FINANCIAL SERVICES REVIEW, 6(4): 227–242
ISSN: 1057-0810

An Analysis of the Tradeoff Between Tax Deferred Earnings in IRAs and Preferential Capital Gains

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This paper extends prior research in evaluating the decision of whether to invest in a mutual fund either outright or through one of the three available IRAs: the deductible IRA, the Roth IRA, and the nondeductible IRA. We provide mathematical models for after-tax accumulations for each of the investments that are a function of return, the percentage of the return currently taxable to the investor, the time horizon of the investment, the capital gain tax rate, and the ordinary income tax rate. The Roth IRA and the deductible IRA always dominate investments in the nondeductible IRA or through outright investment. However, in comparing the nondeductible IRA and outright investments, the outcome is dependent on the investment goals of the mutual fund and whether it generates substantial dividend distributions or capital gain distributions. Mutual funds with small dividend and capital gain distributions may accumulate larger amounts if held outright while mutual funds that pay substantial dividends or make substantial capital gain distributions accumulate larger after-tax amounts when invested in a nondeductible IRA.

I. INTRODUCTION

Today's financial markets provide investors with numerous investment alternatives. Not only are there many specific investments to choose from, but the U.S. income tax system adds another layer of complexity to the investment decision. With the passage of the Taxpayer Relief Act of 1997, investors now have three IRAs to invest in for their retirement. These are (1) deductible IRAs, (2) Roth IRAs, and (3) nondeductible IRAs. Deductible IRAs and Roth IRAs are always preferable to nondeductible IRAs for taxpayers who qualify for them. However, deductible IRAs and Roth IRAs are both subject to adjusted gross income (AGI) limitations, leaving nondeductible IRAs as the IRAs available for upper income individuals covered by another retirement plan.

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While earnings from nondeductible IRAs accumulate tax deferred, later distributions are taxed at ordinary income tax rates. Recent increases in the ordinary income tax rate and decreases in the capital gain tax rate have raised the question of whether individuals should invest in a nondeductible IRA or make an outright investment in a mutual fund. In this paper, we hold the specific investment (a mutual fund) constant and examine the amounts an investor may accumulate in after-tax dollars in a deductible IRA, Roth IRA, nondeductible IRA, and in an outright investment in a mutual fund. The mathematical solution for the decision between the deductible IRA and the Roth IRA is straightforward. Due to greater tax incentives for the Roth IRA and the deductible IRA, the decision between either the of those investments and the nondeductible IRA is obvious. However, the comparison between the nondeductible IRA and the outright investment in a mutual fund is very complex. Therefore, the majority of our analysis is on the choice between nondeductible IRAs or outright investments. Our equations may be modified to allow pre-tax comparisons of the alternatives.

Our analysis is based on a marginal income tax rate of 31% for ordinary income, the marginal tax rate in effect for 1998 for individuals likely to invest in nondeductible IRAs, and 20% for capital gains. We provide mathematical models for after-tax accumulations for each of the investments that are a function of return, the percentage of the return currently taxable to the investor, the time horizon of the investment, the capital gain tax rate, and the ordinary income tax rate. We find that deductible IRAs and Roth IRAs are always preferable to nondeductible IRAs and outright investments in mutual funds. The choice between nondeductible IRAs and outright investments is not as clear cut and depends on the percent of return currently taxable and the investor's marginal tax rate. Our results show that nondeductible IRAs are preferred when a larger portion of the investments return is distributed as dividend or capital gain while the outright investment in a mutual fund is preferred when dividends and capital gain distributions are a smaller percentage of the total return.

The remainder of the paper is organized as follows. The next section discusses the income taxation of IRAs. We review the IRA decision literature in Section III. In section IV, we develop mathematical models to compare investments in deductible IRAs, Roth IRAs, nondeductible IRAs, and an outright investment in a mutual fund. We then apply our model to a sample of mutual funds to determine which mutual funds would be more appropriate for a nondeductible IRA or an outright investment. The final section provides our conclusions and limitations.

II. INCOME TAXATION OF IRAS

Individual Retirement Accounts (IRAs) were introduced in 1974 as a means of encouraging individuals to save for retirement. In order to accomplish this objective, the income tax law allows a deduction for the initial contribution to a deductible IRA and the earnings accumulate tax deferred. When the individual withdraws funds from a deductible IRA, he or she has to include the distribution in ordinary income. However, to discourage individuals from withdrawing the funds before retirement, Congress added a 10% penalty on amounts withdrawn before the individual attains age 59 1/2.

