

CP20: Significant improvements in the Solvency II framework but grave incoherencies remain

EDHEC response to Consultation Paper n° 20

January 2007



Philippe Foulquier

Professor, Director of the EDHEC Financial Analysis
and Accounting Research Centre

Samuel Sender

Research Associate with the EDHEC Risk
and Asset Management Research Centre

About the authors

Philippe Foulquier PhD heads EDHEC's Financial Analysis and Accounting Research Centre and is Professor of Finance and Accounting at EDHEC Business School. He has a PhD in economic science and is a graduate of the SFAF (the French Financial Analysts' Society). He joined EDHEC after an extensive professional career as a sell-side financial analyst specialised in the insurance sector. In 2005, Philippe was named "best French financial analyst in the insurance sector" in the reference international ranking established by Extel/Thomson Financial.

Samuel Sender is a Research Associate with the EDHEC Risk and Asset Management Research Centre. He founded MC2 Finance, an independent consulting firm for life and mutual insurance companies, before joining FINALYSE, a consultancy specialised in risk and performance measurement, as a senior insurance consultant and ALM specialist. Formerly with the Economics, Strategy and Quantitative Research unit at HSBC Asset Management Europe, and then head of Asset-Liability Management at Erisa, the French life insurance subsidiary of HSBC, he is a graduate in Statistics and Economics from ENSAE (Ecole Nationale de la Statistique et de l'Administration Economique) in Paris.



Summary

This document contains our answer to CP20, a consultation process initiated by CEIOPS (Committee of European Insurance and Occupational Pensions Supervisors) on the "*Advice to the European Commission in the Framework of the Solvency II Project on Pillar I Issues*".

The Solvency II project aims to reform regulatory capital for insurance companies. In simple terms, the current arbitrary statutory capital that prevails should be replaced by Solvency Capital Requirement, which is set up according to the risk profile of insurance companies.

The European Commission is due to release the Solvency II directive in 2007. This directive shall be applied to national regulations and implemented in 2010. 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 a previous paper, "QIS 2: Modelling that is at odds with the prudential objectives of Solvency II", EDHEC focused on certain aspects of the modelling suggested by CEIOPS in the QIS 2, demonstrating that the choice of certain concepts, measures and calibrations were sometimes hazardous and in contradiction with the goals of the evolution in the solvency framework.

More precisely, as far as market risks were concerned, we argued that factor-based methods should not be used. For credit risks, we argued that the difference in risk capital between an AA-rated bond and an A-rated bond was disproportionate with their relative default probabilities. We totally disagreed with the approach suggested in QIS2 for non-life reserve risk because of the use of standard market volatilities. The measure of premium risk through the historical volatility of the net combined ratio was at odds with the nature of the non-life business. As far as calibration was concerned, we proved the importance of having realistic scenarios in the case of hedgeable risk factors by showing that inadequate calibration, as was the case in QIS2 – and still is in CP20 for equity risk – creates

incentives for opportunistic regulatory capital arbitrage rather than efficient risk management. And more generally, we underlined the importance of recognising the tools available to mitigate risks, especially where CEIOPS has failed to do so.

There has been a significant improvement in the framework proposed in the current consultation paper (CP20). For instance, the use of factor-based methods to calculate market risks has been suppressed and replaced by scenario analysis. Equally important is the fact that CEIOPS has abandoned the reference to the net combined ratio as the sole indicator of the profitability of non-life business, because not only was the methodology proposed in QIS2 backward-looking, but it also ignored the fact that profit also emerges from financial revenues.

The current consultation is a very important stage because it aims to prepare both QIS3, due in spring, and the 2007 directive. In the current paper, we focus on the flaws that remain in the proposed structure, and more particularly on four points:

- In the first part, we analyse the two choices proposed by CEIOPS for the risk margins (cost of capital and 75th percentile). We conclude that the current proposal on the cost of capital firstly does not allow a reflection of the risk at the level of the lines of business, because required capital is proposed to be proportional to the technical provisions and not to the risk. We suggest a definition of the required capital per line of business as a function of the liability risk of each line of business. Secondly, we demonstrate that the lack of guidelines in the CEIOPS proposal may lead to lack of comparability because of diverging interpretations. CEIOPS must define the classes of risks that are to be hedgeable and non-hedgeable. Thirdly, EDHEC proposes that the component of financial risk that cannot be hedged is accounted for in ALM risk.

Summary

As far as the 75th percentile method is concerned, we conclude that the lack of guidelines in this approach may lead to financial risk being added to insurance risk. More precisely, we argue that firstly it leads to an overestimation of the desired market value margin, because "hedgeable" financial risk may be added to the calculation of "non-hedgeable" insurance risk. Secondly, because CEIOPS currently fails to recognise inflation risk as hedgeable and to separate it from non-hedgeable insurance risk, it generates both an additional capital requirement (SCR through ALM risk) and additional technical provisions (MVM). Thirdly, it does not favour comparability between companies because MVM may reflect insurance risk only in some companies, but insurance risk and financial risk together in other companies. Guidance must be given so that only the non-hedgeable risks are valued with a margin. Finally, EDHEC also proposes that when computing the available capital in the balance sheet, risk margins be aggregated in the very same way as risk-capital charges so as to avoid any situation where the risk margins could be larger than the economic capital.

- In the second part we insist on the importance of being market-consistent in the calibration of the scenarios used as a proxy to measure risk. In particular, we show that the current simplistic assumption that the stock market falls by 40% at the end of the day can lead to the purchase of cheap and inefficient protections that nevertheless save a significant amount of capital. Moreover, we believe that dynamic strategies must be recognised in order to avoid opportunistic capital arbitrage taking place instead of healthy risk management. This lack is a real hindrance to the use of ALM techniques. Lastly, we believe that the bond market is not correctly described in terms of risk factors (choosing only one factor leads to an inability to explain a large part of the source of volatility).

- In the third part, we focus on the structure of the standard approach. Firstly, we argue that in some cases, the buffer component of the profit-

sharing can be used against non-market losses, and therefore the reduction should apply at a higher level than CEIOPS has proposed (market risks only). Secondly, we show that in the current system, there is a risk of double counting the CAT risk, which should be avoided. Moreover, in order to protect policyholders and the industry as a whole, EDHEC believes that CEIOPS has to give clear incentives for using financial protection to cover catastrophe losses.

