

Optimal contribution strategy as a function of the optimal withdrawal decision making: Case of deductible IRA versus Roth IRA

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Abstract

The issue of the attractiveness of the deductible IRA versus Roth IRA is revisited by combining the contribution phase with the withdrawal phase in the analysis. Previous related studies ignore the important implication that the optimal withdrawal sequence first takes funds held in the taxable account followed by the withdrawals from the designated retirement account such as an IRA that will ultimately affect the decision about the optimal contribution strategy. The optimal contribution strategy is not affected by the expected length of the retirement horizon in the flat tax rate environment. In the presence of progressive taxes, the investor should contribute more to the Roth IRA if the retirement period is shorter and if he is more optimistic about the return his investments will produce. Required minimum distributions levied on the deductible IRA but not the Roth IRA do not materially affect the optimal contribution strategy. The decision to convert the funds at the existing deductible IRA to Roth IRA and the decision to start making contributions to a newly available Roth IRA do not necessarily point in the same direction: under some circumstances one should not convert yet make a contribution to the Roth account. © 2013 Academy of Financial Services. All rights reserved.

JEL classification: G11; J26

Keywords: IRA; Withdrawal sequence; Contribution strategy; Conversion

1. Introduction

Starting in 1998, individuals with adjusted gross income below the specified thresholds could contribute to a Roth IRA. Until 2010, taxpayers with modified AGI below the certain

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value could convert a back-loaded IRA into a front-loaded Roth IRA and pay the required taxes as the IRA balance is withdrawn. Starting in 2010, the restrictions on the eligibility to convert the traditional IRA to the Roth account are eliminated, although many high income investors are still unable to contribute to a Roth outright. As a result there are two distinctive groups of individual investors who face a somewhat similar dilemma: one group has to decide which type of account, the traditional IRA or the Roth, to contribute the retirement funds to, while the other is left pondering whether and under what circumstances the conversion from the traditional IRA to the Roth account should be arranged. To make things a bit more complicated, despite the availability and popularity of 401(k)s and IRAs, many investors accumulate substantial assets in taxable accounts to finance their retirement. One of the reasons for that is the existence of contribution limits to the retirement account that have preferential tax treatment. Another reason is that many such portfolios result from the sale of a business or from inheritances.

A string of existing literature concentrates on the first reason (contribution limits) and incorporates it into the analysis of finding the preferred savings vehicle(s) for the retirement. The savings choices offered to an investor consist of two major types of accounts with the preferential tax treatment: a front-loaded Roth IRA where taxes must be paid upon the contribution of assets to the account and a back-loaded deductible IRA and its variations where taxes are deferred until funds are withdrawn from the account. With equal dollar contribution limits, the front-loaded Roth IRA shelters more funds for the retirement than the traditional back-loaded IRA. This implies that the Roth IRA can be the preferred retirement vehicle even if the marginal income tax rates fall during the years of investor's retirement. However, if the tax rates applied to the withdrawals are sufficiently lower than those during the contribution period, the opposite outcome will occur.

To make the comparison of a back-loaded deductible IRA and a front-loaded Roth IRA more legitimate, the invested amount must be held constant. The invested savings can be defined on a pretax or after-tax basis. For example, if both the deductible IRA and the Roth IRA have the contribution limit of \$5,000 and the investor is in the 30% marginal tax rate bracket, using the before-tax basis, he can invest either \$5,000 in the deductible IRA, or \$3,500 in the Roth IRA. Using the after-tax basis, he can either invest \$5,000 in the Roth IRA, or put \$5,000 in the deductible IRA and have \$1,500 in the income tax savings placed somewhere else.

The early studies (Crain and Austin, 1997; Horan, Peterson, and McLeod, 1997; Butterfield, Jacobs, and Larkins, 2000) compare two different retirement savings options (deductible IRA vs. Roth IRA) holding the pretax investment constant. Such an approach does not use the full savings potential of the Roth IRA and is biased towards the deductible IRA. A recent study by Horan and Zaman (2009) compares a traditional IRA and a Roth IRA in the presence of a progressive tax regime, income growth, and exogenous retirement income such as Social Security benefits and finds that aggressive savers who enjoy high rates of return or high levels of other retirement income can be better off opting for Roth IRA instead of the deductible IRA.

By comparing the back-loaded and the front-loaded options on the after-tax basis, it is evident that during the contribution phase the deductible IRA possesses a tax advantage which is captured as tax savings that can be invested outside the IRA. Because the

contribution limit is currently the same for both the traditional and Roth IRA, by choosing a Roth IRA an individual is able to save more after-tax dollars. Thus, for the same amount of today's forgone consumption, if the investor is willing to contribute to her retirement the maximum allowed annual amount for such purpose via the use of the designated retirement accounts with preferential tax treatment, she can achieve her goal using one of the following two options: (1) contribute up to the limit to the Roth IRA, or (2) contribute up to the limit to the traditional IRA and save the amount of t_0 times the contribution limit, where t_0 is the applied marginal income tax rate, by allocating this money somewhere outside of her IRA. Given the existing limits on the contribution to the tax-shielded accounts such as the deductible IRA and the Roth IRA, such tax savings are likely to end up in the taxable account. The after-tax approach allows the investor to take a full advantage of the tax-sheltered asset allocation by investing in such retirement vehicles up to the limit permitted by the tax laws.

A set of existing literature focuses on the comparison of the different retirement investment avenues assuming the equal after-tax investment. If the after-tax investment is held constant, the tax savings obtained because of the deductible nature of the IRA contributions ought to be invested outside the tax-deferred account. Horan and Peterson (2001) and Krishnan and Lawrence (2001) re-examine the optimal choice between the traditional tax-deductible IRA and the Roth IRA by incorporating the opportunity to invest tax savings generated by the tax-deferred nature of the IRA contributions into the taxable account, whereas Kutner, Doney, and Trebby (2001) ignore the tax savings accumulation provided by the deductible IRA. Krishnan and Lawrence (2001) assume that returns on such savings are taxed each year as ordinary income, whereas Horan and Peterson (2001) assume that such savings are invested in a mutual fund that has inherent tax-deferral and capital gain benefits. The analyses presented in these articles are based on the comparison of the future after-tax values, thus concentrating on the accumulation stage of the retirement planning. Their findings are that the less the tax burden on the investments held in the taxable account and the lower the taxes during the withdrawal phase compared to those when the contributions are made, the less attractive the Roth IRA compared with the deductible IRA.

Horan and Peterson (2001) concede that their results are subject to a caveat of the definition of the investor's investment horizon. They mention that this horizon is often deceptively long as it is equal to the length of time for the marginal withdrawal upon the retirement, not necessarily the first withdrawal. The analysis based on the comparison of the future after-tax values employed in the early works makes one implicit yet crucial assumption: the funds invested in either the Roth IRA, or the combination of the IRA and the taxable account are to be withdrawn in full and at the same time. The relevant point that has been missed is that when the individual saves for retirement via a combination of a deductible IRA and a taxable account, once the withdrawal phase begins, the retiree has to decide on the withdrawal strategy with regard to which account to deplete first or whether to take funds simultaneously from both accounts.¹ Each of the withdrawal patterns is likely to result in different outcomes with regard to the after-tax amount that can be withdrawn on a regular basis and/or the period of time for which such withdrawals will last. With regard to the taxable account, it is also relevant which assets or investments are withdrawn first and last. For example, one can withdraw funds invested 10 years ago before withdrawing those

invested 20 years ago or vice versa. One could, therefore, argue that the numerical results in the previous studies that compare future after-tax values of different contribution strategies when retirement savings are accumulated using multiple accounts with different tax treatment underscore the sensitivity of the computations to the subject of the optimal withdrawal pattern from the set of available accounts. Meanwhile, the latter serves as the key determinant of the effective retirement horizon as well as the sustainable amount of the periodic income in the retirement.

This article expands the existing works on the comparison between the retirement income offered by the funds invested in the Roth IRA versus that provided by the combination of the traditional back-loaded IRA and the taxable account under the equal dollar limits on contributions to the tax-shielded retirement accounts by adding the *withdrawal phase* into the analysis and effectively combining it with the *accumulation phase*, thus, completing the full cycle of the retirement planning. Other innovations utilized in this study's analysis of the effectiveness of Roth savings versus those in the deductible IRA include the consideration of the return which is a combination of short-term and long-term capital gains, the implementation of switching strategies where the individual does not have to commit to a specific retirement strategy (either Roth, or a combination of IRA and a taxable account) for her entire working life but is allowed to switch between the two at one point, the incorporation of the required minimum distributions into the computations, and the implications for the Roth IRA conversion at a point during the working life after having saved via the deductible IRA until then. The inclusion of these elements in the analysis is bound to further affect the optimal withdrawal sequence between the assets held in the accounts with different tax treatment and invested at different points of time.

