

May 11, 2005

Non-qualified Annuities in After-tax Optimizations

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Abstract

This study first explains why individuals should calculate an after-tax asset allocation. This asset allocation distinguishes between pretax funds in say a 401(k) and the generally after-tax funds in a taxable account. Separately, it performs mean-variance optimizations for individual investors. It concludes that, in general, almost all investors should locate bonds in Roth IRAs and qualified retirement accounts (e.g., 401(k)) and stocks, especially passively held stocks, in taxable accounts. At lower levels of risk tolerance, investors should substitute bonds held in non-qualified annuities for stocks held in taxable accounts. At higher levels of risk tolerance, they should substitute stocks for bonds held in Roth IRAs and qualified retirement accounts. The analysis suggests that the people who should be most interested in holding stocks in annuities are those who trade too frequently to qualify for preferential capital gain tax rates. Finally, this study may be the first to demonstrate that an individual investor bears more risk when an asset is held in an annuity instead of taxable account, and it considers the implications of this conclusion for optimal asset-allocation and asset-location decisions.

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Non-qualified Annuities in After-tax Optimizations

There are two major parts to this paper. The first argues that individual investors should calculate their after-tax asset allocation, where this asset allocation reflects each asset's after-tax value. The traditional approach to calculating an individual's asset allocation equates \$1 of *pretax* funds in a qualified retirement account to \$1 of *after-tax* funds in a taxable account. By mixing the two, the traditional approach mixes apples and oranges. In contrast, the after-tax asset allocation approach equates \$1 of after-tax funds to \$1 of after-tax funds.

The second part performs mean-variance optimizations for individual investors, and examines their implications for non-qualified annuities. The optimizations consider the tax benefits of non-qualified annuities—that is, tax deferral—but they ignore other benefits such as the death benefit and the generally higher costs of annuities. The optimizations recognize that the same asset can be an effectively different asset when held in different savings vehicles. For example, a bond held in a taxable account and a bond held in a non-qualified annuity are effectively different assets because the after-tax risk borne by the individual and after-tax returns received by the individual investor are different for each savings vehicle.

The after-tax optimizations have implications for an individual's asset-location preference. In general, most individuals should locate stocks in taxable accounts and bonds in tax-exempt retirement accounts (that is, Roth IRAs and qualified retirement accounts such as the 401(k)). Individuals with relatively low risk tolerances should substitute bonds held in non-qualified annuities for stocks held in taxable accounts. Individuals with relatively high risk tolerances should substitute stocks for bonds in tax-

exempt retirement accounts. But, except for individual investors who trade too frequently to qualify for the 15% capital gains tax rates, individual investors should not want to hold stocks in a non-qualified annuity for tax reasons. The current tax structure in the U.S. is more favorable for bond investments held in non-qualified annuities than for stock investments held in annuities. As long as returns on stocks held in taxable accounts receive preferential tax treatment, the Tax Code will encourage most individuals to hold stocks in taxable accounts instead of tax-deferred annuities.

After-Tax Asset Allocation

This section builds on the work of Reichenstein (1998, 2000, and 2001b) and Dammon, Spatt, and Zhang (2001 and 2004) who conclude that the traditional approach to calculating an individual's asset allocation is wrong because it fails to distinguish between pretax and after-tax funds. An individual's asset allocation should be based on each asset's after-tax value. In addition, it explains how pretax funds should be converted to after-tax funds.

Table 1 presents the choice of savings vehicles for a married couple, Bob and Betty. They are in the 28% ordinary income tax bracket before retirement, $t = .28$, and expect to remain in this bracket during retirement, $t_r = .28$. Bob invests \$1,000 today in a 401(k) or any other qualified retirement account. This contribution reduces this year's spending by \$720. The contribution reduces taxable income by \$1,000, which reduces taxes by \$280. So, we can think of this \$1,000 contribution as consisting of \$280 of tax savings plus \$720 of Bob's after-tax funds. Betty invests \$720 today in a Roth IRA. Both Betty's \$720 contribution to the Roth and Bob's \$1,000 contribution to the 401(k)

represent contributions of \$720 of after-tax funds, and they both reduce this year's spending by \$720.

They invest in the same mutual fund for the same length of time. For simplicity, the table assumes the funds are withdrawn during retirement after the account values have doubled. The Roth IRA is worth \$1,440 after taxes (assuming the Roth was established at least five years earlier and Betty is at least age 59 ½). Bob withdraws \$2,000 of pretax funds from the 401(k), which translates to \$1,440 after taxes. Both Bob and Betty invested \$720 of after-tax funds today and they were both worth \$1,440 after taxes at withdrawal.

This example illustrates three points. First, when calculating the asset allocation, the \$2,000 in Bob's 401(k) should be considered the same size as the \$1,440 in Betty's IRA because they both buy the same amount of goods and services. Suppose Betty and Bob invested in the same stock fund, their accounts' market values were \$1,440 and \$2,000 as in the example, and these were their only financial assets. If Bob transferred his 401(k) funds to a bond fund, their asset allocation should still be considered 50% stocks (Betty's \$1,440 after taxes) and 50% bonds (Bob's \$1,440 after taxes). In contrast, the traditional approach to calculating the asset allocation says they would have a 42% stock allocation since it considers the \$2,000 in the 401(k) as being 39% larger than the \$1,440 in the Roth IRA. The asset-allocation calculation should be based on assets' after-tax values because goods and services are purchased with after-tax funds. Stated differently, the asset-allocation calculation should be based on assets' after-tax values because this approach equates after-tax dollars to after-tax dollars. In contrast, the

traditional approach equates pretax funds in qualified retirement accounts to after-tax funds.

