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## Real-world modelling for SII SCR internal models: 'point-in-time' v 'through-the-cycle'

The basic idea of a 1-year VaR calculation is quite straightforward:

- it values assets and liabilities 'today' to obtain an initial balance sheet (eg, Technical Provisions in SII);
- produces an estimate of the joint distribution of relevant risk drivers, eg, using a Monte-Carlo ESG, over the 1-year horizon;
- re-values assets and liabilities based on the projected end-points; and
- it reads-off the estimated

Having an internal model that reliably estimates this is a Solvency II requirement and provides a tool to investigate key risks and strategies for managing those risks. Due to the complex nature of insurance liabilities there are challenges in being able to estimate this 1-year distribution. However, whatever method is adopted for this calculation, an integral part of the process will be the joint real-world projection of the major risk-factors over 1-year.

In this Insights – the first in a series discussing key issues around real-world projection – we discuss the aim of our real-world projection: are we aiming to generate a forward-looking projection relevant to the coming year, or a projection that represents a typical year? This decision can have a significant impact on the size of the SCR and also the viability of any hedging and risk management strategies.

### Projecting risk factors for 1-year VaR

There are a number of key modelling questions that need to be answered when projecting risk-factors (estimating distributions, structure of dependency between risks, type of stochastic model...), however more fundamental is the RW framework in which these modelling decisions are made. In this note we are going to examine two frameworks: 'Point-in-Time' and 'Through-the-Cycle'.

What do we mean by these terms? A 'point-in-time' (PIT) estimate of the distribution would answer the question of what is our best estimate of the return distribution (say on the EURO STOXX index), given (or conditioned on) the state of today's market. This naturally feels like the right thing to consider in order to determine what the VaR will be over the coming year.

In contrast, a 'through-the-cycle' (TTC) estimate is not based upon our estimate of the equity return distribution over the coming year – but rather is based upon our (unconditional) estimate of the distribution in a typical year. For example, we might have a view that, over the long run, the volatility of the FTSE All-Share is (say) 17% - but, today, market volatility is elevated so we believe that, over the next year, an appropriate volatility is 25%<sup>1</sup>. Using the TTC approach, we would calibrate our ESG to a volatility of 17%, whilst in a PIT approach we would use 25% giving us different distributions and SCRs

In this particular situation we would expect the PIT estimate to result in higher capital requirements. (Of course, it is not just volatility that might be expected to change with market conditions: some analysts have argued that expected returns will increase following a period of distress, which could conceivably decrease the severity of tail events in the year following a large negative return. Our own view<sup>2</sup> is that, whilst it may be reasonable to assume some

1. These numbers correspond to Barrie & Hibbert's 1-year Point-in-time and TTC estimates at 30 Sep 2008.

2. See Barrie & Hibbert's Insight Note: Is there a case for a less severe equity stress test following 2008 returns? [http://www.barrhibb.com/knowledge\\_base/article/is\\_there\\_a\\_case\\_for\\_a\\_less\\_severe\\_equity\\_stress\\_test\\_following\\_2008\\_returns/](http://www.barrhibb.com/knowledge_base/article/is_there_a_case_for_a_less_severe_equity_stress_test_following_2008_returns/)

increase in expected returns, we expect the net impact is to increase the severity of tail events<sup>1</sup>.) This brings out a key point often made in opposition to the PIT approach: it will typically require companies to hold more capital (due to rising volatility) at precisely the time when their capital has been eroded by market losses. To maintain capital levels, it is argued, that firms might then be encouraged to sell equities at distressed prices, driving prices lower and deepening the market decline. By contrast, a TTC approach, would essentially leave forward-looking assumptions (eg, volatility) unchanged – reducing the tendency towards procyclicality.

This may be so, but under the TTC approach we are knowingly suppressing our genuine view of probability distributions over the coming year. You might say 'so what?' and argue that the need to avoid procyclicality and the maintenance of stability is more important than the theoretical consistency of approach. However, if you make this choice, it is important to understand that it has some consequences for risk and capital management.

### TTC: an inconsistent approach?

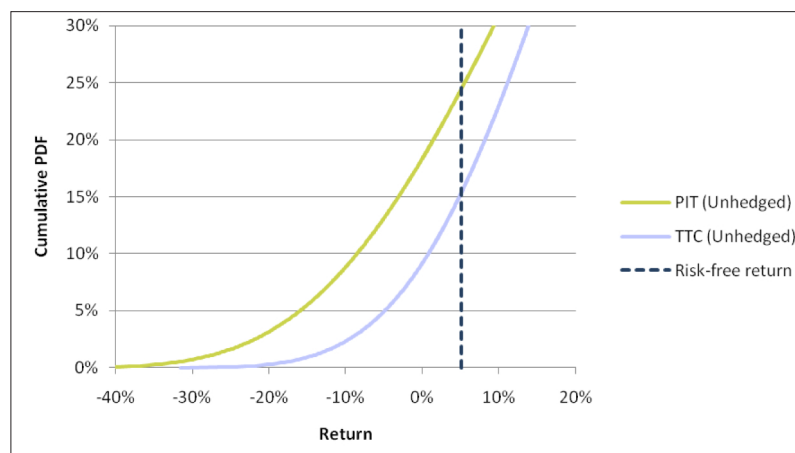
Within a TTC approach, we are combining starting asset prices, set at market levels, with forward-looking views based, loosely speaking, on a 'long-run' estimate. As asset prices incorporate market expectations at that point in time, this presents an inconsistency that can have an impact upon practical risk-management decisions<sup>2</sup>.

