Optimal Withdrawal Strategies for Retirees with Multiple Savings Accounts

by Stephen M. Horan, Ph.D., CFA

Executive Summary

- This article develops optimal distribution strategies for investors having tax-advantaged savings accounts with both front-end tax benefits and back-end tax benefits. It develops withdrawal strategies under two tax-rate environments: a single, uniform tax-rate regime and a progressive tax-rate regime. It then compares residual accumulations and withdrawal sustainability for various withdrawal strategies.
- The results indicate that investors benefit from having multiple types of accounts from which to make withdrawals. In a setting characterized by constant uniform marginal tax rates, withdrawal strategies are irrelevant because all taxable distributions are subject to the same tax rate.
- In a stochastic tax-rate environment, an informed strategy of making traditional (Roth) IRA withdrawals when tax rates are low (high) performs especially well.
- In a progressive tax-rate environment, taxable distributions can be applied against personal exemptions and deductions or against lightly taxed tax brackets. Therefore, withdrawing from the traditional IRA first produces substantially larger residual accumulations.
- A strategy of taking traditional IRA distributions that would be taxed at rates up through 15 percent and satisfying the remainder of the withdrawal requirement from the Roth IRA yields even much greater residual accumulations. Wealthier investors stand to benefit by taking distributions up through the 25 percent tax bracket. Retirees can significantly improve the sustainability of their retirement portfolios by embarking on an optimal withdrawal program.

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Investors today face an array of new decisions that past generations did not. The proliferation of defined-contribution plans, the introduction of different tax-advantaged savings accounts in just the last ten years (for example, Roth IRAs, Section 529 plans, and Roth 401(k) plans) has prompted researchers to develop models to help guide financial planners and investors. Many advances thus far, however, have focused on tax-efficient investment decisions. Analyzing tax-efficient withdrawal policies, which is the focus of this paper, has attracted less attention.

Several authors have investigated the sustainability of retirement withdrawals—for example, Bengen (1994); Cooley, Hubbard, and Walz (1998, 1999, 2001, 2003a, 2003b); Tezel (2004); Guyton (2004); and Ervin, Filer, and Smolira (2005)—but few have focused on tax-efficient withdrawal policies.[1] One exception is Ragsdale, Seila, and Little (1993, 1994) who approach the issue from a tax code perspective. They develop a mathematical programming model that incorporates a myriad of then-prevailing tax regulations regarding retirement distributions, including early withdrawal penalties, minimum distribution taxes, excess distribution taxes, and estate taxes. Since the publication of their work, the Taxpayer Relief Act (TRA) of 1997 repealed excess distribution taxes and introduced the Roth IRA, changing the calculus and balance of considerations. Another exception is Spitzer and Singh (2006), who examine the sequence of withdrawals from retirement accounts, and this paper extends their work.

This paper develops a model that focuses on the salient features of the tax code, specifically recognizing that distributions from some types of accounts are taxed as ordinary income and withdrawals from other accounts are not taxed. Therefore,

the ability to choose the type of account from which to make withdrawals is potentially valuable. For example, a retiree benefits from making Roth IRA withdrawals in high tax-rate regimes and withdrawals from a traditional IRA in low tax rate regimes. As a result, there can be a benefit to retirees of having more than one type of tax-advantaged retirement account from which to make withdrawals during their retirement years.[2]

The general level of tax rates can and does change over time in response to economic conditions, the agenda of the reigning political party, or current and expected budget deficits or surpluses. It is therefore important to understand how a changing tax environment affects optimal withdrawal policies. So this paper models withdrawals that are taxed at a uniform marginal tax rate that may change over time. Of course, required minimum distributions (RMDs) from traditional IRAs dictate to some extent required withdrawals from traditional IRAs after age 70½, but to the extent retirees have discretion over accounts from which they make withdrawals, they can manage their tax obligations.

Even in a more static tax environment, retirees with multiple types of tax-advantaged accounts from which to withdraw will benefit from guidance regarding optimal withdrawal policies from these accounts. For example, should retirees first draw down from traditional IRA or Roth IRA balances in a static tax-rate environment within a progressive tax-rate environment that is characterized by exemptions, deductions, and six tax brackets? This situation is meaningful for investors whose retirement account withdrawals represent most or all of their retirement income. In this case, their withdrawals are not taxed at a uniform marginal rate, but a series of progressively higher rates. Therefore, a second model in this paper incorporates a progressive tax-rate structure.

One of these two models applies to all retirees. The first applies to those for whom alternative sources of retirement income make retirement distributions subject to a uniform marginal tax rate. The second applies to those for whom a paucity of alternative retirement income makes distributions potentially subject to a series of progressive tax rates.[3]

The results indicate that when distributions are taxed at a constant marginal tax rate, withdrawal strategies are irrelevant. When tax rates vary over time, however, an informed strategy of taking traditional IRA distributions when tax rates are low, and Roth IRA distributions when tax rates are high, performs at least as well as naive strategies of taking withdrawals from one account until funds are depleted before withdrawing from the other.

If distributions are subject to a progressive tax-rate system, the best naive strategy is to draw down the traditional IRA before the Roth IRA because a portion of distributions from the traditional IRA will not be taxed or will be taxed lightly. But an informed strategy of making traditional IRA withdrawals that would be taxed at a rate up to 15 percent and satisfying the remainder of the withdrawal requirement from the Roth IRA produces substantially greater residual accumulations than the best naive strategy. The performance of this informed strategy is especially good for retirees with aggressive withdrawal requirements and investment strategies.

