The Behavior and Market Responsiveness of Synthetic GICs

Edward P. Rennie

Synthetic GICs are seen as mysterious instruments that are overly complex and require the additional burden of a third party. Because information on their expected behavior is scarce, increases in their use have been slow. In fact, however, all aspects of the synthetic GICs are fully controlled by a well-known, widely applied amortization equation, and straightforward market simulations are possible. Synthetic GICs have several positive features: They are excellent for smoothing market returns while opening up the potential for active management returns; changes in market yields have only a small impact on short-term returns; and gains and losses show up more quickly than with straight GICs. "Evergreen" synthetic GICs, those managed on an ongoing basis, avoid the effects of periodic insurance company GIC placement and rollover activities.

Insurance company guaranteed investment contracts (GICs) enjoyed an almost monopolistic position in the stable-value investment market for many years. Banks offered some competition with their bank investment contracts (BICs), but it was neither sustained nor significant. Not until the late 1980s did investors begin looking for alternatives to GICs. As is usually the case, this interest in new instruments was brought about more by necessity than by a desire for better returns or increased diversification. In this case, necessity was called the failure of Mutual Benefit and Executive Life, a real estate market in free-fall, and a seemingly endless string of insurance company bond rating downgrades.

BICs benefited to some degree because of these problems. Some sponsors of 401(k) plans, however, dearly wanting to avoid any plan option using the word "guaranteed" in its name, wanted still more: unimpeachable safety. *Voila*! The birth of "wrappers."

Treasuries have long been considered the safest U.S. fixed-income securities. The day-to-day price/yield response of Treasuries to changes in the market cannot replicate the stability of GIC returns, however. A third party—generally called the "wrapper provider"—is needed to provide a return-amortization process. This third party can be a bank, insurance company, investment banker, or any other major institutional player willing to underwrite the attendant risks of the amortization process. The wrapped product is generally referred to as a synthetic GIC.

Edward P. Rennie, CFA, is a Vice President of Pacific Investment Management Company in California.

In recent years, wrapped products have attracted a steady and increasing flow of funds. All manner of fixed-income securities are used in a wide variety of passively and actively managed wrapped products. Little has been published, however, on the responsiveness of synthetic GICs to changes in the market, so an ethereal skepticism seems to pervade any discussion on their behavior. This article provides some analyses to help clear the air.

FUNDAMENTALS

Synthetic GIC products require physically separate but mathematically inseparable accounting treatments for the market-value parameters of the underlying portfolio (assumed here to be fixed-income securities) and the participant-related value parameters. In other words, synthetic GICs require two sets of books: the "market value" books, which track day-to-day changes in the portfolio, and the "book value" books, which are derived from the amortization processes (the wrapper) applied. All contributions and distributions are carried out at book value.

To be effective, the amortization process must ensure the convergence of market and book value parameters at some preselected point in time. At such time, the market value of a portfolio can be calculated as follows:

$$MV_f = MV_p\,(1 + YTM)^t,$$

where

MV_f = future market value
MV_p = present market value
YTM = portfolio yield to maturity
t = time in years

The future book value equation looks quite similar:

$$BV_f = BV_p\,(1 + CR)^t,$$

where

BV_f = future book value
BV_p = present book value
CR = crediting rate

At portfolio inception, $MV = BV$ and $YTM = CR$. In periods thereafter, MV and YTM reflect market valuations, and end-of-period BV is simply the previous end-of-period BV incremented by the CR.

To ensure convergence at time t:

$$MV_p(1 + YTM)^t = BV_p(1 + CR)^t\,. \tag{1}$$

Thus, at the end of any computational period, usually a month or a quarter, the only unknown looking forward is the crediting rate. By rearranging the terms in Equation (1), the crediting rate can be calculated as follows:

$$CR = \left[\left(\frac{MC}{BV}\right)^{(1/t)}(1 + YTM)\right] - 1. \tag{2}$$

For "evergreen" wrapped portfolios, those designed to be run on an ongoing basis, t is the portfolio duration, D. Duration is the weighted average term to maturity of a portfolio having cash flows measured in terms of their present values. Portfolio managers typically vary duration within a defined range around a measurement benchmark consistent with their views on future interest rates. For portfolios that mature on a predetermined date, t is again the duration; in this case, however, portfolio duration decreases steadily over time reaching zero on the maturity date.

