Contributions

Asset Location: A Generic Framework for Maximizing After-Tax Wealth

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Executive Summary

- This paper addresses the placement of asset classes in a client's taxable or tax-advantaged accounts, commonly referred to as the asset location problem.
- We describe a generic framework for finding the optimal location for multiple asset classes. The proposed location approach (referred to as the "difference approach") is shown to provide an average 20-bps-per-year, after-tax return benefit over simply using identical allocations in the multiple accounts with different characteristics.
- Optimal location is shown to depend on the client's particular financial profile (taxes, cash flows), prevailing tax laws, and on the tax characteristics of the asset classes in their portfolio.
- The methodology presented is generic in that it can be extended to any number of asset classes and adapted to address other account types such as Roth IRAs, annuities, and trusts.
- The paper first describes the difference approach, and then evaluates the sensitivity of the proposed locations to the client's financial profile parameters and prevailing tax laws. Next the sensitivity to the asset class parameters is discussed. General rules and some guidelines that apply to most clients are then summarized.
- One of the key metrics for establishing location is after-tax end-wealth, which depends on some combination of return and tax efficiency.
- The article will be of interest to planners who are looking for opportunities to enhance investment performance for their clients with tax-efficient investment management techniques. Planners who already use tax-loss harvesting and rebalancing techniques for their clients will find this article on asset location techniques to be particularly useful.

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for finding the optimal location for multiple asset classes. The proposed location approach (referred to as the "difference approach") is shown to provide an average 20-bps-per-year, after-tax return benefit over simply using identical allocations in the multiple accounts with different characteristics. Optimal location is shown to depend on the client's particular financial profile (taxes, cash flows), prevailing tax laws, and on the tax characteristics of the asset classes in their portfolio. The methodology presented is generic in that it can be extended to any number of asset classes and adapted to address other account types such as Roth IRAs, annuities, and trusts.

Background

Assume that the client's equity exposure and portfolio asset allocation among asset classes have been determined. The next step in portfolio management is the placement of these asset classes in their various taxable and tax-deferred accounts. Typically, the client's portfolio may consist of 4 to 15 asset classes, and the client will own a taxable account and a tax-advantaged traditional IRA account. Asset location defines how much of each of these asset classes is placed in the traditional IRA and the taxable account. More generally, these asset classes may need to be distributed among accounts with other tax characteristics, such as a Roth IRA, an annuity, or in trusts.

Formal studies in the literature on asset location have addressed the location of two-asset classes, namely stocks and bonds. Dammon[1] concluded that bonds should be located in the IRA before stocks, while Shoven and Sialm[2] came to the opposite conclusion. A number of trade journals have documented recommendations on asset location from leading planners and mutual fund companies. These opinions vary, with some managers favoring bonds in the IRA and others the opposite strategy of stocks in the IRA. Some planners use the same percentage of all asset classes in both the traditional IRA and the taxable accounts (called the "pro-rata" approach). The pro-rata approach is also prevalent in nonmanaged 401(k) plans and when multiple managers are involved.

This paper describes a formal approach for addressing the optimal location for multiple asset classes. The approach, referred to as the "difference approach," is conceptually based on comparing the relative value (value is defined as after-tax end-wealth) when the asset class is placed in a traditional IRA account versus when it is placed in a taxable account. The proposed asset location methodology is shown to provide after-tax benefits ranging from 10 bps to 30 bps (average 20 bps) a year over simply using the pro-rata approach. These after-tax benefits are on par with projected benefits from tax-loss harvesting and rebalancing[3] (for typical clients in the 30 percent tax bracket with 50 percent of their portfolio in a taxable account). It should be noted that considerations other than maximizing end-wealth, such as client preferences (such as wanting their taxable and IRA accounts to have similar performance), and fund constraints (certain funds cannot be held in a taxable account) are not accommodated in the formal analyses.

The paper first describes the difference approach, then evaluates the sensitivity of the proposed locations to the client's financial profile parameters and prevailing tax laws. Next, the sensitivity to the asset class parameters is discussed. General rules that apply to most clients are then summarized.