The balance of this paper develops withdrawal models for two different settings—one in which withdrawals are taxed at a uniform marginal tax rate and one in which withdrawals are taxed at progressively higher rates as distributions increase. It implements these withdrawal models in a scenario analysis that accommodates both static and stochastic tax-rate environments, and it offers avenues for future research.

The Models

This section develops withdrawal models for two broad tax environments. The first environment is one in which a

retiree's withdrawals from a tax-advantaged account with front-end-loaded tax benefits, such as a traditional IRA, are taxed entirely at a single marginal tax, perhaps because an investor has exogenous taxable income or taxable retirement portfolios large enough to exhaust their exemptions, deductions, and tax brackets with lower tax rates.

The second model focuses on a progressive tax-rate regime characterized by exemptions and deductions and six tax brackets. It applies to investors with little or no exogenous taxable income or small taxable investment portfolios such that retirement withdrawals represent most or all retirement income, taxable and otherwise. The model allows deductions, exemptions, and tax brackets to grow by the rate of inflation.

Although it may seem restrictive to assume that, in the case of the progressive tax-rate model, retirement income is entirely composed of withdrawals from retirement accounts, the models remain relevant for several reasons. First, sometimes retirees have little or no alternative sources of retirement income other than their investment portfolios. For example, employees of certain states, such as Ohio, are exempt from Social Security withholdings and therefore do not receive Social Security retirement benefits. Even when retirees do receive Social Security payments, those payments are oftentimes largely tax exempt. Second, even if Social Security benefits are taxable, the financial planner can easily modify the progressive tax rate model to reflect the relevant tax brackets to which retirement distributions would apply. Third, to the extent that retirement distributions do not fall into different tax brackets, then the first model based on marginal tax rates is applicable. As a result, one of the two models applies to all retirees. The planner chooses the model best suited to the particular situation.

Uniform marginal tax rate. Consider a retiree with balances in both a traditional IRA and a Roth IRA, the pretax balance at any time t being represented by $V_{Trad,t}$ and $V_{Roth,t}$, respectively. Both portfolios are similarly invested to generate a pretax expected return, r, over some withdrawal horizon, n. The retiree intends to generate after-tax withdrawals initially equal to w percent of the combined value of the two accounts at the beginning of the year. The retiree increases this initial after-tax withdrawal annually by g to maintain his or her purchasing power. Therefore, let $W_t \equiv w(V_{Trad,0} + V_{Roth,0})(1 + g)^{t-1}$ represent the after-tax withdrawal requirement for period t. Each year withdrawals from the traditional IRA are taxed at either T_{hi} or T_{lo}, depending on the prevailing marginal rate.

The retiree can implement one of three withdrawal strategies—two naive and one informed. The first naive strategy in this marginal tax rate framework satisfies the after-tax withdrawal requirement by making withdrawals from the traditional IRA until its balance is depleted, at which time withdrawals from the Roth IRA commence, regardless of the prevailing tax rate. The second naive strategy reverses this sequence by making withdrawals from the Roth IRA until its balance is depleted, then making withdrawals from the traditional IRA. The informed withdrawal strategy generates the retiree's after-tax withdrawal requirement from either the traditional IRA or Roth IRA conditioned on the prevailing tax rate. If the tax rate is high (low), the retiree makes withdrawals from the Roth (traditional) IRA as long as funds are available. The appendix specifically models these withdrawal strategies.

A shortcoming of this model is that it assumes that retirees know whether they are currently facing high or low tax rates, which, strictly speaking, is impossible to discern without knowing what future tax rates will be. That said, financial planners and retirees can make judgments about whether current tax rates are abnormally high or low based on historical experience, future expectations, or both. This framework therefore remains useful in estimating the potential value in managing withdrawals from retirement accounts.

Another shortcoming of the model is that retirees are subject to RMDs after age 70½, thereby limiting discretion over the accounts from which withdrawals are made. The model nonetheless provides heuristic guidance regarding optimal withdrawal policies and can be modified by simply imposing RMD constraints on the withdrawal algorithms in the appendix. These constraints are not likely to be severely binding in some circumstances because, in the progressive tax-bracket setting presented below, the optimal naive strategy calls for the retiree to deplete the traditional IRA before making Roth IRA withdrawals, and the optimal informed strategy calls for significant withdrawals from the traditional IRA. In either case, the retiree is making substantial traditional IRA distributions.

Progressive tax rates. For some retirees, taxable distributions may not be taxed at the marginal rate but may be applied directly against exemptions, deductions, and sequentially against higher tax brackets. This second model analyzes the impact of naive and informed distribution policies on residual accumulations and withdrawal sustainability in a progressive tax-rate system. It assumes the current progressive tax rate structure characterized by exemptions and deductions at low income levels and six tax brackets, each having progressively higher tax rates. It assumes further that these brackets grow by the rate of inflation, π, over time.[4]

Six different withdrawal policies are examined—two naive and four informed. The two naive distribution policies mimic those in the first model, the first (second) being that withdrawals are made from a traditional (Roth) IRA until that balance is depleted, at which time the retiree commences withdrawals from the Roth (traditional) IRA. The four informed distribution strategies withdraw from the traditional IRA balance, if available, up to either the exemption and deduction limit or up to a specified tax bracket. Any additional funds required to satisfy the after-tax withdrawal requirement would be distributed from the Roth IRA.