Second, when the tax rate in the contribution year equals the tax rate in the withdrawal year (i.e., $t = t_r$), the after-tax value of funds in qualified retirement accounts grows effectively tax exempt.

Third, we can convert pretax funds in qualified retirement accounts to after-tax funds by multiplying by $(1 - t_r)$, where t_r is the expected tax rate during retirement. Bob's \$1,000 original deposit and the \$2,000 at withdrawal should be viewed as worth \$720 and \$1,440 after taxes.

Let us change the example. This second example illustrates that the proper way to convert pretax values in qualified retirement accounts to after-tax values is to multiply by $(1 - t_r)$ even if the tax rates in the contribution year and withdrawal year are not the same. Suppose Betty and Bob are in the 28% tax bracket before retirement but expect to be in the 25% bracket during retirement. What is the after-tax value of Bob's \$1,000 contribution to his 401(k) immediately after the contribution? Although Bob's \$1,000 contribution only reduces this year's spending by \$720, after the contribution he should view its after-tax value as \$750 or $\$1,000 (1 - t_r)$. As before, the pretax value of qualified retirement accounts can be converted to after-tax funds by multiplying by $(1 - t_r)$. The after-tax value grows from $\$1,000 (1 - t_r)$ today to $\$1,000 (1+r)^n (1 - t_r)$ in n-years, where r is the asset's pretax rate of return; *the after-tax value of qualified retirement accounts grows effectively tax exempt.*

Adjusting Taxable Accounts for Embedded Gains and Losses. Sometimes an asset in a taxable account has embedded but unrealized capital gains or losses. In this

case, it may be appropriate to reduce the asset's market value for the embedded tax liability or increase the market value for the tax savings from the embedded tax loss. For most individuals, there tends to be relatively little difference between the market value and after-tax value of assets held in taxable accounts. For simplicity, in this study we assume the market value and after-tax values are the same for assets held in taxable accounts. For further information, see Reichenstein (1998, 2000, 2001b) and Reichenstein and Jennings (2003).

After-tax Mean-Variance Optimizations

In this section, we will apply after-tax mean variance optimization for a taxable investor. For simplicity, we assume there are two assets—stocks and bonds—but they can be held in four savings vehicles—Roth IRA, qualified retirement account, taxable account, or non-qualified annuity. This is important because after-tax optimization recognizes that the portion of an asset's return received by and risk borne by a taxable investor varies with the savings vehicle. Thus, a bond held in a taxable account is effectively a different asset than a bond held in a Roth IRA. Brunel (2001) examines the asset-location decision for individuals with assets in other savings vehicles including various types of trusts and variable life insurance.

Table 2 presents Peggy's after-tax risk and after-tax returns on bonds and stocks when held in tax-exempt retirement accounts (i.e., Roth IRAs or qualified retirement accounts), taxable accounts, and non-qualified annuities. Peggy is in the 28% ordinary income tax bracket and 15% capital gain tax bracket and expects to remain in these brackets. Stocks earn 8% pretax, all in the form of capital gains. Bonds earn 4% pretax, all interest. The pretax standard deviations are set at 15% for stocks and 6% for bonds.

Recall that the after-tax value of funds in Roth IRAs and qualified retirement accounts grows effectively tax exempt. Therefore, Peggy receives all returns and bears all risk on investments in these savings vehicles. So, her after-tax returns and after-tax risks on stocks and bonds are the same as their pretax returns and pretax risks.

For bonds held in taxable accounts, Peggy's after-tax return is 2.88% or $4\%(1 - 0.28)$ and her after-tax risk is 4.32% or $6\%(1 - 0.28)$. Peggy receives 72% of the returns and bears 72% of risk. The government takes 28% of returns and bears 28% of risk.

When stocks are held in taxable accounts, the investor's share of returns and risk depends upon his or her stock management style. We assume for now that Peggy is an active investor who realizes all gains in one year and one day, and pays taxes at 15%. Her after-tax return is 6.8% or $8\%(1 - 0.15\%)$ and her after-tax risk is 12.75% or $15\%(1 - 0.15)$; the government takes 15% of returns and bears 15% of the risk.

Since this study is designed to examine the implications of the tax structure facing annuities, it assumes a low-cost annuity with costs no higher than those on other savings vehicles. We use Monte Carlo simulations to estimate the after-tax returns and after-tax risk on bonds and stocks held in non-qualified annuities. In a non-qualified annuity, the individual invests after-tax funds, the funds grow tax deferred, and at withdrawal they are taxed at the ordinary income tax rate. Although withdrawals before age 59½ are generally subject to a 10% penalty tax, we assume withdrawals occur after this age. Since funds in an annuity accumulate tax deferred, the effective tax rate decreases as the investment horizon lengthens. Thus the after-tax returns and after-tax risk vary with the investment horizon. We assume a 25-year horizon.

For bonds, we assume each year's returns come from a normal distribution with mean of 4% and standard deviation of 6%. For stocks, we assume returns are normally distributed with mean of 8% and standard deviation of 15%. Each year's return is independent. Returns accumulate tax deferred for 25 years. After 25 years, all funds are withdrawn and the deferred returns are taxed at 28%. In 10,000 simulations, the mean ending after-tax wealth per initial \$1 investment in bonds and stocks were \$2.20 and \$5.21, respectively. These totals are the same as the ending after-tax wealth values if annual returns were a constant 4% and 8%. For example, the ending after-tax wealth for bonds would be $(1.04)^{25} - 0.28\{(1.04)^{25} - 1\}$ or \$2.20, where the part after the first minus sign denotes taxes paid at 28% on the withdrawal of deferred returns 25 years hence; the original \$1 investment is tax free since it is already after-tax funds. Therefore, we set the expected after-tax returns on bonds and stocks held in an annuity at 3.20% or $(2.20)^{1/25} - 1$ and 6.83% or $(5.21)^{1/25} - 1$.