Because the proposed analysis is concerned with both the accumulation and the withdrawal phases of the retirement planning, a careful description of the methods used to model the accumulation of funds and their subsequent withdrawals is required first. For the case of tax-deferred or tax-shielded account like the deductible IRA and the Roth IRA, respectively, the processes of accumulation and withdrawal are methodologically trivial because of the tax-free growth of the assets held in them and these processes have been described in the literature. The computations behind the accumulation and withdrawal of assets such as bonds that are taxed annually at ordinary income rates held in the taxable account are also straightforward. What is less clear and so far has received relatively scant attention in the literature is the accumulation and the withdrawal of funds invested in common stocks or equity funds via the taxable account, where the taxation of return is split between ordinary income or short-term capital gains and long-term capital gains. This issue is of major importance in the context of the Roth versus the deductible IRA analysis on the after-tax basis as it involves the share of retirement funds held at and subsequently distributed from the taxable account. The next two sections review the literature on the accumulation and the withdrawal of equities held in the taxable account and how the presence of differently taxed short-term capital gains and long-term capital gains affects the computations. Subsequently, Section 4 describes the model utilized for the comparison of the Roth IRA and the deductible IRA on the after-tax basis and Section 5 provides the results of the estimation modeling. Section 6 offers an insight into the implication of the model's results for the Roth IRA

conversion. Section 7 suggests a number of alternatives that can be incorporated into the modeling to further extend the analysis and Section 8 concludes.

2. Stocks in the taxable account: accumulation

When funds are held in the taxable account, the future after-tax value of such an account depends on how the investment is taxed. Previous literature used one of the following three approaches. The first one assumes that all investment returns are taxed annually as ordinary income. In this case the future after-tax value of \$1 invested via the taxable account and held for N years there is equal to $(1 + r^*)^N$, where $r^* = r(1 - t_i)$ with r being the constant annual before-tax return and t_i being the applied constant ordinary income tax rate. Assuming the contribution limit of \$1 for both the deductible IRA and the Roth IRA, Burman, Gale, and Weiner (2001) suggest that Roth IRA will produce more retirement income in N years than the combination of the deductible IRA and the taxable account if $(1 + r)^N > (1 + r)^N(1 - t_N) + (1 + r^*)^N t_0$, where t_N is the applied marginal income tax rate in year N , and r^* is less than r , albeit the former is not defined precisely. Such a condition is true as long as the invested portfolio consists of bonds or stocks where all gains are taxed annually, but it must be modified appropriately if the portfolio is composed of equities or equity funds where the realization of at least part capital gains is deferred until the time of the withdrawal.

The second approach assumes that only a portion of the return is taxed annually, whereas the remaining portion of the annual return represents long-term capital gains whose taxation is deferred upon their realization. Here one often relies on the trivial distinction between the annual rate of return earned by the assets held in the tax-sheltered account, r , and the annual after-tax rate of return earned in the taxable account, r^* , where r^* is strictly less than r (Burman, Gale, and Weiner, 2001; Hulse, 2003; Lewis and Caliendo, 2004; Hrung, 2007). The gains in the taxable account are taxed upon their realization (with some exceptions)² and the tax burden depends on the mix of short-term capital gains that are taxed as ordinary income and long-term capital gains that are taxed at lower long-term capital gains tax rates. The post-tax value of the initial investment of \$1 in the assets held in the taxable account for N years is then calculated as $[(1 + r^*)^N - 1](1 - t_{cg}) + 1$, where t_{cg} is the tax rate on capital gains applied upon the asset sale at the end of year N . The problem with such an approach is that it assumes that the cost basis of the investment stays unchanged at \$1 until the realization of capital gains. That would imply the double taxation of previously realized short-term capital gains where they are first taxed at their respective tax rate upon their initial realization and then taxed again at the tax rate on long-term capital gains.

The third approach assumes that a portion of the annual return is taxed as ordinary income, a portion is taxed as realized capital gains, and the remaining portion represents unrealized capital gains, tax on which is deferred until the gains are realized. Crain and Austin (1997) provide mathematical models for after-tax accumulations in the taxable account where the portions of annual returns are taxed differently. Horan (2002) offers more simple and intuitive exposition of the expression obtained by Crain and Austin. In those works it is shown that the after-tax value of the taxable account is represented as $[(1 + r^*)^N - 1](1 - t^*) + 1$, where $r^* = r(1 - p_i t_i - p_{cg} t_{cg})$ and $t^* = t_{cg}(1 - p_i - p_{cg}) / (1 - p_i t_i - p_{cg} t_{cg})$

with p_i being a portion of the return that is taxed as ordinary income and p_{cg} being a portion of the return taxed as realized capital gains. The value of t^* represents the effective capital gains tax rate that is adjusted for taxes previously paid on ordinary income and realized capital gains.

In the presence of realized capital gains that are subsequently reinvested back into the equity, the cost basis of the original investment held in the taxable account jumps by the after-tax amount of the realized gains each time they are reinvested. If the annual after-tax rate of return r^* is computed as $r_{cg} + d(1 - t_d)$, where r_{cg} is the portion of the rate of return in the form of long-term capital gains, d is the portion of realized capital gains and t_d is the tax rate on short-term capital gains, then to calculate the after-tax value of the investment held in the taxable account for N years one should use the formula that accounts for the ever changing cost basis of the investment: $[(1 + r^*)^N - B_c(N)](1 - t_{cg}) + B_c(N)$, where $B_c(N)$ is the adjusted cost basis after N years that is strictly higher than one given the presence of short-term capital gains and assuming that the latter are reinvested back into the equity.

The adjusted cost basis is composed of the initial investment and all the realized capital gains less the amount of tax on those gains. The value of the adjusted cost basis is derived in Crain and Austin (1997) for the case that also includes realized capital gains. Poterba (2004) provides the differential equation according to which the cost basis evolves. Assuming a constant dividend yield, constant rate of capital gains and constant tax rate on short-term capital gains, the solution of the differential equation given the initial condition where the original investment value is \$1 offers the closed-form formula for the equity's adjusted cost basis:

$$B_c(N) = 1 + \frac{d^*}{r^*} [(1 + r^*)^N - 1],$$

where $d^* = d(1 - t_d)$ and $r^* = r_{cg} + d^*$. In light of a new legislation introduced by the Internal Revenue Service (IRS) that became effective on January 1, 2011, the value of the adjusted cost basis as computed above, however, can be of limited use when the withdrawal phase is considered and funds are taken from the taxable account via a series of withdrawals over a number of periods.

3. Stocks in the taxable account: withdrawals

There are several studies that attempt to annuitize equity holdings in the taxable account for the withdrawal purposes. The major difference between withdrawing funds from the tax-shielded account and the taxable account is that in the latter case, every time a withdrawal is made, a portion of the original investment and a portion of the accumulated capital gains are withdrawn together but only the capital gains are taxed. The value of the withdrawn principal and the value of the withdrawn capital gains are proportional to each other according to a predetermined relationship. Clearly, if an individual sells 100 shares of stock in his or her portfolio, he or she withdraws the amount of principal equivalent to the original cost of investment in 100 shares, and the amount of capital gains that has been earned by

those shares. Hence, there is a unique relationship between the amount of withdrawn principal and the value of withdrawn capital gains.

Lewis and Caliendo (2006) annuitize the balance of the taxable account in a manner similar to how it is done for a regular IRA. They, however, use the definition of “taxable account” loosely assuming by that an equivalent of Roth IRA or any other front-loaded account where money grows tax free. Technically, their derivations are correct but those cannot be applied to the traditional taxable account where the growth is not tax free but any realized capital gains are subject to taxation.

Reichenstein (2006b, 2006c) discusses strategies for selecting the sequence of fund withdrawals from savings vehicles during the retirement and considers the impact of alternative withdrawal strategies on a portfolio’s longevity where a part of the retirement portfolio in the form of equities is held in the taxable account. Reichenstein specifies the value of after-tax funds held in the taxable account as well as the effective tax rate on assets held in such account. The missing link is a clear distinction between the cost basis of the investment held in the taxable account and the accumulated unrealized capital gains. In one example, a married couple has \$800,000 of after-tax funds in the taxable account and the applied tax rate on capital gains is assumed at 15%. There are an infinite number of before-tax values of the portfolio satisfying these two conditions. One of such portfolios has the cost basis of \$375,000 and the unrealized capital gains of \$500,000; another portfolio consists of the cost basis of \$630,000 and the unrealized capital gains of \$200,000. Each portfolio is likely to result in a different amount of the constant real annual withdrawal since every time funds are withdrawn from the taxable account, a portion of the cost basis is taken out together with a portion of the unrealized capital gains.