For example, consider a retiree with a $50,000 after-tax withdrawal requirement, and exemptions and deductions totaling $16,900, the sum of personal exemptions and standard deductions for a married couple filing jointly in the 2006 tax year. Suppose further that taxable income up to $15,100 is taxed at 10 percent. The first of the four informed withdrawal strategies would distribute $16,900 from the traditional IRA and the remaining $33,100 from the Roth IRA, in which case the investor would pay no tax on distributions. The second informed withdrawal strategy would distribute $32,000 from the traditional IRA. Of this amount, $16,900 would escape taxation and $15,100 would be taxed modestly at 10 percent, generating a total after-tax distribution of $30,490. The remaining $19,510 after-tax required distribution would be withdrawn from the Roth IRA. The third and fourth informed withdrawal strategies would be similarly constructed except that the withdrawal from the traditional IRA would increase to the next higher tax bracket. The appendix presents formal algorithms for these withdrawal strategies.[5]

One advantage of these strategies is that they relax, at least to some degree, the constraints imposed by traditional IRA RMDs, which are not explicitly incorporated into the models. Because the informed strategies mandate significant traditional IRA withdrawals, RMD constraints may not be non-binding.

Residual Accumulations and Withdrawal Sustainability

Uniform marginal tax rate. This section uses scenario analysis to decipher the effects of withdrawal strategies on residual accumulations and withdrawal sustainability in different tax-rate environments. The first set of residual accumulations and withdrawal sustainability outcomes are derived from the withdrawal models based on a uniform marginal tax rate, which may or may not vary over time. The base-case scenario involves a retiree with $1 million pretax in a traditional IRA. It

also assumes an economically comparable balance in a Roth IRA. Because the after-tax value of a dollar in a traditional IRA equals $(1 - T_n)$ of a dollar in a Roth IRA, the Roth IRA balance in this scenario is $720,000, or 72 percent of the traditional IRA balance to reflect a 28 percent tax rate, to equate their after-tax values.

The base-case scenario also assumes that a retiree has a 6 percent after-tax withdrawal requirement, so that the initial after-tax distribution is $103,200 (that is, 0.06*($1,000,000 + $720,000)), and that this distribution grows by 3 percent annually (that is, g = 3 percent).[6] We assume a 25-year withdrawal horizon over which time the marginal tax is either 28 percent or 33 percent.[7] To meaningfully compare residual accumulations of traditional and Roth IRAs at the end of this period, it is necessary to evaluate them on a comparable basis. Similar to the after-tax treatment of initial balances, the after-tax value of a dollar in a traditional IRA is equal to (1 – 0.28) of a dollar in a Roth IRA.

Table 1 displays residual accumulations 25 years hence and withdrawal sustainability for three withdrawal strategies in four tax rate environments. The first two tax regimes are static and assume either a constant high or a constant low tax rate. The second two tax-rate regimes alternate between high and low tax rates each year, differing only on the initial value. Panel A of Table 1 examines outcomes for various withdrawal rates. Perhaps the most immediate inference to draw from panel A is that outcomes are quite sensitive to the required withdrawal, which is not surprising. For example, no withdrawal strategy lasts more than 24 years for withdrawal rates 6 percent and greater.

Table 1: After-Tax Accumulations and Withdrawal Sustainability for Three Withdrawal Strategies in Four Marginal Tax-Rate Environments

Panel A: By After-Tax Withdrawal Rate Assuming an 8% Return

Withdrawal Rate (*w*)	Constant 33% Tax Rate			Constant 28% Tax Rate			Alternating Tax Rate: 28%/33%			Alternating Tax Rate: 33%/28%		
	Traditional then Roth	Roth then Traditional	Informed	Traditional then Roth	Roth then Traditional	Informed	Traditional then Roth	Roth then Traditional	Informed	Traditional then Roth	Roth then Traditional	Informed
4.0%	$2,976,917	$3,199,075	$3,199,075	$3,319,341	$3,319,341	$3,319,341	$3,152,837	$3,262,724	$3,319,341	$3,131,858	$3,255,692	$3,319,341
4.5%	$2,159,109	$2,320,237	$2,320,237	$2,501,533	$2,501,533	$2,501,533	$2,333,994	$2,410,704	$2,501,533	$2,315,013	$2,411,066	$2,501,533
5.0%	$1,341,301	$1,441,398	$1,441,398	$1,683,725	$1,683,725	$1,683,725	$1,521,732	$1,564,959	$1,683,725	$1,492,045	$1,560,164	$1,683,725
5.5%	$523,493	$562,560	$562,560	$865,917	$865,917	$865,917	$697,361	$723,402	$865,917	$679,074	$705,075	$865,917
6.0%	[23]	[23]	[23]	$48,109	$48,109	$48,109	[24]	[24]	$48,109	[24]	[24]	$33,585
6.5%	[20]	[20]	[20]	[21]	[21]	[21]	[21]	[21]	[21]	[21]	[21]	[21]
7.0%	[18]	[18]	[18]	[19]	[19]	[19]	[18]	[18]	[19]	[18]	[18]	[19]