The after-tax risks of bonds and stocks in an annuity were estimated from the simulations. For each of 10,000 simulations, we calculated the 25-year geometric average annual *after-tax* return. The standard deviation of this 25-year average return was 1.03% for bonds and 2.77% for stocks. Since annual returns in the simulations were independent, we know that the standard deviation of the 25-year arithmetic average annual *pretax* return was 1.2% or $6\%/(25)^{0.5}$ for bonds and 3% or $15\%/(25)^{0.5}$ for stocks. We use the ratio of after-tax return to pretax return to approximate the percent of risk borne by the taxable investor. This suggests that bond investors in annuities bear about $1.03/1.20$ or 85.8% of the after-tax risk, while annuity investors in stocks bear $2.77/3$ or

92.3% of the after-tax risk.¹ In the optimizations, we thus use 5.15% or 6%(0.858) as bonds' after-tax risk and 13.85% or 15%(0.923) as stocks' after-tax risk on an annuity.

The key point is that annuity investors bear more of an asset's risk than investors in taxable accounts. For example, compare the reduction in after-tax risk for assets held in taxable accounts and annuities. For bonds held in taxable accounts, the government bears 28% of the risk. For bonds held in annuities for 25 years, the government bears about 14.2% of the risk. For the active stock investor with the stocks held in taxable accounts, the government bears 15% of the risk. For stocks held in annuities for 25 years, the government bears about 7.7% of the risk.

Table 3 presents the mean-variance optimization for Peggy assuming her risk tolerance is 47. Although there are only two assets—stocks and bonds—there are effectively three separate savings vehicles. So, Table 3 presents the six effective assets—stocks in tax-exempt retirement accounts (i.e., Roth IRA or qualified account) (Sr), bonds in tax-exempt retirement accounts (Br), stocks in taxable accounts (St), bonds in taxable accounts (Bt), stocks in annuities (Sa), and bonds in annuities (Ba). Peggy maximizes her utility by allocation her after-tax funds among these six “assets.” Her utility function is $U = ER - SD^2/RT$. U denotes the level of utility. It also denotes the certainty equivalent return, meaning it is the risk-free return that would provide the same level of utility as the portfolio. SD denotes standard deviation and RT is the level of risk tolerance. The correlation coefficient between bonds and stock is set at 0.1. The usual portfolio constraints apply; there can be no short trading, and the sum of the six assets

¹ There numerator of this ratio is the *geometric* average after-tax return, while the denominator is the *arithmetic* average pretax return. The mixing of geometric and arithmetic averages probably causes the ratio to be too low, which suggests that annuity investors actually bear a larger portion of the asset's risk than the ratio implies.

equals 1. In addition, the sum of stocks in tax-exempt retirement accounts and bonds in tax-exempt retirement accounts is set at 40%. The optimal portfolio contains 40% bonds held in tax-exempt retirement accounts and 60% stocks held in taxable accounts. This reflects her usual *asset location*: In general, bonds should be held in tax-exempt retirement accounts and stocks in taxable accounts.

Exhibit 1 presents Peggy's optimal portfolio for various levels of risk tolerance. At a risk tolerance level of 47, she holds only bonds in tax-exempt retirement accounts and only stocks in taxable accounts. At lower levels of risk tolerance, she substitutes bonds held in annuities for stocks held in taxable accounts. At higher levels of risk tolerance, she substitutes stocks for bonds held in tax-exempt retirement accounts. Her optimal portfolio never contains stocks held in non-qualified annuities.

The same pattern holds when the utility function is $U = ER - SD/RT$. At one level of risk tolerance, only stocks are held in taxable accounts and only bonds are held in tax-exempt retirement accounts. At lower levels of risk tolerance, she substitutes bonds in annuities for stocks in taxable accounts. At higher levels of risk tolerance, she substitutes stocks for bonds in tax-exempt retirement accounts. But her optimal portfolio never contains stocks held in non-qualified annuities.

This study builds on the prior work of Reichenstein (2001a), Dammon, Spatt, and Zhang (2004), and Jennings and Reichenstein (2004). These authors reach the same conclusion about the optimal asset location. In general, bonds should be held in tax-exempt accounts and stocks should be held in taxable accounts. The Dammon, Spatt, and Zhang (2004) study goes well beyond this study in that it considers the impacts of age, basis-price ratio on the asset held in taxable account, and the split of after-tax wealth

between taxable and tax-exempt accounts on both an individual's optimal asset-allocation and asset-location decisions. However, the prior studies only considered two types of savings vehicles—taxable accounts and tax-exempt savings vehicles—while this study is the first to include annuities among the choice of savings vehicles.

Table 4 presents an intuitive explanation for the asset-location decision. It presents the asset-allocation decision if there were only two savings accounts—taxable accounts and tax-exempt retirement accounts. Asset-location Strategy 1 holds stocks in taxable accounts and bonds in tax-exempt retirement accounts. Strategy 2 holds bonds in taxable accounts and stocks in tax-exempt retirement accounts. Since the after-tax value of assets held in tax-exempt retirement accounts grows effectively tax exempt, the key question is whether it is better to pay taxes on stocks held in taxable accounts at 15% or to pay taxes on bonds held in taxable accounts at 28%. Not surprisingly, the better strategy is to hold stocks in taxable accounts since they are taxed at preferential rates for this active investor. In contrast, bonds should be tax sheltered since their returns are taxed at the higher ordinary income tax rates.

