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Risk-adjusted pricing: Risk-neutral, real-world, or does it matter?

By Seng Goh and David Wang

Traditionally, U.S. actuaries have relied on real-world profit measures in product pricing. In the past few years, there has been an increasing interest in the industry to apply a more market-consistent approach to value products. There have also been debates on which approach is better. The two approaches, however, are not so fundamentally different, if used appropriately.

Below is a list of some of the commonly used real-world profit measures:

- Premium margin: Ratio of present value of pre-tax statutory profits over the present value of premiums at an assumed discount rate
- Internal rate of return (IRR): The rate at which the present value of distributable earnings is equal to zero
- Embedded value: Present value of distributable earnings discounted at an assumed discount rate
- Return on asset (ROA): Ratio of present value of pre-tax statutory profits over the present value of projected assets at an assumed discount rate

A common feature of these measures is that the assumptions typically reflect the actuaries' best estimate of what happens in reality, particularly the investment assumptions. This seems a very reasonable approach. If the company invests in equities in real life, then it makes sense for the actuary to assume an expected return that corresponds to the historical performance of the equity assets. However, investing in equity assets exposes the investor to risks. And a general belief in finance is "high risk, high return." So by assuming a higher return from equity investment, actuaries bring in extra risk to the product's risk profile. The question is then: *How is this risk quantified and reflected in pricing?*

One common place to reflect risk in pricing is through the discount rate. However, the selection of the discount rate often involves great subjectivity. Some might argue that the discount rate should be the company's weighted average cost of capital (WACC). WACC may reflect the overall investment risk of the company, but does not directly reflect the risk associated with the product itself.

Aside from the investment risk (or market risk), there are also other risks associated with the product, including uncertainties related to lapses, mortality/longevity,

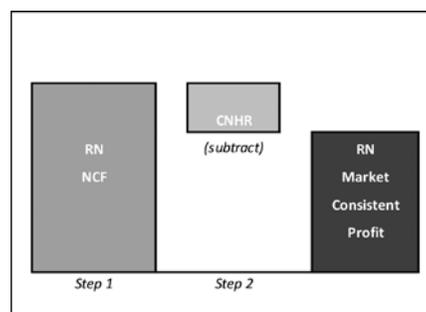
expenses, and even operational risks. These risks are not accounted for explicitly in any of the real-world profit measures that we have seen. Sensitivities can be performed to study the variability of the profitability to the risks, but the results are more of an indication rather than quantification of the risk exposure.

Therefore, we believe the biggest issue with traditional real-world pricing is a lack of explicit consideration for all the risks associated with the product and how the product is managed.

Interestingly, this issue is directly addressed in the market-consistent embedded value (MCEV) calculation recommended by the CFO Forum. The market risk is directly addressed through risk-neutral valuation, where the risks associated with investments in different assets are directly removed and all assets are expected to earn the same risk-free return. The non-market risks are required to be quantified through a component called cost of non-hedgeable risk (CNHR). Although the CFO Forum provides no explicit guidance on the calculation of CNHR, companies typically follow the cost of capital approach as recommended under the Solvency II.

MCEV and Solvency II probably sound too European for us actuaries in the United States. However, if we strip out the details, as illustrated below, essentially the Europeans try to calculate a price at which all risks are accounted for and at which the product can be traded (at least conceptually) in the market. The risk-neutral net cash flow (RN NCF) is the average present value of cash flows calculated over a set of risk-neutral scenarios, thus allowing for market risk. The CNHR is the cost of capital required for all non-market risks. The net result is therefore a market-consistent price (or profit in pricing concept).

Illustration 1: Risk-neutral pricing



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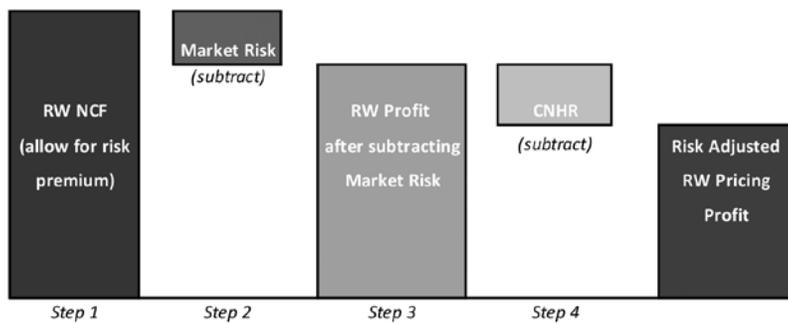


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It is probably debatable whether a market-consistent price applies to insurance products, since no market exists today where investors can trade insurance products. However, we can still learn from our European peers and modify our current pricing approach to explicitly account for the risks.

Illustration 2: Risk-adjusted Real-world Pricing



As illustrated above, the real-world net cash flow (RW NCF) is the average present value of cash flows over the best-estimate real-world investment assumptions. Since we will address the market risk explicitly, the discount in this step should just be at the earned rate. The market risk is a quantification of the market risk associated with the asset investment. The CNHR is the same as in MCEV, a quantification of the non-market risks. The net result is what we call risk-adjusted real-world profit.

Illustration 3: Economic Capital



The two approaches in Illustration 1 and 2 could potentially produce the same result. When that happens, the adjustment for both market and non-market risks in real-world pricing is exactly the same as the adjustment that the market would require to achieve a market-consistent price. However, they do not have to be the same. The market risk and CNHR in real-world pricing can reflect the company's own view of the cost of these risks instead of the market's view. This is an important thing to note, and fundamentally differentiates our suggested approach from either MCEV or the traditional real-world pricing. In order to calculate the market risk and CNHR in real-world pricing, perhaps the cost of capital approach that is often adopted by our European peers can also be borrowed. For example, the variable annuity product is subject to C3 Phase II (C3P2) capital, which essentially quantifies the market risk. The C3P2 requires conditional tail expectation 90 or CTE90, which is the regulator's view on the minimum capital for market risk. The company may investigate its own view on market risk, and may decide on, say, CTE98 to be more closely reflective of the product's market risk. Then the difference between CTE98 and CTE90 is the additional economic capital the company decides to hold for the market risk. Reflecting the cost of this capital in pricing will thus provide the market risk component in Illustration 2.

The CNHR can also be calculated in a similar manner. Again, we can start from the regulatory minimum required capital and recalculate the additional capital required if the non-market risk factors (such as lapse, mortality, expense, etc.) are worse than the best-estimate assumption. This is fundamentally similar to how Solvency II determines CNHR, except that we do not calculate this in a risk-neutral framework. The degree of stress to assume in the CNHR calculation is again based on the company's own view of these risks. Solvency II provides some useful guidance on the assumptions, but companies can develop their own view and methodology. As illustrated in Illustration 3, the market risk and CNHR effectively combine to form the company's economic capital in addition to the regulatory minimum.

In summary, it is probably wrong to ask whether real-world pricing or risk-neutral pricing is better. A more important question is whether and how risks are reflected

in pricing. We have offered our view on how this can be done in a real-world pricing framework. And the risk-adjusted real-world pricing effectively does the same thing as risk-neutral pricing in MCEV. But the former allows the company to build in its own view on the risks rather than to accept the market's view. Through our illustration, we have also shown that a very important piece in risk-adjusted pricing is the quantification of the risks. Therefore, pricing is very much linked with risk management directly, and economic capital can play a significant role at the outset of product development rather than simply serve as a tool for in-force management. □

“A very important piece in risk-adjusted pricing is quantification of the risks.”

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