Panel B: By Pretax Return Assuming a 6% Withdrawal Rate

Pretax Return (*r*)	Constant 33% Tax Rate			Constant 28% Tax Rate			Alternating Tax Rate: 28%/33%			Alternating Tax Rate: 33%/28%		
	Traditional then Roth	Roth then Traditional	Informed	Traditional then Roth	Roth then Traditional	Informed	Traditional then Roth	Roth then Traditional	Informed	Traditional then Roth	Roth then Traditional	Informed
5%	[16]	[16]	[16]	[17]	[17]	[17]	[16]	[16]	[17]	[16]	[16]	[16]
6%	[18]	[18]	[18]	[18]	[18]	[18]	[18]	[18]	[18]	[18]	[18]	[18]
7%	[20]	[20]	[20]	[21]	[21]	[21]	[20]	[20]	[21]	[20]	[20]	[21]
8%	[23]	[23]	[23]	$48,109	$48,109	$48,109	[24]	[24]	$48,109	[24]	[24]	$33,585
9%	$755,681	$812,075	$812,075	$1,186,835	$1,186,835	$1,186,835	$984,620	$1,004,562	$1,186,835	$940,811	$994,348	$1,186,835
10%	$2,173,616	$2,335,826	$2,335,826	$2,715,351	$2,715,351	$2,715,351	$2,449,656	$2,535,643	$2,715,351	$2,418,711	$2,515,534	$2,715,351
11%	$4,059,520	$4,362,469	$4,362,469	$4,738,793	$4,738,793	$4,738,793	$4,407,249	$4,545,405	$4,738,793	$4,368,039	$4,555,856	$4,738,793
12%	$6,537,547	$7,025,424	$7,025,424	$7,387,551	$7,387,551	$7,387,551	$6,984,666	$7,216,917	$7,387,551	$6,907,064	$7,196,057	$7,387,551

Note: Figures in brackets represent the number of years over which withdrawals are fully sustained.

Several insights become apparent. First, in a constant tax-rate environment, all three withdrawal strategies yield the same residual accumulations because all traditional IRA withdrawals are taxed at the same rate regardless of when they occur in time. In a constant 33 percent tax-rate environment, it appears as if the traditional-then-Roth strategy underperforms the other two strategies. This is misleading, however, because the other two strategies often leave a residual balance in the traditional IRA at the end of the 25-year period, which in this case is assumed to be taxed at a relatively low 28 percent. These strategies perform better than the traditional-then-Roth strategy only because the tax rate is assumed to

drop after 25 years. The implication of this result can be extended to situations in which parents with IRAs are in higher tax brackets than their beneficiary children. In this case, the parents should spend down the Roth IRA balances first. Otherwise, they should take traditional IRA distributions first.

The last two sets of results in panel A of Table 1 present outcomes when tax rates alternate between 28 percent and 33 percent from one year to the next. In this case, the naive Roth-then-traditional strategy performs better than the alternative naive strategy because it requires smaller pretax withdrawals in the earlier years, leaving more assets in tax-sheltered vehicles for a longer period of time. But an informed withdrawal strategy produces greater accumulations than either naive strategy, particularly for high withdrawal rates. The differences in after-tax accumulations can be as great as 30 percent, increasing with the withdrawal rate and ranging from about $70,000 to $160,000. Interestingly, the initial tax rate in the alternating tax rate pattern has no impact on after-tax accumulations for investors employing the informed withdrawal strategy and little impact on the naive strategies.

Although this scenario assumes that tax rates alternate each year, these results do not rely on that specific construction. Unreported results indicate that if tax rates are low for the first half of the period and high for the second half of the period (or vice versa), the incremental benefits of the informed strategy are nearly identical to those presented in panel A of Table 1. But if tax rates are low (high) for the first half of the period, the naive traditional-then-Roth strategy is superior (inferior) to the naive Roth-then-traditional strategy. These results suggest that the value of a given withdrawal strategy depends entirely on the rate at which traditional IRA distributions are taxed.

Panel B of Table 1 examines after-tax accumulations for various pretax returns. Many of the same conclusions are evident. The informed withdrawal strategy performs at least as well as either naive strategy in stable tax-rate environments but is superior to either in a changing tax-rate environment, with accumulations varying by as much as 20 percent, or about $200,000. These results indicate that retirees can benefit from the flexibility offered by having multiple types of tax-advantaged savings accounts from which to withdraw, thereby allowing them to manage their tax liabilities.

Table 2 displays differences in after-tax accumulations between an informed withdrawal strategy and the naive strategy of making initial distributions from the Roth IRA until its balance is exhausted, which is the better of the two naive strategies in our scenarios. This table assumes an 8 percent pretax return. The differences tend to increase with the after-tax withdrawal rate and the withdrawal growth rate, but not monotonically. In cases where the withdrawal rate or growth rate are too high to sustain 25 years of withdrawals, the informed strategy often adds an extra year of sustainability. In cases where 25 years of withdrawals can be sustained, the informed withdrawal strategy often accumulates $100,000 or more of after-tax assets.

Table 2: Differences in After-Tax Accumulations and Withdrawal Sustainability Between Informed and Naive Withdrawal Strategies in an Alternating Tax-Rate Environment

	After-Tax Withdrawal Rate (w)										
g	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%
0.0%	[0]	[0]	$2,238	$24,753	$48,275	$69,563	$96,832	$120,329	$141,473	$162,472	[1]
1.0%	[0]	[0]	$17,781	$42,501	$72,183	$96,167	$113,394	$151,789	$163,465	[1]	[1]
2.0%	[0]	$7,651	$38,138	$62,631	$88,948	$121,715	$147,517	$157,832	[1]	[1]	[1]
3.0%	[0]	$29,023	$56,617	$90,829	$118,765	$142,515	$48,133	[0]	[1]	[1]	[0]
4.0%	$14,164	$50,020	$79,924	$112,339	$151,692	[0]	[0]	[1]	[1]	[0]	[0]
5.0%	$36,956	$69,136	$109,634	$143,214	[0]	[0]	[1]	[1]	[0]	[0]	[0]
6.0%	$58,244	$100,000	$139,820	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
7.0%	$81,109	$127,122	$85,055	[1]	[0]	[0]	[1]	[0]	[0]	[0]	[0]

Note: Figures in brackets represent the difference in number of years over which withdrawals are fully sustained.