Thus, by substituting the portfolio D for t, Equation (2) takes on the form of the equation most widely used for crediting rate calculations:[1]

$$CR = \left[\underbrace{\left(\frac{MV}{BV}\right)^{(1/D)}}_{\uparrow\ \textit{Term A}}\underbrace{(1 + YTM)}_{\uparrow\ \textit{Term B}}\right] - 1. \tag{3}$$

Term A in Equation (3) effectively amortizes all portfolio gains and losses relative to book value over the portfolio duration, or amortization period.

Consider a three-year-duration portfolio with a YTM of 6 percent in which active management results in MV exceeding BV by 2 percent. The crediting rate calculation is as follows:

$$\begin{aligned} CR &= [(1.02)^{0.33} \times (1.06)] - 1 \\ &= [(1.0066) \times (1.06)] - 1 \\ &= 0.0670, \text{ or } 6.70 \text{ percent.} \end{aligned}$$

Thus, the 2 percent MV surplus translates to an increase in the crediting rate of 70 basis points. Naturally, the inverse occurs when MV trails BV.

MARKET RESPONSIVENESS—EVERGREEN STRATEGIES

For wrapped portfolios, the most commonly asked questions pertain to response of the crediting rate to various market conditions. Second are questions about the relationship between market and book value at any point in time. The simulations that follow use single and sometimes purposely exaggerated events to illuminate these relationships. For computational simplicity, bond portfolios consist of one zero-coupon bond; at the end of each month in the simulation period, the old zero-coupon bond is sold and a new one is purchased to keep the duration constant. Fees for the wrapper, investment management, and custody are disregarded.

Market Events

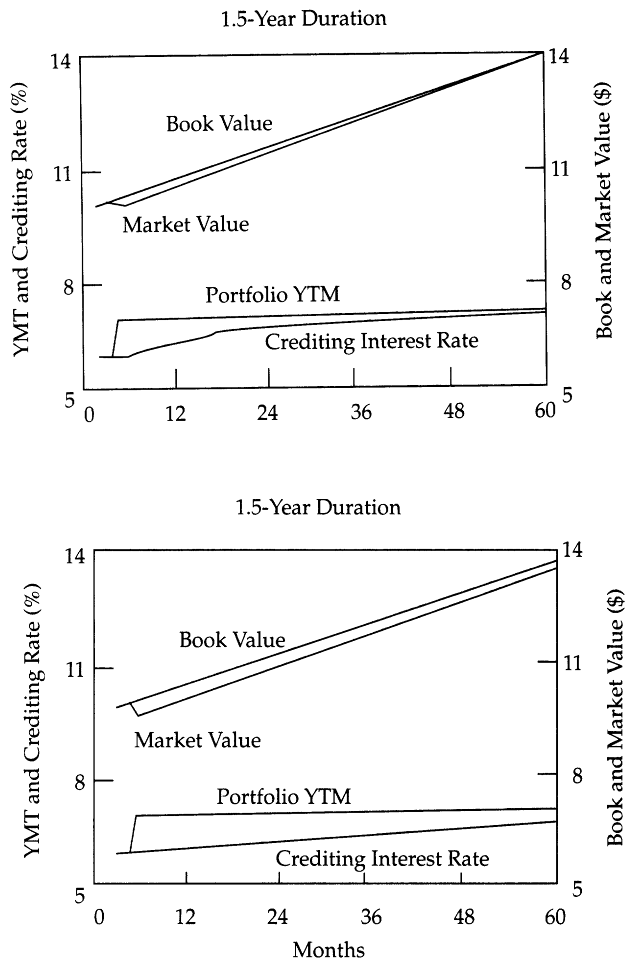
The top panel of Figure 1 shows the effect of an instantaneous increase in market interest rates (YTM) from 6 percent to 7 percent at the end of the second year in the simulation period for a fixed-income portfolio with a 1.5-year duration. The lower panel provides the same data for a portfolio with a 4.5-year duration.

The rapid increase in YTM causes a corresponding decrease in portfolio MV, yet its immediate impact on BV is almost nil; the result is that MV quickly falls below BV. Nevertheless, the attendant convergence of BV and MV begins immediately thereafter; because YTM is higher than CR, MV increases faster than BV.

The result of the higher duration shown in the lower panel of Figure 1 is obvious. It causes a more significant reaction to MV and also lengthens the period of convergence between MV and BV and between YTM and CR.

Those contemplating the use of synthetic

Figure 1. Effect of Interest Rate Increase, Synthetic GICs with 1.5- and 4.5-Year Durations



GICs worry that the difference between *MV* and *BV* will grow inordinately large. As Figure 1 shows, however, the size of the differences are fairly small even immediately after the change in *YTM*. Also, the convergence process is always at work. These factors should mollify such concerns.

