Putting a dampener on Solvency II

One aim of Solvency II is to reduce the effect of market volatility on solvency. CEIOPS has proposed a so-called 'dampener' approach, but does this in fact simply reduce the capital charge, still leaving agents susceptible to asset fire-sales?

BY MOHAMED LECHKAR AND DENNIS VAN WELIE

Solvency requirements for EU insurance undertakings are under review. As the current system has been perceived as being insufficiently risk-based, the European Commission has proposed a revision to the solvency standards under the so-called Solvency II project. This solvency framework for (re-) insurance undertakings is scheduled to be implemented in 2012. Like Basel II for banks it is founded on three pillars: financial requirements, including a risk-based solvency capital requirement (SCR) in Pillar I, management and supervisory practices in Pillar II, and supervisory reporting and disclosure requirements in Pillar III.

Recent market events have raised some concerns about risk-based solvency systems such as Solvency II. One concern is the volatility of asset prices. A sharp decline in asset prices could potentially lead to breaches of solvency requirements. This could then lead to fire sales of assets, which in turn would depress prices even further, creating a vicious cycle. Some view declines in asset values as a short-term effect that has no bearing on the long- term return, and believe insurance companies, due to the long-term nature of their investments, should not be forced to take such declines in value into account when determining solvency requirements. In this way, they hope to eliminate incentives to sell off their assets during periods of downturn.

Several measures have been proposed to address this issue within Solvency II. These focus either on Pillar II measures (own risk and solvency assessment, longer recovery period when in breach of the SCR) or on quantitative Pillar I measures focused on addressing equity market volatility, such as 'dampener' approaches. One such dampener proposal is included in the fourth quantitative impact study (QIS4) of CEIOPS.[1]

In this article, we focus on the effects of dampener approaches in general and assess the impact on solvency of the specific duration-based dampener tested in QIS4 in particular using data from the recent market turmoil. We find the QIS4 dampener does not dampen the effect of volatility, but instead lowers the capital charge for equity risk significantly. We argue that this is a very unwelcome feature of a risk-based solvency regime like Solvency II.

1 See QIS4 Technical Specifications [1]

Figure 1. The impact of the simple dampener on the capital charge

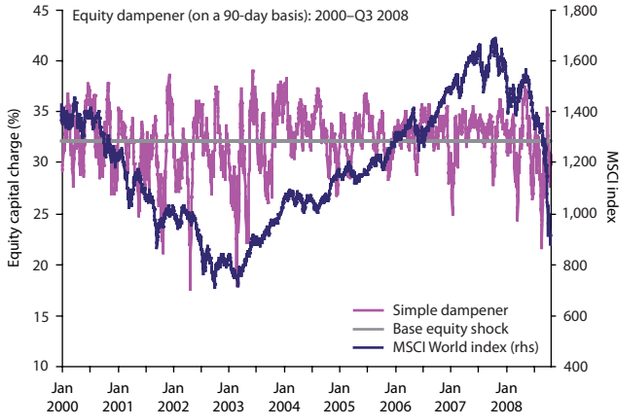


Table 1: The impact of different time horizons on the dampener

	Largest decrease (percentage points)	32% shock decreases to:	Largest increase (percentage points)	32% shock increases to:
45 days	14%	18%	7%	39%
90 days	14%	18%	7%	39%
180 days	21%	11%	14%	46%
360 days	25%	7%	21%	53%

Recent market events show that equity markets can be very volatile and that markets fall by more than the mean stresses allowed for by the approach in QIS4. The duration dampener approach therefore results in insurers being significantly undercapitalised and unable to reach the necessary safety standard for European consumers. To avoid the fire-selling of shares during stressed markets we propose to further develop the ladder of intervention in Solvency II, which in itself creates a natural dampening mechanism.

