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Variable annuities versus mutual funds: a Monte-Carlo analysis of the options

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Abstract

Mutual funds and variable annuities are similar instruments that differ mainly in their tax treatment. Their relative appeal is the subject of intense debate in the industry. This paper contributes to the literature by quantifying the impact of investment return uncertainty when comparing the two. We focus on the embedded tax options using Monte-Carlo simulations. We conclude that although low-cost variable annuities are superior to low-cost mutual funds over long time horizons, the critical threshold is at least 10 years for typical levels of risk aversion. If, however, one ignores the tax options, the erroneous break-even horizon drops to 5 years.

Introduction

Mutual funds and variable annuities are very similar savings and investment instruments that differ mainly in their tax treatment. While the former is treated akin to a portfolio of individual securities—which primarily consists of capital gains—the latter is taxed entirely as ordinary income, but with tax-deferred investment gains. The relative appeal of one versus the other, is the subject of intense debate in the industry and ultimately depends on subtle assumptions regarding investment horizons, management expenses and investment returns, as well as pre- and post-retirement tax rates. However, we believe that most of the existing debate between the defenders and detractors of non-qualified variable annuities are ignoring the crucial impact of *return* uncertainty when making their comparisons to fully-taxable mutual funds.

A priori, one would think that the *stochasticity* of returns—conditional on a particular growth rate—would not affect the relative superiority of one product versus the other. But this is not the case. The possibility of an investment loss endows the holder of the mutual fund with a ‘real tax option’ to harvest those losses. The strategic investor can re-establish a similar position at a lower tax-basis, and deduct any current losses against comparable gains. *De facto*, this creates a tax refund, which supplements the return from the mutual

fund. Indeed, the recent market decline during the 2000–2001 period has generated much tax-loss selling activity. This type of strategy cannot be easily employed within a variable annuity (VA). Since, despite the favorable ordinary income treatment on losses, which can be netted against ordinary interest gains, lapsing or selling, the VA will most likely induce surrender charges on the order of 5–10%. Furthermore, this 'real tax option' to use losses against other gains would be even more valuable when comparing variable annuities to a portfolio of individual securities in which losing positions can mitigate the tax liability of winners, or with highly tax-efficient index funds.

Indeed, during any given year investment returns can be extremely volatile, even if the long-term growth rate of the market is relatively stable. We will demonstrate that, *ceteris paribus*, while the expected after-tax return of a variable annuity is higher, the after-tax returns from a variable annuity are more volatile than the after-tax returns from a mutual fund. Therefore, consumers might rationally shun the higher expected (after-tax) return from the variable annuity simply because of the higher volatility. One therefore, requires a risk adjustment mechanism for choosing amongst the two alternatives.

Similarly—although we do not pursue this directly—if the holder of the investment faces the (albeit) small possibility of having to lapse, surrender or sell the investment, prior to his or her intended time horizon, then the possible stochasticity of time horizon should also be factored into the comparison. In other words, even if the holder has a *declared* 10-year horizon, the possibility of early termination introduces another dimension of stochasticity. This is especially important given the 10–15% annual lapsation rates that are built into industry pricing models for variable annuities.

Therefore, to account for and value this uncertainty, we introduce a risk-adjustment mechanism. Namely, we compare non-qualified variable annuities to mutual funds by computing the certainty equivalent of utility (CEU). This methodology will be explained in detail, but is commonly used in the economics literature when comparing the welfare implications of various product designs, investment strategies or policy changes. Knight and Mandell (1992) used a similar method to analyze the costs and benefits from dollar-cost averaging. In our framework, a variable annuity is preferred to a mutual fund—conditional on a particular investment horizon—*only* if its Certainty Equivalent of Utility is greater. This method of ranking risky alternatives is quite common in the finance and economics literature, and can be traced to work by Aboudi and Thon (1995), Thistle (1993), Levy (1992), and Hadar and Seo (1988).