- We end our feedback with a few comments on the requirements and guidelines that in our view need to be set up for the internal models. Here we highlight that whilst using the same data set, very different estimates of capital charges will result from the use of different laws to estimate the tail of the liabilities. As a consequence, some guidelines must be given as early as possible to avoid cherry-picking in internal models.

1. More guidance needed for market value margins to reflect risk

Out of the 514 insurance companies from 23 countries that contributed to QIS2, about three quarters of them evaluated technical provisions by means of the best estimate approach, and only one out of two calculated the 75th percentile or the cost of capital. Insufficient available data and resources, but also poor guidelines, probably explain this low response rate.

Our analysis of the two proposed methodologies to calculate risk margins allows us to conclude that CEIOPS must give more guidance in order for risk margins to reflect risk in an adequate and comparable way.

1.1. Introduction – Principles of market value margin for non-hedgeable risks

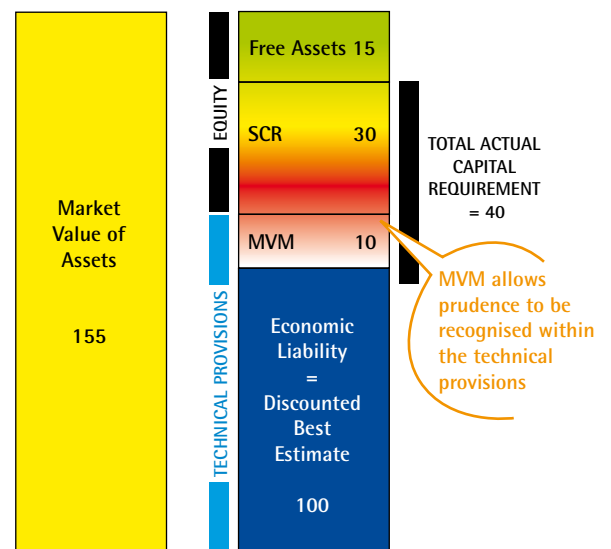
The principle enounced by CEIOPS is that the reserves related to non-hedgeable risks are valued with a margin called the market value margin (MVM). This notably concerns the eleven lines of businesses in non-life insurance¹ as well as technical provisions related to the four biometric risks of the life business², as defined in the Solvency II framework. Just as the expected return on equities is supposed to be above the risk-free rate, a risk margin must be applied to non-hedgeable risks in order for them to be defined as market consistent. It is calculated for each line of business or product groups (where the products have similar risk profiles), for each risk type, and added to the best estimate liability value. In others words, the market value margin equals the difference between the best estimate of the discounted liability and the technical provisions.

This difference is a form of capital that is locked-in the technical provisions as opposed to equity. The underlying philosophy is in line with the traditional representation of the insurance business, which states that profit emerges from the release of risk.

Some of the total required capital is locked in the technical provisions in the form of market value margin, and the release of the risk allows a profit to emerge.

The Solvency II decomposition of liabilities is illustrated below:

Balance Sheet view
SCR, MVM, total capital requirement



In order to measure this market value margin, two approaches are suggested:

- The percentile approach, which, up to now, has been preferred by the regulator. The mainstream approach for QIS2 defined technical provisions for non-hedgeable risks as the 75th percentile of the present value of claims. Hence, MVM is the difference between the technical provisions and the discounted best estimate of claims. The term structures to be used for discounting the cash flows are the stripped swap curves as provided by CEIOPS.
- The cost of capital approach, which received strong support from the insurance companies, backed notably by the Chief Risk Officer Forum, because the percentile approach may lead to double counting of risks: the mean-75th percentile may be counted once in the MVM and once in regulatory capital.

1 - Accident and health, third party liability motor insurance, other classes of motor insurance, MAT (maritime, aviation, transport), fire and other property damage, third party liability, credit and suretyship, legal expenses, assistance, miscellaneous non-life insurance and reinsurance.
2 - The four categories in life insurance are: contracts with discretionary participation features, unit-linked contracts, other contracts without discretionary participation features, and reinsurance. The six risk factors in life underwriting are: mortality, morbidity, longevity, disability, lapse rate, and expenses assumption (the first four are biometric risks).

1. More guidance needed for market value margins to reflect risk

The cost of capital approach was first used by the Swiss regulator in the Swiss Solvency Test. This approach adopts the perspective that in case of insolvency, the company that takes over will have to add capital to the balance sheet, and that this capital has to be served with a BBB-equivalent spread over the risk-free rate. The Swiss authorities propose that in an advanced approach, required capital is reduced over time by the willingness on the part of the company that takes over after bankruptcy to shed hedgeable risk away. More precisely it is assumed that the company is bankrupt at the end of year one and that the third party company takes a full year to shed financial risk, which leaves us at the end of year two. In other words, MVM is the present value of the cost of holding required capital (RC) during the whole run-off period of the in-force portfolio, with $RC = SCR$ for year 1 and year 2, and $RC = SCR$ excluding hedged risks for year 3 and after.

As mentioned previously, the cost of capital approach to market value margins is supported by many insurance companies because the percentile approach may lead to double counting of risks. It has also been argued that for skewed laws, the 75th percentile can be less than the average, which means that the technical provision would be less than the average liability and would hence not be a prudent estimate. Finally, the perspective of the cost of capital approach to the market value margin is that sufficient capital is needed to be able to run-off the business, and this seems natural to many professionals because it is close to the concept used in embedded value.

Now that these concepts are introduced, we will come to the target of this section, which consists in demonstrating that the lack of guidelines from CEIOPS can lead to a deep lack of coherence with the principles of the market value margin, as well as an unfortunate lack of comparability between companies and countries.

1.2. Lack of guidelines in the 75th percentile method may lead to financial risk being added to insurance risk

From a theoretical standpoint, CEIOPS made a clear distinction between hedgeable and non-hedgeable risks. While liabilities linked to hedgeable risk must be valued at market to market, liabilities which embed non-hedgeable risks must be valued with a market value margin.