The Difference Approach

We will first describe the method used in prior studies (the sum approach) to address asset location. Consider a client who has $500,000 in a taxable account and $500,000 in a traditional IRA. Her asset allocation is 50 percent in stocks and 50 percent in bonds. Let us assume the following for the clientÕs tax profile and asset classes:

Ordinary tax rate = 30 percent
Capital gains rate = 15 percent
Stocks pre-tax return = 8 percent
Bonds pre-tax return = 5 percent
Horizon N = 30 years

Assume that all growth in the taxable account is long term and realized (taxed at 15 percent); the IRA account grows at the pre-tax rate and taxes become due on the full account at liquidation in year 30. Given these assumptions, which location maximizes after-tax end-wealth? Stocks in the IRA or bonds in the IRA? In the traditional sum approach, both scenarios are analyzed and the one that leads to higher after-tax end-wealth is chosen. Elaborating,

Strategy 1: Stocks in IRA
Total end-wealth = end-wealth stocks in IRA (*SI*) + end-wealth bonds in taxable (*BT*)
$SI = \$500{,}000*(1 + .08)^{30}*(1 - .3)) = \$3{,}521{,}930$
$BT = \$500{,}000*(1 + .05*(1 - .3))^{30} = \$1{,}403{,}397$
$SI + BT = \$4{,}925{,}327$

Strategy 2: Bonds In IRA
Total end-wealth = end-wealth bonds in IRA (*BI*) + end-wealth stocks in taxable (*ST*)
$BI = \$500{,}000*(1 + .05)^{30}*(1 - .3) = \$1{,}512{,}680$
$ST = \$500{,}000*(1 + .08*(1 - .15))^{30} = \$3{,}598{,}385$
$BI + ST = \$5{,}111{,}065$

For this set of assumptions, Strategy 2 results in greater end-wealth, so the client should locate their bonds in the IRA and stocks in the taxable account. Mathematically, bonds go into the IRA first if,

$BI + ST > SI + BT.$ (1)

With different assumptions, the order may flip: for example, if the capital gains rate is 20 percent, stocks in the IRA do better than bonds in the IRA. Stocks also do better in the IRA if pre-tax return is 10 percent, the horizon is 40 years, or the ordinary tax rate is 25. By "stocks-in wins" we mean stocks in the IRA do better than bonds in the IRA. Clearly the results are dependent on the input assumptions.

What if the client had three classes: A, B, and C? Then it's not a question of which class goes into the IRA and which doesn't, but rather which of the three classes goes into the IRA *first*. The three classes would somehow need to be *rank ordered* to determine the fill sequence into the IRA. A brute-force approach would be to compare A and B, A and C, and B and C, just as we did above.

That would then lead to a rank order for the three classes. That would mean six analyses, since each analysis requires two comparisons. So, using the sum approach, two asset classes require 2 comparisons, three asset classes require 6 comparisons, four asset classes require 12 comparisons, ten asset classes require 90 comparisons, and so on. In general, N asset classes require $N*(N-1)$ comparisons. Doable but quite a chore!

An alternate to the sum method is the difference method, outlined in the following. The thought process emanates from the question, How much difference does it make to end-wealth whether an asset class is placed in an IRA versus a taxable account? If it makes a lot of difference, favoring the IRA, the asset class should be placed in the IRA. If it makes a lot of difference, favoring the taxable, it should be placed in the taxable account. If it makes little difference, it does not matter much whether the asset class is placed in the taxable account or the IRA. Thus, the formalized approach suggested by this line of thinking is to (a) rank order the asset classes based on the differences in end-wealth between placing it in the IRA versus the taxable account, then (b) fill the IRA using this rank ordering. For the two-asset class problem the differences would be as follows:
$SI - ST$ = \$3,521,930 – \$3,598,385 = –\$76,455 and
$BI - BT$ = \$1,512,680 – \$1,403,397 = \$109,283.
Mathematically, bonds go into the IRA first, since
$BI - BT > SI - ST$ (2)

Equation (2) can be derived from equation (1) by simply subtracting BT and ST from both sides of the inequality. Thus, the sum method is exactly equivalent to the difference method. The primary advantage offered by the difference method is that it requires fewer comparisons. In the difference method, for 10 asset classes, we require 10 comparisons to establish the rank order for filling the IRA, while in the sum approach we would require 10*(10 – 1) = 90 comparisons.

If one had N asset classes, the steps for determining the optimum asset location would go as follows: For purposes of rank ordering, assume the same amount of money in the taxable and the IRA account (say \$1). For the first asset class, compute the end-wealth when placed in an IRA account, then in the taxable account, and record the difference. Repeat this for each of the N classes, recording a total of N differences. Rank order the asset classes based on the differences. This rank order establishes the sequence in which the IRA gets filled. That is the essence of the difference approach.

Let us illustrate this with an example using four asset classes. Suppose a client owns \$1 million split between two accounts: \$300,000 in an IRA and \$700,000 in a taxable account. The client's overall portfolio allocation is

- U.S. large-cap stocks: 50 percent (\$500,000)
- Short-term bonds: 30 percent (\$300,000)
- Real estate: 10 percent (\$100,000)
- Corporate bonds: 10 percent (\$100,000)

Using the difference method, how should these asset classes be located in the two accounts? The client's horizon is 30 years and the characteristics of the asset classes are known. The first step is

to rank order these classes based on end-wealth for each of the asset classes. Assume that someone did this analysis for you (we are skipping this step for the illustration) and the end-wealth of a dollar for each of the classes is as shown in Table 1.

