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Commentary

BUFFIN PARTNERS INC. ECONOMIC INVESTMENT AND ACTUARIAL RESEARCH

Principle of Actuarial Uncertainty

The work of actuaries is principally concerned with the projection of asset and liability cash flows for institutional entities such as insurance companies, pension funds and social security systems. But these asset and liability cash flows cannot be projected with certainty; there is an inherent element of uncertainty associated with any actuarial projection. In a 2004 document published by the Society of Actuaries *Principles Underlying Asset Liability Management*, the Principle of Uncertainty was described as follows: "The dynamic environment as well as pure randomness create uncertainties in the cash flows and, hence, in the true risk exposure. Risk varies as the underlying risk factors (e.g. interest rates, equity returns, mortality, etc.,) change and as future expected cash flows are replaced by actual cash flows. This process reflects cash flows reacting to factor changes (e.g. interest-sensitive cash flows), truing up to actual experience, and results in revisions of future assumptions. The ultimate risk exposure will be a function of the actual cash flows. Asset Liability Management (ALM) requires the use of models to project future uncertain cash flows. In some cases, simple deterministic models can be used and ALM can be based on one set of expected future cash flows. In other cases, such as when future cash flows are expected to depend on future economic conditions, more complex models may be required to understand the interaction of the asset and liability cash flows. Stochastic models are often used to simulate future expected cash flows under various scenarios to help identify the associated risk exposures. These models produce statistical distributions of potential results and different ALM strategies can be evaluated by studying the range of results produced from modeling these strategies. Modeling can also be used to construct many possible futures or scenarios, and then, results across all the scenarios can be used to measure risk in the portfolio. Model risk is the additional risk created when the model does not adequately represent the underlying process or reality. There are two general classes of model risk; the risk of model misspecification, oversimplification, (or even outright errors), and the risk of a changing environment not anticipated in the model. For example, using a lognormal model of stock market prices produces a distribution with too few extreme value sample points to adequately assess the risk for some complex embedded options, such as guaranteed minimum death benefits. In addition, the volatility of equity returns varies over time and this may not be accurately captured in the model."

Communicating the nature of uncertainty requires particular care and skill to ensure that the intended users of actuarial projections fully comprehend the implications of reliance on single-scenario or multi-scenario deterministic projections. A particular skill is required in communicating the comparable uncertainties and the degree of credibility to be given to stochastic projections. Many users of actuarial projections intuitively interpret them as absolute measures of future outcomes without an explicit acknowledgment of the uncertainty principle or the stochastic nature of the various risk elements underlying the projections. Conventional actuarial practice converts the future cash flows into a single number as a discounted present value. This process, while intended to convey the actuarial value of a series of future contingent cash payments, by converting them into a simple, easy-to-understand, single number, has the effect of masking the extent of the uncertainty associated with this discounted present value. Actuarial projections are typically re-evaluated on a continuous dynamic basis at regular intervals over time so as to capture the extent of deviations of the actual emerging experience from that assumed in the original or preceding projection values. This process is often the source for revealing unanticipated financial risks that were inherent in the principle of actuarial uncertainty. For this reason, the use of stochastic projection techniques is gaining wider acceptance, replacing or supplementing traditional deterministic projection techniques. Stochastic projections produce an array of plausible outcomes with an associated probability or credibility measure. While a single deterministic projection or the median (50th percentile) of a stochastic projection may represent a "best estimate" at a single point in time, the stochastic projection model permits the user to see a full array of potential outcomes that deviate from the best estimate value. Some would argue that the use of stochastic models to present an array of results with associated probabilities is too confusing and too difficult for the typical user or policy-maker to comprehend and, as a result, believe in the "keep it simple" principle and advocate the use of simple deterministic projections only. We firmly believe, however, that there is great merit in presenting and carefully explaining the results of stochastic projections as a means of illustrating the nature of uncertainty and the quantification of risk associated with the interpretation of an actuarial "best estimate" of future contingent events.

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