We argue that the methodology and insufficient guidelines proposed by CEIOPS in the so-called percentile approach may:

- lead to an overestimation of the desired market value margin, because "hedgeable" financial risk may be added to the calculation of "non-hedgeable" insurance risk;
- generate both additional capital requirement (SCR through ALM risk) and additional technical provisions (MVM) because CEIOPS currently fails to recognise inflation risk as hedgeable and to separate it from the non-hedgeable insurance risk;
- not favour comparability between companies because MVM may reflect insurance risk only in some companies but insurance risk and financial risk together in other companies.

Guidance must be given so that only non-hedgeable risks are valued with a margin. In a Monte Carlo framework (which is, in most cases, necessary to derive the percentile of the discounted sum of claims), some of the volatility in the present value of the cash-flows is simply due to the variation in the discount factor, not to mention the volatility of financial risk. This is because as the log of the discount factor is minus the integral of the short-term rate, the discount factors will differ in each scenario, which gives rise to an artificial volatility of the present value of a fixed cash flow. However, as payoffs with hedgeable financial risk are to be valued without a risk margin, this source of volatility needs to be excluded from the valuation, and only the best estimate should be kept.

1. More guidance needed for market value margins to reflect risk

In the case of non-life insurance, which by nature is non-hedgeable, liabilities have a large exposure to hedgeable risk factors, such as interest rates and inflation. This makes it particularly important to treat the volatility that comes from financial risk in a separate fashion to the volatility that arises from insurance risk. Clear guidelines should be given to insurance practitioners so as to avoid an unwanted additional risk margin arising from the financial risk that is mixed with the insurance liabilities. For instance where the insurance risk is independent from the financial risk, guidelines could recommend that simulated claims be discounted with the current discount factors (deterministic risk-free rate) instead of a stochastic discount factor. In this case the 75th ordered scenario out of 99 would be an unbiased estimate of the technical provision with the desired MVM linked exclusively to non-hedgeable risks. On the other hand, discounting the 75th percentile of the distribution with the stochastic discount factor would overstate the risk margin.

The situation becomes more complex where the financial risk and the insurance risk are not independent. If paid claims depend on interest rates, then interest rates must be projected stochastically, and the discount factors cannot be considered as fixed. Sensitivity analysis may be used to assess how much the insurance risk adds to the volatility of the present value of the claims.

As far as inflation is concerned, EDHEC reiterates³ that inflation risk should be considered as an ALM risk rather than as an insurance risk. The following example shows that the choice of CEIOPS can have a substantial impact on long lines of business. We will suppose that the volatility of inflation is 1% per annum. This means that it is 5% = $\sqrt{25\% \times 0.01}$ over 25 years. Therefore, inflation alone would add $0.67 \times 5\% = 3.4\%$ to the technical provisions because of the market value margin⁴. Worse still,

as inflation is not recognised as ALM risk in the current setting, a company that has inflation-linked securities to help reduce inflation risk would see market risk rise rather than fall because of these securities. For instance in the stylised case of a 25-year zero coupon inflation-linked bond, the zero-coupon yield curve as of Dec 31st 2005 and the calibration of the interest rate risk module would imply a capital requirement of 7% of the nominal⁵.

Overall, in the case of a long-term liability linked to inflation, companies that correctly manage their inflation exposure could need to add more than 10%⁶ of the nominal exposure in capital because the proposed framework penalises both inflation risk and its management.

How to account for market risk in the case of a mixed exposure

Naturally, as in the methodology we propose that financial risk be excluded from the MVM, it has to be fully taken into account in the market risk module of the SCR. However, in the specific case where insurance risk and market risk combine (as is the case for inflation in non-life insurance), we propose the establishment of a specific test that would combine the two factors to check whether the balance sheet has been properly protected.

In the specific case where hedgeable and non-hedgeable risks combine, optimal hedging of the risk capital is achieved by an over-hedging strategy, i.e. there must be enough of a financial hedge to secure the case where both hedgeable and non-hedgeable risk-factors are in the red zone⁷.

As a consequence, for inflation risk we propose to test the scenario where inflation rises above the best estimate and claims are at their 95th worst percentile⁸.

3 - Cf. Noel Amenc, Philippe Foulquier, Lionel Martellini and Samuel Sender, "The Impact of IFRS and Solvency II on Asset Liability Management and Asset Management in Insurance Companies", EDHEC Publications, November 2006, and Philippe Foulquier and Samuel Sender, "QIS2: Modelling that is at odds with the prudential objectives of Solvency", November 2006, EDHEC Position Paper, p. 12.

4 - This would rise towards 5% in the case where inflation and claims are correlated.

5 - This is the price impact of a 0.3% rise in the 25-year zero coupon yield curve from a level of 3.838% to a level of 4.138%: $(1+3.838\%)^{-25}(1+4.138\%)^{-25} - 0.07$.

6 - $7\% + 3.4\% = 10.4\%$.

7 - See for example Noel Amenc, Philippe Foulquier, Lionel Martellini and Samuel Sender, "The Impact of IFRS and Solvency II on Asset Liability Management and Asset Management in Insurance Companies", EDHEC Publications, November 2006.

8 - The scenario where X and Y are at their 95% VaR is generally representative of the 99% VaR of the combined effects of X and Y, when the risk factors are independent and their effects combine.

1. More guidance needed for market value margins to reflect risk

The same methodology must be applied to all similar cases, as well as in the case where the correlation between risks is not taken into account because of the structure of the standard formula. For instance, in the case of life contracts, lapse rates are bound to increase in the case of stress market conditions because policyholders may exercise the put value they own on the assets of the companies. But the correlation is not taken into account because lapse risk and interest rate risk are in two separate modules. Therefore, a consistency test shall be provided that illustrates what happens in the case where additional lapses happen during stressed market conditions.

Are life savings contracts hedgeable?

Once more, it seems that clarification is needed on this point.

Is there any un-hedgeable component in the savings contract beyond biometric risks? It has sometimes been argued that the lack of long-term assets to match long-term liabilities makes them unhedgeable. However, it seems to us that this should be reflected in the market risk component (for instance in interest rate risk, where the inability to buy the necessary long-term bonds to match long-term liabilities would result in ALM risk).

If any other financial payoff is considered unhedgeable, it must be clearly specified by CEIOPS so as to avoid diverging interpretations.