Progressive tax rates. The second set of scenarios is based on the notion that taxable distributions are subject to a progressive tax rate characterized by exemptions and deductions at low income levels and six tax brackets. Therefore, retirees may apply exemptions and deductions against some of their taxable distributions. Furthermore, a portion of taxable distributions are taxed at relatively lower rates. This analysis begins with the personal exemptions, standard deduction, and tax brackets for a married couple filing jointly in 2006 displayed in Table 3. Of course, individual circumstances may vary and a retiree may have different exemptions and deductions, but the analysis can be modified accordingly.[8] The level of the exemptions and tax brackets generally increases over time by the rate of inflation. The base-case scenario assumes, therefore, that these values increase by a 2.5 percent inflation rate, p. The remaining assumptions for the base-case scenario (for example, initial values, withdrawal rate, pretax return, terminal tax rates) are borrowed from the previous section.

Table 3: Exemptions, Deductions, Tax Rates, and Tax Brackets for a Married Couple Filing Jointly in 2006

	Exemptions, Deductions, and Tax Brackets	AGI from	AGI to	Taxed at Rate
Personal Exemption and Standard Deduction	$16,900[a]	$0	$16,900	0%
Bracket 1	$15,100	$16,900	$32,000	10%
Bracket 2	$61,300	$32,000	$78,200	15%
Bracket 3	$123,700	$78,200	$140,600	25%
Bracket 4	$188,450	$140,600	$205,350	28%
Bracket 5	$336,550	$205,350	$353,450	33%
Bracket 6	> $336,550	$353,450	greater	35%

a. Taxpayers over the age of 65 are entitled to an additional standard deduction of $1,000 per spouse.

We examine six different withdrawal strategies. The two naive strategies are identical to the previous section, withdrawing first from either the traditional IRA or Roth IRA until the balance is depleted, then withdrawing from the other. The four informed strategies take distributions from the traditional IRA up to the available exemptions and deductions or up to a specified tax bracket. Outcomes for these strategies under various after-tax withdrawal rates are displayed in Table 4. According to panel A, withdrawing from the traditional IRA until funds are exhausted before withdrawing from the Roth IRA is the better of the two naive strategies. With incremental residual accumulations ranging from about $150,000 to about $900,000, taking initial distributions from the traditional IRA is preferable because a portion of the distribution is applied to exemptions and deductions, and a portion is taxed very lightly at 10 percent or 15 percent. In fact, distributions up to $78,200 are taxed at 15 percent or less. This modest tax burden decreases the pretax distribution required to generate the after-tax withdrawal requirement, leaving more after-tax assets in tax-sheltered accounts.

Table 4: Residual Accumulations and Withdrawal Sustainability for Various Withdrawal Strategies and Withdrawal Rates Under a Progressive Tax Rate System

Panel A: Residual Accumulations and Withdrawal Sustainability

Withdrawal Rate (w)	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%
Traditional then Roth	$4,789,549	$3,796,555	$2,825,820	$1,874,359	$920,329	[24]	[21]	[19]	[17]
Roth then Traditional	$3,876,792	$3,120,582	$2,351,591	$1,561,373	$765,010	[24]	[21]	[19]	[17]
Traditional to Exemption	$4,033,009	$3,275,109	$2,501,365	$1,705,852	$913,474	$91,122	[21]	[19]	[17]
Traditional to Bracket 1	$4,283,768	$3,407,038	$2,588,092	$1,792,728	$992,043	$174,932	[22]	[19]	[17]
Traditional to Bracket 2	$4,826,322	$3,948,868	$3,072,138	$2,195,409	$1,318,680	$441,950	[23]	[20]	[18]
Traditional to Bracket 3	$4,789,549	$3,796,555	$2,825,820	$1,874,359	$920,329	[24]	[21]	[19]	[17]

Panel B: Incremental Residual Accumulations and Withdrawal Sustainability over Traditional IRA Naive Withdrawal Strategy

Withdrawal Rate (w)	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%
Roth then Traditional	($912,757)	($675,973)	($474,230)	($312,986)	($155,318)	[0]	[0]	[1]	[1]
Traditional to Exemption	($756,540)	($521,446)	($324,456)	($168,507)	($6,855)	n.m.	[0]	[0]	[0]
Traditional to Bracket 1	($505,781)	($389,517)	($237,728)	($81,631)	$71,714	n.m.	[1]	[0]	[0]
Traditional to Bracket 2	$36,773	$152,313	$246,318	$321,050	$398,351	n.m.	[2]	[1]	[1]
Traditional to Bracket 3	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]

Note: Figures in brackets represent the number of years over which withdrawals are fully sustained.

Using this preferred naive strategy as a benchmark, we can compare the performance of the informed strategies against it as in panel B of Table 4. The informed withdrawal strategies take distributions from the traditional IRA equal to the allowable exemptions and deductions, or up to a specific tax bracket. The remainder of the withdrawal requirement is satisfied from the Roth IRA. According to panel B, which presents the residual accumulations or withdrawal sustainability in excess of the best naive strategy, only one informed strategy performs substantially better. Taking distributions from the traditional IRA through the 15 percent tax bracket is optimal. Any additional withdrawal requirement would be met with Roth IRA distributions. In this way, the highest marginal tax rate on taxable withdrawals is 15 percent. This strategy can produce residual accumulations of almost $400,000, or over 40 percent, greater than the next best naive strategy, and the difference tends to increase with the withdrawal rate although not monotonically. At high withdrawal rates, the optimal withdrawal strategy produces an extra year or two of sustainability. Making traditional IRA withdrawals through the 25 percent or higher tax bracket produces identical results to the best naive strategy because it yields identical withdrawal patterns. In unreported results, the optimal withdrawal strategy for an initial traditional IRA balance of $2 million and initial Roth IRA balance of $1.333 million is to make withdrawals through the 25 percent tax bracket. The incremental residual accumulations in this case are almost $800,000.