The dampener

The principal function of a dampener, as its name suggests, is to 'dampen' the effect of a short-term market fluctuation on a company's solvency, by temporarily adjusting the capital charge. If stock market prices suddenly and sharply drop, the equity charge is lowered. Over time, either as the equity prices rise again to their previous level or as the long-term average adjusts to the lower value, the equity charge increases back to the standard value. The box above provides an outline of a simple example of a dampener.

An equity dampener generally works by adjusting for short-term volatility by including a moving average (the term

$$\frac{Y_t}{\sum_{t-x}^{t} Y/x}$$

in the example above). If the equity price suddenly drops sharply, the average decreases by a smaller fraction, so the capital charge decreases considerably. If the equity shock is temporary, the stock values and capital charge increase to their original values and the effect on the solvency position will be small. If the equity shock turns out to be permanent, the stock values remain low but the capital charge increases to its original level. In this case, the dampener buys the insurers some time. Note that since the dampener lowers the capital charge, it in effect assumes that the risk of a further reduction has decreased. The use of a dampener therefore assumes mean reversion in equity markets: that equity prices have a 'mean' value, and any move away from this value is more likely to be followed by a return to that level than a further move away from it. This is a very strong and controversial assumption with no broad consensus among academics and the industry.

Figure 1 reflects the impact of the simple dampener with a 90-day time horizon and a base equity shock as considered in QIS4[2], EQ = 32%, over the period January 1, 2000–October 24, 2008. The graph shows the equity capital charge drops significantly in several cases.

While the principle of the dampener is straight-forward, it can be structured in many different ways. A dampener has five features that have to be decided upon: the reference index, the length of the time horizon on which the dampener is based, the symmetry or asymmetry of the adjustments, and the use of a cap or floor on the dampening effect and the base equity shock. We discuss each of these in turn.

A simple dampener for equity risk

Simple dampener equity charge =

$$EQ - \left(1 - \frac{Y_t}{\sum_{t-x}^{t} Y/x} \right), \qquad (1)$$

where EQ is the standard equity charge in %, Y_t is the value of a reference index at time t and x is the time horizon of the dampener.

Reference index

The first feature of a dampener is the index that determines the distance between the current asset value and the 'long-term average'. The dampener can be based on the equities held by the insurer, or on some 'typical' portfolio of assets.

Time horizons

Basically, the dampener compares the recent, short-term value to a long-term, 'mean' result. For the short-term value, the value at calculation date t could be used, or an average over several trading days. For the long-term value, a simple mean could be used over some longer time period, from say a month up to the one-year horizon the Solvency II framework employs: the draft directive [2] states that the charge needs to be explicitly based on the capital needed to cover, with a 99.5% probability, the losses occurring over one year.[3] The greater the difference between long-term and short-term horizons, the greater the dampener effect. This is an intuitive result: by lengthening the measurement period for the long-term value, this value becomes more constant, and any short-term effect would bring it further from the long-term 'mean'. Note that this also means it takes longer for the capital charge to

2 This is for global equity indexes. A higher shock of 45% is placed on developing market indices, etc. See [2]
3 See Article 104.4 in the draft Solvency II Directive [2]

adjust to a realignment of market prices, thereby creating a greater disconnection between the market-based reality and the calculated capital charge. Table 1 shows the impact of different time horizons for the long-term value on the dampener, based on an MSCI world developed market index for the period January 1, 2000–August 14, 2008, and a shock of 32%. The longer this dampener period, the greater the effect on the capital charge.[4]

(A-)symmetry, caps, floors

Table 1 brings to our attention the third and fourth features of the dampener: symmetry and a cap/floor. These two features are actually interconnected. If the dampener is symmetric, any short-term increase in stock market values would lead to a correspondingly higher capital charge. An asymmetric dampener would in effect have a cap in place at the standard level of the capital charge. If, for instance, the capital charge is 32%, a sharp increase in the stock market value would not increase the capital charge over the 32% value. Note here that a symmetric dampener could also include a cap, but would be expected to have a floor equidistant from the base shock. For instance, a cap at 42% (=32%+10%) for the symmetric dampener would be expected to be accompanied by a floor at 22% (=32%-10%). An asymmetric dampener could be rationalised by remembering the original reason for creating a dampener: to prevent fire sales; there is no reason to institute a higher shock for increasing stock values. However, this would imply that there is only mean reversion present for bear markets, while bull markets are expected to continue. While mean reversion is in itself a strong assumption, a 'bear market mean reversion' would be even more controversial.