1.3. Summing the 75th percentile of each business line would result in an excessively high MVM for the balance sheet as a whole

We believe that risk margins must be aggregated rather than summed. More precisely, we recommend that risk be diversified in the balance sheet in the same way it is in regulatory capital: market value margins calculated for each line of

business are to be aggregated in the same way as capital requirements.

By doing so, the regulator will allow for a clear vision of the market value margins both at the level of the line of business and at the level of the balance sheet.

On the other hand, where the regulator fails to take diversification benefits into account when computing the MVM at the group level, this could lead to a totally undesirable situation where the market value margin exceeds the (tail) Value-at-Risk of the portfolio, and therefore the reference solvency capital.

The proof is straightforward:

Where there are n independent lines of business with volatility σ , under the assumption of a normal distribution, the volatility of the book composed of the n lines of business is $n^{1/2} \sigma$. This means that if regulatory capital is defined as the 99.5 % VaR of the book, it equates $\Phi^{-1}(0.995) * \text{book_volatility} = 2.57 * n^{1/2} * \sigma$, where Φ is the probability distribution function of a Gaussian variable.

However, the market value margin for each line can be defined as the 75th percentile of the distribution, i.e. equates $\Phi^{-1}(0.75) \sigma = 0.67 \sigma$. If these market value margins are just added, the total market value margin in the balance sheet is $0.67 * n * \sigma$. Therefore, the market value margin displayed would be superior to the 99.5% Value-at-Risk of the portfolio as soon as $0.67 * n * \sigma > 2.57 * n^{1/2} * \sigma$, i.e. as soon as $n > (2.57/0.67)^2 = 14.6$.

Practically speaking, for the eleven lines of business chosen by CEIOPS, the market value margin alone could be of the order of magnitude of what should theoretically be the required capital!

On the other hand, where they are aggregated in the same manner as capital, the market value margins at the group level would remain in our example at approximately 25% ($0.67/2.57 \approx 0.25$) of risk capital.

1. More guidance needed for market value margins to reflect risk

To conclude, this example probably shows not only that the risk margins should be aggregated in the same way that the risk charges are, but also that the 75th percentile is too demanding.

1.4. The cost of capital approach supported by the insurers

While the cost of capital has been included as an alternative mode of calculation of the market value margins in QIS2, which will probably continue to be the case, at this stage there has been too little work made to transpose the work of the Swiss Regulator so that it may fit the European requirements.

The rationale behind the Swiss version of the cost of capital is that a third party that would take over the company and its liability in case of bankruptcy would have to add capital to the balance sheet, and that this capital must be served a yield equivalent to a BBB-rated bond. This naturally leads to a calculation of a risk margin at the company's balance sheet level, as opposed to the level of the line of business.

The most straightforward calculation proposed is that required capital by line of business is proportional to the technical provisions of this line of business. Hence, it does not allow a reflection of the risk at the level of the lines of business, because required capital is proposed to be proportional to the technical provisions and not to the risk.

As far as this issue is concerned, we propose the definition of the required capital per line of business as a function of the liability risk of each line of business. Since in the cost of capital approach market value margins are calculated after the individual risk charges, this can easily be done.

Once this is done, aggregation of market value margins must be done in the same way as proposed in the above paragraph.

Once more, we will demonstrate that the lack of guidelines in the proposal of CEIOPS may lead to a lack of comparability because of diverging interpretations.

CEIOPS has left open the question of whether with-profit liabilities are considered hedgeable or non-hedgeable. This means that some of the risk associated with these liabilities will alternatively be accounted for in technical provisions (in the MVM) or in the solvency capital required. It is necessary to compute the cost of capital to define what can and cannot be hedged.

A distinction must be made between, on the one hand, the frontier of what can and cannot be hedged in the Swiss Solvency Test and, on the other, the classes of risks that CEIOPS has defined as being hedgeable and non-hedgeable. In particular, though financial risk is considered hedgeable, there may remain residual financial risk that cannot be hedged in some books. EDHEC proposes that the component of financial risk that cannot be hedged be accounted for in ALM risk. For instance, where the lack of available long-term bonds on the market makes the replication of long-term liabilities difficult, the company will have less long-term bonds than long-term liabilities, and this will be reflected in interest rate risk. However, this also means that financial risk cannot be shed by the third party that would take over in case of bankruptcy. EDHEC proposes that financial risk be assumed to be shed only where the insurance company can demonstrate that this is a reasonable assumption.

2. Calibration improves in CP20, but remains inadequate for some risks

2.1. Please be market-consistent!

We have already demonstrated in our previous papers⁹ that CEIOPS sometimes proposes unrealistic calibration. We believe that the scenarios must be calibrated to market data and that dynamic strategies must be recognised in order to avoid opportunistic capital arbitrage taking place instead of healthy risk management.

In particular, we have shown that the current simplistic assumption that the stock market falls by 40% at the end of the day can lead to the purchase of cheap and inefficient protections that nevertheless save significant amounts- of capital. As since our previous position paper CEIOPS has improved on many topics in the CP20, but not this one, we suggest the following:

- Principles: the scenario for equity risk is that all equity indices and stocks fall by 40% at the end of the year (as opposed to at the end of the day), which is more relevant in terms of the age-long historical volatility. Guidelines: insurance companies will need to write down the actions that can be instrumental in reducing risk in order for these to be approved and will need to be prudent when valuing infra-annual payoffs.
- This means for instance that it is supposed that all holdings will be kept for a year unless the ALM policy specifies that the composition of the portfolio is bound to be changed within the course of the year.
 - In the special case of dynamically managed positions (CPPI funds or dynamic position of the book), CEIOPS must be able to provide for a degree of inefficiency;
 - When it is necessary to assess the path followed by the stock market within the course of the year, a prudent scenario may be applied. For long positions (e.g. a call option with a smoothed asset price, or a position in the stock market that is bound to be cut at a certain date), the fall of the stock market shall be larger than the conditional best estimate¹⁰. For short positions (e.g. a put with a smoothed asset price), the reverse will be true.

2.2. Additional comments on inappropriate measurement of equity risk

We have commented in our previous reports that both the calibration of the equity risk scenario and the lack of understanding of dynamic hedging schemes were a real hindrance to the use of ALM techniques.