Now, let's add annuities to the choice of savings vehicles. At low levels of risk tolerance, bonds are held in annuities instead of taxable accounts. Due to tax deferral, bonds are effectively taxed at lower rates in annuities than in taxable accounts. At high levels of risk tolerance, stocks are held in taxable accounts instead of annuities. Although stocks have a slightly higher after-tax return (6.83% instead of 6.8%) when held in annuities instead of taxable accounts, stocks are much riskier when held in annuities. Thus the better strategy for this active investor is to hold stocks in taxable accounts instead of non-qualified annuities.

Generalizing across Stock Management Styles

So far, we have assumed that Peggy is an active investor who realizes all gains after a year and a day and pays taxes at the 15% preferential rate. If we change the assumed stock management style, we change the after-tax risk and after-tax returns on stocks held in taxable accounts. The after-tax risk and after-tax returns on the other five “assets” in Tables 2 and 3 remain the same. Inserting these new after-tax risk and returns on stocks held in taxable accounts into the optimizer produces different results. In this subsection, we consider the impact on optimal portfolios if we change the stock management style. We consider three other management styles, those of passive-and-exempt investors, passive investors, and traders.

Passive-and-exempt investors buy and hold stocks and never pay taxes on the accumulated capital gains. They either await the step-up in cost basis at death or give the appreciated asset to charity. They bear all risk and receive all returns on stocks held in taxable accounts. When held in taxable accounts, stocks’ after-tax returns and after-tax risk are 8% and 15%.

Exhibit 2 presents the optimal asset allocations by risk tolerance level for the passive-and-exempt investor. In this case, only bonds are held in annuities and only stocks are held in taxable accounts for risk tolerance levels between 51 and 59; as before, the usual asset location is to hold bonds in tax-exempt retirement accounts and stocks in taxable accounts. At lower levels of risk tolerance, this investor substitutes bonds in annuities for stocks in taxable accounts. At higher levels of risk tolerance, he substitutes

stocks for bonds in tax-exempt retirement accounts. Not surprisingly, since stocks held in taxable accounts are tax exempt this investor should hold stocks in taxable accounts instead of annuities.

Passive investors buy and hold stocks until the end of the investment horizon and then pay taxes at the 15% tax rate. For a 25-year horizon, the after-tax return is set at 7.41%, which is the geometric average after-tax return if stocks earned a constant 8% per year. Based on simulations, the standard deviation is set at 14.55% using the same procedure as discussed earlier for annuities. Exhibit 3 presents the optimal asset allocations by risk tolerance level for the passive investor. It follows the same pattern as for the active and passive-and-exempt investors. At a risk tolerance level of 56, only bond are held in tax-exempt retirement accounts and only stocks are held in taxable accounts. At lower levels of risk tolerance, this investor substitutes bonds in annuities for stocks in taxable accounts. At higher levels of risk tolerance, he substitutes stocks for bonds in tax-exempt retirement accounts. The passive investor benefits from tax deferral of unrealized gains, just like someone investing in annuities, but he eventually pays taxes at 15% instead of the 28% that would apply to annuities. Consequently, it is not surprising that he should hold stocks in taxable accounts instead of annuities.

The last stock management style considered is that of a trader. A trader buys and sells so frequently that he pays taxes each year on all returns, and the returns are taxed at the ordinary income tax rate. In the optimizations, stocks held in taxable accounts have an after-tax expected return of 5.76% and an after-tax risk of 10.80%. Exhibit 4 presents the optimal asset allocations for the trader. The pattern of optimal asset allocations is substantially different than the patterns for other stock management strategies. At a risk

tolerance of 37, the optimal portfolio contains 40% stocks held in tax-exempt retirement accounts and 60% bonds held in annuities. At lower levels of risk tolerance, bonds are substituted for stocks in tax-exempt retirement accounts. At higher levels, stocks and substituted for bonds in annuities. There is a slight preference to holding stocks in tax-exempt retirement accounts and bonds in annuities instead of the opposite asset location.²

We finally found someone who should want to hold stocks in annuities for tax reasons. It required the somewhat extreme case of the trader. The keys to this finding are the trader 1) does not take advantage of preferential capital gain tax treatment and 2) does not take advantage of the ability to defer taxes on unrealized gains. Since annuities provide tax deferral but are assumed to have no higher costs than taxable accounts, it is clearly better to save in annuities than in taxable accounts.

This analysis suggests that when long-term capital gain tax rates are below ordinary income tax rates few investors should hold stocks in annuities. The few investors who should hold stocks in annuities are traders who trade too frequently to qualify for preferential capital gain tax rates. There have been times in the U.S. history when long-term gains have not received preferential tax rates. A return to such an environment should make annuities (or, at least, low-cost annuities) much more attractive than they are today.

Generalizations beyond Stocks and Bonds: So far, we have only considered investments in stocks and bonds or stock and bond mutual funds. A key finding is that, in general, it is best for all investors except traders to locate bonds in tax-exempt retirement accounts and stocks in taxable accounts. In this section, we expand the

² At risk tolerance of 37, the utility is 0.06 lower if the asset allocation is $B_r = 0.4$, $S_a = .43$, and $B_a = .17$. This asset allocation appears to be optimal at this risk tolerance level conditional on bonds being held in tax-exempt retirement accounts.

analysis to include alternative investments. Generalizing, all investors except traders should hold bonds and other assets whose returns are taxed at ordinary income tax rate in tax-exempt retirement accounts. These assets include bonds, REITs (real estate investment trusts), and most hedge funds.