The relationship between *YTM* and *CR* is somewhat similar to that between *MV* and *BV*. Immediately after the increase in *YTM*, *CR* changes very little, but then the convergence process begins reducing the difference between *YTM* and *CR*.

Most defined-contribution plans consider synthetic GICs as additions to or replacements for a portfolio of insurance company GICs. Figure 2 compares the responsiveness of both types of GIC to changing market conditions. The portfolios are of equal duration, and *YTM* increases from 6 percent to 7 percent two months into the simulation period. The GIC portfolio is assumed to be the average interest rate of 36 rolling GICs; each month, a new one is purchased at the market *YTM* and an old one matures. The synthetic GIC response is geometric, and it responds more quickly to market events than does the GIC portfolio, for which the response is linear. Nevertheless, the GIC portfolio reaches the market *YTM* faster. So, if the objective is to increase the response rate of *CR*, the synthetic GIC has a slight advantage over a portfolio of GICs.

Figure 2. Comparison of Crediting Rate Response, 1.5-Year Duration Synthetic GIC versus GIC Portfolio

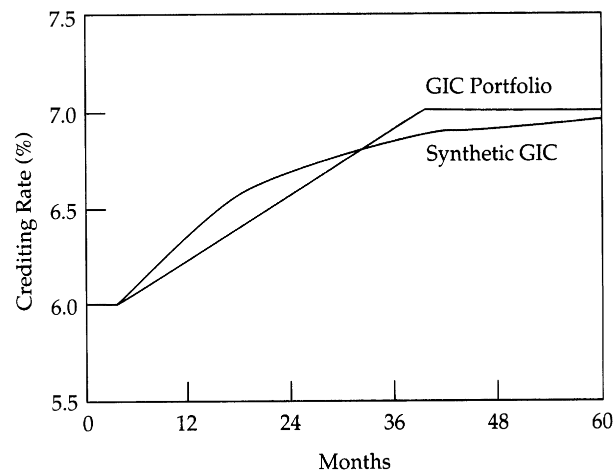
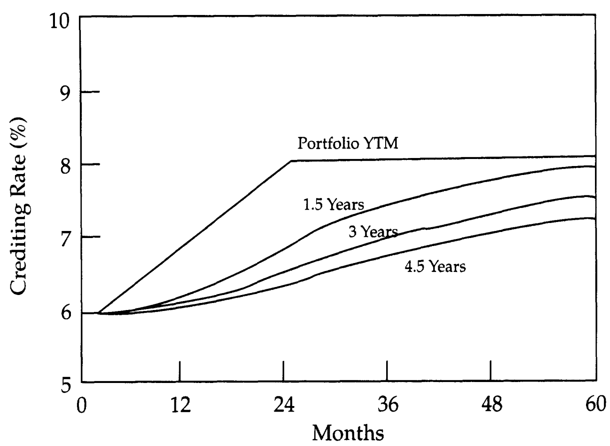


Figure 3 illustrates the more typical case: gradually increasing interest rates. In this case, interest rates are assumed to increase linearly from 6 percent to 8 percent over the course of two years. The *MV–BV* relationship is not shown, but it can be estimated based on Figures 1 and 2. The *CR*s for portfolio durations of 1.5, 3.0, and 4.5 years are shown in addition to *YTM*. Consistent with Figure 1, the convergence of the *CR* response rates with *YTM* is proportional to duration.

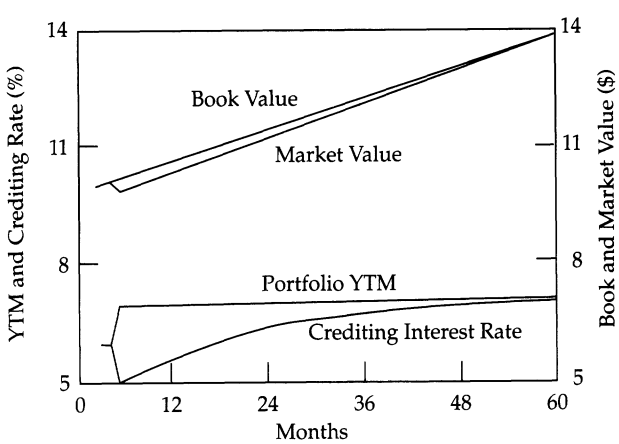
An investment manager pondering ways to improve the response rate of *CR* relative to *YTM* might conclude that using a shorter amortization period will do the trick. For example, is it possible that a three-year-duration synthetic GIC earning at three-year interest rates can achieve a better market response by substituting a 1.5-year amortization period in place of the normal three-year pe-

Figure 3. Comparison of Portfolio YTM and Synthetic GIC Crediting Rate, Various Durations



riod? This simulation is shown in Figure 4, which assumes the same 6–7 percent scenario as in Figure 1. The response rate for the shorter amortization period is faster, but the unexpected and immediate reduction in *CR* is unacceptable.