In this sub-section, we will briefly comment further on why this choice made by CEIOPS is at odds with the prudential targets of Solvency II, and why we disagree with the choice of CEIOPS not to take any dynamic hedging scheme into account.

Bad management of the equity holdings has been observed in the past; however it was largely induced by a regulatory and accounting regime that did not give incentives to monitor the market value of holdings.

The most striking example lies in 2002-2003, where some companies just watched the value of their equity holdings fall progressively, up to the point where they had to add capital to their balance sheet. In countries like the UK, Germany or France, some companies would have had larger problems if the regulator had not changed the law. For example in France, companies were allowed to provision only a third of the unrealised loss, as opposed to 100%, as imposed by law before the crash.

EDHEC views this bad management scheme as the result of different factors. The main trigger of the losses however was the fact that the accounting framework at that time (before the IFRS implementation) mainly referred to book value, which did not provide much of an incentive to monitor the market value of the assets. Moreover, the local regulation was very restrictive in the use of derivatives, both because proper regulation was lacking and because a real dynamic management process was hindered by

9 - Op. cit.

10 - For instance, it can be noticed that if the stock market reaches its 99.5% Value-at-Risk at any point in time between $t=0$ and $t=1$, its fall within the course of the year is larger than the maximum likelihood conditional to the fact that it reaches the 99.5% Value-at-Risk at the end of year 1.

2. Calibration improves in CP20, but remains inadequate for some risks

the need for approval requests to be transmitted to the supervisors. There was also a degree of inexperience in risk management amongst some small or medium-sized insurance companies, where ALM was underdeveloped relative to pure actuarial or investment functions.

However, since this crash there has been a general enhancement in the financial techniques and methods used in the insurance sector, and a minimum degree of monitoring of risks so that hardly any company nowadays would leave itself go nearly bankrupt without taking action.

It is important to underline that CEIOPS has an important role to play in the implementation of these pertinent ALM techniques. It can contribute to the improvement of risk management by authorising these dynamic hedging schemes to be taken as instrumental in reducing market risks, provided the hedging scheme is duly documented.

2.3. Asymmetrical treatment of assets and liabilities overstates risks

CEIOPS has provided clear guidelines for the valuation of technical provisions, which state that [2.27] *"Future management actions should be reflected in the projected cash-flows. The assumptions used should reflect the actions that management would reasonably expect to carry out in the circumstances of each scenario, such as changes in asset allocation, changes in bonus rates or product changes, or the way in which a market value adjustment is applied. Allowance should be made for the time taken to implement actions."*

Is it not unreasonable to give guidelines whereby liabilities are valued according to principles that account for all management actions while the risk on the asset-side is accounted for without taking any management action into account?

In insurance companies where liabilities are computed according to the actual return on assets, the asymmetry would mean that the sensitivity of the assets to an equity shock would be overstated, while that of the liabilities would be correct. Overall risk would clearly be overstated. Once again, this would lead to intricate situations where numbers reported are meaningless.

In our view the modelling choices made by CEIOPS may lead to a strong overestimation of equity risk. Our reasoning is entirely based on the reference to market consistency and the need for a symmetric treatment between assets and liabilities. However our objective here is to defend a coherent framework that allows the best possible risk management, but we do not aim to defend the idea that insurance companies should hold large positions in equities whatever the circumstances.

2.4. The bond market is not correctly represented in one dimension

The standard formula is the result of the aggregation of the Value-at-Risk of each risk factor. Naturally, all risk factors must be represented in order for the calculation of the standard formula to be accurate. Exposure to risk factors is mathematically equivalent to holding risky assets – if one forgets to take one asset into account then the calculation of the risk of the portfolio is flawed.

It must therefore be determined whether all the risk factors are correctly represented. While it may be the case that some of them are represented twice, as explained in the following section about non-life CAT risk, we believe that the bond market is not correctly described in terms of risk factors.

This is all the more surprising as on the asset side, the biggest risk exposure tends to arise from interest rate risk. The analysis of the bond market

2. Calibration improves in CP20, but remains inadequate for some risks

is traditionally based on a principal component analysis and refers to three factors: level, slope and curvature. According to most studies¹¹, two to three factors are needed for a correct representation of this market.

However, choosing one factor only, as CEIOPS has proposed, leads to an inability to explain 40% or more of the source of volatility in the bond market, because the first factor of the principal component analysis of the bond market explains roughly 60% of the variance of this market and leaves 40% unexplained¹². For some companies, disregarding the second factor in interest rates could bring more distortion to the calculation of market risks than disregarding equity risk.

While leaving the subject of calibration to these factors aside for further work, we should emphasise that calibration of the scenarios to market prices may be more difficult for the slope and curvature factors because of the lack of listed securities that depend solely on these factors. In that case, principal component analysis may be helpful in extracting these risk factors and giving additional input to correct calibration where market prices only do not provide sufficient information.

Finally, EDHEC insists that at least two factors should be included for the bond market, and not just one. The first factor should clearly be changes in the level of interest rates while the second should be changes in the slope of the yield curve, in order to be coherent with the results from principal component analysis.

¹¹ - F. Fabozzi, L.Martellini and P. Priaulet, "Hedging interest rate risk with term structure factor models", in *The Handbook of Fixed-Income Securities*, 7th edition, edited by Frank Fabozzi, John Wiley, 2005.

¹² - *Op. Cit.*

3. CP20 improves the standard formula but some issues are not yet adequately solved

3.1. Profit-sharing can be a buffer against non-financial risks

In the standard approach for Solvency II, market risk is defined as the Value-at-Risk on the asset side. The reduction for profit-sharing "RPS" is measured as the ability to pass through market risk as well as other risks to policyholders.

In QIS2, the reduction for profit-sharing was applied at the higher level of the calculation: this buffer was applied to the Basic Solvency Capital Requirement "BSCR" that was calculated as the aggregation of all individual risk charges. "RPS" could be understood as the buffer that the profit-sharing provides against all risks that life insurance companies face. This was an interesting standpoint for insurance companies, as they generally model profit-sharing as being a buffer against financial risks.

However, in CP20 CEIOPS proposes to account for RPS at the level of market risks, which means that it cannot be supposed that profit-sharing can be used as a buffer against non-market risks, such as mortality or other unexpected events.