TABLE 1

Four Asset Classes Example

	Step 1—Establish Rankings			Step 2—Fill the IRA Using Rankings			
	IRA	Taxable	Difference	Allocation	IRA $300,000	Taxable $700,000	
Real Estate	9.0	7.0	2.0	$100,000	$100,000	$0	$100,000
Corporate Bonds	5.0	4.0	1.0	$100,000	$100,000	$0	$200,000
Short-Term Bonds	2.2	2.3	-0.1	$300,000	$100,000	$200,000	$500,000
U.S. Large Cap	7.0	10.0	-3.0	$500,000	$0	$500,000	$1,000,000
Totals				$1,000,000	$300,000	$700,000	
	Step 1—End wealth, after taxes, for a $1 investment. The differences establish the order for filling the IRA account.			Step 2—Location of the four asset classes using the rank ordering from step 1.			

Step 1 in Table 1 is read as follows: If one had $1 of real estate, in 30 years it would grow to $9 after taxes in the client's IRA account, and $7 after taxes in the client's taxable account. The difference is $2 in favor of the IRA account. Thus, one would want to locate real estate in the IRA. The differences for the other classes are shown and ranked accordingly. Step 2 is to fill the IRA, starting with the top-ranked asset class (real estate) and continuing down until the $300,000 of the IRA account is filled; the remaining funds are placed in the taxable account. This location of assets is optimal in that it maximizes after-tax end-wealth for the client (under the assumptions that have been made).

Case Study

In this section we will describe the complete model developed for studying asset location, and apply it to a case study for a client who owns ten asset classes.

The taxable account was modeled for variable cash flows and tax rates, and included the treatment of dividends, long-term gain (realized and unrealized), netting of losses, and step-up in basis. The IRA model included minimum required distributions, with any excess withdrawals being transferred to a taxable account. Our assumption was that the portfolio would be rebalanced annually, and we included simulation capabilities to study the effects of volatility. This model, referred to as the Asset Locator,[4] is used for the analyses presented in this paper.

The baseline case study considers a client age 60, who has $500,000 in a taxable account, (basis $450,000), and $500,000 in a traditional IRA (no basis). The client's effective federal tax rate is 35 percent pre-retirement and 30 percent post-retirement, and state tax is assumed to be 5 percent. The client retires at age 65, and we assume a time horizon of 30 years (to age 90). In the base case we assumed no additions or withdrawals (except for required minimum distributions), no step-up in basis, and no carry-forward losses. Realized capital gains and dividends are taxed at 15

percent.

Referring to Table 2, the client's overall portfolio contains ten asset classes: 40 percent in bond classes (two classes); and 60 percent in equities (eight asset classes, with different tax-efficiency characteristics). This is a reasonably well-diversified portfolio for a client with a moderate risk tolerance. The return characteristics of the asset classes are shown in Table 3. The notes[5] at the end of this paper detail how the data were derived. The return components of equity classes are read as follows: for example, U.S. Small Stocks Active assume a total return of 11.5 percent, of which .5 percent is dividends return and 11 percent is capital gains return; of the 11 percent capital gains, 80 percent is long term (8.8 percent) and 20 percent is short term (2.2 percent); 60 percent of the long-term capital gain is realized annually (6.6 percent) and 20 percent of the long-term capital gain is unrealized (2.2 percent).

TABLE 2

Return Data for 10 Asset Classes Used in Baseline Study

Asset Class	Mean	SD	DivPerc	LTG-Perc	LTGRlzd-Perc	Allocation 60% Equities
Short-Term Bonds	2.50%	2.79%	0.00%	0.00%	0.00%	32.0%
High-Yield Bonds	6.00%	7.72%	0.00%	0.00%	0.00%	8.0%
U.S. Large Stocks — Active	11.00%	19.78%	1.50%	35.00%	15.00%	6.0%
U.S. Large Stocks— Tax Efficient	8.50%	17.38%	1.50%	100.00%	0.00%	18.0%
U.S. Small Stocks— Active	11.50%	29.56%	0.50%	80.00%	60.00%	9.0%
Int'l Large Stock	9.00%	18.72%	0.00%	80.00%	67.00%	6.0%
Emerging Markets	12.00%	27.18%	0.00%	90.00%	60.00%	6.0%
Real Estate (Public)	10.50%	16.80%	0.00%	25.00%	10.00%	6.0%
Commodities	8.00%	20.95%	0.00%	0.00%	0.00%	4.5%
Absolute Return	8.00%	7.00%	0.00%	10.00%	10.00%	4.5%