The best assets to hold in taxable accounts are those that produce capital gains or other returns, such as dividends today, that are subject to low effective tax rates. These assets include common stocks, most passively-managed stock funds, and non-income producing real estate. From a tax-efficiency perspective, it would be ideal to hold an appreciated capital asset until it receives the step-up in basis or is used to fund the investor's charitable desires. If this ideal is not feasible, an appreciated asset should be held as long as possible to benefit from the tax-deferral of unrealized gains. Thus the individual should first allocate to taxable accounts 1) individual stocks that he would be willing to hold for decades and 2) tax-efficient stock funds, especially stock funds that allow gains to grow unharvested and do not distribute short-term capital gains.

Stock index funds are usually considered ideal tax-efficient investments, but not all index funds are as tax efficient. In practice, large-cap and total stock market index funds are more tax efficient than small-cap or mid-cap stock index funds. The better performing stocks in a small-cap or mid-cap index fund will grow too large for the index, thus forcing the manager to realize gains.

This Study in Perspective

To put the results of this study in perspective, assume that an individual is trying to decide the ranking order of savings vehicles when it comes to saving for retirement. His

choices include saving within 1) tax-exempt retirement account (i.e., Roth IRA or qualified retirement account), 2) taxable account, and 3) non-qualified annuity.

His first choice should be a tax-exempt retirement account. He should save all he is allowed to save or all he can afford to save within these most-favored savings vehicles.

His second choice should be to save in either a taxable account or a non-qualified annuity. In general, the major advantage of a non-qualified annuity is tax-deferred growth, while its major disadvantages are 1) higher costs and 2) its returns do not qualify for preferential capital gain tax rates. So, most prior studies have asked how long the investment horizon must be before the annuity's tax-deferred growth advantage offsets its disadvantages. Examples of these studies include Toolson (1991), Reichenstein (1999, 2001, 2003), and Ding and Peterson (2003).

Let's return to an active investor with a risk tolerance level of 47. She holds 40% of her portfolio in bonds held in a tax-exempt retirement account and 60% in stocks held in a taxable account. At lower level of risk tolerance, she wants more than a 40% bond allocation. She could sell stocks held in a taxable account and move into bonds held in either an annuity or a taxable account. In practice, the annuity's comparative advantage is tax-deferred growth and its comparative disadvantage is higher expenses. Since this study assumes the annuity has no higher costs, it is not surprising that the conclusion is that she should hold the additional bonds in an annuity instead of a taxable account.³

Next, let's consider why an active investor with a risk tolerance of 47 or higher would want to hold stocks in a taxable account instead of an annuity. Since we assumed

³ At risk tolerance of 35 and additional annuity expenses of 0.14% that lower the annuity's returns by the same amount, the investor would be indifferent between holding the additional bonds in an annuity or a taxable account. Thus for this risk tolerance and a 25-year horizon, the annuity's tax-deferral advantage is more than offset if its expenses are more than 0.14% higher than the taxable bond fund. This suggests that only the lowest-cost non-qualified annuities are favorable savings vehicles even for bond investors.

the annuity has no higher costs, the comparative advantage of the taxable account is its eligibility for the 15% capital gain tax rate, while the comparative advantage of the annuity is tax-deferred growth. So, the question is how long the investment horizon must be before the annuity's tax-deferral advantage offsets its disadvantage of not qualifying for the 15% capital gain tax rate. After 25 years, the annuity produces a slightly higher after-tax return. That is, after 25 years the annuity produces an ending after-tax wealth of $(1.08)^{25} - 0.28\{(1.08)^{25} - 1\}$, which exceeds the taxable account's ending wealth of $(1 + 0.08(0.85))^{25}$. Based on this higher wealth (and thus higher annual return), prior studies would have concluded that it takes about 25 years for the annuity to offset its disadvantage. This study says that the 25-year horizon is not long enough because someone who saves in an annuity incurs more risk than if he saves in a taxable account.

Toolson (1991), Reichenstein (1999, 2001, 2003), and Ding and Peterson (2003) looked only at after-tax ending wealth (or after-tax ending returns), but they ignored differences in after-tax risk.⁴ But this is the first study that demonstrates that someone who saves in an annuity bears more risk than someone who saves in a taxable account. Since investors should be concerned with risk and returns, the breakeven period for the annuity is even longer than prior studies suggest.

Limitations of Study

As with any study, this one relies on models and assumptions that allow us to better understand key tradeoffs between non-qualified annuities and other savings vehicles. However, these models and assumptions do not consider all tradeoffs that should influence the desirability of annuities. The major deficiencies of the study may be the

⁴ Dammon, Spatt, and Zhang (2004) examined utility levels across different consumption patterns, so their simulation analysis implicitly considers risks.

following: 1) it did not consider the higher costs of annuities; 2) it did not adequately consider the value of real tax options from investing in taxable accounts; and 3) it did not consider the value of annuity's other benefits, especially the death benefit. We consider these in order.

Recall that we implicitly assumed that the non-qualified annuity has no higher costs than a mutual fund held in a taxable account or a tax-exempt retirement account. Despite this assumption, it would appear that all investors except traders should refrain from holding stocks in an annuity. In reality, most annuities have about 2% higher costs than low-cost no-load mutual funds (and ETFs) and at least 1% higher costs than average-cost mutual funds. Once we factor in these higher costs, individuals should have as strong incentive to save in a taxable mutual fund instead of a typical annuity. There are a few low-cost annuities whose costs are similar to those of low-cost mutual funds. As shown in this study, they should remain desirable savings vehicles, especially for individuals seeking an underlying investment in bonds.