In order to appreciate at which level of the tree the reduction for profit-sharing must be applied, it is interesting to underline a couple of interesting features concerning profit-sharing:

- Profit-sharing is a discretionary part of the payoff to the policyholder. As such, it can potentially be used against all risks. This means that management theoretically has the ability to diminish profit-sharing under certain circumstances, such as overall low profitability of the group.

- Profit-sharing is also the option-like part of the payoff to the policyholder. As such, it relates how the payoff varies in given states of the world, which may be calculated as either depending on the market risk factors or the assets held. For instance, profit-sharing is typically partially indexed to the stock market, which means that it will be predictably lower than average when the stock market falls.

While it would be conceptually interesting to isolate the indexed part of profit-sharing from its pure buffer component, it seems that differing modelling methodologies across both countries and insurance companies would make it hard to find a quick and simple way to measure the two sub-components of the profit-sharing separately. This is all the more true because these features are not independent, and a large sudden fall in the stock market will generate lower profit-sharing, due to the fact that the best estimate profit-sharing is a function of the stock market and also due to the fact that unexpected losses¹³ may leak to the policyholder, as has been observed in the case of underwriting losses because of lower than expected mortality rates.

However, while it is generally clear that the indexed part of profit-sharing reduces market risks only, the pure buffer¹⁴ part of profit-sharing can be used against non-market losses. For instance, in some cases annuities may be pooled together with with-profit savings contracts. In this case, unexpected changes in mortality rates would be passed entirely to the profit-saving component of the savings contracts. Beyond this fact, which shows that profit-sharing can be used as a buffer against non-financial losses, there is no reason why to some extent profit-sharing could not be used against underwriting or operational losses in a company.

EDHEC proposes that RPS be applied at a higher level of the balance sheet, provided that the company documents that profit-sharing can serve as a buffer against all risks and not only financial risks.

3.2. Non-life – towards a more pragmatic methodology

In the QIS2 measure of non-life underwriting risk, CEIOPS used the combined ratio not as the indicator of underwriting profitability, but as an

¹³ - E.g. for those who delta-hedge their positions.

¹⁴ - By buffer part, we mean the component of profit-sharing that is worth zero (on average), but which is negative when the company is subject to unforeseen stressed conditions.

3. CP20 improves the standard formula but some issues are not yet adequately solved

indicator of overall profitability. The empirical volatility in the net combined ratio was directly input in premium risk. Premium risk was defined as $NL_{prem2} = \rho(\sigma_u) \cdot P$, where P is the estimate of net earned premium of the overall business in the forthcoming year, σ_u is the historical standard deviation of the combined ratio, and $\rho(.)$ represents the 99th percentile of the normal distribution.

In CP20, CEIOPS has made large improvements both in its statements and in the proposed methodology. They now state that the risk measure has to be prospective rather than retrospective, which is a positive move. They also propose to measure premium and reserve risk together rather than on a separate basis. However, there are still some unnecessary complications which need to be reviewed. These will appear in our explanation of the proposed methodology below.

In our previous studies¹⁵, we argued that the net combined ratio should not be the sole indicator of the profitability of a non-life insurance business. A company that aims for stable margins should indeed take the fluctuation of interest rates into account in the pricing of its products, and the expected net combined ratio is just a partial result from the complete pricing formula. 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 liabilities¹⁶.

Practically, this means that the profitability of the non-life business must be reprocessed from the variation in interest rates. This can be done by the company where it uses an undertaking-specific volatility measure. It can also be inferred by the regulator to compute the market standard volatility for each line of business, by reprocessing sector-wide data from the variation in interest rates.

However we do not agree with the CEIOPS view that past technical provisions should be re-calculated according to the Solvency II principles in order to re-evaluate profitability. We feel it would be overly complex to re-evaluate the 75th percentile of past technical reserves, as well as to account for past NLPL (expected profit for non-life) by calculating the release of the market value margin as would have been calculated in previous years. The view of CEIOPS relates to a traditional accounting scheme that in our opinion should not be transposed in the modern framework we are now switching to. It is probably both meaningless and impossible to compute the volatility of profitability if one adds the constraint that this volatility in a past market value margin must first be taken into account¹⁷. However, we consider that it would not be worthwhile spending time on this as the exercise is somewhat pointless.

Rather than asking the insurers what their provisions would have been if their accounting scheme was different and did not allow the use of variable buffers and discounting and the addition of a market value margin, we think it is a lot more pragmatic to evaluate whether the premiums received were enough to cover the claims to be paid. We simply propose to state that for a given line of business, the current portfolio is composed of bands defined by their subscription years. For a subscription year t_0 , we need to calculate the volatility of the discounted claims at time t_0 , with these claims naturally being discounted with the zero coupon yield curve observed at t_0 . Discounting these flows gives what could be defined as the "realised premium" at the line of business, which just needs to be compared to the commercial premium at time t_0 .

15 - *Op. cit.*

16 - *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*

17 - *If CEIOPS requires past market value margins to be calculated according to the cost of capital approach, then the situation is even more complex because past SCR needs to be calculated before one is able to compute current SCR - this is a circular process.*

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The data needed can usually be found in the balance sheet. To do this we simply need:

- Interest rates per subscription year;
- Paid claims per subscription year and development year;
- Premiums per subscription year.

A number of re-calculations can be made on the data, which will generally also be feasible. As CEIOPS suggests, (large) catastrophes can be excluded from paid claims in order to avoid double counting of the catastrophe risk. As we argue in the next section, ideally all claims related to the underlying catastrophe factor should also be excluded, and not only the largest ones. That is to say that if for a given line of business, catastrophe risk is that of a hurricane, then damages resulting from storms should also be excluded from paid claims because a hurricane is simply a larger scale storm – storms and hurricanes are representative of the same risk factor.

The methodology proposed above probably gives a clear view of the volatility part of premium risk.

To compute reserve risk¹⁸, we feel it is a lot easier to assume that the portfolio is the sum of the risks that make up the subscription year. This means that the "volume measure"¹⁹ needs to be decomposed by subscription year, data which are generally available. Volatility can be assumed to be constant in time (for a given subscription year risk only depends on the size), and CEIOPS can provide a correlation matrix if they do not consider these different layers of risk to be fully independent.