Mean: Arithmetic annual return
SD: Annualized standard deviation
DivPerc: Annual dividend expressed as a percent of the asset
LTG_Perc: Percentage of the mean return that is taxed at the long-term capital gain rate
LTG_Rlzd_Perc: Percent of the long-term gain that is realized (taxed) in the current year
Allocation: Percent of total assets allocated to the class

TABLE 3

End-Wealth Differences for Baseline Case

	IRA Factor	Taxable Factor	Difference
Real Estate (Public)	10.33	8.21	2.11
U.S. Large Stocks—Active	11.97	9.99	1.98
Commodities	5.29	4.45	0.83
U.S. Small Stocks—Active	14.24	13.51	0.73
Absolute Return	5.33	4.62	0.71
High-Yield Bonds	3.16	3.08	0.08
Emerging Markets	16.01	16.06	–0.05
International Large Stock	7.41	7.63	–0.22
Short-Term Bonds	1.26	1.59	–0.33
U.S. Large Stocks—Tax Efficient	6.80	8.60	–1.80

IRA Factor: After-tax end-wealth for a $1 investment in the IRA account
Taxable Factor: After-tax end-wealth for a $1 investment in the Taxable account
The difference establishes the rank order for filling the IRA, for the baseline case

Using the asset locator model, we first computed the difference in after-tax end-wealth between the IRA and the taxable accounts for each of these classes. Note that the accounts are liquidated at the end of the horizons to establish the after-tax wealth. The rank ordered differences are shown in Table 3.

Observe that the *high return and low tax-efficiency* asset classes (Real Estate, U.S. Large Active, Commodities and Absolute Return) do much better in the IRA. The high returns enhance the

benefits from tax deferral, and these classes would not benefit much from the lower capital gains tax rates in the taxable account since only a small portion of their return is subject to capital gains treatment. On the other hand, the *high return, highly tax-efficient class* (U.S. Large Tax Efficient) does much better in the taxable account. This is because it benefits from both the lower taxation of capital gains and the tax deferral of the capital gains (since these gains are not realized each year). Further, note that the differences are relatively small for the *low return classes* (short-term bonds and to some extent corporate bonds); thus, the penalty of misplacing these classes in one account versus the other will be small.

Emerging Markets, International Large, and U.S. Small Active have medium efficiencies. For such classes, for *this* particular client's profile, the benefits of tax deferral in the IRA are high, but so are the benefits of lower capital gains tax rates in the taxable account. These two opposing forces tend to cancel each other, resulting in a small difference between the IRA and the taxable end-wealth. But changes in the client's profile can swing the advantage in favor of the IRA or the taxable account. Such *medium-efficiency* (or *tax-efficiency*) classes are "swing classes" in that their location will depend strongly on the client's profile. For location purposes, asset classes generally can be categorized in the four groupings described above.

The asset location process is completed by filling the IRA with these established rankings. The results are shown in Table 4.

TABLE 4

Asset Allocation and Difference-Based Location for the Baseline Case

	Allocation	IRA	Taxable
Real Estate (Public)	$60,000	$60,000	$0
U.S. Large Stocks D	$60,000	$60,000	$0
Commodities	$45,000	$45,000	$0
U.S. Small Stocks—Active	$90,000	$90,000	$0
Absolute Return	$45,000	$45,000	$0
High-Yield Bonds	$80,000	$80,000	$0
Emerging Markets	$60,000	$60,000	$0
International Large Stock	$60,000	$60,000	$0
Short-Term Bonds	$320,000	$0	$320,000
U.S. Large Stocks—Tax Efficient	$180,000	$0	$180,000
	$1,000,000	$500,000	$500,000

This difference-location strategy was compared with three alternate location strategies: all bonds in the IRA ("bonds-in"), all stocks in the IRA ("stocks-in"), and a pro-rata location strategy (using the same percentage asset allocation in both the taxable and the IRA). The resulting end-wealth for these four location strategies is shown in Table 5. Annual rebalancing was assumed in this analysis.