To give an example, say an insurer is choosing whether to hedge equity exposure through an option contract. The market option price will be based upon a conditional view of market volatility – if the impact of that option upon capital requirements is calculated based upon unconditional assumptions, its apparent impact on market risk will be mis-stated, and will not be consistent with its cost. Put simply, if (PIT) 1-year market volatility is 25% - and option costs reflects this – but the impact on capital is evaluated on a lower (TTC) volatility of 17%, then the hedge will appear unattractive.

Making some simple assumptions allows us to construct a quantitative example. Suppose that an insurer has written a policyholder guarantee that amounts to an ATM (spot) 1-year vanilla put option, so the company can hedge by purchasing that option in the market, or can choose to bear the risk (which we assume, for simplicity, is backed with a cash investment earning 5%). Finally, we assume that the equity index is lognormally distributed with a TTC volatility (as above) of 17% and a PIT 1-year volatility of 25%. On a TTC basis, the unhedged position might appear attractive (dependent upon the firm's risk appetite) – bearing the risk offers an expected return of 7% over the risk-free rate, at the cost of risking a -18% loss at the 99.5% level. However, on the PIT basis this risk looks less attractive with a lower expected return (4% over cash), and a significantly larger loss at 99.5% (-32%). As, by assumption, the PIT approach represents (our best guess at) the 1-year distribution, the TTC projection makes the naked position appear more attractive than we really believe, reducing the incentive for the company to acquire the simple option hedge. The impact of projecting equity returns based on TTC or PIT assumptions is shown in Chart 1, overleaf.

1. This is consistent with a 'back-of-the-envelope' calculation of the effect of increasing volatility, making the assumption that the equity market-price-of-risk remains constant (and is 0.2, consistent with a volatility of 20% and a mean return of 4%) and that the shape of the returns distribution does not change significantly.
2. A 'fully unconditional' approach – in which both characteristics of the projected returns, and initial prices, would be set at typical 'Through-the-cycle' levels – would restore consistency, but of course would not be consistent with initial market conditions. But such an approach might arguably be of use in 'benchmarking' strategic asset allocation type work.

**Chart 1:** The impact of using a PIT or TTC approach to projecting equity returns in our simple example.



This issue is clearly not restricted to equity options. As a result of breaking the link between today's market prices and expectations, the impact of many different exposures may be misrepresented when we use a TTC projection. eg, under TTC projections of expected defaults, in benign market conditions credit default insurance will appear 'cheap' as the projection will overstate expected losses – in this case the impact of a hedge would be overstated .

What do regulators have to say on this subject? With one notable exception, recent CEIOPS consultation papers covering the Standard Formula (CPs 69 & 70) do not suggest that stress-tests should vary with market conditions. The exception is the Symmetric Adjustment Mechanism which suggests that equity-market stresses (alone) should be conditional upon current market conditions – but this adjustment is explicitly intended to reduce the risk of procyclicality and so is of the opposite sense to our economic view that forward-looking risk increases following distress events. As such, it is even further from an 'economic PIT' approach than TTC.

So, regulation which takes a TTC approach (or adjusts stress tests in a way that differs from the economic viewpoint) has the potential to create a disconnection between economic and regulatory capital management. Or, under SII, where the two are intended to be in very close alignment (eg, the Use Test), it motivates the business to manage risk under the TTC approach, potentially leading to spurious actions caused by (knowingly) using expectations which do not match genuine views. This is not good risk management.

So if we are to avoid TTC projections, how do we avoid procyclicality? This remains an open and challenging question for regulators, but we would suggest that hiding genuine changes in market volatility, for example, is not the right approach. Isn't it better to acknowledge our view of the forward-looking distribution over the coming year and be open about the implications that has for confidence levels? That is, if we demand that firms are (only) capitalised to withstand a 99.5% event over 1-year, a natural consequence is that, following that event, capital levels will be eroded and might not be sufficient to withstand an additional 99.5th percentile event.

One option is simply to acknowledge this fact and deal with it as well as possible through flexible regulation to avoid distressed selling of risky assets and the systemic risk that may bring. The CRO forum expresses a similar view, suggesting "A decrease in available capital due to distressed market prices for assets shall not require immediate regulatory intervention"; and "regulatory intervention must be flexible"<sup>1</sup> .

1. But note that the CRO forum do not make this argument in favour of a PIT approach that leads to more variable equity stress tests, but rather make it against a PIT approach that dampens the equity stress test following a market fall, such as the Symmetric Adjustment Mechanism. In another note (Calibration Principles), the forum clearly advocates Standard Formula stress tests using a TTC approach, contrary to our arguments in this note.

## Summary

A Real-World ESG projection of relevant risks over 1-year is a key input to many methods for the calculation of Solvency II SCR. The nature of the model calibration to be used is an important question.

Many in the insurance industry have argued that approaches to capital under Solvency II should be based upon a through-the-cycle approach to projection (or upon an approach which dampens stress-tests following distress). This may be appealing in the interests of stability but introduces an inconsistency between the basis on which we project to assess market risk, and the point-in-time information which drives market prices. When market conditions are far from typical, this approach could have important implications for the Internal Model's usefulness as a risk management tool, and for the alignment of regulatory and economic capital.

Given this, we argue that a better approach is to recognise that our best assumption for the forward-looking distribution will change with market conditions, and then to deal with the impact of that reality to manage the risk of procyclicality. A difficult challenge for sure; but surely a better option than hiding problems in a way that, in the 'right' conditions, could significantly understate the risk to solvency.

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