TABLE 1
Requirements for IRA Investments

Characteristic	*Deductible IRA*	*Nondeductible IRA*	*Roth IRA*
Initial Contribution	Deductible in computing taxable income	Not deductible in computing taxable income	Not deductible in computing taxable income
Withdrawal of earnings	Taxable as ordinary income	Taxable as ordinary income	Excluded from taxable income
Withdrawal of contributions to IRA	Taxable as ordinary income	Nontaxable return of investment	Nontaxable return of investment
Limits on contributor	Income limit if covered under another retirement plan	No limitations	Income limit if covered under another retirement plan
Income limitation on contributor (1998)			
Married filing jointly	No deduction if adjusted gross income exceeds $60,000 and a phase out if adjusted gross income is between $50,000 and $60,000	No limitations	Cannot contribute if adjusted gross income exceeds $160,000 and a phase out if adjusted gross income is between $150,000 and $160,000
Single	No deduction if adjusted gross income exceeds $40,000 and a phase out if adjusted gross income is between $30,000 and $40,000	No limitations	Cannot contribute if adjusted gross income exceeds $110,000 and a phase out if adjusted gross income is between $95,000 and $110,000

Prior to 1981, individuals who were covered by other retirement plans could not participate in IRAs. However, in 1981 Congress relaxed the participation rules to allow individuals who were covered by other retirement plans to also participate in IRAs. This relaxation of the participation rules spurred investment in IRAs. U.S. Internal Revenue Service (1984) shows that contributions to IRAs increased over 250% from 1981 to 1982.

In 1986, Congress again changed the participation rules to disallow an income tax deduction for individuals covered by other retirement plans whose income exceeded $35,000 for single taxpayers and $50,000 for married taxpayers filing joint returns. However, Congress introduced a new type of IRA, the nondeductible IRA, which retains the deferral of earnings but does not allow the investor an income tax deduction. Since the investor is not allowed a deduction for the investment in the nondeductible IRA, only the withdrawal of earnings is subject to income taxation and a portion of each withdrawal is treated as a tax free return of capital.

The Taxpayer Relief Act of 1997 added the Roth IRA, a retirement account where no deduction is allowed for the contribution to the account, but all earnings are excluded from income tax. The Roth IRA is available to married individuals filing joint returns with adjusted gross income less than $160,000 and single individuals with adjusted gross

income less than $110,000. The IRA alternatives and qualifications for 1998 are shown in Table 1.

Each taxpayer is allowed to contribute $2,000 per year to an IRA. Generally, taxpayers are better off contributing to deductible IRAs or Roth IRAs if they qualify. However, individuals covered under another retirement plan who exceed the deductible IRA income levels as shown in Table 1, may not contribute to a deductible IRA. Such persons may qualify for a Roth IRA, since the income limits for Roth IRAs are substantially higher than for deductible IRAs. Individuals covered under a retirement plan who exceed the income level for Roth IRAs ($110,000 single or $160,000 joint), may make contributions to a nondeductible IRA. The sum of all contributions to IRAs for a given year cannot exceed $2,000. Therefore, if an individual's annual investment in a Roth IRA is limited to, say $1,500, he or she may make an additional $500 investment in a nondeductible IRA. The literature that examines the IRA investment decision is discussed in the next section.

III. LITERATURE REVIEW

Several previous studies have examined various aspects of the IRA investment decision. Burgess and Madeo (1980) and O'Neil, Saftner and Dillaway (1983) use simulations to examine the break-even point for a deductible IRA by considering the 10% premature withdrawal penalty. Burgess and Madeo's study is for the tax law in effect prior to 1981, while O'Neil, Saftner, and Dillaway's study is an extension to the law in effect after the 1981 tax law changes. Both studies find that, for long-term investments, deductible IRAs perform better than non-IRA investments. However, if the deductible IRA is held only for a short time period, the penalty for premature withdrawal causes deductible IRAs to not perform as well as non-IRA investments.

Owens and Willinger (1985) also use a simulation to examine deductible IRA investments. However, instead of a break-even analysis, they compute internal rates of return to evaluate the IRA investment decision. They find that an investment in a deductible IRA has a greater internal rate of return, even in the short term, as long as the penalty for premature withdrawal is not imposed.

Yaari and Fabozzi (1985) investigate the use of growth stocks in deductible IRAs. While their analysis suggests that IRAs should be invested in non-growth stocks, they point out that IRAs tend to invest in growth stocks. Simonds (1986) examines the situation for an investor who wishes to have a balanced portfolio of interest-earning assets and aggressive-growth mutual funds. He finds that the interest-earning assets should be in a deductible IRA and the aggressive-growth funds should be held outright. However, if the investor wishes to hold only aggressive-growth mutual funds, he or she should do so in a deductible IRA.