Figure 4. YTM and Crediting Rate Response, Synthetic GIC with Three-Year Duration and 1.5-Year Amortization Period



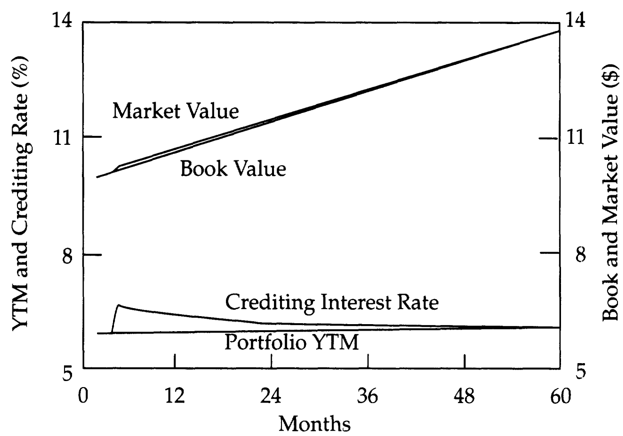
Capital Gains And Losses

Understanding synthetic GICs' response to market events is critically important, but knowing how realized or unrealized capital gains and losses in an actively managed portfolio translate to *BV* and *CR* is also useful. A simple example of such a gain would be an increase in a bond's price resulting from an upgrade in its quality rating.

A close examination of Equation (3) explains why even a large change in *YTM* has an almost negligible short-term effect on *CR*. *YTM* increases cause corresponding decreases in *MV*. Because *CR* is the product of Term A, containing *MV*, and Term B, containing *YTM*, it changes little. Such is not the case for capital gains and losses, however.

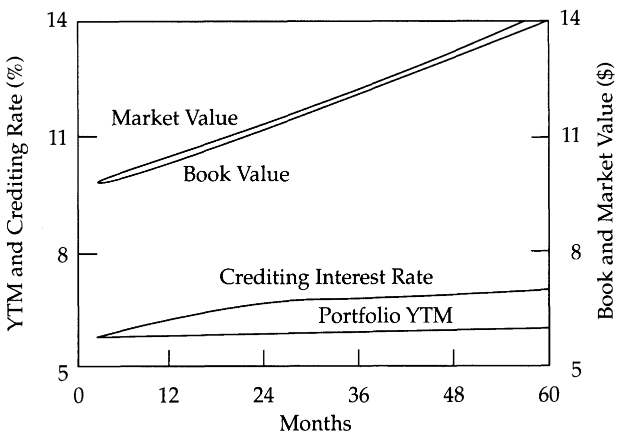
If, under static market conditions, a capital gain accrues in a fixed-income portfolio, only *MV* increases in Equation (3). Thus, one would expect a noticeable and immediate impact on *CR*, and Figure 5 confirms this expectation. It simulates a 1 percent capital gain occurring at the end of the third month. As expected, an immediate and significant increase in *CR* is realized, followed by a gradual convergence back to the market *YTM*.

Figure 5. Response to 1 Percent Capital Gain, Synthetic GIC, 1.5-Year Duration



A steady accrual of small gains following the initial funding of a portfolio also increases *BV* and *CR*. This situation is similar to the case in which an active manager is able to add incremental value in small amounts over time. Figure 6 depicts an ideal case in which an active manager is able to add steady additional return amounting to 100 basis points annually over *YTM*. The incremental gains result in a gradually increasing *CR*; in the long term, *CR* becomes asymptotic at 1 percent above *YTM*. Likewise, *MV* increases faster than *BV*, eventually reaching an equilibrium spread. The message in this simulation is that plan sponsors using superior active managers to manage the portfolio underlying the synthetic GIC should not expect immediate incremental returns. After portfolio initialization, the rewards are realized on a gradually increasing basis.