TABLE 5

Comparison of Location Strategies for Baseline Case

Showing the Benefits of the Difference-Location Method Over Pro-Rata, Bonds-In and Stocks-In

	Straight-Line Analyses with Annual Rebalancing			Benefit/Loss			
	Start	AT End	Return	Versus Pro-rata	Versus Bonds-In	Versus Stocks-In	Versus Located
Pro-Rata	$1,000,000	$5,118,229	5.59%	0.00%	0.06%	-0.06%	-0.24%
Bonds-In	$1,000,000	$5,035,322	5.54%	-0.06%	0.00%	-0.12%	-0.30%
Stocks-In	$1,000,000	$5,208,722	5.66%	0.06%	0.12%	0.00%	-0.18%
Diff-Located	$1,000,000	$5,485,881	5.84%	0.24%	0.30%	0.18%	0.00%

Start: The initial value
AT End: After-tax end wealth value
Benefit/Loss: The benefit/loss (per year, after taxes) of alternate strategies relative to the grayed strategy

The difference-location strategy results in $5,485,881 – $5,118,229 = $367,652 more end-wealth than the pro-rata location strategy. This translates to an after-tax benefit of 24 bps a year over the pro-rata location strategy, a 30-bps benefit over the bonds-in location strategy, and 18-bps benefit over the stocks-in location strategy. The analysis shown in Table 5 was based on a straight-line fixed return for the classes. To study the impact of volatility on these results, we ran Monte Carlo simulations comparing the difference-location strategy with the pro-rata location strategy. As can be seen from the results, shown in Table 6, the mean benefit is slightly lower (22 bps versus 24 bps), but the benefit is quite robust, in that it stays positive even for the 25th percentile of the simulations.

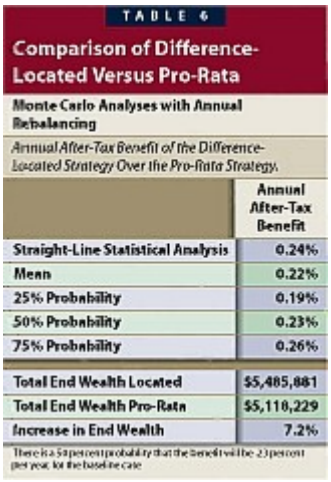


TABLE 6

Comparison of Difference-Located Versus Pro-Rata

Monte Carlo Analyses with Annual Rebalancing

Annual After-Tax Benefit of the Difference-Located Strategy Over the Pro-Rata Strategy.

	Annual After-Tax Benefit
Straight-Line Statistical Analysis	0.24%
Mean	0.22%
25% Probability	0.19%
50% Probability	0.23%
75% Probability	0.26%
Total End Wealth Located	$5,485,881
Total End Wealth Pro-Rata	$5,118,229
Increase in End Wealth	7.2%

There is a 50 percent probability that the benefit will be 23 percent per year for the baseline case

In summary, the mean benefit of the difference-location strategy over a pro-rata location strategy for the baseline client has been shown to be 22 bps. The pro-rata location of asset classes is sub-optimal, leading to 7 percent less end-wealth than the difference-location strategy.

Sensitivity Analyses

In this section we will study how the rank ordering of asset classes and location benefit is affected by changes in the client's financial profile, tax laws, and by the characteristics of the asset classes. This sensitivity analysis will lead to some general guidelines on location and will help identify the parameters that are most critical in location decisions.

Client Profile

The client-profile parameters we studied were their tax rates, horizon, withdrawals, carry-forward losses, percent of assets in the IRA, and equity exposure. The location analysis results for the base case are shown as Scenario A in Table 7 on p. 50. Recall that for this base case we assumed a pre-retirement tax rate of 35 percent, and post-retirement tax rate of 30 percent, a time horizon of 30 years, no withdrawals, and no carry-forward losses at the beginning of the study. The impact of changing post-retirement tax rates is shown as scenario B and C in Table 7. The top part of the table shows the differences between placing asset classes in the IRA versus taxable accounts. The bottom part of the table shows the ranking for filling the IRA based on these differences.

TABLE 7

Sensitivities to Tax Rates

	Difference Between Placing in IRA and Taxable		
Scenario	A	B	C
Scenario Description	Base Case	Tax Rate 35%	Tax Rate 15%
Real Estate (Public)	2.11	1.67	2.13
U.S. Large Stocks—Active	1.98	1.39	2.31
Commodities	0.83	0.63	0.82
U.S. Small Stocks—Active	0.73	−0.25	2.07
Absolute Return	0.71	0.50	0.77
High Yield Bonds	0.08	−0.04	0.16
Emerging Markets	−0.05	−1.25	1.76
International Large Stock	−0.22	−0.73	0.58
Short-Term Bonds	−0.33	−0.39	−0.18
U.S. Large Stocks—Tax Efficient	−1.80	−2.35	−0.71
End Wealth	5,485,881	5,135,019	6,782,134
Location Benefit Over Pro-Rata	0.22%	0.22%	0.14%
	Rank Order for Filling IRA		
Real Estate (Public)	1	1	2
U.S. Large Stocks—Active	2	2	1
Commodities	3	3	5
U.S. Small Stocks—Active	4	6	3
Absolute Return	5	4	6
High-Yield Bonds	6	5	8
Emerging Markets	7	9	4
International Large Stock	8	8	7
Short-Term Bonds	9	7	9
U.S. Large Stocks—Tax Efficient	10	10	10

The top table shows the difference in end wealth, after taxes, between placing $1 in an IRA over placing the $1 in a taxable account.
The differences establish the rank order for filling the IRA, shown in the bottom table.
The last row in the top table shows the benefit (per year, after taxes) of this difference-based location strategy over a pro-rata strategy.

