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Flight Testing a New Investment Strategy

In recent years, the growing use of dynamic financial analysis (DFA) in asset/liability management for insurance companies has demonstrated the value of stochastic modeling as a decision-support framework that integrates underwriting and investments. Combined with the increasing sophistication of the financial markets, this development has created new opportunities for managing enterprise risk, while at the same time enhancing investment return.

We can think of dynamic financial analysis (DFA) as a “flight simulator” that we can use for testing insurance company investment strategies. The process begins with constructing a model that captures the essential features of an insurance company, such as expected levels of future premiums and losses, fluctuations in investment returns, and volatility in reserves. The next step—the fun one—involves creating and testing alternative business strategies to see their impact in the simulator, giving management a turn in the cockpit. Afterward, it is possible to replay the flight recorder and investigate what happened in various parts of the company over time and across several scenarios.

The most powerful aspect of DFA, however, is the ability of its expert practitioners to distill the copious numeric output into a compact set of metrics that are relevant to a specific company. Much of the

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industry, understandably and correctly, focuses on traditional metrics such as standard deviation, total return, operating leverage, and combined ratios in managing day-to-day operations. However, our experience has shown that these metrics provide a limited perspective on the long-term enterprise-level concerns. Rather, we have found that customized variables, such as the likelihood of achieving specified goals, can often be more enlightening. Utilizing such variables, the DFA process can focus a company’s attention on the handful of actionable metrics that best articulate its key enterprise objectives. This is particularly helpful when a company is faced with a rapidly changing investment and underwriting environment. We illustrate such an approach in this article.

Introducing DMIC

We start with a hypothetical company, DMIC, operating at some hypothetical future date. The company has experienced several years of poor underwriting results. However, recent tort reform and a hardening of the market due to the exit of several large companies have created an environment in which DMIC is beginning to thrive. DMIC’s board of directors has committed to increasing the company’s surplus





Taking an incremental approach to portfolio reconstruction gives management the flexibility to conform the magnitude of change in portfolio holdings to the realities in its annual statement.

by 50% over the next five years, from \$200 million to \$300 million.

In the investment markets, DMIC observes that credit spreads have expanded, the yield curve is moderately upward-sloping, and volatility is on the rise. For the time being, DMIC has chosen not to use common stock.

Against this backdrop, DMIC would like to explore whether changing its asset allocations will help the company achieve its medium-term business objectives. Several years prior, DMIC's board had viewed the results of a traditional mean-variance portfolio optimization and noted that it was difficult to interpret standard deviation and total return in terms of their specific impact on the company's prospective financial statements. However, because DFA models incorporate key elements of insurance company business logic, the board is able to specify the metrics that they find most relevant to their current situation.

On the reward side of the risk-reward equation, the board selects two variables: average ending surplus (at the end of the 5-year period specified in the simulation) and the probability that ending-date surplus might equal or exceed the 50% objective for growth. For a better assessment of risk, the board selects the probability of a year-over-year decline in surplus. To address a paramount concern, they also choose

the probability of a negative investment return in any single year. These customized variables seem more in tune with the goals of the company and the management risks it confronts, and will be analyzed in addition to the traditional frontier chart.

To complete the simulation, the insurance analyst must arm himself with company information he will need: both historical and prospective financial data, including schedule P loss triangles; details on the company's reinsurance program; tax information; future underwriting projections; and operating cost assumptions. With the company's objectives in mind, the analyst then builds a "base-case" model that is analogous to the virtual 747 in the flight simulator.

The "base-case" model is a dynamic representation of the company that will react realistically as various parameters such as asset allocation are tweaked. This model is carefully tuned to produce start-of-simulation financial statements that match the company's actual starting conditions as closely as possible, and also produce a series of mean values similar to what would be expected in future financial statements that reflect DMIC's latest business plan.

After a detailed presentation on the procedures used to select the parameters included in the model, DMIC signs off on the business assumptions and financial statements produced by the DFA simulation, as representative of the status quo. The next phase is to contemplate the alternative strategies that can help DMIC achieve its objectives.

The Investment Alternatives

The board is interested in exploring different ways to increase long-term after-tax return via a change in its investment mix. They have also expressed a willingness to consider assuming additional risk, if accompanied by a sufficiently large additional return.

As a starting point, because of past underwriting losses, DMIC has been investing solely in taxable instruments, which include Treasuries, agencies, mortgage- and asset-backed securities (MBS/ABS), and corporate obligations. It has tended to favor "AA"- and "AAA" rated securities and to overweight short-term investments, relative to the industry. Scenario A will look at optimizing the mix of investments (Set A) among these fully taxable asset classes.

Now that the hardening-rate environment has exhausted its net-operating loss, it has become worthwhile to investigate the possible gains from tax-advantaged instruments, such as municipal bonds and dividend-received-deduction (DRD) -eligible preferred stocks. The set of assets that includes both those in Scenario A and these new asset classes is Set B.