Base shock

Finally, the base shock value has to be considered. The shock tested in QIS4 is 32%, but further work is still needed to ensure this is calibrated to the 99.5% confidence level. Insurers generally use equity shocks greater than 32% in their internal models; a leading industry body, the CRO Forum, noted in its QIS3 benchmarking study[5] that the average equity stress applied by firms in their internal models was 39%. The 32% equity shock that was tested in QIS4 not only threatens the level of protection of policy holders, but also has a negative impact on the incentives for firms to develop their risk management. Promoting better risk management is one of the most important objectives of Solvency II, and having an equity shock in the standard formula that is consistent with economic reality is an essential aspect of achieving this goal.

Once the desired base shock value is determined, one considers how it should be incorporated in the design of the dampened charge. When the short-term and long-term values of the stock market are equal, should the dampened charge equal the original base shock? Should the same shock be applied in a dampener based charge, or does the presence of a dampener justify a different shock? To give an example, when an asymmetric dampener is present, a higher base shock could be justified.

At its core, a dampener approach is about smoothing changes in equity prices. A dampener approach explicitly moves away from market valuation. Whereas the recent financial turmoil originated in a class of assets for which estimating a market value is very difficult, the dampener approach amends explicit market values established by deep, liquid markets. The dampener could be seen as a way to extend the recovery period for undertakings in breach of the capital requirement, but this is not quite correct. An extension of the recovery period buys the insurer more time to take action to comply with the capital requirement while still recognising that the undertaking is in effect in non-compliance, whereas a dampener approach adjusts the calculation of the capital requirement to ensure the undertaking remains compliant. In effect, the 'blame' of non-compliance is placed on the markets instead of on the insurer.

The duration dampener in QIS4

The technical details of the duration dampener approach tested in the European impact study carried out in the summer are set out below.

The QIS4 duration dampener is symmetric and uses a 10-day average for the short-term effect (Y_t^{-10}), a one-year average for the long-term effect (Y_t^{-261}) and a base shock of 32%. The use of the natural logarithm in the short- and long-term averages results in a greater dampening effect; the minimum and maximum capital charges are lower than a dampener based on simple averages. The dampening term $VaR(k, c_t) = F(k) + G(k) \times c_t$ consists of a cyclical component $G(k) \times c_t$ and a duration component $F(k)$. Since both components depend on the duration of the liabilities of the insurer, it is clear the total equity charge does also. This is a very controversial assumption.

The duration dampener has the effect that certain assets are 'earmarked' to cover certain liabilities, in that their capital charge is lowered if they cover

The QIS4 duration dampener

Inputs

The market value of the equity portfolio, MVEP.
The duration of liabilities (of more than 3 years), *k*.
The share of the technical provisions accounting for more than 3-year commitments, α.

Output

$SCR_{equities} = MVEP \times (\alpha \times VaR(k,C_t) + (1-\alpha) \times 32\%)$

where
$VaR(k,C_t) = F(k) + G(k) \times c_t$,
and $F(k)$ and $G(k)$ are coefficients defined in the following table:

Duration of the liabilities *(k)*	*F(k)*	*G(k)*
3–5 years	29%	0.20
5–10 years	26%	0.11
10–15 years	23%	0.08
Over 15 years	22%	0.07