We see that the tax-inefficient, high-return classes (Real Estate, U.S. Large Active, Absolute Return, and Commodities) remain the first classes to fill the IRA. The high-return, tax-efficient U.S. Large is consistently the last class to fill the IRA—that is, it is the first class to fill the taxable account. The long-term tax-deferred benefits of placing this class in a taxable account far exceed all other considerations. Note that, given a choice between filling the taxable account with short-term bonds or tax-efficient high return classes, the tax-efficient class is the clear winner.

Tax-efficient, high-return classes gain a lot from being placed in the taxable account; in contrast, it does not make much difference in which account one places the low-return, short-term bond class. The differences are relatively low for the other classes, and their IRA-fill priority depends on the scenario parameters. Our analyses showed that the benefit is greater, and therefore more critical, if the client will be withdrawing funds. This is not unexpected, since we would intuitively expect a larger penalty for mis-location if the assets are going to be withdrawn soon thereafter. We also found that location optimization does not matter as much if the assets are going to be liquidated within a few years.

The final client-based parameter we will discuss is the percent of assets they hold in an IRA. Clearly, there would be no benefit due to location if all assets were in a taxable account (0 percent in an IRA) or 100 percent were in an IRA, since there would be nothing to cross-locate. The benefit of difference-location over pro-rata location increases as the percent in the IRA departs from these extremes. For this client, we found that the location benefit ranges from 0 bps to 25 bps, depending on the percent of assets in the IRA. If this client had 80 percent in an IRA and 20 percent in a taxable account, the benefit would be 17 bps.

In separate analyses, we observed that location benefits increased with the client's equity exposure. This is expected since the equity classes contribute more to end-wealth.

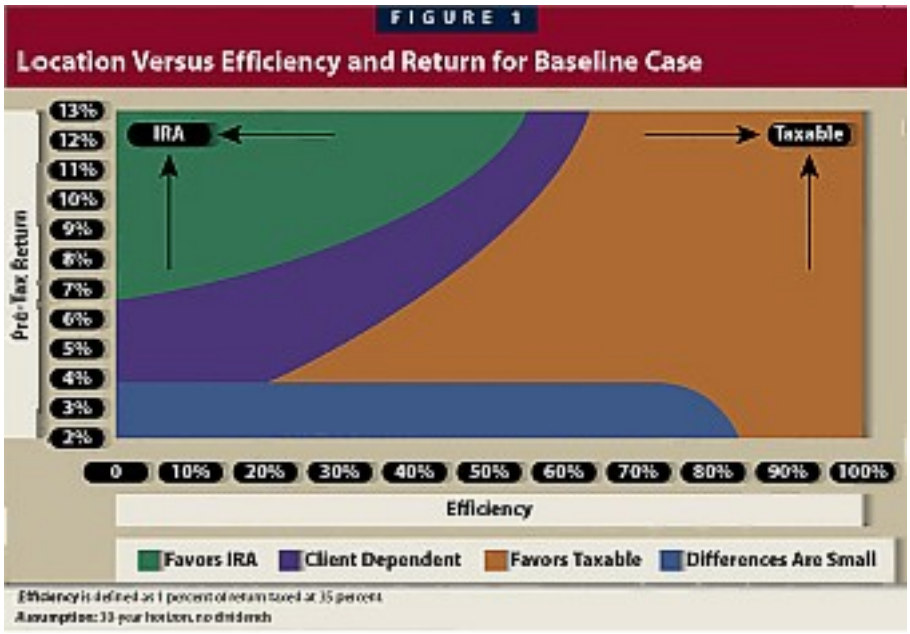
Tax Laws

This formalized study of asset location was triggered by our need to understand the impact of reductions in the dividend taxation rates (from ordinary rates to 15 percent) and capital gains taxation rates (from 20 percent to 15 percent), per the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). We found that the reduction in these tax rates had only a small impact on the end-wealth in the IRA (insofar as minimum distributions transferred to the taxable account received some tax benefits); however, the end-wealth in taxable accounts was significantly increased. As would be expected, the higher-return assets showed more of an increase. The top two classes and the bottom two classes still remained in their respective bands, while the middle classes' rankings changed slightly. Emerging Markets (a swing class) is the only class that moved in rank by more than two positions (but the difference remained small). Thus, we conclude that if this client had placed his or her asset classes correctly before JGTRRA, no major changes would have been required in the asset location as a result of JGTRRA. The reduction in tax rates did increase the projected end-wealth by approximately 5 percent, and the benefit of difference-location over pro-rata stayed the same.