Table 5, panel A, displays the incremental outcomes of the best informed strategy over the best naive strategy for various withdrawal tax rates and pretax returns. The advantage of the informed strategy generally increases with the pretax return and the withdrawal rate. Specifically, the incremental value of the informed strategy is greatest for high returns and high withdrawal rates, with incremental accumulations exceeding $500,000 in many cases. This result indicates that following an informed strategy is particularly important for retirees with aggressive investment and withdrawal strategies. Panel B indicates that the performance of the informed strategy over the worst naive strategy is enormous, with incremental residual accumulations around $2 million in some cases.

Table 5: Incremental Accumulations and Withdrawal Sustainability Between the Best Informed and Naive Withdrawal Strategies for Various Withdrawal Rates and Pretax Returns

Panel A: Best Informed Strategy Compared with Best Naive Strategy

Pretax Returns (*r*) / Withdrawal Rate (*w*)	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%
4.0%	$6,613	$38,917	$18,390	$23,740	$36,773	($10,198)	($11,087)	($12,069)	($13,156)
5.0%	[0]	[1]	$148,161	$188,529	$246,318	$227,841	$127,739	($9,593)	($136,951)
6.0%	[1]	[1]	[1]	n.m.	$398,351	$402,913	$349,551	$276,651	$141,091
7.0%	[0]	[1]	[1]	[2]	[2]	$531,275	$531,893	$475,235	$407,954
8.0%	[0]	[0]	[0]	[1]	[1]	[1]	n.m.	$678,654	$699,387
9.0%	[1]	[0]	[0]	[0]	[1]	[1]	[1]	[2]	$874,812
10.0%	[0]	[0]	[1]	[0]	[0]	[0]	[1]	[1]	[2]

Panel B: Best Informed Strategy Compared with Worst Naive Strategy

Pretax Returns (*r*) / Withdrawal Rate (*w*)	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%
4.0%	$93,942	$226,122	$406,270	$639,087	$949,530	$1,255,865	$1,590,089	$2,000,350	$2,348,374
5.0%	[1]	[1]	256,480	$450,516	$720,548	$978,152	$1,247,515	$1,587,309	$2,007,429
6.0%	[1]	[1]	[2]	n.m.	$553,669	$759,391	$988,643	$1,273,571	$1,616,222
7.0%	[0]	[1]	[1]	[2]	[2]	$614,149	$799,485	$1,027,141	$1,332,097
8.0%	[0]	[0]	[0]	[1]	[1]	[1]	n.m.	$873,376	$1,099,609
9.0%	[1]	[0]	[0]	[0]	[1]	[1]	[1]	[2]	$980,225
10.0%	[0]	[0]	[1]	[0]	[0]	[0]	[1]	[1]	[2]

Note: Figures in brackets represent the incremental number of years over which withdrawals are fully sustained.

Conclusion and Extensions

This paper investigates the importance of a proper withdrawal strategy on residual accumulations and withdrawal sustainability for retirees having two types of tax-advantaged savings accounts from which to make withdrawals. Because distributions from traditional IRAs are taxable and those from Roth IRAs are not, it is advantageous to make withdrawals from traditional IRAs when the tax burden is light and to make withdrawals from Roth IRAs when the tax burden would otherwise be heavy. This paper therefore models withdrawal strategies in two broad contexts. It develops the first set of withdrawal strategies for settings in which taxable distributions are taxed at a uniform marginal rate, presumably because a retiree has exogenous sources of income or because the size of his or her portfolio and withdrawals makes the tax bracket structure of the U.S. tax code largely inconsequential. The second set of models is developed for distributions that are subject to a progressive tax rate system characterized by exemptions and deductions at low income levels and six tax brackets.

An important insight from this paper is that retirees can benefit from having multiple types of tax-advantaged retirement accounts from which to make withdrawals. The flexibility of having multiple types of accounts can allow retirees and financial planners to manage tax liabilities.

In a setting characterized by constant uniform marginal tax rates, withdrawal strategies are irrelevant because all taxable distributions are subject to the same tax rate. If tax rates vary, the best naive withdrawal strategy is to deplete the Roth IRA first because it requires smaller pretax withdrawals in earlier years, leaving more funds in tax-sheltered accounts for a longer time. An informed strategy of making traditional (Roth) IRA withdrawals when tax rates are low (high) performs especially well when tax rates vary from one year to the next or when an investor faces two tax rate regimes of similar duration.

In a progressive tax-rate environment, taxable distributions can be applied against personal exemptions and deductions or against tax brackets with relatively low tax rates. In this situation, the naive strategy of withdrawing from the traditional IRA first performs substantially better than the naive strategy of withdrawing from the Roth IRA first. But an informed strategy of taking traditional IRA distributions that would be taxed at rates up to 15 percent, and satisfying the remainder of the withdrawal requirement from the Roth IRA, yields residual accumulations that are 20 percent to 40 percent greater than the best naive strategy. For retirees with initial balances in traditional and Roth IRAs greater than $1 million and $720,000, respectively, it may be optimal to make withdrawals through the 25 percent tax bracket. The value of an informed strategy increases for retirees with aggressive investment strategies and high withdrawal requirements. As a result, retirees can significantly improve the sustainability of their retirement portfolios by embarking on an optimal withdrawal program.