Spitzer and Singh (2006) compare the longevity of pairs of portfolios that differ in significant ways including the one where funds are held in the accounts with different tax treatment. Spitzer and Singh provide information about the tax rate on returns in the taxable account as well as its value at the beginning of the retirement. The annuitization of the taxable account is performed in a trivial fashion: the beginning value of the account is taken as the present value of a regular annuity and the rate used to compute the annual withdrawal amount is taken as the after-tax rate of growth. Such result will be unambiguously correct under the assumption that all capital gains are realized at the end of each year that would represent a significant deviation from the conventional approach of employing a tax-efficient buy-and-hold strategy for the purposes of holding equities in the taxable account.

Shynkevich (2010) presents a framework to model withdrawals from a taxable account that is able to accommodate for varying rates of return, changing tax rates, different time periods, flexible withdrawal amounts, inflation, cost basis, and short-term capital gains and derives closed-form solutions for several special cases where the model parameters are held constant. The derivations are supplemented by numerical examples where the taxable account is depleted via multiple withdrawals spread over a number of periods instead of a single withdrawal. The presented model allows to avoid the assumption used in Spitzer and Singh (2006) that annual return on the assets held in the taxable account is fully taxed at ordinary income tax rate and allows to split the taxation of return between short-term capital gains taxed annually and long-term capital gains taxed upon their realization.

The withdrawals from the combination of the deductible IRA and the taxable account can

be made in one of several ways: withdraw simultaneously from both the IRA and the taxable account; withdraw from the IRA first and from the taxable account last; withdraw from the taxable account first and from the IRA last. Is the retiree better off when he is to withdraw from the taxable account or from the tax-deferred account first? Raabe and Toolson (2002) and Reichenstein (2006b, 2006c) find that, as a rule of thumb, retirees should withdraw funds from the taxable accounts before they do it from their retirement accounts since returns are taxed more heavily in the taxable account. Raabe and Toolson add further that the higher the retiree's income bracket that would be applied to the withdrawals from her tax-deferred accounts, the more important it is to draw first from the taxable accounts. The rule is subject to several exceptions, however. If different assets expect to yield different rates of return, the withdrawal sequence may need to be adjusted so that low yielding assets are withdrawn before high yielding ones. According to Spitzer and Singh (2006), withdrawals should be made first from the account with the lower expected after-tax rate of return. According to Reichenstein, retirees should deviate from the rule of thumb when they have minimal taxable income to fully use low tax rates or when their major goal is to maximize the value of bequests left after death and they have substantial unrealized capital gains in the taxable account as the heir receives a step-up in cost basis in the assets held in the taxable account.

When there are multiple equities in the taxable account, the existing literature advises the withdrawal of the assets with the largest unrealized capital losses first and the largest unrealized capital gains last to maximize the constant or inflation-adjusted amount of the regular withdrawal and/or the longevity of the retirement portfolio. When multiple contributions in the same equity or equity fund held in the taxable account have been made over a period of time, one of the several allowed methods can be chosen for the purpose of computing the tax base upon a withdrawal.

The Emergency Economic Stabilization Act of 2008 includes new reporting requirements for adjusted cost basis for assets held in the taxable account for tax calculation purposes. Under the new IRS regulations, beginning with the 2011 tax year, financial institutions must report to the IRS on clients' Forms 1099-B not only gross proceeds but also the adjusted cost basis for covered securities sold and whether the related gain or loss is long-term or short-term.³ The IRS requires that each firm establishes a default tax lot relief method to determine cost basis on all accounts in the event a client does not specify a tax lot relief method. A tax lot relief method is a way of computing the realized gain or loss for an asset sold in a taxable transaction. It determines which lot of a security as well as its associated cost basis and holding period are used in computing the gain or loss upon the sale of the security.

Under the old federal income tax regulations, the FIFO (first-in-first-out) tax lot relief method where the oldest lots are sold first is used as a default method. Under the new policies, other accepted cost basis methodologies include LIFO (last-in first-out) where the most recently acquired lots are sold first, and the average cost basis method. Only the last one is consistent with the value of the adjusted cost basis derived in Crain and Austin (1997) presented in the previous section when the funds are depleted via multiple withdrawals over a period of time.

The average cost basis method is usually more tax efficient than the FIFO previously used by default. The best choice of the three options described above to accompany the buy-and-

hold strategy is, however, the LIFO since the most recent additional holdings that tend to spot smaller accumulated capital gains are withdrawn before the relatively older additional holdings that tend to have larger share of the unrealized gains. This is consistent with Raabe and Toolson (2002) who suggest that to minimize the tax liability from the sales of the assets held in the taxable account, the order in which to liquidate appreciated equities should be from those with the lowest to the highest tax liability. The presence of realized short-term capital gains does not affect the perceived optimality of the LIFO withdrawal strategy whenever the taxable account is solely composed of a single asset such as the S&P 500 SPDR exchange traded fund. The next section that describes the modeling offers more detailed guidelines as to how the asset withdrawals are modeled in the context of the proposed analysis.

4. The model

The ultimate goal of this study is to find the optimal contribution strategy that yields the highest amount of the regular inflation-adjusted withdrawal during the individual's retirement or, equivalently, results in the longest period of time during which the withdrawals preset at the fixed inflation-adjusted level can be taken out. The optimal contribution strategy is defined as the combination of annual contributions to a Roth IRA up to the allowed annual contribution limit and to the deductible IRA account up to the allowed annual contribution limit, where the contributions to the deductible IRA are supplemented by placing the tax savings in the taxable account, at different points of time during the investor's working life that maximizes the after-tax amount of the annual inflation-adjusted retirement income. Such definition of the contribution strategy allows for switching between contributing exclusively to Roth up to the limit and to the combination of the deductible IRA and the taxable account at a point of time during the working life, an important point that has not been fully addressed in the previous research on the topic.

The analysis is based on a set of assumptions with regard to both accumulation and distribution of the retirement funds. The investor starts making contributions at the age of 30. The original contribution limit for both the deductible IRA and the Roth IRA is set at \$5,000. The limit is allowed to change with inflation by a \$500 increment. As soon as the cumulative inflation since the start of the retirement accumulation phase reaches 10%, the limit goes up by \$500. Another 10% increase in inflation from its level seen at the beginning of the accumulation phase will result in another rise of the limit by \$500, and so on.⁴ The investor always contributes the maximum allowed amount to either the deductible IRA, or its Roth alternative plus in the former case he or she places the tax savings into the taxable account.

The retirement funds are invested in the broad equity market portfolio by way of purchasing an appropriate exchange traded fund or a mutual fund. The return on the investment is generated via the long-term capital gains as well as the short-term capital gains that are distributed to the shareholders annually and such distributions are taxed at ordinary income rates if the investment is held in the taxable account. This study assumes a buy-and-hold approach where the short-term capital gains are taxed annually and the after-tax amount of such gains is reinvested in the original equity portfolio, whereas the

original contributions and the accumulated long-term capital gains are held until the assets are sold by the then retiree for consumption purposes at the time of the appropriately scheduled withdrawal. Following the previous studies on the subject, the annual rate of return on the equity portfolio is assumed constant. The annual rate of return is equal to 5% and it includes the short-term capital gain rate of 2%. The annual rate of inflation is set at a constant 2%. The income tax rate during the contribution phase is 35%. The assumed rate of return, share of short-term capital gains, inflation, and tax rate can be changed without the loss of generality.

The individual is expected to retire at the age of 65 when he is to take his first withdrawal. The sole purpose of his retirement income is to finance his retirement and the funds he has accumulated in his Roth and/or deductible IRA as well as the tax savings in the taxable account represent the only source of such income. The retirement periods of 15, 20, 25, and 30 years are considered, meaning that the withdrawals made annually over the specified period of time are set at such levels that result in the full depletion of retirement funds at the end of the retirement period. The withdrawals are made annually and the after-tax amount of each subsequent annual withdrawal is adjusted by inflation to preserve the purchasing power of the retirement income. The tax rate on realized long-term capital gains is 20%. A set of different income tax rates during the retirement stage is considered. Note that as long as the income tax rate during the retirement phase differs from the one during the contribution phase, the short-term capital gains earned during the retirement will be taxed at rates that will differ from those applied to short-term capital gains distributed during the contribution years.