Asset Class Parameters

In this last section on sensitivity analysis, we will study the impact of changes in the return assumptions underlying the asset classes. In particular, we will discuss the sensitivity to the total return, sensitivity to percent of return that is long term, and sensitivity to risk premium.

We have shown that location of an asset class depends on the difference in end-wealth when placed in the IRA versus the taxable account. For the taxable account, tax efficiency is high if most of the return is deferred long-term gain, and it is inefficient if the return is taxed in the current year as short-term gain or long-term realized gain. We have seen that high-return classes are better placed in either a taxable or tax-deferred account depending on the efficiency of the asset class. Thus, return or tax efficiency alone cannot be used to determine the location of a class. The key metric for establishing location is *after-tax end-wealth*, which depends on some *combination* of return and tax efficiency. This is depicted in Figure 1 for a client with a 30-year horizon. In this analysis, we defined efficiency as 1 minus the percent of total return that is not deferred and is taxed at a *normalized* 35 percent rate. Consider, for example, an asset class that has a pre-tax return of 7 percent, and suppose that 20 percent of the return was taxed at the ordinary tax rate of 35 percent and 40 percent was realized at a long-term rate of 15 percent. The normalized percent of return taxed at 35 percent is 20%*35/35 + 40%*15/35 = 37.1%, and the efficiency is 1 – 37.1% = 62.9%. From Figure 1, this class would be better placed in the taxable account. Similar generic charts could be developed for shorter and longer horizons.

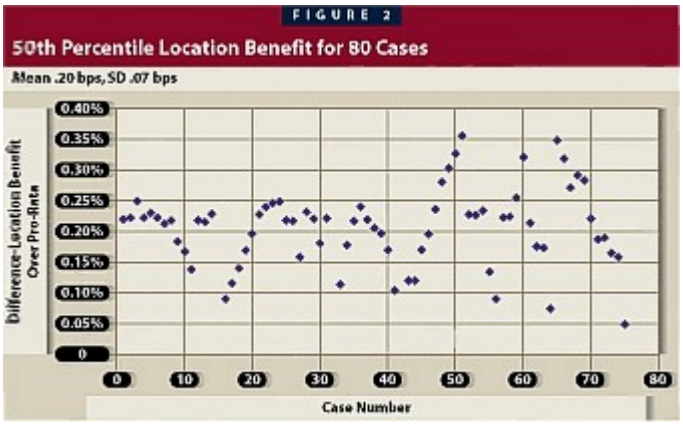


We have shown that if the total returns are low (such as short-term bonds), the differences will be small, and the location of such asset classes will not significantly affect end-wealth. Equity classes that are projected to have higher return will make a larger difference to the end-wealth, so their location will be more critical. Because the placement of higher-return equity classes makes more of a difference to end-wealth, we would expect location benefits to increase with the assumed risk premium (excess arithmetic return of U.S. Large Tax Efficient over long-term bonds). If the assumed risk premium is 1 percent, the returns among all the classes do not differ much, and location benefits are relatively small. The ranking of classes was not found to change much with risk premium.

Summary of Case Studies

This section summarizes our findings on location benefits over a range of client profiles and tax law variations including the client's age, tax rates, equity exposure, percent in IRA, horizon, withdrawals and additions, changes in tax laws, and risk premium. Over 75 cases were explored. The mean benefit of difference location over pro-rata location for these cases is plotted in Figure 2. The results of simulations used to derive the 25th and 75th percentiles for these cases are shown in the table. The mean location benefit is 20 bps per year after taxes, and the location benefits are robust, in that even the 25th percentile benefit is over 10 bps per year after taxes. This is in contrast with benefits from tax loss harvesting and rebalancing,[6] where the 25th percentile benefits are typically negative (which means that these tax efficiency measures can hurt 25 percent of the time).

FIGURE 2



In Figure 2, the top figure shows the 50th percentile location benefits for the 80 cases studied for this client. The lower table shows the 25th percentile and 75th percentile of the location benefits. The standard deviation of the benefits (SD) is relatively small.

The location benefits for other pairs of account types for the baseline case were studied and are reported in Table 8. The relative benefit of location increases with the difference in tax characteristics of the accounts. If the client had a Roth IRA and a taxable account, the difference-based location of the asset classes would provide a 35 bps-per-year advantage over a simple pro-rata location, suggesting that efficient location is even more important for this pair of accounts. Intuitively, one would want to fill the Roth IRA with the higher-return classes. In contrast, for similar account types, such as an IRA and an annuity, the location benefits are relatively small (six bps per year), which suggests that even a pro-rata location strategy should be quite acceptable. Thus far, all our studies were limited to pairs of accounts; the study of location if the client has more than two account types has yet to be developed.