An avenue for future research is to incorporate RMDs from traditional IRAs into the withdrawal models, although optimal distribution strategies in a progressive tax-rate environment call for sizable distributions from a traditional IRA in any case, limiting the impact of RMDs on the results presented here. Other research might formally incorporate the effect of traditional IRA distributions on the taxation of Social Security benefits or implement similar withdrawal models assuming a different return structure. For example, one could perform a Monte Carlo analysis using simulated returns based on historical time series of different asset classes. Alternatively, returns might be based on a factor model. Until then, the results contained herein provide valuable guidance to retirees and their advisors.

Endnotes

1. Sabelhaus (2000) analyzes aggregate accumulations and withdrawals for the United States.
2. For succinctness, this paper uses the term "traditional IRA" to represent generically all tax-deferred accounts with front-loaded tax benefits, including 401(k), 403(b), 457, and Keogh plans. Likewise, the term "Roth IRA" can most often be understood as omnibus vernacular representing tax-deferred annuities with back-loaded tax benefits, such a Section 529, Roth 401(k), and lifetime savings accounts. Therefore, the applicability of the models in this paper is broader than the parlance might initially suggest.
3. Employees of certain states, such as Ohio, are exempt from Social Security withholdings and therefore do not receive Social Security retirement benefits.
4. The inflation rate, p, by which tax brackets are assumed to grow over time, is distinct from g, the nominal growth rate of the retiree's withdrawal amount. The simulations that follow assume that the former is 2.5 percent and the latter is 3.0 percent, such that the retiree's withdrawal growth rate does more than preserve his or her purchasing power. It grows slightly in real terms over time.
5. This analysis presumes that larger withdrawals are always taxed at higher marginal rates, which is not the case in the alternative minimum tax phase-out ranges when effective marginal rates can drop from 35 percent to 28 percent. In this situation, an analyst can simply substitute the applicable tax rates and tax brackets in the algorithms. The conclusions of the scenario analysis are likely to change, however. A similar situation arises in relation to the phase-in of Social Security income taxation.
6. Six percent is considered "safe" according to Guyton (2004). Recall that the growth in nominal distributions, *g*, is distinct from the general rate of inflation, *p*, which does not factor into this analysis but enters the analysis that assumes multiple tax brackets.
7. A retiree's marginal tax can be a bit illusive at times. For example, a portion of Social Security benefits may be taxable, depending on the retiree's total income and marital status. Because traditional IRA withdrawals are treated as income, these distributions can make some Social Security benefits subject to tax, thereby increasing the effective marginal tax rate. The AMT can also make the marginal tax rate illusive.
8. For example, taxpayers over the age of 65 are entitled to an additional standard deduction of $1,000 for 2005 for each spouse.

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Appendix

Uniform Marginal Tax Rate

For either IRA account type *i*, let $V_{i,t} \equiv V_{i,t-1}(1 + r)$, which reflects the effect of the tax-sheltered investment earnings on asset growth. Under the first naive withdrawal strategy, the algorithm for pretax withdrawals (that is, distributions) from the traditional IRA at the end of time *t* can be expressed as

$$D_{1,Trad,t} = \min\left[\frac{W_t}{1-T_t}, V_{Trad,t}\right]. \quad (1)$$

The first value inside the brackets is the pretax distribution necessary to generate W_t after-tax dollars at tax rate, T_t. The second value inside the minimum operator is the remaining traditional IRA balance should it be insufficient to satisfy the after-tax withdrawal requirement. The algorithm for distributions from the Roth IRA under the first naive strategy is

$$D_{1,Roth,t} = \max\left[0, \min\left\{W_t - D_{Trad,t}(1-T_t), V_{Roth,t}\right\}\right]. \quad (2)$$

This implies that withdrawals from the Roth IRA should com-

$$D_{3,Roth,t} = \begin{cases} \min\left[W_t, V_{Roth,t}\right] & \text{if} \quad T_t = T_{hi} \\ \max\left[0, \min\left\{W_t - D_{Trad,t}(1-T_t), V_{Roth,t}\right\}\right] & \text{if} \quad T_t = T_{lo} \end{cases} \quad (6)$$

and

$$D_{3,Trad,t} = \begin{cases} \max\left[0, \min\left(\frac{W_t - D_{Roth,t}}{1-T_t}, V_{Trad,t}\right)\right] & \text{if} \quad T_t = T_{hi} \\ \min\left[\frac{W_t}{1-T_t}, V_{Trad,t}\right] & \text{if} \quad T_t = T_{lo}. \end{cases} \quad (7)$$

Equation (6) specifies a Roth IRA withdrawal if the tax rate is high to the extent that the fund balance allows. If the tax rate is low, equation (6) specifies no Roth IRA withdrawal unless the balance in the traditional IRA is insufficient to meet the retiree s after-tax withdrawal needs. Equation (7) stipulates a traditional IRA withdrawal if tax rates are low and if the fund balance allows, but no traditional IRA withdrawal if the tax rate is high, unless the Roth IRA balance is insufficient to meet the retiree s withdrawal needs.

mence once the balance in the traditional IRA is insufficient to meet the after-tax withdrawal requirement. These withdrawals are constrained to not exceed the available Roth IRA balance. The residual balance in either type of IRA account *i* at withdrawal horizon *n* can then be expressed as the future value of the initial balance less the future value of any distributions, or

$$V_{i,n} = V_0(1+r)^n - \sum_{t=1}^{n} D_{i,t}(1+r)^{n-t}. \quad (3)$$

The second naive withdrawal strategy, in which withdrawals are made from the Roth IRA first until that fund balance is exhausted, can be expressed in a similar fashion. Specifically,

$$D_{2,Roth,t} = \min\left[W_t, V_{Roth,t}\right] \quad (4)$$

and

$$D_{2,Trad,t} = \max\left[0, \min\left(\frac{W_t - D_{Roth,t}}{1-T_t}, V_{Trad,t}\right)\right]. \quad (5)$$

The residual balance in each account is again given by equation (3).