The cyclical component c_t is defined as:

$$c_t = \bar{Y}_t^{10} - \bar{Y}_t^{261},$$

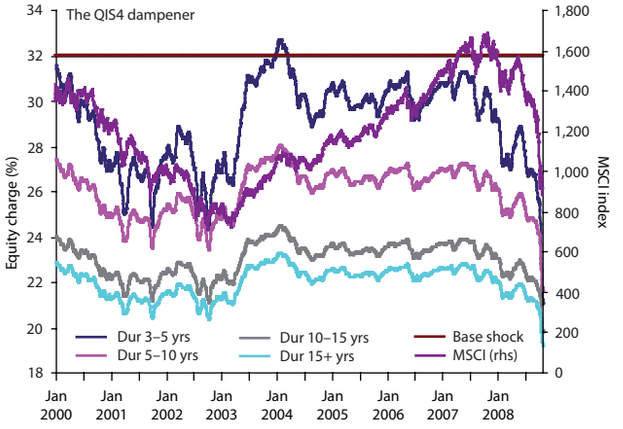
where

$$\bar{Y}_t^N = \frac{1}{N}\sum_{i=0}^{N-1} \ln\left(Y_{t-i}\right)$$

is the mean of the (log of the) equity index over the last *N* trading days. The value of c_t in the QIS4 specifications (set on December 31, 2007) is c_t=-0.013.

4 We have calculated the dampener effect on a daily basis.
5 See [3]

Figure 2. The impact of the dampener approach on the base equity shock in QIS4



Assets		Liabilities	
Equities	25	Own funds	20
Fixed income	50	Liabilities	80
Real estate	10		
Other	15		
Total	100	Total	100

longer-term liabilities. This is to adjust for mean reversion. Interestingly, there are no requirements to actually hold the earmarked covering the long-term liabilities for that time period. A lot can be said about this feature, but here we focus on two of the main drawbacks. First, note that the dampener already implies a mean reversion effect. A second adjustment of the capital charge for mean reversion is difficult to justify, especially as it is not explicitly linked to prevention of fire sales. Second, it is very hard to believe this duration approach is a suitable methodology to provide 99.5% confidence that assets will cover liabilities in 12 months time, a key requirement in the Solvency II draft directive. Even if the strong assumptions on mean reversion hold in practice, the insurer still has to show their assets will cover the liabilities on a one-year time horizon. It appears that with such an approach the insurer may seem to have a strong solvency position in the long term, but in reality will fail in the short-term.

The duration dampener is a factor-based calculation: it does not take any risk-mitigation strategies (eg, put options) into account. This means the actual risk exposure could be overestimated by the calculated. We do not discuss the effect of the choice for a factor-based calculation in this paper.

Figure 2 demonstrates the effects of the QIS4 dampener, based on the MSCI world developed markets index, on companies with liabilities of different duration over the period January 1, 2000–October 24, 2008. The graph shows, for example, that in the case of an insurer with duration of liabilities higher than 10 years, the equity capital charge can drop below 22%.

The effect of the dampener on the solvency ratio

The most relevant question is the ultimate effect of the dampener on the solvency ratio of an insurance company. When equity values fall, the available capital consequently also drops. Given the fact that the equity exposures have decreased, the total equity capital charge also decreases. In the dampener proposal the capital charge declines even more. Theoretically this might even lead to the counter-intuitive outcome that the solvency ratio improves in adverse economic circumstances.

Owing to the design of the formula, the impact of the QIS4 dampener in solvency terms does not seem obvious at first sight. To show the effects, we set up a simple example. We take three fictitious 'average' life insurers with the following assumptions[6] that hold for all three:

- The insurers invest in the MSCI world developed markets fund
- Equities form 25% of assets
- Basic own funds form 20% of the liability side of the balance sheets
- Equity risk forms 60% of total market risk, and market risk forms 80% of the total capital requirement, so that equity risk accounts for roughly 50% of total risk. We will use this later on when calculating the total SCR
- The SCR for other risks, in addition to equity exposure, is 8% of total assets
- Average duration of the portfolios of both insurers lies between 10 and 15 years
- The equity investments are less than the size of the liability portfolio so that all equities can be 'earmarked' to cover the liabilities, ie α=1.