This study did not consider the full value of the real tax option if stocks are held in taxable accounts. The full value of the real tax options include 1) the option to avoid taxes by awaiting the step-up in basis at death or giving the appreciated asset to charity, 2) the option to realize losses that offset capital gains or reduce taxable income, and 3) the option to time the realization of capital gains for low tax rate years and losses for high tax rate years. This study considered the first option, but it did not consider the latter two. Milevsky and Panyagometh (2001) examined the value of the second option, the option to realize losses that offset capital gains or reduce taxable income. They concluded that the breakeven period for non-qualified annuities compared to taxable

mutual funds was substantially longer when the value of this real tax option is considered.

Variable annuities have other benefits that are not available in mutual funds. The death benefit may be the most valuable of these other benefits. A popular type of death benefit is the return-of-principal death benefit that promises at the death of the annuitant, the beneficiary will receive the larger of the subaccounts' current value or the sum of principal investments (adjusted for any withdrawals). There are other types of death benefits, but the insurance firms charge higher fees to cover their additional value.

Milevsky and Posner (2000) estimate the value of the return-of-principal death benefit by age for males and females with average life expectancies. They assume the underlying subaccount portfolio has a standard deviation of 20%, which reflects the risk of a volatile stock fund. The estimated values are:

Age	Sex	Return of Principal
50	m	0.035%
50	f	0.02%
60	m	0.087%
60	f	0.05%

Many annuity investors prefer a balanced portfolio of subaccounts instead of concentrating their annuity portfolio in one stock subaccount. At the time of Milevsky and Posner's study, the standard deviation of Vanguard Balanced Fund, which contained about 60% stocks and 40% bonds, was about 10%. At a standard deviation of 10%, Milevsky and Posner estimate that the value of the death benefit would be about one-fourth as high as when the standard deviation is 20%. This suggests that this death benefit would have a fair insurance value of less than 0.03%.

The strongest evidence that the value of the death benefit is low is the cost of buying this benefit in the marketplace. Vanguard charges 0.05% for its return-of-principal death benefit.⁵ Therefore, although this study ignores the value of the death benefit and other annuity benefits, this omission appears to be relatively minor.

Conclusions

The major conclusions from this study can be briefly stated. First, individuals' asset allocation should be based on accounts' after-tax values. The traditional approach to calculating an individual's asset allocation equates \$1 of *pretax* funds in a qualified retirement account to \$1 of *after-tax* funds in a taxable account. By mixing the two, the traditional approach mixes apples and oranges. In contrast, the after-tax asset allocation approach to calculating the asset allocation compares after-tax funds to after-tax funds.

Second, pretax funds in qualified retirement accounts can be converted to after-tax funds by multiplying by $(1-tr)$, where tr is the expected ordinary income tax rate during retirement.

Third, mean-variance optimizations for individuals must recognize that the same asset can be effectively different assets when held in different savings vehicles. For example, a bond held in a taxable account and a bond held in a Roth IRA are effectively different assets because the investor has different after-tax risks and after-tax returns in each savings vehicle.

Based on after-tax optimizations, this study concludes that all individual investors except traders should have an asset-location preference. In general, they should locate stocks in taxable accounts and bonds in tax-exempt retirement accounts (that is, Roth

⁵ See <http://flagship2.vanguard.com/VGApp/hnw/content/AccountServ/Retirement/ATSVARDefAnnFeesExpContent.jsp> .

IRAs and qualified retirement accounts). Individuals with low risk tolerance should substitute bonds held in non-qualified annuities for stocks held in taxable accounts. Individuals with high risk tolerances should substitute stocks for bonds in tax-exempt retirement accounts. But individual investors except traders should not want to hold stocks in non-qualified annuities. This conclusion prevails despite the study's assumption that the annuity had no higher costs than other savings vehicles. This lack of demand for stocks held in an annuity results from the fact that the annuity's returns do not qualify for the 15% capital gain tax rate. Unless and until we return to a tax structure where capital gains are taxed at the same rate as ordinary income then there should be little demand for holding stocks in annuities.

Previous studies would have suggested that after about 25 years stocks held in an annuity would be preferred to stocks held in a taxable account because the former produced a higher after-tax return or after-tax wealth. One contribution of this study is that it demonstrates that an individual bears more risk when an asset is held in an annuity instead of taxable account. Optimizations consider risk and returns, while most prior studies only looked at returns. Thus, the minimum breakeven period before stocks should be held in an annuity instead of a taxable account is longer than previously assumed.

In short, individual investors should calculate their after-tax asset allocation, which reflects each account's after-tax value. In terms of asset location, they should generally hold bonds, REITs, and other assets whose returns are subject to ordinary income tax rates in tax-exempt retirement accounts, while holding stocks, especially passively managed stocks, in taxable accounts.

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Table 1: Savings Vehicles and After-tax Asset Allocation

Savings Vehicle	Original Investment	Ending Wealth
401(k), Bob	\$1,000 pretax	\$2,000 pre tax
	\$ 280 tax savings	\$ 560 taxes due
	\$ 720 after tax	\$1,440 after tax
Roth IRA, Betty	\$720 after tax	\$1,440 after tax

Table 2: After-Tax Expected Returns and Risk across Savings Vehicles*

	Expected Returns	Standard Deviation
Active Investor		
1. Stocks in tax-exempt retirement accounts	8.0%	15.00%
2. Bonds in tax-exempt retirement accounts	4.0%	6.00%
3. Stocks in taxable accounts	6.8%	12.75%
4. Bonds in taxable accounts	2.88%	4.32%
5. Stocks in non-qualified annuities	6.83%	13.85%
4. Bonds in non-qualified annuities	3.20%	5.15%

* Tax-exempt retirement accounts include Roth IRA and qualified tax-exempt retirement accounts such as 401(k), 403(b), Keogh, deductible IRA, Sep-IRA, etc.

