

Actuaries and Assumptions

by Jonathan Jacob

The recent financial crisis has highlighted the ability of the actuary to manage risk. After all, professionals in the world of finance were to blame for the crisis by taking on excessive risk through leverage and illiquid assets. As actuaries were busy managing risk profiles for insurance companies and pension plans the investment professionals were piling more risk on and in different formats.

But are actuaries and the actuarial profession truly blameless?

In any model, assumptions are necessary to generate output. Typically, the model is run with varying assumptions to determine how sensitive the output is to the input. But what if the philosophy of generating assumptions is flawed?

Actuarial assumptions are based on historical analysis. Mortality rates used for annuities and for life insurance premium calculation are based on historical death rates, usually with some augmentation for expected longevity improvement which is also based on historical improvements. These rates are obviously different, perhaps accounting in some sense for what financial practitioners would call “bid-offer” but in the actuarial world the term used is adverse selection. There is a greater likelihood a buyer of an annuity will live longer than a buyer of life insurance:

“...set of results acknowledges that annuity purchasers tend to have a mortality experience that differs from that of the general population. Whether this is the result of those who have information that they are likely to be long-lived purchasing annuities, or simply a function of different (and potentially observable) characteristics of annuitants and non-annuitants, is not clear. In any case, because annui-

tants have longer life expectancies than the broader population, insurance companies have developed a second set of mortality tables.”³

While this sense of accounting for adverse selection has been well utilized in the realm of mortality, it may be coincidental due to “different characteristics of annuitants and non-annuitants”. In fact, one can posit that if historically observable mortality rates for annuitants were higher than those of life insurance buyers the insurance companies would use those higher mortality rates for annuity premium calculations. Leaning on historical observable data for generating assumptions permeates the actuarial world from lapse rates to pension fund discount and return assumptions to models for guaranteed minimum death benefits.

In the investment world, however, the base assumption is maximization of economic utility. In other words, every participant will exploit financial products to maximize its value for him or herself. For example, given the choice of refinancing his or her mortgage, the consumer will account for the cost of the refinancing as well as the rate differential to determine if the decision to refinance is financially optimal. The mortgage issuer realizes a loss at the time of refinancing as the present value of cash flows is now lower than it was prior to the refinancing. However, the issuer has likely taken two important steps prior to the refinancing. First of all, the mortgage was priced with the value of the option embedded into the price and the value of the option assumes that the consumer will exercise the refinancing option when it is optimal to do so. Second, the issuer has likely hedged the risk of rates declining and the likely refinancing that would occur at that time. This means that in practice the mortgage issuer does not realize a loss when the mortgage refinances; rather, the issuer is actually realizing a gain

³ J. Brown, O. Mitchell, J. Poterba “Mortality Risk, Inflation Risk and Annuity Products”, Working Paper 7812, NBER Working Paper Series, July 2000

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whenever the consumer does not refinance since optimal re-financing was a pricing assumption.

Over the past 20 years, insurance companies have waded into the capital markets with outright financial products and hybrid products, such as segregated fund guarantees, variable annuities and guaranteed minimum death benefits. Unfortunately, some of these products have cost insurance companies dearly. The assumptions underlying many of these products were generated by historical experience rather than maximizing financial utility, which may have distorted both the pricing and the hedging of these products. Some examples where actuaries can improve assumptions:

- An owner of a policy will not lapse unless the present value of future payments exceeds the present value of expected cash flows;
- Conversely, the policy owner will lapse once the present value of future payments exceeds the present value of expected cash flows;
- An owner of a product with a guarantee who can choose from an array of assets, will always choose the asset with the highest volatility;
- Since a financial product or index has not behaved in a certain way in the past, one cannot assume this will always be the case;
- The best estimate of forward yields can be extracted from the current yield curve.

Implications of this shift in methodology would be significant. Pricing of products would increase significantly and the products would no longer be financially viable to consumers.

Furthermore, the strongest counterargument to adopting this methodology is the fact that consumers do not behave optimally. Products with embedded life contingencies should continue to see suboptimal behavior from consumers with respect to the financial component of the product, since the life contingencies component is the main reason for purchasing the product.

While the above may be true, an investor in life insurance companies would be disappointed to learn that the profitability of the company rests on consumers behaving in a suboptimal fashion. Or an investor in a manufacturer with a relatively significant pension plan may be shocked to learn that actuaries valued the plan assuming a return of 8 percent when the expected return based on the yield curve for fixed income and long-term expectations for the stock market should be closer to 6 percent.

There is no right answer when dealing with assumptions in financial models. However, both actuaries and investment professionals can agree that if the input is inappropriate the output will certainly not add value. If assumptions are based on historical behavior, one can argue that behavior changes over time. The Internet, for example, provides a forum for experts to instantaneously disseminate information to consumers on how to optimally take advantage of insurer products. It should be acknowledged that it may not be appropriate in all areas of practice for actuaries to assume that consumers behave in a way which maximizes their financial utility. But it is time for actuaries to learn from investment professionals with respect to the assumptions used in models.

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