While remaining simple enough for a standard approach, the proposed methodology allows us to take a look at empirical volatility per subscription year of a line of business, which seems to be a further step towards internal models when compared to the methodology proposed by CEIOPS.

3.3. Double counting of risks in the catastrophe and volatility parts of non-life underwriting

In the framework proposed by CEIOPS, underwriting risks are split. As far as non-life risks are concerned, they are split into volatility risk and CAT risk. As far as biometric risks are concerned, trend risk is added. The sum of these sub-risks is supposed to be the underwriting risk, i.e. the 1% Tail VaR or 99.5% VAR.

We have therefore been puzzled by the definition of CAT risk provided in CP20. In this document, it is stated that [5.366] *"When considering possible catastrophe losses over the following 12 months, the intention is that the CAT charge should represent the average effect on the net asset value of the insurer of the 1% of scenarios, including multiple catastrophes that cause the greatest fall in net assets (i.e. 1% TailVaR)."*

Because 99% VaR and 99.5% VaR are quite close, this definition implies that CAT risk alone would account for almost the entire targeted measure of underwriting risk. We fear that applying this calibration leads to a double counting of risks. To illustrate this, let us suppose that the target measure of underwriting risk is the 99.5% VaR for the Gaussian law. This amounts to 2.57. Measuring CAT risk as the 99% VaR of the portfolio leads to a risk capital of 2.32. If volatility risk capital is also the 99% VaR of the portfolio, the current formula would lead to an underwriting risk charge of 4.65 – much higher than the theoretical requirement of 2.57.

We will now detail the various potential pitfalls behind the current proposed approach.

It is appealing to distinguish between the different sources of risk an insurer is exposed to, and to name these volatility and catastrophe risk. However, in the case where volatility risk and catastrophe risk are distinct sources of risk, the charges (99%TVaR) for each sub-risk must be

18 - Or underwriting risk as a whole where reserve and premium risk are measured together.

19 - Technical provision in the CEIOPS mode.

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aggregated rather than simply summed, as is currently being proposed in the formula.

Risk charges should only be summed where the risks are perfectly co-linear, which actually means there is a single risk factor. In this case, there is no need at all to split this unique risk factor into two sub-components, as this would only add unnecessary complexity to the calculations.

For instance, in the case of insurance against natural events (flooding, hurricanes), it should be sufficient to take the CAT scenario to account for the risk, with no need to add a volatility component.

It can also be noticed that in some cases, segregating the "CAT" and "Volatility" risk drivers may require extra data processing. This is because it is not always sufficient to segregate claims according to their amounts when segregating the risk drivers, because small claims can also arise because of natural events (e.g. limited higher sea levels, storms or flooding). Here, double-counting of the CAT risk may occur, because the inability to correctly process the claims database would lead to incorporating some of the CAT risk into volatility risk (because a storm is a limited natural disaster).

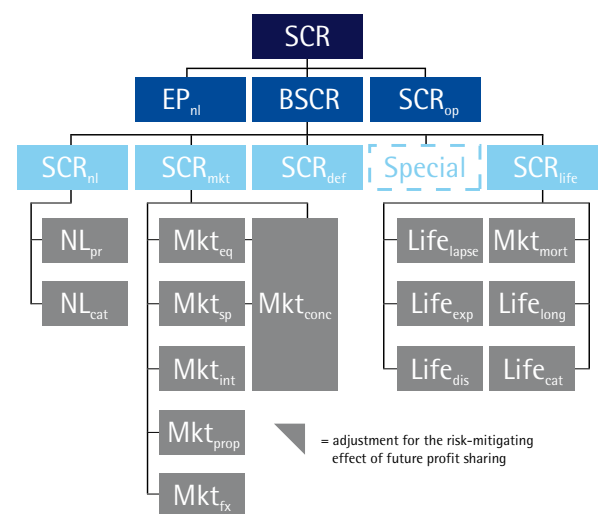
We also insist²⁰ that in order to encourage diversification in catastrophe risk, geographical diversification must be recognised in the formula²¹. That is to say that an insurer that holds risk in both Portugal and Poland should hold less "CAT-risk" capital charge than two national insurers combined.

Finally, it should be remembered that the capacity of the financial market to sell protection to insurance companies, in particular with regards to CAT risk, is much higher than that of the reinsurance market. As a consequence, CEIOPS must give incentives to insurance companies to seek protection on the financial market in order to ensure a management of systematic risk for

the European insurance industry. All financial forms of protection and risk shedding should be recognised, even in the standard formula.

3.4. Aggregating individual capital charges

The illustration below comes from CP20.



It shows the structure of the standard formula. The individual risk charges are aggregated into the four main risks (non-life, market, default, life), which in turn are aggregated into the basic solvency capital requirement (BSCR).

Where all the dependencies between risks are known, the most practical way would be to aggregate all single capital charges thanks to a single correlation matrix instead of a two-stage process. However CEIOPS argues that estimating all co-variances between all risk factors is too demanding in terms of data.

It should be added that where there is a large dependency between sub-risks that are in different modules, as is the case between lapse risk and market risk, it is probably necessary to add a scenario where lapses increase during large changes in interest rates.

20 - See our previous position paper "QIS2: modelling that is at odds with the prudential objectives of Solvency II".

21 - The recognition of the benefits from diversification, formally named subadditivity of risks, is a property of coherent risk measures such as TVaR. This property is to be expected from a sound solvency framework.

4. Guidelines for internal models are needed to facilitate comparability between insurers

As far as the standard model is concerned, we view the formula as overly restricted, because, for instance, the benefits of dynamic strategies in risk management are never considered in the standard approach, while we have judged this approach to be totally inefficient and at odds with the initial Solvency targets.

The flaws of the internal model approach are very different from those of the standard formula, but may be equally dangerous. We argue that the current lack of guidelines encourages cherry picking in the design of internal models. To demonstrate this, we will show that from a single dataset, there can be various estimates of risk capital depending on the method used as well as on the family of probabilities of distributions allowed for fitting the dataset.

We will consider that two generic approaches are available to insurers in order to estimate the Value-at-Risk of a portfolio. They are empirical analysis and parametric VaR.