Assumptions: 28% ordinary income tax rate and 15% capital gain tax rate. Stocks earn 8% a year, all capital gains. The active investor realizes all gains in one year and one day and pays taxes at 15%. The implicit assumption is that expenses and thus pretax returns are the same on each savings vehicle.

Table 3: Optimal After-Tax Asset Allocation for Active Investor

	Asset Weight	Expected Return	Standard Deviation
1. Stocks in tax-exempt retirement accounts	0%	8.0%	15%
2. Bonds in tax-exempt retirement accounts	40%	4.0%	6%
3. Stocks in taxable account	60%	6.8%	12.75%
4. Bonds in taxable account	0%	2.88%	4.32%
5. Stocks in annuities	0%	6.83%	13.85%
6. Bonds in annuities	0%	3.2%	5.15%

Maximize Utility = $ER - SD^2/RT$

$ER = Sr (8\%) + Br (4\%) + St (6.8\%) + Bt (2.88\%) + Sa (6.83\%) + Ba (3.2\%)$

Constraints:

$Sr, Br, St, Bt, Sa, Ba \geq 0$

$Sr + Br = 0.4$

$Sr + Br + St + Bt + Sa + Ba = 1.0$

ER is portfolio expected returns. SD is portfolio standard deviation. RT, the investor's risk tolerance level, is 47. The correlation coefficient between stock and bond returns is 0.1, and this correlation coefficient applies across savings vehicles.

Sr denotes the weight of stocks in tax-exempt retirement accounts. Br, St, Bt, Sa, and Ba denote the weights of bonds in tax-exempt retirement accounts, stocks in taxable accounts, bonds in taxable accounts, stocks in annuities, and bonds in annuities. $Sr + Br = 0.4$ restricts tax-exempt retirement account assets to 40% of total after-tax funds.

Tax-exempt retirement accounts include the Roth IRA and all qualified retirement accounts, where contributions are deductible in the contribution year, returns grow tax deferred, and are taxable at ordinary income tax rates upon withdrawal. Examples include 401(k), 403(b), Keogh, and traditional (deductible) IRA.

The values reflect an active investor in the 28% ordinary income tax bracket and 15% capital gain tax brackets. Stocks earn 8%, all long-term capital gains that are realized each year or, technically, in one year and one day.

Optimizations were performed in Excel.

Table 4: Optimal Combination of Asset Location and Stock Management Style for an Active Investor

<i>Asset Location</i>	<i>Stock Management Style</i>
Strategy 1. Stocks in taxable accounts	15% tax rate
Bonds in tax-exempt retirement accounts	0% tax rate
Strategy 2. Bonds in taxable accounts	28% tax rate
Stocks in tax-exempt retirement accounts	0% tax rate

Exhibit 1 - Optimal Asset Allocation by Risk Tolerance Level for Active Investor

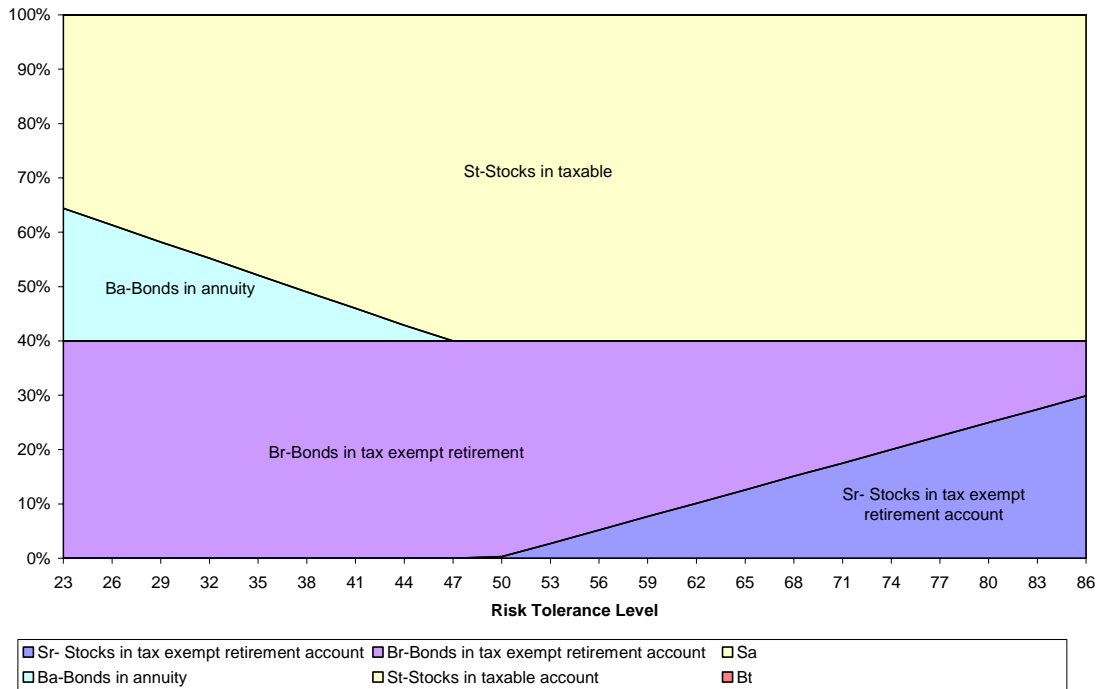


Exhibit 2- Optimal Asset Allocation by Risk Tolerance Levels for Passive and Exempt Investor