Following Raabe and Toolson (2002) and Reichenstein (2006b, 2006c), the withdrawals from the retirement funds are made sequentially starting with those in the taxable account. After the taxable account is fully depleted, withdrawals begin from the deductible IRA, followed by the withdrawals from the Roth account. Such a withdrawal strategy is more tax efficient than the opposite one that leaves funds in the taxable account until last because the funds in the designated retirement accounts are allowed to stay and grow tax-free for a longer period of time. It does not make a difference whether the withdrawals from the deductible IRA are followed by the withdrawals from the Roth IRA or vice versa as long as the constant flat income tax rate schedule is used.⁵ It is also irrelevant whether the funds are taken simultaneously from both the Roth and deductible IRAs as long as the income tax rate at the retirement applied to the withdrawals from the deductible IRA does not depend on the amount of the withdrawal.⁶

For the case when the retirement portfolio includes investments accumulated in the taxable account, to determine the tax basis for capital gains tax computations, this study uses the LIFO method where the most recently purchased shares are sold first. Such approach is more tax efficient than the FIFO or the average tax basis method as long as the constant positive annual rate of return is assumed because the most recently acquired lots have the highest tax liability as a percentage of the accumulated capital gains and, respectively, the oldest lots have the lowest tax liability. The withdrawals from the taxable account are thus performed sequentially in the following manner: all distributed short-term capital gains at the end of each year are taxed and their after-tax value is used for consumption purposes. If the after-tax value of such distributions is not sufficient, a portion of funds from the taxable account is liquidated following the LIFO method to fully satisfy the consumption needs. If

only a partial liquidation of a particular investment lot acquired during the contribution phase is required, the remaining before- and after-tax values of that lot are calculated following Shynkevich (2010), that is, in such a manner that preserves the existing ratio of the cost basis to the value of unrealized capital gains. In other words, the cost basis of that lot is reduced proportionally to the reduction of the lot's before-tax value and so are the accumulated unrealized capital gains. This is equivalent to selling a portion of the stock shares held in the taxable account while realizing capital gains on only those shares that were sold and paying the capital gains tax on the realized capital gains.

5. Results

It is expected that the strategy of investing exclusively in either a Roth IRA or the combination of the deductible IRA and the taxable account throughout the entire working life will be suboptimal unless the tax rate at the retirement is either significantly lower or substantially higher than the one applied to the investor's income during the contribution phase. For a certain range of tax rates at the retirement, the better solution that will yield a higher retirement income is to use one contribution strategy for a period of time and then switch to the opposite one. Given lower tax rates in the retirement than during the working life and the fact that part of the investment income in the form of short-term capital gains is taxed annually upon the realization, investing via a Roth IRA is beneficial early in the career while investing via the combination of a deductible IRA and the taxable account can be preferred when the investor approaches his or her retirement age. Hence, for a range of tax rates at the retirement, a Roth IRA must be the initial strategy but afterwards, the investor should start contributing to the IRA and the taxable account instead and keep doing it until he or she retires. The resulting switching strategy would leave the individual better off compared to a strategy that contributes exclusively to either Roth or deductible IRA and the taxable account. The big question is when to switch the contribution strategy to maximize the amount of the annual inflation-adjusted after-tax retirement income. This section investigates whether and when it is optimal to change the preferred retirement investment vehicles to achieve the maximum amount of annual retirement income. The optimal contribution strategy is defined as n/m , where n stands for the number of years since the start of the accumulation phase when the contributions are made via a Roth IRA, and m represents the number of years until the investor's retirement age when the contributions are made via a combination of a deductible IRA and a taxable account. In other words, after n years of contributing to Roth IRA the contribution strategy is switched to the deductible IRA plus the taxable account and the latter lasts for the remaining years of working life until the individual retires. The sum of n and m is equal to the length of the accumulation phase measured in years that is fixed at 35 in this study.

Table 1 shows panels of the after-tax values of the initial withdrawal amounts for various tax rates during the retirement, four different longevities of the retirement period, and different retirement portfolio strategies with regard to whether investment is made via the Roth, or the combination of the deductible IRA and the taxable account. The initial withdrawal takes place at the age of 65, after which its after-tax value is adjusted to inflation

Table 1 Maximum after-tax value of the withdrawal amount at the age of 65 for the optimal contribution strategy (in bold) and the deviations from it for suboptimal contribution strategies for different tax rates at the retirement and different longevity of the retirement period

Roth/ IRA (n/m)	Tax rate = 24%				Tax rate = 26%				Tax rate = 28%			
	Retirement period, years				Retirement period, years				Retirement period, years			
	15	20	25	30	15	20	25	30	15	20	25	30
0/35	-19	-25	-25	-28	-577	-507	-463	-435	-1,617	-1,378	-1,238	-1,150
1/34	-5	-9	-8	-11	-463	-408	-373	-352	-1,402	-1,197	-1,074	-999
2/33	84076	-1	-1	-2	-365	-323	-297	-279	-1,213	-1,035	-929	-864
3/32	-3	69884	61681	56463	-283	-250	-233	-218	-1,044	-890	-801	-743
4/31	-14	-8	-5	-4	-213	-190	-178	-168	-894	-761	-686	-639
5/30	-31	-22	-14	-13	-155	-141	-132	-125	-760	-650	-585	-546
6/29	-57	-43	-31	-27	-103	-98	-90	-87	-631	-542	-486	-455
7/28	-88	-69	-53	-45	-62	-64	-60	-56	-518	-448	-402	-375
8/27	-128	-98	-79	-68	-34	-37	-36	-33	-422	-365	-329	-306
9/26	-172	-132	-109	-95	-16	-18	-19	-18	-340	-293	-265	-248
10/25	-220	-168	-141	-124	-5	-5	-8	-7	-270	-232	-211	-198
11/24	-275	-213	-178	-158	82985	68992	-1	-1	-206	-176	-160	-151
12/23	-333	-262	-218	-194	-2	-2	60904	55756	-152	-131	-117	-112
13/22	-394	-312	-262	-232	-10	-9	-5	-2	-108	-95	-83	-79
14/21	-456	-364	-307	-273	-24	-20	-15	-9	-73	-65	-57	-53
15/20	-525	-421	-358	-319	-44	-36	-29	-23	-44	-41	-35	-33
16/19	-596	-480	-410	-367	-68	-57	-47	-39	-22	-23	-19	-18
17/18	-668	-539	-462	-415	-97	-80	-68	-58	-7	-10	-8	-8
18/17	-748	-604	-519	-467	-134	-109	-93	-81	82375	-3	-2	-2
19/16	-831	-669	-577	-520	-176	-140	-121	-106	-2	68489	60462	55356
20/15	-913	-736	-635	-573	-221	-175	-151	-134	-9	-3	-2	-2
21/14	-996	-805	-693	-625	-268	-215	-183	-163	-22	-14	-7	-7
22/13	-1,085	-878	-757	-682	-322	-259	-221	-196	-40	-29	-20	-16
23/12	-1,173	-951	-822	-741	-377	-305	-261	-232	-62	-47	-36	-31
24/11	-1,260	-1,024	-886	-800	-433	-352	-303	-270	-88	-68	-55	-48
25/10	-1,353	-1,101	-954	-862	-495	-403	-348	-312	-119	-94	-78	-69
26/9	-1,445	-1,178	-1,021	-924	-559	-456	-395	-354	-153	-123	-103	-92
27/8	-1,536	-1,253	-1,088	-985	-623	-509	-442	-398	-191	-154	-130	-117
28/7	-1,631	-1,333	-1,158	-1,049	-692	-566	-492	-444	-233	-189	-161	-146
29/6	-1,726	-1,411	-1,228	-1,113	-761	-624	-543	-491	-277	-226	-194	-175
30/5	-1,819	-1,489	-1,296	-1,175	-831	-682	-595	-538	-324	-265	-228	-207
31/4	-1,916	-1,570	-1,368	-1,241	-905	-744	-649	-588	-375	-308	-266	-241
32/3	-2,012	-1,649	-1,438	-1,305	-980	-806	-704	-638	-428	-352	-305	-277
33/2	-2,107	-1,728	-1,507	-1,369	-1,054	-868	-759	-688	-483	-397	-345	-313
34/1	-2,205	-1,810	-1,580	-1,435	-1,133	-933	-816	-740	-541	-446	-388	-353
35/0	-2,302	-1,890	-1,651	-1,500	-1,211	-998	-874	-793	-601	-495	-432	-393

to keep the real value of the annual income during the retirement constant. The higher the expected tax rate during the retirement, the more contributions are put into Roth. The optimal contribution strategy is 34/1 when the tax rate at the retirement is expected to be 34%, whereas it is recommended to make no more than the first three contributions to Roth when the expected tax rate at the retirement is 24%. The contribution strategy remains virtually unaltered when different retirement longevity are considered. It is more costly to significantly deviate from the optimal contribution strategy when the tax rate at the retirement is either too low, suggesting that most of the contributions must be made via a deductible IRA

Table 1 (Continued)