Figure 6. Response to 1 Percent Return to Active Management, Synthetic GIC, 1.5-Year Duration



YTM Sensitivities

The accuracy and method of calculation used to obtain the *YTM* in Equation (3) are very important. If *YTM* is too high or too low, the *CR*s and *BV*s will be inaccurate.

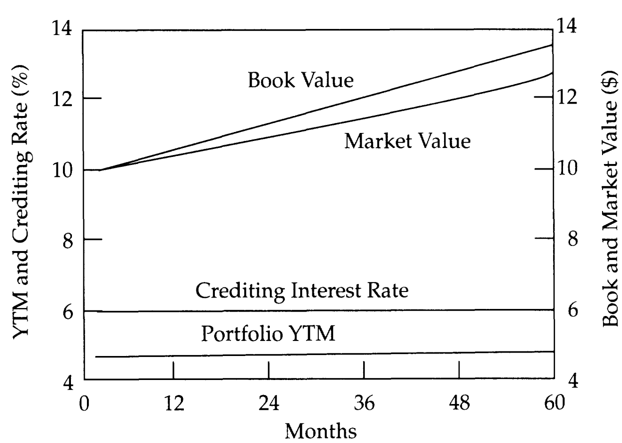
Assume, for example, that the *YTM* calculation for a new 1.5-year-duration portfolio is simply incorrect. The calculated *YTM* is 7 percent; the correct *YTM* is 6 percent. If this error persists for three months, given a steady yield curve, the resultant *CR* will be 6.16 percent—0.16 percentage points overstated. Although this discrepancy also results in an overstatement of *BV*, the levels of these inaccuracies are small. Future correct calculations of *YTM* will gradually true up the differences.

A more serious situation can arise when a duration-weighted *YTM* is used in place of a dollar-weighted *YTM*. When the securities in a portfolio are concentrated around the intended duration (a "bullet" portfolio), both dollar-weighted and duration-weighted *YTM*s will produce similar results. When portfolios are "barbelled" (concentrated at the short and long portions of the yield curve), however, the *YTM*s will be quite different.

Consider the following example in which market *YTM*s, durations, and maturities are arbitrary but fairly representative of their actual counterparts in early March 1994. A constant three-year-duration portfolio can consist of one 3.3-year-maturity Treasury (the ultimate bullet portfolio). Whether dollar-weighted or duration-weighted, the *YTM* is the Treasury *YTM* of 5.75 percent. Suppose, however, that a three-year-duration barbelled portfolio is constructed such that half of the assets are invested in three-month Treasury bills (0.25-year duration) and half in eight-year-maturity Treasuries (5.75-year duration). The dollar-weighted *YTM* is 4.7 percent. (That this percentage is lower than the bullet portfolio's 5.75 percent should not be surprising; with positively sloped yield curves, barbelled portfolios generally give up *YTM*.) The duration-weighted *YTM*, however, is much higher at six years. Which one is correct for *CR* calculation purposes? The answer becomes clearer by examining the actual return the owner of the barbelled portfolio realizes, exclusive of any wrapper or amortization process. That return would be the dollar-weighted *YTM*.

Figure 7 illustrates this example. Note the increasing spread of *BV* over *MV*. If the sponsor decides to terminate this portfolio, *BV* would be adjusted to *MV* for the payout, resulting in a significant reduction in payout value.

Figure 7. Return to Barbelled Portfolio with Duration-Weighted YTM, Synthetic GIC with 1.5-Year Duration



Similar problems result from a *YTM* that is consistently understated. In this case, the plan will continuously be incremented by a *CR* that is too low and *MV* will steadily increase over *BV*. If a termination occurs, the payout will be higher because of the upward adjustment of *BV* to *MV*.

Historical Simulation

All of the situations described so far involve single causative events. What happens when many events are occurring almost randomly, as happens in the real world?

To answer this question, we constructed a simulation using the Lehman Brothers One- to Three-Year Government Bond Index as the underlying portfolio for a synthetic GIC for the 1988–93 period. Incremental return resulting from active management was not considered. Figure 8 illustrates this scenario. The fairly steady interest rates from 1988 to near the end of 1990 caused no significant changes in *CR* or *BV*. Although the *BV–MV* and *YTM–CR* spreads varied by small amounts, *CR* and *BV* were very steady. As interest rates began dropping at the end of 1990, however, *CR* trended lower; the corresponding increase in *MV* resulted in an increasing trend in *BV*. Spreads widened. In 1993, with steadier rates, the *BV–MV* and *YTM–CR* spreads narrowed.