TABLE 8

Benefit of Difference-Based Location Over Pro-Rata Location for Different Account Pairings

IRA—Taxable	Roth—Taxable	Annuity—Taxable	Roth IRA	Annuity IRA
0.21%	0.35%	0.27%	0.21%	0.06%

Cost Issues

While there is a definite after-tax return benefit to properly locating assets, one needs to weigh these against certain costs of location. First, in contrast with pro-rata location (where all account types have the same allocation), the rebalancing of asset classes becomes much more difficult when the client has different asset classes in the different account types. Some planners have chosen the pro-rata approach primarily to minimize the administration costs of rebalancing accounts with different asset classes. We believe the end-wealth benefits provided by difference-based location over the pro-rata method justify the extra rebalancing efforts. But to further enhance the use of optimal asset location, the industry needs further studies on optimal rebalancing techniques, and an automation of rebalancing when different asset classes are located in different tax-category accounts (across-account rebalancing).[7]

A second consideration is that the relocation of asset classes (assuming the client is not located correctly) may require the sale of assets with unrealized gains. One needs to assess the benefits of relocation versus the cost of recognizing these gains. As in the real estate business, relocation would not make sense if the horizon of the portfolio is relatively short.

Our end-wealth-based location analysis did not consider restrictions that may preclude the location of certain asset classes in taxable or tax-deferred accounts, and we have not yet addressed the location between more than two account types. Optimizers may be required to accommodate such constraints.[8] Lastly, we have not addressed client preference issues, such as a desire to have all accounts provide similar returns. Such constraints may need to be considered in the location decisions.

Guidelines

We have shown that the rank ordering of which assets to place in an IRA should be based on end-wealth, not on return or efficiency alone. High-return, high-tax-efficiency classes do much better in a taxable account, while high-return, low-efficiency classes do better in an IRA. Low-return classes can be placed in either account, since the difference in end-wealth will be small. Low return and very high efficiency classes, such as muni bonds, should be located in taxable accounts. For medium return and efficiency classes, a customized analysis may be needed to find the optimal location that maximizes end-wealth.

The benefits of tax-efficient location are on par with the projected benefits from tax-efficient rebalancing and tax-loss harvesting. The authors recommend using tax-efficient location for medium to high net worth clients who would also benefit from tax-loss harvesting and across-account rebalancing.

Asset location is relatively sensitive to return assumptions, clients' equity exposure, and their horizon, but is relatively insensitive to tax law changes (such as the JGTRRA).

Conclusions

We have described a generic framework for addressing the optimal asset location using the difference in end-wealth between two account types. This difference-location approach leads to an average advantage of approximately 20 bps per year, after taxes, over the sub-optimal pro-rata location strategy of using the same asset classes in the taxable and IRA accounts.

Endnotes

1. Robert M. Dammon, Chester S. Spatt, and Harold H. Zhang, "Optimal Asset Location and Allocation with Taxable and Tax-Deferred Investing," *Journal of Finance*, LIX, 3 (June 2004).
2. John B. Shoven and Clemens Sialm, "Long-Run Asset Allocation for Retirement Savings," *Journal of Private Portfolio Management*, 2, 2 (Summer 1998): 13–26.
3. Robert D. Arnott, L. Berkin and Jia Le, "Loss Harvesting: What's It Worth to the Taxable

Investor" *Journal of Wealth Management*, 26, 4 (Summer): 84–94; Robert D. Arnott and Robert M. Lovell, "Rebalancing: Why? When? How Often?" *Journal of Investing*, 2, 1 (Spring 1993): 5.

4. Asset Locator is a software program developed by Digiqual Inc., www.beyondmontecarlo.com.
5. This standard deviation and correlations (not shown) were based on historical data for the period 1970 to 2002. The projected arithmetic mean return for the U.S. Large Tax Efficient was assumed to be 8.6 percent, corresponding to a risk premium of 3.5 percent over long-term bonds return of 5.1 percent. The returns of the other equity classes were based on historical differences relative to the U.S. Large Tax Efficient asset class. The dividends, percent long-term gain, and percent realized long-term gain were derived from MorningstarÕs data on the 50 largest funds in each asset class. *Note that benefits of tax-loss harvesting opportunities for certain volatile asset classes (such as emerging markets) can be addressed by increasing their efficiency.*
6. Arnott, Barkin, and Le; Arnott and Lovell, n. 3.
7. Across Account Rebalancing: basic concepts of across-account rebalancing, www.iRebal.com.

8. PORTAX is a software tool developed by Windermere Investment Associates, www.windinvest.com.