Analytic techniques aside, our main practical observation is that although we find that low-cost variable annuities are indeed superior to low-cost mutual funds for investors with a long-time horizon, the critical threshold is at least 10 years for typical levels of risk aversion. If, however, we ignore the embedded real tax options, the erroneous break-even horizon drops to 5 years. We can summarize the main message of this paper with one sentence. *The uncertainty of investment returns increases the break-even horizon*.

The remainder of this paper is organized as follows. In Section 2, we review some of the existing academic and practitioner literature on the topic of 'real tax options' and the choice between variable annuities and mutual funds. Section 3 develops the concept of the CEU and how it can be used to compare and contrast risky alternatives. Section 4 goes back to basics and presents a deterministic model of the trade-off between variable annuities and mutual funds. This framework serves to confirm and calibrate existing models as well as to set the background for the stochastic simulation model, which is presented in Section 5. We then generate a statistical distribution of after-tax wealth at the terminal horizon, assuming that either mutual funds or variable annuities have been employed. The mutual fund investor is assumed to utilize all tax-timing strategies at his or her disposal. We then rank the distribution—and the value to the consumer—by computing their CEU. This allows us to determine which of the two strategies is 'better' in the face of

uncertain outcomes for both. As a by-product of the simulation, we can also provide a risk and return trade-off between variable annuities and mutual funds. Arguably, this type of financial recommendation is more appropriate, accurate and helpful than a deterministic either/or statement picking one type of savings vehicle over the other. Section 6 concludes the paper with a summary of the key insights.

Section snippets

The existing literature

Non-qualified variable annuities have mushroomed into a trillion-dollar market that is currently inhabited by both insurance companies and banks. Cowan, Howell, and Power (2001) provided a discussion of the benefits from selling these products.

However, this growth has not been without controversy. Financial commentators and practitioners alike criticized a study by Price Waterhouse Coopers (PWC, 1997) on the impact of the 1997 Taxpayers Relief Act on the relative appeal of VA contracts. Geer…

The certainty equivalent of utility (CEU)

Under the minimum set of conditions for consistent and rational behavior and the assumption that all investors always prefer more wealth to less, a utility function *exists* and can be used to analyze investors' choices under uncertainty. Under these assumptions, investors will maximize their expected utility and we can use expected utility to rank risky alternatives. Stated differently, if the expected utility of the risky outcome X (read: the random after-tax return from a variable annuity) is…

A deterministic analysis of VA versus MF

This section provides a deterministic example of the trade-off. We assume the initial investment is $10,000, which is critical for the analysis since only $3,000 of losses can currently be netted against other gains. For a base case, an investor is assumed to pay a combined federal and state tax rate of 39.6% on ordinary income before retirement, and a tax rate of 31.6% during retirement. Furthermore, the investor pays the applicable capital gains tax rate of 23.6% both before and after…

The stochastic simulation

In the past, Milevsky and Posner, 2000a, Milevsky and Posner, 2000b) used simulation techniques to analyze variable annuities. However, previous research has focused on the limited value of the Guaranteed Minimum Death Benefit (GMDB) *vis a vis* the added insurance charges. Yet, the simulation methodology is quite robust and can help answer a much wider set of questions.

Our simulation makes the following set of assumptions. As in the deterministic example, we assume that an initial investment is…

Comparative statics

This section determines the minimum investment horizon needed for the VA to have the higher utility of after-tax terminal wealth compared to the MF with and without the real tax option, for various parameters in our model.

Table 5 shows that, holding other parameters constant, the lower the annual mean return, the longer the horizon needed for the VA to outperform the MF. This is consistent with the deterministic analysis. Given other parameters, the higher the standard deviation of the gross…

Conclusion and final remarks

The main objective of this paper was to quantify the impact of return uncertainty when measuring the relative benefits of variable annuities versus mutual funds. We introduced the concept of a 'real tax option' to harvest losses in mutual funds, that does not exist within a variable annuity structure. We argued that the distribution of (uncertain) after-tax wealth within a variable annuity, compared to a mutual fund, is higher, but more volatile. This fact calls for a risk-adjustment mechanism…

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