Figure 8. Return to Synthetic GIC Portfolio Based on Lehman Brothers Index

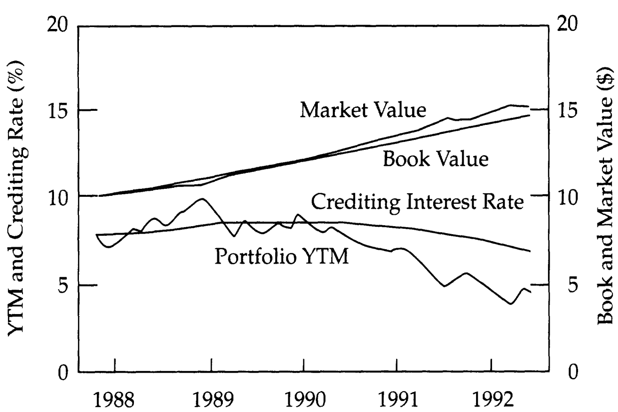
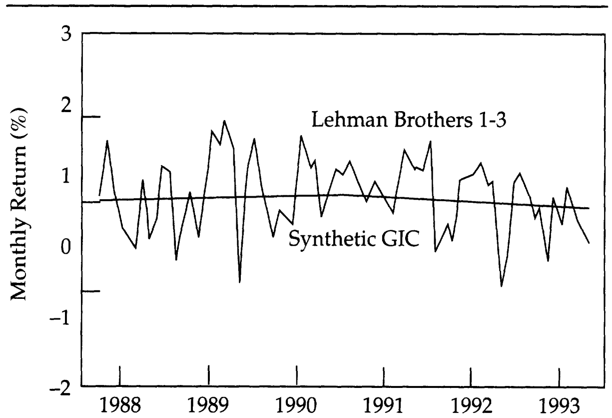


Figure 9. Comparison of Monthly Portfolio Returns, Lehman Brothers Index and Synthetic GIC



A closer look at these monthly data shows the effectiveness of synthetic GIC amortization. Figure 9 shows the actual monthly returns of the Lehman Brothers One- to Three-Year Government Bond Index relative to the resultant *CR* for the 1988–93 period. The synthetic GICs' significant degree of volatility reduction is obvious.

MARKET RESPONSIVENESS—MATURING STRATEGIES

Although more and more users of synthetic GICs are using evergreen portfolios, many still prefer portfolios that mature on a predetermined date. The most likely reason for this preference is that experienced GIC users are accustomed to the maturing structure. Although most users, especially plan sponsors, maintain fairly constant durations for their portfolios of multiple GICs, they still think in terms of discreet vehicles. In truth, an evergreen portfolio is similar to a portfolio of GICs except that fixed-income securities under the management of an investment manager replace the user-selected individual GICs.

Maturing portfolios are really a special case of the evergreen strategy. All of the relationships covered in this article hold for both. The potential for active management return for maturing portfolios, however, is limited by the required immunization of the duration to the remaining term to maturity. Those considering synthetic GICs for return enhancement are better served by evergreen strategies because of the increased degrees of freedom they provide to the active manager.

CONCLUSIONS

The relationships explored in this article are straightforward and are controlled by well-defined processes that can be easily simulated. The simulations illustrated the following relationships:

- The market responsiveness of *CR* for synthetic GICs is governed entirely by the *CR* Equation (3).
- Changes in *YTM* result in gradual changes in *CR*.
- Under almost all conditions, *MV* and *BV* stay fairly close.
- Synthetic GICs respond slightly faster to changes in market interest rates than do portfolios of GICs.

- The use of an amortization period shorter than the portfolio duration can cause unacceptable changes in *CR*.
- Capital gains and losses not attributable to changes in interest rates have an immediate though somewhat muted impact on *CR*.
- Minor, short-term misstatements of *YTM* result in slight, almost self-correcting errors in *CR*. Persistent misstatements are more serious.
- The amortization process is always at work forcing convergence of *BV* with *MV* and *CR* with *YTM*.
- Successful active management results in a gradual increase in *CR* relative to *YTM* after portfolio initialization.
- The amortization process is extremely effective in reducing the volatility of monthly returns.

Thus, synthetic GICs are shown to be effective substitutes for portfolios of equivalent-duration insurance company GICs. In addition, synthetic GICs offer the potential for improved returns through active management and eliminate the arduous insurance company GIC placement and maturation process.

FOOTNOTES

1. This equation is used by Bankers Trust Company, Providian Capital Management, and Pacific Mutual Insurance Company, among others.