Finally, we will investigate the impact of allowing newer investment-grade structured products and high-yield corporate debt as the Set C scenario. In recent years, the size of the structured-products market has expanded rapidly, allowing investors to participate in

underlying pools of loans (CLOs), bonds (CBOs), and other debt instruments (CDOs). These products are typically designed with tranches, which are analogous to layers in a reinsurance program, that allow investors to pick their desired risk profile, from unrated through “AAA.” Yields are typically higher than for corporate bonds of equivalent rating and tenor. We will also allow for the possibility of an investment in investment-grade catastrophe bonds, although this is admittedly unlikely for many smaller insurance companies.

The eligible asset classes under each scenario are summarized in Table 1.

Illustrative Results

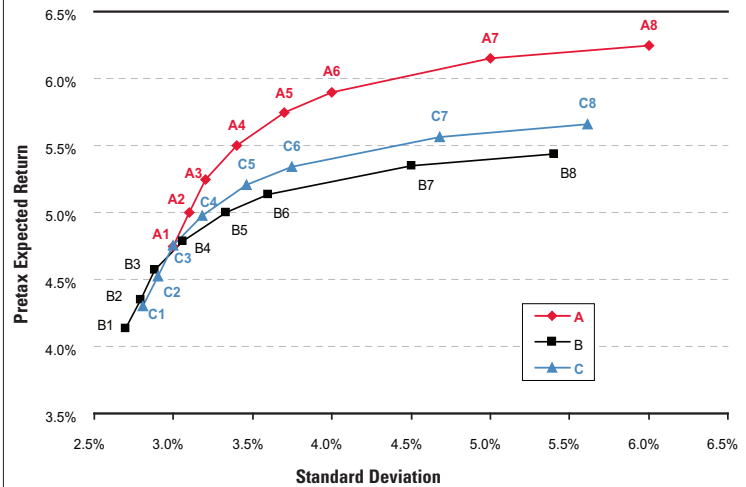
When set in the context of the traditional efficient frontier (standard deviation vs. total return), the results of the three scenarios are neither surprising nor particularly helpful. In such a configuration, as shown in Figure 1, the eight observation points contained on each frontier represent different mixes of the “permitted” asset classes in the three categories listed above.

Shifting from the original, fully-taxable security mix (Set A) to one containing municipal obligations, preferred stocks, and a more liberal selection of taxable securities (Set B) has the predictable effect of lowering pre-tax returns (due to lower municipal yields) and reducing portfolio volatility. Adding a variety of structured products to the mix (Set C) increases returns relative to Set B—but at the expense of the somewhat higher volatility. In terms of pretax return, the company’s current guidelines allow for the highest “reward” in most cases.

If we were to number the points along each curve as “A1, A2 ... A8”, “B1, B2 ... B8” etc., someone looking only at Figure 1 might decide that A4, A5, and A6 are good allocations to consider. However, because DMIC is a tax-paying entity, it is not possible to draw any solid conclusions from this analysis.

In Figure 2, the risk-reward tradeoff assumes a distinctly different shape when the first set of customized variables is analyzed. All three

Figure 1 Standard Efficient Frontier Sets A, B, C



Source: BBH Analysis

of the “frontiers” bend backward to the right in their lower-case observation points. Since reward is described here as a specific level of surplus, the most conservative allocations under each set of guidelines are actually “riskier”: they increase the probability of a surplus decline, once the company’s variable underwriting results are incorporated into the analysis. The lower nominal returns of municipal and preferred securities in Set B can increase the odds of a year-over-year decline in surplus in years when the underwriting result turns unexpectedly negative. The tax-efficiency of these returns also generates a higher average ending surplus. The higher yields and greater portfolio efficiencies offered by the new securities in Set C enhance surplus relative to Set A. They also result in a lower probability of an outright decline in surplus relative to the traditional tax-advantaged mix in Set B.

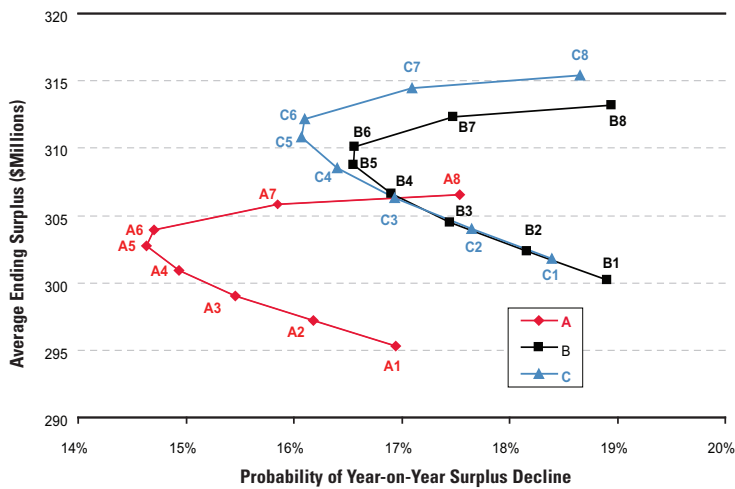
Now we can see the advantage of incorporating real-world metrics. While A4 looked like a reasonable choice in Figure 1, in Figure 2 it is clearly inferior to A5. Also, while Set A appeared to be uniformly superior to B and C in Figure 1, here the approximately \$7 million higher expected ending surplus of C5 that appears in Figure 2 may be worth the extra 1.5% probability of a year-on-year surplus decline relative to A5. As a result of this exhibit, the Board eliminates A1-A4, B1-B4, and C1-C4 from consideration.