Roth/ IRA (n/m)	Tax rate = 30%				Tax rate = 32%				Tax rate = 34%			
	Retirement period, years				Retirement period, years				Retirement period, years			
	15	20	25	30	15	20	25	30	15	20	25	30
0/35	-2,916	-2,465	-2,206	-2,040	-4,390	-3,693	-3,293	-3,037	-5,976	-5,015	-4,462	-4,110
1/34	-2,600	-2,202	-1,969	-1,822	-3,974	-3,347	-2,982	-2,751	-5,460	-4,584	-4,078	-3,756
2/33	-2,318	-1,962	-1,754	-1,625	-3,598	-3,030	-2,697	-2,491	-4,990	-4,190	-3,725	-3,432
3/32	-2,063	-1,745	-1,562	-1,445	-3,257	-2,741	-2,442	-2,252	-4,562	-3,828	-3,404	-3,135
4/31	-1,832	-1,548	-1,388	-1,285	-2,945	-2,476	-2,208	-2,036	-4,170	-3,497	-3,111	-2,863
5/30	-1,624	-1,374	-1,231	-1,141	-2,662	-2,238	-1,995	-1,841	-3,811	-3,194	-2,842	-2,617
6/29	-1,417	-1,202	-1,075	-998	-2,378	-2,001	-1,782	-1,646	-3,449	-2,893	-2,572	-2,369
7/28	-1,231	-1,047	-937	-869	-2,119	-1,787	-1,590	-1,468	-3,119	-2,618	-2,325	-2,143
8/27	-1,067	-908	-814	-754	-1,886	-1,592	-1,418	-1,307	-2,817	-2,367	-2,103	-1,935
9/26	-923	-784	-704	-653	-1,679	-1,415	-1,261	-1,164	-2,547	-2,138	-1,901	-1,749
10/25	-794	-673	-606	-563	-1,492	-1,255	-1,120	-1,034	-2,301	-1,928	-1,716	-1,580
11/24	-670	-567	-511	-476	-1,308	-1,098	-981	-906	-2,057	-1,721	-1,532	-1,412
12/23	-561	-476	-427	-399	-1,143	-960	-855	-791	-1,836	-1,537	-1,366	-1,259
13/22	-464	-396	-354	-331	-994	-837	-743	-688	-1,635	-1,370	-1,215	-1,120
14/21	-380	-326	-292	-272	-861	-726	-646	-595	-1,453	-1,219	-1,081	-994
15/20	-301	-260	-234	-218	-733	-619	-551	-509	-1,276	-1,071	-951	-874
16/19	-233	-203	-184	-173	-619	-524	-468	-432	-1,115	-937	-833	-766
17/18	-175	-155	-142	-134	-518	-440	-393	-364	-971	-817	-727	-669
18/17	-125	-112	-103	-98	-423	-361	-323	-299	-833	-702	-624	-576
19/16	-86	-76	-71	-69	-344	-291	-261	-243	-714	-598	-533	-492
20/15	-56	-47	-46	-45	-276	-230	-207	-194	-608	-506	-451	-417
21/14	-33	-28	-25	-27	-218	-182	-161	-151	-514	-428	-379	-351
22/13	-16	-13	-11	-12	-166	-138	-121	-113	-427	-355	-313	-288
23/12	-5	-4	-3	-4	-122	-101	-89	-82	-350	-291	-256	-235
24/11	82023	68201	60213	55131	-86	-72	-63	-58	-283	-235	-208	-191
25/10	-1	-1	-1	-1	-56	-47	-40	-38	-222	-185	-163	-150
26/9	-6	-5	-4	-5	-33	-28	-24	-22	-170	-142	-125	-115
27/8	-16	-14	-12	-12	-16	-14	-12	-11	-127	-106	-93	-86
28/7	-32	-27	-23	-22	-5	-5	-3	-4	-90	-74	-65	-60
29/6	-52	-43	-38	-35	81845	68053	-1	-1	-59	-49	-43	-40
30/5	-75	-63	-55	-51	-1	-1	60082	55011	-36	-30	-26	-25
31/4	-103	-86	-76	-70	-5	-5	-4	-4	-18	-15	-13	-13
32/3	-135	-112	-99	-91	-15	-13	-11	-11	-7	-6	-5	-5
33/2	-169	-141	-124	-114	-29	-25	-21	-20	-1	-1	-1	-1
34/1	-208	-173	-153	-140	-48	-41	-35	-33	81778	67997	60033	54966
35/0	-249	-207	-183	-168	-71	-59	-52	-48	-4	-3	-3	-3

plus the taxable account, or too high, when only a few such contributions are recommended. It will be costlier to deviate from the optimal contribution strategy when the latter is heavily skewed toward the Roth IRA rather than the deductible IRA.

As was mentioned above, Table 1 shows that the optimal contribution strategy is virtually independent of the longevity of the retirement period. That is true under the assumption that the tax rate at the retirement is also independent of its expected longevity. This assumption is subject to a caveat that the shorter the expected retirement period, the larger is the amount of the annual inflation-adjusted withdrawal. The larger is the value of the withdrawal, the heavier is the expected tax burden given the progressive scale of income taxation. Table 2

Table 2 Maximum after-tax value of the withdrawal amount at the age of 65 and the respective optimal contribution strategy as the function of the tax rate at the retirement and the retirement's expected longevity given the capital gains yield of 5%

Retirement period, years	Tax rate at retirement, percent					
	24	26	28	30	32	34
15	84,076	82,985	82,375	82,023	81,845	81,778
n/m	2/33	11/24	18/17	24/11	29/6	34/1
20	69,884	68,992	68,489	68,201	68,053	67,997
n/m	3/32	11/24	19/16	24/11	29/6	34/1
25	61,681	60,904	60,462	60,213	60,082	60,033
n/m	3/32	12/23	19/16	24/11	30/5	34/1
30	56,463	55,756	55,356	55,131	55,011	54,966
n/m	3/32	12/23	19/16	24/11	30/5	34/1

shows the maximum after-tax amount of the withdrawal at the age of 65 and the respective optimal contribution strategy as the function of the tax rate at the retirement and the retirement's expected longevity. The results in Table 2 are extracted from those presented in Table 1. Because larger amounts of the annual inflation-adjusted withdrawals are likely to be taxed at higher rates, the optimal contribution strategy will depend on the expected length of the retirement period: all else equal, the longer the retirement is expected to last, the more weight is given to the combination of the deductible IRA and the taxable account in the optimal contribution strategy. This is demonstrated in Table 2 by moving from its upper right corner to its lower left corner.

A similar line of arguments can be applied to the case when different rates of return are considered.⁷ Table 3 shows the maximum after-tax amount of the withdrawal at the age of 65 and the respective optimal contribution strategy as a function of the tax rate at the retirement and the expected rate of return, given a fixed longevity of the retirement and a fixed 2% rate of short-term capital gains as a portion of the total return. Higher expected rates of return will result in larger inflation-adjusted values of the retirement withdrawals, thus implying a higher tax burden. Hence, a more optimistic investor will assign more weight to the Roth contributions, while a more pessimistic investor will prefer to contribute relatively more to the combination of the deductible IRA and the taxable account. This is demonstrated in Table 3 by moving from its lower right corner to its upper left corner. For example, if Ann is an optimist and her optimal contribution strategy is n_1/m_1 , then Bob's optimal contribution strategy, who is relatively pessimistic about the expected rate of return, will be n_2/m_2 , where $n_1 > n_2$ and $m_1 < m_2$.

All results demonstrated so far have not incorporated the minimum distribution requirement that is applied to the deductible IRA but not to Roth IRA. The requirement introduces a disbalance to the optimal withdrawal sequence, where the withdrawals from the taxable account are followed by the distributions from the tax-shielded accounts (IRA and Roth), and serves as a disadvantage for the deductible IRA. In the context of this article's analysis, the question is whether the presence of the required minimum distributions imposed on the deductible IRA holders would significantly alter the mix of the optimal contribution strat-

Table 3 Maximum after-tax value of the withdrawal amount at the age of 65 and the respective optimal contribution strategy as the function of the tax rate at the retirement and the expected capital gains yield given the retirement period of 25 years

Rate of return, %	Tax rate at retirement, percent					
	24	26	28	30	32	34
3.0	34,225	33,681	33,333	33,118	32,998	32,946
n/m	0/35	9/26	16/19	22/13	28/7	33/2
3.5	39,621	39,028	38,660	38,436	38,312	38,261
n/m	0/35	10/25	17/18	23/12	28/7	33/2
4.0	45,897	45,247	44,855	44,627	44,499	44,448
n/m	2/33	10/25	17/18	24/11	29/6	33/2
4.5	53,196	52,483	52,067	51,830	51,700	51,650
n/m	2/33	11/24	18/17	24/11	29/6	33/2
5.0	61,681	60,904	60,462	60,213	60,082	60,033
n/m	3/32	12/23	19/16	24/11	30/5	34/1
5.5	71,551	70,699	70,233	69,972	69,840	69,791
n/m	3/32	12/23	19/16	25/10	30/5	34/1
6.0	83,028	82,092	81,600	81,330	81,197	81,149
n/m	3/32	13/22	19/16	25/10	30/5	34/1
6.5	96,373	95,347	94,824	94,547	94,413	94,365
n/m	4/31	13/22	20/15	26/9	30/5	34/1
7.0	111,888	110,764	110,208	109,925	109,789	109,742
n/m	4/31	13/22	20/15	26/9	30/5	34/1

egies obtained earlier by increasing the number of recommended early contributions to the Roth IRA, which is not subject to mandatory withdrawal requirements.