Empirical analysis refers to the method presented by CEIOPS at the end of the consultation paper. It consists in referring to a sample of data and assuming that all possible events have been observed in that sample. The data can consist of risk factors, as is the case in the example proposed by CEIOPS. It can also consist of the observation of direct losses in the case of insurance risk. The main advantage of this approach is that provided the dataset is common between practitioners and the exposure is similar, the result will also be the same. For instance, in the example provided by CEIOPS, one can see that the worst annual change in equity price in the given sample is 40%. In more refined approaches, the scenarios would be drawn in a random fashion from the sample, and the Value-at-Risk would be extracted as a given ranked scenario.

However, empirical analysis has strong drawbacks. Where there is a long data sample, such as is the case for equity and bonds in the United States,

people would claim that what happened nearly 100 years ago is a naive estimate of the 1% worst risk because times have changed, and would tend to restrict the data set to a smaller range, where naturally the probability of having observed an extreme event is reduced. In the data set proposed by CEIOPS, which is reduced to a length of 15 years, the probability of having observed an event that happens once in 200 years is 7.5%²². In other words, CEIOPS proposes an example where there is more than 90% probability that the worst case scenario will not be observed.

Moreover, where the data set is small, not only is there a high probability of underestimating the necessary capital. But when there are important tail-losses, one single important loss in a small set will lead to a considerable overestimation of the necessary capital. This method introduces volatility in the estimation of the risk capital. When the data set differs across financial institutions as is the case when one refers to its own loss data set, then empirical analysis will result in large variability in the estimates of capital of financial institutions that are nevertheless similar.

For parametric²³ VaR, the choice of the candidate laws for fitting the data has a strong impact on the measure of risk capital. While it is obvious that within the family of laws chosen by the financial institutions, only those which show acceptable goodness of fit will be kept, it is not obvious that all institutions will take the same family as the basis of their work. If no constraint is imposed upon the companies, there may be a tendency for cherry picking. Some practitioners have observed cherry picking in the modelling, that is to say, some law that would demand a much larger capital than the Gaussian assumption can be rejected despite being the best fit to the data.

We therefore think it is important that CEIOPS specifies a minimum set of probability laws to be tested for each class of risks. For instance, it could be specified for certain high tail risks that

22 - If there are only fifteen points of observation over one year, then the probability of observing a scenario with probability p is $1-(1-p)^{15}$. The infra-annual data in the sample proposed by the CEIOPS provide an extra length to the sample, and hence a marginally higher probability.

23 - Parametric VaR supposes that the data follow a given law of probability, but not necessarily the normal one.

4. Guidelines for internal models are needed to facilitate comparability between insurers

Extreme Value Theory techniques must be applied. EVT techniques focus on the tail of the law (on extreme losses). This implies a two-stage process to fit the parameters of the candidate laws of distributions to the data, one for the body and one for the tail. Without a specific process to estimate tail risk, the standard normal or log-normal laws can sometimes appear to fit the data (they would for instance pass the Kolmogorov-Smirnov adequacy test) but could lead to serious underestimation of tail risk.

Also important is to try to set up a market standard for the risk measure within certain categories of risk. While for the normal law there is a perfect equivalence between Value-at-Risk at a certain threshold and Tail Value-at-Risk with another level, this is not the case for all laws, and CEIOPS must provide a clearer standard. CEA has already pinpointed that for the Gaussian law the 99% VaR is slightly more demanding in capital than the 99.5% VaR. There is no need to add that this is even more important for fat-tailed distributions, which could be relevant for the non-life lines of business.

Conclusion: Significant improvements in the Solvency II framework but grave incoherencies remain

The standard formula represents a short-term view of the solvency of insurance companies, just as Basel II does in the case of banks. This is despite the fact that the nature of the insurance business and its risks is long-term, which would ideally plead for an ALM-based regulation where solvency requirements are calculated from internal models, provided these reflect management actions and vice versa. However, in order to be standard, the formula needs to be a good compromise between accuracy and simplicity in terms of implementation, which pleads for a short-term view because solvency is easier to evaluate over the short term. In this paper, EDHEC defends the idea that the necessity of a relatively simple formula that can be implemented in all institutions should not hinder the evolution of the sector and in particular its ability to manage its risks.

EDHEC recognises there has been significant progress since the framework proposed in QIS2. In particular, most of the concepts appear to be clear, as should be the case in an economic framework. However, the very nature of the insurance business, where risks from different sources are combined, in particular hedgeable and non-hedgeable risks, makes it necessary to give precise guidelines. EDHEC insists that CEIOPS must now focus on improving the guidelines to be applied when calculating the solvency capital requirements. Guidelines are necessary to avoid the temptation of cherry picking, but also to avoid diverging interpretations of the concepts and methods to apply, as this would make the comparability of the balance sheets illusory. Most dangerously, we have shown in this document that the lack of guidelines may lead to double counting of risks.

- Double counting may happen in the cases of CAT Risk. The Market Value Margin may also be excessive because financial risk may be mixed with insurance risk.

- On the other hand, the unrealistic view that the stock market may fall by 40% at the end of the day may lead either to excessive

capital requirements or to arbitrage strategies. Concerning market risk, we also recommend that CEIOPS use more than one factor to represent the bond market.

More generally, as far as calibration is concerned, the principle should be calibration to market prices where these are available, as well as a symmetrical treatment of assets and liabilities. Where, as is the case today in the formula proposed by CEIOPS, risk is calculated by taking all actions from management into account on the liability side but none on the asset side, the relevance of the results can legitimately be questioned.

A final word is that CEIOPS would probably appear to be more proactive if it were to authorise available techniques to reduce risk. Dynamic risk management, i.e. the ability to modify one's portfolio long before the company is close to bankruptcy, is very efficient in reducing risk. Transferring risks to the financial market is for insurance companies an efficient complement to reinsurance programmes, as it allows for better management of counterparty exposure and dynamic risk management, for instance by monitoring exchange-traded catastrophe options such as those issued by the Chicago Board of Trade (CBOT). As reinsurance companies themselves can transfer their risks to the financial markets, this form of transfer also guarantees that both the reinsurance companies, and as a consequence the insurance sector as a whole, are immune from systematic risks. For these reasons, we expect CEIOPS to make sure that these efficient risk absorbers can be used in the standard formula.

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.

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