When viewed through the prism of the DMIC’s 150%-of-initial-surplus objective and its overriding concern regarding a negative investment return, Figure 3 yields the not-surprising result that the traditional

Table 1 Eligible Asset Classes Under Alternative Guidelines

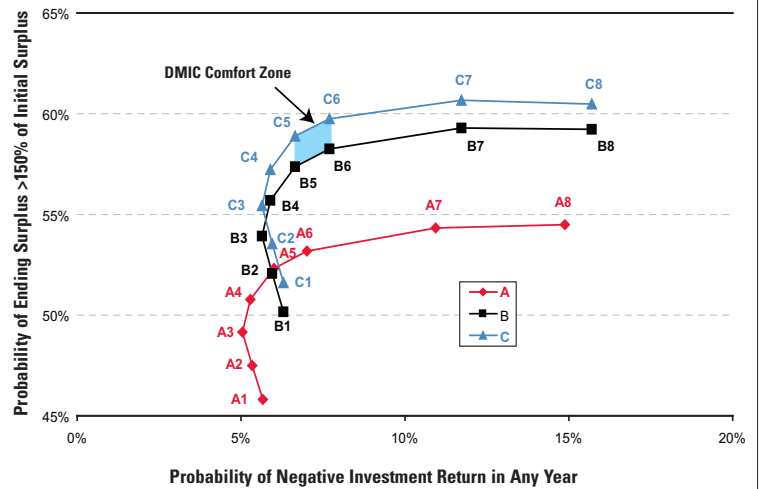
Asset Class	Set "A"	Set "B"	Set "C"
Traditional Investments			
Cash and Short Term	■	■	■
Government Bonds	■	■	■
Corporate Bonds	■	■	■
Mortgage-Backed Securities	■	■	■
Tax-Advantaged Investments			
Municipal Bonds		■	■
DRD-eligible Preferred Stocks		■	■
Structured Products and Other			
CDO/CLO/CBO			■
High-Yield			■
Investment-Grade Cat Bonds			■

Figure 2 Ending Surplus vs. Probability of Year-on-Year Surplus Decline



Source: BBH Analysis

Figure 3 Probability of Ending Surplus >150% of Initial Surplus vs. Probability of Negative Investment Return in Any Year



Source: BBH Analysis

tax- advantaged strategy (Set B) grows surplus faster, but at some additional risk of a negative investment return. It also generates the perhaps unexpected result that probability of a negative investment return is relatively comparable across all three alternative scenarios (note the scale of the X-axis.) The Board has determined that they would like to see a positive investment return, with at least 90% probability. This eliminates A7-A8, B7-B8, and C7-C8 from consideration, leaving only A5-A6, B5-B6, and C5-C6 in play.

The DMIC board is now satisfied that “reward” and “risk” have been couched in terms more relevant to their business. Having quantified the incremental contribution that an expanded toolkit can make to its strategic goals, they now understand the tradeoffs that are relevant to their unique situation and can select the strategic path that best meets their objectives. As a result of this analysis, they decide to move immediately to increase their allocation of tax- advantaged instruments (Set B) and to permit the use of NAIC Class I-rated structured products (part of Set C). While catastrophe bonds sound interesting, they are not prepared at this point to add them to the guidelines. They have also decided that they are comfortable with the risk-reward characteristics of a portfolio whose allocations are displayed somewhere in the area bounded by B5-B6 and C5-C6.

Implementing the Strategy

Now that a strategic path has been chosen, how will the required changes in portfolio composition be implemented? What are the costs of execution? How should the performance benchmark be revised to accommodate the new guidelines? And of

particular importance to the board—and to DMIC’s auditors—how much turnover would be involved in converting the current portfolio to one of the identified target allocations?

Implementation optimization models are designed to address precisely these issues. Using their current portfolio and other initial conditions as a starting point, they can identify individual purchase

and sale candidates, and estimate their impact on variables such as yield, capital gains and losses, and portfolio turnover within preset portfolio constraints, such as an “average credit quality of AA” or “target duration of between three and four years.”

When linked to a DFA engine, tactical implementation models also offer the added advantage of incorporating periodic updates of underwriting trends in the analysis. Taking an incremental approach to portfolio reconstruction gives management the flexibility to conform the magnitude of change in portfolio holdings to the realities in its annual statement. Armed with data for each of several finalist portfolios, DMIC’s Investment Committee can then more accurately evaluate the respective impact, and therefore the desirability, of the various choices identified by the modeling effort.

By integrating the strategic elements of a customized DFA “flight simulator” with real-time security pricing and contemporaneous underwriting data, DMIC is better able to navigate both the turbulence of the underwriting cycle and the vagaries of the investment environment as it pursues its portfolio restructuring. [PIAA](#)

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