The informed withdrawal strategy takes on a somewhat different form. Being conditioned on the prevailing tax rate, such that withdrawals are made from the traditional IRA to the extent possible if the tax rate is low or from the Roth IRA if the tax rate is high, the algorithm can be expressed as

Progressive Tax Rates

To model these withdrawal strategies it is first useful to establish a function that defines the pretax distribution that would be required to generate a particular after-tax cash flow, *X*, in a progressive tax-rate structure characterized by exemptions and deductions at low income levels and six tax brackets. Such a function, *P*, can be expressed as

$$P(X) = \min\left[X, A_{0,t}\right] + \sum_{j=1}^{6} \frac{\max\left[0, \min\left(X, A_{j,t}\right) - A_{j-1,t}\right]}{1-T_{bj}}, \quad (8)$$

where $A_{j,t}$ is the j^{th} tax bracket in period *t*, and T_{bj} is the applicable tax rate for bracket *j*. In this formulation, $A_{0,t}$ represents exemptions and deductions available in period *t*. $A_{1,t}$ is equal to the sum of $A_{0,t}$ plus the amount of income that could be taxed at Tb_1. Note that the tax brackets, $A_{j,t}$, in equation (8) are expressed on an after-tax basis. For example, using the above example, A_1 is not $32,000, or $16,900 plus $15,100. Rather, A_1 is $30,490, the after-tax income resulting from $32,000 of taxable income. The inverse of this function, the after-tax proceeds of a pretax withdrawal, *Y*, can be expressed as

$$F(Y) = \min\left[Y_t, B_{0,t}\right] + \sum_{j=1}^{6} \max\left[0, \min\left(Y, B_{j,t}\right) - B_{j-1,t}\right]\left(1-T_{bj}\right), \quad (9)$$

where $B_{j,t}$ is the j^{th} tax bracket expressed on a pretax basis in

Appendix *(continued)*

period t. For instance, B_0 would be $16,900, and B_1 would be $32,000 in the example above.

Using these functions, the traditional IRA distribution for the first naive strategy, whereby the retiree draws from the traditional IRA until funds are depleted, can be expressed as

$$D_{4,Trad,t} = \min\left[P(W_t), V_{Trad,t}\right]. \quad (10)$$

The first value inside the square brackets is the pretax withdrawal from the traditional IRA necessary to generate the after-tax withdrawal requirement, W_t. Equation (10) is quite similar to equation (1) and differs only in how the traditional IRA distribution is taxed. The Roth IRA distribution is then

$$D_{4,Roth,t} = \max\left[0, \min\left\{W_t - F(D_{Trad,t}), V_{Roth,t}\right\}\right]. \quad (11)$$

Equation (11) is quite similar to equation (2). Again, the difference lies in the way the traditional IRA distribution is taxed, which in this case could potentially involve six different tax brackets rather than one uniform marginal rate.

The second naive withdrawal strategy directs the retiree to make withdrawals from the Roth IRA as long as funds are available, followed by withdrawals from the traditional IRA. In this case, the Roth IRA withdrawal algorithm is identical to equation (4). The traditional IRA withdrawal is similar to equation (10), but the desired after-tax income from the traditional IRA is not W_t. It is the difference between the after-tax withdrawal requirement and the Roth IRA distribution, if positive. Substituting $\max\left\{0, W_t - D_{Roth,t}\right\}$ for W_t in equation (10) yields

$$D_{5,Trad,t} = \min\left[P\left(\max\left\{0, W_t - D_{Roth,t}\right\}\right), V_{Trad,t}\right]. \quad (12)$$

Each of the four informed withdrawal strategies specifies withdrawals from the traditional IRA up to some exemption or tax bracket limit, $B_{j,t}$, to the extent funds are available and to the extent the withdrawal requirement demands it. The first informed withdrawal strategy makes traditional IRA withdrawals up to allowable exemptions and deduction, $B_{0,t}$. The second withdrawal strategy makes traditional IRA withdrawals up to the first tax bracket, $B_{1,t}$, and so on. The remaining withdrawal requirement, if any, would be distributed from the Roth IRA. Each of these strategies for tax bracket j can be expressed with the following algorithms:

$$\begin{aligned} D_{j,Trad,t} &= \max\begin{bmatrix} \min\left\{B_{j,t}, V_{Trad,t}, P(W_t)\right\}, \\ \min\left\{P(W_t - V_{Roth,t}), V_{Trad,t}\right\} \end{bmatrix} \\ D_{j,Roth,t} &= \min\left[W_t - D_{Trad,t}, V_{Roth,t}\right] \end{aligned} \quad (13)$$

The first algorithm stipulates a traditional IRA withdrawal up to the j^{th} tax bracket in period t, $B_{j,t}$, subject to fund availability and the size of the withdrawal requirement. The second algorithm indicates that the remaining withdrawal requirement will be distributed from the Roth IRA to the extent funds are available. If the Roth IRA contains insufficient funds for the remainder of the withdrawal requirement, the traditional IRA is tapped for the additional withdrawal, which is represented in the second value in the square brackets of the first algorithm.