Under the required minimum distribution (RMD) rules, participants in “qualified plans” and individual retirement accounts are generally required to begin taking distributions no later than April 1 of the year after they attain age 70½.⁸ The amounts of the required distributions are determined by the value of the account and the age of the account holder. The minimum distribution requirement is expressed in the form of the percentage of the account’s remaining value that must be withdrawn by the retiree upon reaching a certain age. The amount of the RMD each year is measured by dividing the account balance as of the end of the prior year by a distribution factor. The distribution factor is generally equal to a life expectancy from the uniform lifetime table published by the IRS. Failure to make an RMD triggers an onerous 50% excise tax, payable by the individual or the individual’s beneficiary. Because the accumulation and withdrawal modeling in this study is based on annual contributions and payouts, the first withdrawal from the deductible IRA must be taken no later than at the age of 71 to avoid a costly penalty. The RMD rules are taken from the IRS Publication 590 “Individual Retirement Arrangements (IRAs)” used to prepare tax returns for 2010.

The RMD rules are applied to the tax-deferred accounts but spare the accounts where funds are contributed on after-tax basis such as a Roth IRA. The presence of RMD limits the potential for taxpayers to accumulate assets in the tax-deferred account without ever paying taxes and is deemed a less favorable type of savings than the Roth IRA, especially when the primary goal of such savings is to leave substantial bequests to the beneficiaries. In the context of this study, as soon as the retiree reaches the age when the required minimum distributions must be taken out of his or her deductible IRA, she withdraws the required

Table 4 Maximum after-tax value of the withdrawal at the age of 70 and the respective optimal contribution strategy for the case with no RMD (in bold) and the deviations from those for the case with RMD for different tax rates at the retirement and different longevities of the retirement period given the rate of return of 5%

Retirement period, years	Tax rate at retirement, percent							
	22		24		26		28	
	No RMD	RMD	No RMD	RMD	No RMD	RMD	No RMD	RMD
15	85,704	-25	84,076	-14	82,985	Same	82,375	Same
n/m	0/35	Same	2/33	3/32	11/24	Same	18/17	Same
20	71,233	-42	69,884	-24	68,992	-2	68,489	Same
n/m	0/35	Same	3/32	same	11/24	12/23	19/16	Same
25	62,871	-62	61,681	-30	60,904	-4	60,462	Same
n/m	0/35	Same	3/32	4/31	12/23	Same	19/16	Same
30	57,549	-82	56,463	-37	55,756	-4	55,356	Same
n/m	0/35	Same	3/32	4/31	12/23	Same	19/16	Same

amount from her IRA and the rest is taken from the taxable account if there are any funds still left there. Otherwise, she takes the entire amount of the scheduled withdrawal from the deductible IRA and the Roth IRA, if necessary.

It turns out that neither the optimal contributions strategies, nor the numerical results presented in Table 1 change if the minimum distribution requirements are incorporated into the modeling. This happens because of the fact that the assumed retirement age is 65 and that the taxable account is always fully depleted by the age of 71 when the required withdrawals from the deductible IRA are to start. This holds for any rate of return, any longevity of the retirement period and any contribution strategy including the one that contains no contributions to a Roth IRA. The picture will change though as the retirement age approaches 71.

If the retirement age is 70, the minimum required distributions start taking place at the end of the first year in the retirement. The recalculated results for a set of tax rates at the retirement given the constant annual rate of return of 5% are shown in Table 4 and they provide little evidence that the minimum distribution rules significantly alter the mix of the optimal contribution strategy or the amount of the annual after-tax inflation-adjusted withdrawal. The higher the tax rate at the retirement and the longer the retirement period, the less likely the RMD is to have any effect on the optimal contribution strategy. In the low tax rate environment in the retirement, the optimal contribution strategy n/m is expected to either stay unchanged, or change to $n+1/m-1$, while the after-tax value of the initial withdrawal amount given the optimal contribution strategy will decline slightly. In summary, the presence of the required minimum distributions that represent the relative disadvantage of the deductible IRA if compared to the Roth IRA does not have any impact on the optimal contribution strategy when the retirement begins at the age of 65 and has a negligible effect if the retirement is postponed until later.

6. Implications for the Roth IRA conversion

Many high income earners are not eligible to contribute directly to a Roth IRA; however, they still can contribute to a regular IRA. Those who do not participate in an employer-

sponsored retirement plan are eligible to contribute deductible amounts to their IRAs, while others can contribute only nondeductible amounts to the IRA. The income restriction on converting to a Roth IRA from the regular IRA was eliminated in 2010 making everybody eligible for such a conversion. The repeal of the income limitation on the conversion to a Roth IRA also has ramifications for regular annual IRA contributions and subsequent conversions to Roth: high income individuals are still able to make regular contributions to the regular IRA (deductible or nondeductible amounts depending on the individual's and his or her spouse's participation in the employer-sponsored retirement plan) and then immediately convert those to Roth IRA.⁹ The questions are whether an investor is better off by converting from the existing IRA to Roth IRA as soon as the restriction is lifted, whether he should convert the entire amount of his IRA or proceed with a partial conversion instead, and whether he should use the conversion in the future. Based on the framework developed earlier in the article, this section investigates whether an individual holding the regular IRA should retain the retirement funds there or convert the existing retirement account to the Roth IRA.

With the deductible IRA, the income tax on the entire converted amount is due at the time of the conversion. In some instances, an IRA can start out as a deductible IRA but subsequently have nondeductible amounts contributed to it as the individual's income grows sufficiently high making her no longer eligible for the deduction. In such circumstances, both deductible and nondeductible balances are taken into account to determine the tax basis if only a portion of funds is converted to Roth and the lower is the ratio of the nondeductible IRA balance, the greater is the percentage of the conversion subject to income taxation.¹⁰ The analysis below is performed for the cases when the existing IRA balance is comprised solely of deductible contributions.

The individual incurs no early withdrawal penalty on the converted amount but may be subject to a 10% tax on the amount taken from the existing IRA to pay the income tax on the converted funds. It is preferable to pay the income tax on the conversion¹¹ from the funds located outside the designated retirement account, for example, the taxable account, to avoid the costly penalty and also to eliminate the opportunity cost of having a portion of the retirement funds grow at a lower rate and being subject to capital gains tax upon the distribution in the taxable account instead of having them appreciate at the before-tax rate and subject to tax-free withdrawals in the Roth IRA.

The income tax liability at the time of the conversion can be raised significantly even without the penalty tax. While converting from the regular IRA to Roth IRA an amount of funds with a sizable tax basis,¹² the individual is risking to be pushed in a higher income tax bracket during the year of the conversion resulting in a higher tax rate applied on the converted amount. In such circumstances it can be beneficial to spread the planned conversion over a number of years to minimize the associated tax liability. The analysis below assumes the model's basic case when the income tax rate during the contribution phase is 35%, and that the individual is already in the highest tax bracket. The decision whether to convert or not depends on the individual's age, that is, the timing in the contribution phase when the conversion becomes eligible, the expected longevity of the retirement period, and the taxation of returns in the taxable account versus the before-tax return earned in the tax shielded account such as a Roth IRA.

Under the model's assumptions, converting the entire value of the deductible IRA without incurring the 10% penalty on at least part of the converted amount is not possible since the after-tax value of the taxable account is not sufficient to pay the income tax on the conversion. Such an outcome is the result of a higher tax-free accumulation growth experienced by the assets located in the deductible IRA relative to the taxable account which is subject to the taxation of short-term capital gains at a higher ordinary income tax rate. Hence, the question is whether to go ahead with the full conversion and incur the penalty on a part of it, proceed with a partial conversion that is penalty free, or do not convert at all. Given the lower expected tax rate at the retirement, it is not justified to pay the hefty penalty. Therefore, the decision reduces to whether to convert such a portion of funds from the existing IRA so that the entire after-tax amount of the accumulated savings in the taxable account is used to pay the conversion tax or not to convert. The model further assumes that after the conversion to a Roth IRA becomes available, the investor can effectively start making regular contribution to Roth by contributing funds to the deductible IRA and then immediately converting those to the Roth IRA.