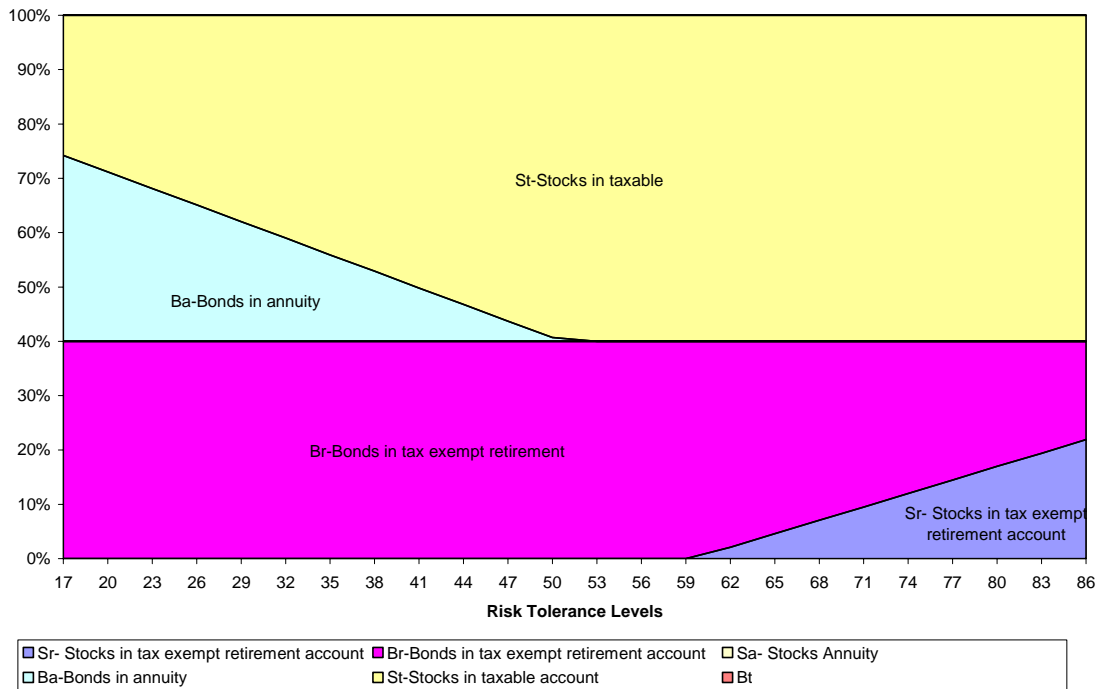


Exhibit3- Optimal Asset Allocation by Risk Tolerance Levels for Passive Investor

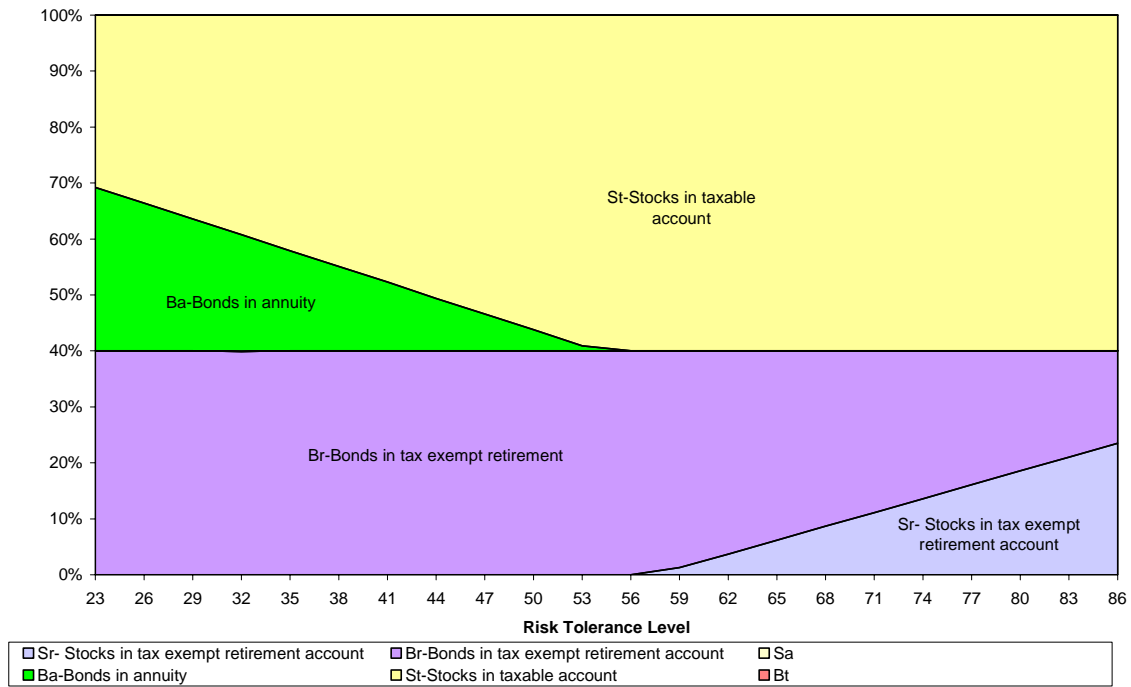


Exhibit 4- Optimal Asset Allocation by Risk Tolerance Levels for Trader

