior to the adjustment for the capacity to absorb risks associated with future life insurance dividends. Only the guaranteed and statutory dividends are then included in the valuation of the technical provisions.

• The capital needs are then adjusted by finding the aggregate of needs for individual risks while accounting for a correlation matrix (diversification effects).

• Lastly, the final SCR is determined by integrating the fact that a proportion of the technical provisions associated with future discretionary dividends can be used to absorb some of the risks. This proportion, which is known as the k factor and is between 0 and 1, is also the subject of intense debate among insurers, who argue as to the subjective nature of the figure.

2.3. Determining the anticipated profit or loss due to the following year's activities (NL_PL)

The surplus or deficit expected in the following year (NL_PL) can be determined by adding together two elements:

• The expected surplus or deficit (NL_PL_{prem}) of the following year's premiums, which is obtained from the combined estimated ratio between non-life activities (weighted average of the premiums from the various activities in the ratios of the last three to five years) and net earned premiums for each branch of activity for the following year;

• The expected surplus or deficit (NL_PL_{res}) from the liquidation of past periods during the following year. Under the method proposed herein for evaluating non-life insurance provisions, some of the risk is tied into the policy reserves (and not the shareholders' equity) in the form of a market value margin. The disappearance of this risk over time generates profit through the elimination of this margin. NL_PL_{res} is the release of the market value margin defined as the difference between the 75^{th} percentile and best estimate. It is assumed that cash flows are as expected (best estimate) during the following year, while they had been accounted for with a risk margin.

The overall SCR is thereby defined as follows:

$$SCR = BSCR - RPS - NL\_PL$$

3. SCR formula through the internal model approach

The approach adopted by the CEIOPS in the QIS 2 in relation to insurance companies' internal models is highly pragmatic. In as much as is possible, estimates of required capital as produced by the internal models are requested for each of the risk types used by the CEIOPS (see presentation in previous section).

At this stage, "the CEIOPS expects that internal model estimates submitted for the QIS 2 will be of greatest use in assessing the design of the standard formula modelling treatments, rather than refining its calibration." It recognised that the level of granularity and internal risk classification of internal models may differ from that in the QIS 2, and insurance companies are requested to comment on the differences encountered between the two approaches (QIS 2 and internal), particularly where the risk approach employed by the QIS 2 is

deemed to be inappropriate. However, as far as SCR is concerned there are no guidelines on the requirements for the supervisor to agree on internal models and on their outputs, which, given the time necessary to build realistic modelling of the full balance sheet, must be seen as a shortcoming.

4. Minimum Capital Requirement formula (MCR)

The QIS 2 provides two approaches to the MCR:

- One is a transition approach based on the requirement of Solvency I, but which reflects the method used in Solvency II for the valuation of technical provisions.

- The other is a post-transition approach based on the same calculation methods as used for the standard SCR formula (notably SCR_1, SCR_2 and SCR_3), whereby only the primary elements are accounted for and the factors are calibrated to set amounts with a lower degree of confidence. In the QIS 2, however, the operational risk is not used to determine the MCR, which reduces the number of risk categories to five: underwriting risk for life, non-life and health insurance, market risk and credit risk.

Notes

EDHEC is one of the top five business schools in France owing to the high quality of its academic staff (100 permanent lecturers from France and abroad) and its privileged relationship with professionals that the school has been developing since its establishment in 1906. EDHEC Business School has decided to draw on its extensive knowledge of the professional environment and has therefore concentrated its research on themes that satisfy the needs of professionals.

EDHEC pursues an active research policy in the field of finance. Its **Financial Analysis and Accounting Research Centre** deals with financial analysis issues: valuation of firms; impacts of IFRS on the management of companies and risk pricing; due diligence; and reform of the status of independent financial experts. The research centre aims notably to use state-of-the-art academic expertise to question certain financial paradigms, particularly that which ignores idiosyncratic risks in the calculation of the risk premium on the basis that such risks are diversifiable.

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