Table 5 demonstrates whether it is beneficial to convert at a certain age as soon as the conversion becomes available for a set of different tax rates at the retirement and two prospective retirement horizons, a short one (15 years) and a long one (30 years). The table shows the maximum after-tax withdrawal amount at the age of 65 given the optimal contribution strategy by the individual over the remaining span of the contribution phase following the decision whether to convert a part of funds from the existing deductible IRA to a newly available Roth IRA when the tax on such conversion is paid from the funds accumulated at the taxable account. As usual, all subsequent after-tax withdrawals are adjusted by inflation implying that the optimal strategy defined in this study yields the highest possible after-tax withdrawal *each* year in the retirement. It is obvious that converting at earlier age is preferential even if the expected tax rate at the retirement is lower than the one charged on the conversion. What is less obvious is that the decision to convert existing retirement savings and the decision to start making new contributions to a newly created Roth IRA are relatively independent and do not necessarily point in the same direction. For example, if the expected tax rate at the retirement is 26%, and the investor's age is 38, Table 5 indicates that she will be better off if she does not convert a penalty-free portion of savings from the existing deductible IRA to the Roth IRA if the conversion becomes available at that time. However, what Table 5 does not show is that the subsequent optimal contribution strategy following nonconversion is to contribute to the Roth IRA over this and the next year followed by contribution to the traditional deductible IRA. From Table 1, the optimal contribution strategy given the 26% tax rate at the retirement is 11/24 meaning that first 11 contributions during the contribution phase must be made to the Roth IRA as long as it is possible to do so, with the last such contribution made when the investor reaches the age of 40. It turns out that it is still optimal to start making contributions to the Roth IRA until the age of 41 if it becomes available eventually; however, it does not necessarily imply that the conversion to Roth is optimal at that age. For the same 26% tax rate at the retirement, both new contributions to the Roth IRA and the conversion are optimal when the investor is 36 years old or younger, but the conversion is not advised for older investors even though they should start making regular contributions to the Roth IRA until the age of 41. Similar

Table 5 Maximum after-tax value of the withdrawal amount at the age of 65 given the decision to convert or not at certain age and the subsequent optimal contribution strategy for different tax rates at the retirement and different longevity of the retirement period given the rate of return of 5%

Tax rate at retirement = 26%					Tax rate at retirement = 28%				
Age	Retirement period, years				Age	Retirement period, years			
	15		30			15		30	
	Convert	Do not	Convert	Do not		Convert	Do not	Convert	Do not
36	82,528	82,489	55,449	55,399	43	80,878	80,857	54,349	54,299
37	82,416	82,458	55,373	55,374	44	80,712	80,824	54,237	54,272
38	82,295	82,435	55,292	55,356	45	80,542	80,798	54,123	54,251
39	82,166	82,420	55,206	55,341	46	80,369	80,780	54,007	54,234
40	82,031	82,411	55,115	55,330	47	80,192	80,768	53,888	54,221
Tax rate at retirement = 30%					Tax rate at retirement = 32%				
Age	Retirement period, years				Age	Retirement period, years			
	15		30			15		30	
	Convert	Do not	Convert	Do not		Convert	Do not	Convert	Do not
49	79,300	79,207	53,300	53,182	54	77,893	77,554	52,354	52,061
50	79,106	79,177	53,170	53,157	55	77,682	77,524	52,212	52,037
51	78,910	79,151	53,038	53,136	56	77,471	77,501	52,071	52,017
52	78,713	79,133	52,906	53,119	57	77,260	77,480	51,929	52,001
53	78,516	79,119	52,773	53,107	58	77,050	77,466	51,788	51,989
Tax rate at retirement = 34%									
Age	Retirement period, years								
	15		30		15		30		
	Convert	Do not	Convert	Do not		Convert	Do not	Convert	Do not
59	76,461			75,875		51,392			50,920
60	76,239			75,849		51,243			50,899
61	76,019			75,829		51,095			50,883
62	75,800			75,815		50,948			50,872
63	75,582			75,806		50,801			50,862

cases take place for other tax rates at the retirement and the outcome is largely independent of the length of the retirement period, although there are few cases where the decision to convert at a particular age depends on the expected retirement horizon. Hence, the decision whether to convert or not and the decision whether to start making contribution to a newly available Roth IRA do not necessarily coincide since under certain circumstances it is optimal not to convert yet contribute to Roth IRA.

7. Possible extensions

The analysis of the optimal contribution and withdrawal strategies between the deductible IRA and its Roth counterpart can be extended further by incorporating into the modeling a

number of other factors or expanding the goal of such savings by including the maximization of value of transferred bequests upon the investor's death. Certain options and implications, such as the availability of early withdrawals without penalty under certain circumstances for a Roth IRA, the opportunity to contribute to Roth at any age, the impact on itemized deductions for income tax purposes, and the fact that distributions from Roth accounts do not affect the taxation of Social Security benefits, that are hard to quantify and incorporate into the analysis would represent an extra challenge for a more comprehensive investigation of the optimal contribution and withdrawal strategies. A few of such possible factors that could serve to extend the research in the area are mentioned below and any related work is left for future research.

It is very difficult to predict tax rates that will be applied to retirement income given the uncertainty about future rates of return and possible changes in tax legislation. Therefore, it is imperative to have a flexible approach and periodically review the contribution and/or withdrawal strategies and make appropriate adjustments that reflect the current tax rate environment as well as the expectations about future rates of return. Length of the retirement period is another unknown. Although it can be estimated from the life expectancy tables, an individual's medical conditions and health history should be taken into account while projecting the length of the withdrawal phase.

Horan (2006a, 2006b) shows that in a progressive tax rate environment with multiple income tax brackets characterized by the presence of personal exemptions and deductions at low income levels it is possible to achieve longer drawdown periods in the retirement if withdrawals are made simultaneously rather than sequentially when the retirement portfolio consists of multiple types of tax-advantaged accounts even though the required minimum distributions from the regular IRA may impose certain restrictions on the optimization of the withdrawal strategy. The value of such withdrawal strategy increases for retirees with aggressive investment allocations and those who are subject to high withdrawal requirements. The issue that is directly related to this study is whether the alteration of the *optimal withdrawal* strategy by allowing simultaneous withdrawals from the deductible IRA and the Roth IRA will result in a significant change in the *optimal contribution* strategy. In all likelihood the possible change will imply a larger number of contributions to the combination of the deductible IRA and the taxable account, but the significance in the shift in the contribution strategy and the increase in the maximum withdrawal amount will depend on the expected tax brackets in the retirement.

The analysis of this study closely follows the setup of previous works on the comparison of the deductible IRA and its Roth alternative on the after-tax basis that are subject to the restriction that if the contributions are made to the combination of the deductible IRA and the taxable account, the entire portfolio is proportionally allocated between the two accounts. This, however, is likely to result in a suboptimal asset location in the retirement portfolio as long as the portfolio consists of multiple assets that are taxed in different manners. It may be beneficial to split income-bearing assets like bonds and high dividend yield stocks from the assets that provide return in the form of capital gains, such as nondividend paying growth stocks, between the investment vehicles with different tax treatment. The subject is referred as asset location and it received its share of attention in the financial planning literature (see Shoven, 1999; Dammon, Spatt, and Zhang, 2004; Poterba, Shoven, and Sialm, 2004;

Reichenstein, 2004, 2006a, among others). The existing literature advises to identify a preferred location for a particular asset relative to others to maximize the after-tax value of the retirement portfolio. In the context of this study, the *optimal location* decision is likely to affect the *optimal contribution* strategy by shifting the number of required contributions toward the combination of the deductible IRA and the taxable account since the contributions made via a Roth IRA are not affected by the change in the location strategy whereas the contributions via the deductible IRA and the taxable account are. This study can be extended further by incorporating the location decision into the analysis of the optimal choice between the two retirement investment vehicles when the retirement portfolio is composed of a combination of tax inefficient bonds, return on which is taxed as ordinary income, and tax efficient equities, where capital gains are taxed at a lower long-term capital gains rate.

The presence of other forms of retirement income could complicate the task of determining the optimal withdrawal and contribution strategies even further. The individual may have an opportunity to save for retirement via 401(k) or 403(b) plans subject to an employer's match of the employee's contributions. Social Security benefits represent another form of retirement income and the withdrawal strategy from a chosen mix of investment vehicles for retirement can have a profound impact on the income taxation of such payments. Because distributions from tax deductible retirement plans such as 401(k), 403(b), and IRA are included in gross income, they may result in a greater amount of Social Security benefits being taxed. Alternatively, withdrawals from a Roth IRA or a Roth 401(k) are not included in gross income and, therefore, have no impact on the taxation of Social Security payments. Liquidation of assets held in the taxable account also affects the taxation of Social Security benefits: the larger the amount of realized capital gains, the greater is the impact.