The simplified balance sheet for the three insurers is shown in the table to the left.

To determine the SCR for equity exposure, we now apply the 32% base shock to insurer 1, the QIS4 dampener to insurer 2, and the simple dampener (1) to insurer 3, leaving all other assumptions the same.

For insurer 1 we look at the effect of a 32% base shock on his solvency ratio:

SCR_{equity} = 25*0.32 = 8
SCR_{total} = 8 + 8 (for other risks) = 16
Initial solvency ratio (insurer 1) = 20/16 = 125%

For insurer 2 we look at the effect of the QIS4 dampener on its solvency ratio. The initial solvency ratio for this insurer in a stable environment (ie, the condition that the long-term and short-term equity values are equal,

$$\bar{Y}_t^{10} - \bar{Y}_t^{261}$$

which leads to $c_t = 0$) would then become:

SCR_{equity} 25*$(F(k) + G(k)*c_t)$ = 25*(0.23 + 0.08*0) = 5.75
SCR_{total} = 5.75 + 8 = 13.75
Initial solvency ratio (insurer 2) = 20/13.75 = 145%

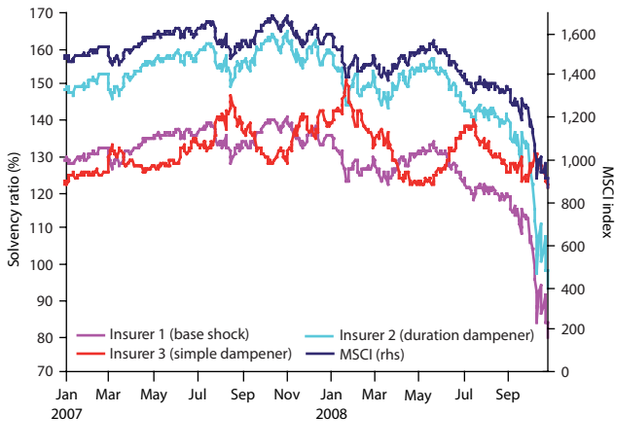
For insurer 3 we use a 32% shock including the simple dampener (1) from our earlier example, based on a 90 day long-term average. We do this to assess and compare the dampening effect of the QIS4 charge.

The impact of the MSCI world developed markets index on the solvency ratios of these insurers on a day-to-day basis can be seen in figure 3.

This simple example shows three important effects: (1) even the 32% basic shock is too optimistic in the context of recent market movements, (2) for an insurer with the simple dampener, an increasing solvency ratio could indicate either good or bad news in the balance sheet and (3) the

6 These figures are based on input from various public sources: see [4], [5]

Figure 3. The solvency ratios of the fictitious insurers



duration dampener does not dampen but instead lowers the capital charge for equity risk significantly.

The solvency ratio of insurer 1 (based on the equity shock without dampener) closely tracks the MSCI index, since the index is the only variable that affects the solvency ratio. The impact on the solvency ratio for insurer 3 (the base shock with simple dampener) is almost diametrically opposed: when the equity value strongly decreases, the capital charge for the simple dampener decreases, and the positive effect of the lower shock overshadows the negative effect of the lower value of the assets. Therefore, the solvency ratio increases (decreases) when equities sharply decline (increase) in value. See for example the strong opposite movements of the MSCI index and the solvency ratio for insurer 3 in the period July 2007 through October 2008. A sensitivity analysis we performed with other amounts of equity investments and time periods (not displayed), returned qualitatively similar results.

Interestingly, the course of the solvency ratio of insurer 2 does not follow that of insurer 3. The duration dampener seems not so much a dampener of equity volatility as a reduction in the equity charge. The result is that the solvency ratio of insurer 2 is not dampened but just gets higher, although the economic environment is the same for both insurers. This is caused by the design of the duration dampener.