The goal of such savings can also be extended from securing the retirement income to leaving bequests to the eligible inheritors. A caution must be exercised as to the asserted timing of the withdrawals, however. Having all assets withdrawn from the tax-sheltered accounts and all capital gains realized in the taxable account by the inheritors immediately after the investor's death is a very conservative assumption.¹³ If the funds left at the tax-deferred account such as the deductible IRA are withdrawn at once in full and the withdrawn amount represents a sizable value, it is likely that it will be subject to a higher income tax rate than the one applied to the withdrawals during the investor's retirement. By not considering the beneficiary's withdrawal timeframe from the inherited retirement accounts, the analysis will ignore the potential benefits that heirs receive from not withdrawing all the funds immediately after inheriting the bequests, but rather, letting it grow tax-free further by taking only the required minimum distributions, if any.¹⁴

Given a high level of heterogeneity in the way states tax individual income and interpret taxation of inheritances, the impact of state income and inheritance taxes must also be considered in determining the optimal approach to contributions and withdrawals of retirement funds. All else equal, for individuals who spend most of their working lives in high-tax states but plan to move to a state that is tax friendly toward distributions from the designated retirement accounts, the optimal contribution strategy would tilt to having more before-tax dollars allocated to a deductible IRA relative to after-tax dollars put to a Roth IRA.

The findings in this study have, in fact, a larger scope of application in light of the emerged opportunity to contribute after-tax dollars to 401(k) and 403(b) plans. Roth 401(k)s

and 403(b)s became available in 2006. In 2011, these retirement account allow employees of most income levels to save up to \$16,500 (plus an extra \$5,500 for those of age 50 and above) and they also offer an option for an employer's matching contributions. For those eligible, the choice between deductible and Roth 401(k)s will be similar to that between deductible and Roth IRAs. An important quirk to remember here is that any employer's matching contribution can be made in pretax dollars only, even if the employee opts to contribute after-tax dollars to her Roth 401(k) or 403(b).

8. Conclusions

This study revisits the question about which retirement account, deductible IRA or Roth IRA, if compared on the after-tax basis, yields higher income during the retirement by adding the withdrawal phase into the analysis and effectively combining it with the accumulation phase, thus, completing the full cycle of the retirement planning. During the withdrawal phase, the investor has to optimize the withdrawal of funds from multiple accounts with different tax treatments to produce a maximum possible amount of the after-tax value of retirement income throughout the retirement. The funds are withdrawn from the taxable account first, followed by the withdrawals from the designated retirement accounts such as the deductible IRA and Roth IRA. The optimal withdrawal sequence subsequently determines the optimal contribution strategy defined as n/m , where n stands for the number of years since the start of the accumulation phase when the contributions are made via Roth IRA, and m represents the number of years until the investor's retirement age when the contributions are made via the combination of the deductible IRA and the taxable account.

Given the higher expected tax rate during the retirement, more contributions should be placed in the Roth IRA. The optimal contribution strategy remains virtually unaltered if a different longevity of the retirement period is considered given the flat tax rate charged on the retirement income. It is more costly to significantly deviate from the optimal contribution strategy when the tax rate at the retirement is either too low, suggesting that most of the contributions must be made via the deductible IRA plus the taxable account, or too high, when only a few such contributions are recommended. It will be costlier to deviate from the optimal contribution strategy when the latter is heavily skewed toward Roth rather than the deductible IRA.

In the progressive tax environment, a larger amount of the annual inflation-adjusted withdrawal is likely to be taxed at a higher rate. The optimal contribution strategy will depend on the expected length of the retirement period: all else equal, the longer the retirement to last, the more weight is to be given to the combination of the deductible IRA and the taxable account. Similarly, a more optimistic investor will assign more weight to the Roth contributions, while a more pessimistic investor will prefer to contribute relatively more to the combination of the deductible IRA and the taxable account.

The minimum distribution requirements introduce a disbalance into the optimal withdrawal sequence and serve as a disadvantage for the deductible IRA if compared to the Roth IRA that is not subject to mandatory withdrawal requirements. It is demonstrated that the minimum distribution rules have a negligible effect on the optimal contribution strategy or

the amount of the annual after-tax inflation-adjusted withdrawal. The higher is the tax rate at the retirement, the earlier is the retirement age, and the longer is the retirement period, the less likely is the RMD to have any effect on the optimal contribution strategy. In the low tax rate environment in the retirement, the optimal contribution strategy n/m is expected to either stay unchanged, or change to $n+1/m-1$, while the after-tax value of the initial withdrawal amount given the optimal contribution strategy will decline only slightly.

Many high income earners are not eligible to contribute directly to a Roth IRA, however they still can contribute to a deductible IRA. Those who do not participate in an employer-sponsored retirement plan are eligible to contribute deductible amounts to their IRAs. As soon the restriction for conversion is lifted, high income investors can convert the existing IRA to a new Roth IRA and can effectively start making contributions to a Roth IRA by contributing retirement funds to the existing deductible IRA and then immediately converting those to a Roth IRA. Under certain circumstances, the decision whether to convert or not and the decision whether to start making contribution to a newly available Roth IRA, do not necessarily agree: sometimes it is optimal not to convert the existing IRA, yet to contribute new funds to a newly available Roth IRA.

Notes

- 1 Horan (2003) shows that, as far as the accumulation phase is concerned, the standardized pre-tax and after-tax frameworks are consistent with each other but he also ignores the possibility of a scenario where retirement funds are depleted via multiple regular withdrawals.
- 2 Unrealized capital on the following assets held in a taxable account gains can be subject to taxation: exchange-traded funds, exchange-traded notes and master limited partnerships specializing in commodities such as oil, gas, and precious metals, as well as foreign currencies, and Treasury Inflation Protected Securities (TIPS).
- 3 The first phase of the regulations covers stocks purchased after January 1, 2011. In 2012, the coverage extends to mutual fund sales and in 2013 the program will be expanded to options and fixed income assets. Old rules will still apply to purchases before January 1, 2011.
- 4 This assumption of the inflation-adjusted growth in the contribution limits in \$500 increments reflects the current expectations of how the IRS intends to revise the contribution limits in practice. Last time the limits were raised was in 2008 and they have remained unchanged since.
- 5 Horan (2006a, 2006b) shows that in the progressive tax rate environment, whenever a retiree has accumulated retirement funds in both front-end and back-end designated retirement accounts, the optimal withdrawal strategy can involve simultaneous withdrawals from both Roth and deductible IRA.
- 6 The exception is when less than five years have passed since the contribution to a Roth IRA since Roth dollars must be aged for at least five years to qualify for tax-free withdrawals. In this case withdrawals must initially be taken from the deductible IRA to avoid a 10% penalty for early withdrawals from Roth.

- 7 The effect of a having a higher portion of the return taxed as ordinary income is more trivial and was addressed in Krishnan and Lawrence (2001) and in Horan and Peterson (2001).
- 8 For example, if you turn 70½ in 2011, you can wait until April 1, 2012 to make your withdrawal based on your IRA balance as of the end of 2010. Another withdrawal will be required by December 31, 2012, based on your balance as of the end of 2011.
- 9 Such strategy has been coined a “backdoor Roth IRA.”
- 10 See more on that in Anderson and Hulse (2007) and Adelman and Cross (2009).
- 11 For the conversions performed in 2010, the individual was allowed to spread the resulting income tax burden associated with it over the next two years: a half of the taxable income is included in the individual’s gross income in 2011 and the other half is added to the gross income in 2012.
- 12 Equal to 100% of the converted amount from a deductible IRA but less than 100% for a nondeductible IRA
- 13 With efficient estate planning, assets can remain in the account, including the tax-deferred one, for many years after the original contributor’s death. For example, if the beneficiary is the spouse of the account holder, then the decedent’s IRA can be rolled over into the spouse’s IRA. The surviving spouse can then draw down the combined assets in his or her IRA according to the general rules that govern distributions based on the spouse’s age. If the beneficiary is substantially younger than the original account holder and is holding a job while contributing funds toward his or her own retirement, than it can imply a very low, if any, rate of the initial withdrawals. That would allow the rolled over assets to continue growing at the before-tax rate after the death of the original accumulator for many more years.
- 14 Roth IRA has an advantage over the deductible IRA as far as estate planning is concerned. Not only does the Roth reduce the amount of tax on the taxpayer’s estate, but the lack of the required minimum distributions and the ability to keep contributing to it after attaining age 70½ could result in passing a larger value of after-tax estate to the heirs.

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