The impact of the duration of liabilities (parameter F in the formula) is much greater than the dampening effect (parameters G and c_t), which in the end results in almost no dampening but instead in a (significantly) lower capital charge. Therefore in a dampener approach the solvency ratio is in danger of losing its signalling effect. This is an unwelcome feature for the ladder of intervention, but also has negative effects on market discipline through public disclosure under pillar III of the Solvency II proposals. While it may be possible to construct a dampener that reduces the equity volatility and still provides solvency ratios that give correct information on the actual solvency position, neither of the dampeners tested here meet these objectives.

Conclusion

The duration dampener approach in QIS4 moves away from the risk-based and market-consistent values of Solvency II. It thereby creates a disincentive for firms to develop further risk models and use them for regulatory capital calculations, one of the most important aims of Solvency II. In particular, the approach reduces the base capital charge significantly without lessening the effects of market volatility. The result is that the duration dampener approach does not provide the necessary confidence that assets will cover liabilities within the Solvency II one-year time horizon. Furthermore, there is an implicit assumption in the duration approach that the firm will stay in business long enough for the markets to rise again. This proved not to be the case for some insurers and pension schemes in the recent past. The purpose of a risk-orientated approach such as Solvency II should be to force an institution to take action when its risk profile reaches an undesirable level.

The recent financial market turmoil shows the importance of an adequate treatment of the risks associated with asset volatility. We recommend working with a soundly calibrated equity capital charge without a Pillar I dampener. The draft Solvency II directive provides enough possibilities to mitigate any possible procyclical effects through the use of the two solvency standards (the minimum- (MCR), and solvency- (SCR) capital requirements in Solvency II), combined with a range of measured supervisory interventions (Pillar II). The ladder of intervention in Solvency II is designed in a way that when capital drops below the SCR, gradual interventions are triggered until available capital reaches the MCR. These gradual triggers create a natural dampening mechanism, and avoid selling shares during stressed markets.[7] Unlike the dampener approach, these measures will also maintain the most important benefits that Solvency II claims to offer to the European insurance industry: market-consistent capital requirements and an incentive to develop better risk management systems. This would be welcome in the context of current market conditions, where the troubles have exposed the fact that much of the world's financial institutions' risk management was not up to the expectations placed upon it. L&P

7 The European Central Bank also recognizes that this is the way to avoid procyclicality by Solvency II. See [6].

Mohamed Lechkar (m.lechkar@dnb.nl) and Dennis van Welie (d.van.welie@dnb.nl) are policy advisers in the quantitative risk management department at De Nederlandsche Bank (DNB). They have written this article in a personal capacity. *The authors want to thank Marc Pröpper for valuable comments.*

References

[1] European Commission, 'QIS4 Technical Specifications', 2008,
http://ec.europa.eu/internal_market/insurance/docs/solvency/qis4/technical_specifications_2008_en.pdf.

[2] European Commission, 'Draft Solvency II Directive', 2008,
http://ec.europa.eu/internal_market/insurance/docs/solvency/proposal_en.pdf.

[3] CRO Forum, 'QIS3 Benchmarking Study', 2007,
www.croforum.org/publications/qisiiibenchmarkingstudy_resource/File.ecr?fd=true&dn=qis3_crof_20071109_final.

[4] CEIOPS, 'CEIOPS Report on its third Quantitative Impact Study (QIS3) for Solvency II', November 2007,
http://www.ceiops.eu/media/docman/public_files/publications/submission-stotheec/CEIOPS-DOC-19-07%20QIS3%20Report.pdf .

[5] CEA, 'European Insurance in Figures', CEA Statistics No 31, August 2007,
http://www.cea.eu/uploads/DocumentsLibrary/documents/1216125503_eif.pdf.

[6] ECB, 'Potential impact of Solvency II on financial stability', July 2007 ECB,
http://www.ecb.int/pub/pdf/other/potentialimpactsolvencyiionfinancialstability200707en.pdf.