The aforementioned studies all examine the issue of investing in a deductible IRA. However, in 1986 the federal income tax law was changed to allow nondeductible IRAs for persons who do not qualify for deductible IRAs. Randolph (1994) examines the issue of investing in a nondeductible IRA and finds that the nondeductible IRA (invested in a mutual fund) dominates the outright investment in a mutual fund. However, in his study no distinction was made between ordinary income tax rates and capital gain tax rates.

Scholes and Wolfson (1992, pp. 34-40) discuss after-tax accumulations for two types of investments. The earnings on the first investment accumulate tax deferred until maturity of the investment. Once the funds are withdrawn, the earnings are taxed at the ordinary income tax rate (similar to a nondeductible IRA). The earnings on the second investment are taxed annually at the capital gain tax rate. Scholes and Wolfson conclude that either investment may accumulate a larger amount depending on the length of time the investment is held and the percentage of the investment return that is taxed at the ordinary income tax rate. The primary difference between Randolph's analysis and Scholes and Wolfson's analysis is that Scholes and Wolfson allow for capital gain to be taxed at a lower rate than is ordinary income.

The Taxpayer Relief Act of 1997 introduced the Roth IRA, which provides for no tax deduction but allows exclusion for all income. Steuerle (1997) provides an example showing that accumulations in a deductible IRA and a Roth IRA appear to be equal if the investor is in the same tax bracket when the funds are invested and when the funds are withdrawn. However, he points out that the same $2,000 contribution limit applies to both deductible IRAs and Roth IRAs. The investor in a deductible IRA owns only one minus his or her tax rate times $2,000 while the investor in the Roth IRA owns the full $2,000 investment. Therefore, the Roth IRA may generate a larger after-tax accumulation than the deductible IRA.

In ranking the three types of IRA investments, the following conclusions may be drawn. First, the tax-favored deductible IRA and Roth IRA will accumulate larger after-tax amounts than either the nondeductible IRA or the outright investment. Second, the deductible IRA will accumulate a larger after-tax amount than the Roth IRA if the individual is in a lower tax bracket after retirement. On the other hand, if the investor is in a higher tax bracket after retirement, the Roth IRA will accumulate a larger amount of after-tax funds than will the deductible IRA. If the taxpayer is in the same tax bracket before and after retirement, the accumulations in the Roth IRA and the deductible IRA will be the same. The mathematical verification is provided in Section IV.

An individual who qualifies for either a deductible IRA or a Roth IRA should invest in the deductible IRA or Roth IRA instead of investing in a nondeductible IRA. However, individuals who are covered under another retirement plan, and whose AGI exceed the limits shown in Table 1, cannot contribute to either a deductible IRA or a Roth IRA. These individuals may invest in a nondeductible IRA. The issue of whether to make a contribution to an nondeductible IRA is a very challenging one. Depending on the assumptions made, an investment in a nondeductible IRA, which still provides tax deferral of income, might be advisable. However, when funds are withdrawn from the nondeductible IRA, all income is taxed at ordinary income rates, even when the nondeductible IRA is invested in mutual funds. As an alternative to the nondeductible IRA, the investor might invest outright in a mutual fund. While the investor must pay tax annually on dividend income and capital gain distributions, unrecognized gains are deferred and qualify for more favorable long-term capital gain tax rates when recognized later.

In discussing the effect of the 1997 reduction in the capital gain tax rates on investments in mutual funds, Brush (1997) points out that the greater the difference in long-term capital gain tax rates and ordinary income tax rates, the less likely a nondeductible IRA will outperform an outright investment in a mutual fund. In general, a narrowing of the difference between the ordinary income tax rates and the long-term capital gain tax rates favors an investment in a nondeductible IRA while the widening of the difference between the ordinary income tax rates and the long-term capital gain tax rates favors an outright investment.

IV. DEVELOPMENT OF MATHEMATICAL MODEL

In this section, we develop mathematical models to compare investments in deductible IRAs, Roth IRAs, nondeductible IRAs, and outright investment in mutual funds. For our analysis, we assume that the investor does not dispose of the investment in an IRA (deductible, Roth, or nondeductible) before he or she reaches age 59 1/2, thus there will be no penalty for premature withdrawal. The after-tax accumulation is a function of the return, the percentage of the return that is currently taxed, the ordinary income tax rate, the capital gain tax rate, and the number of years that the investment will be held.

$$Accumulation_{at} = f(r, p, t_o, t_{cg}, n) \tag{1}$$

All variables are defined as follows:

A_{at} = after-tax accumulation
A_{pt} = pre-tax accumulation
r = return (appreciation, dividends, and capital gain distributions)
p_o = percentage of return that is a dividend distribution and is taxed at the ordinary income tax rate
p_{cg} = percentage of return that is a capita gain distribution and is taxed at the capital gain tax rate
t_o = ordinary income tax rate
t_{cg} = capital gain tax rate
n = number of years the investment will be held

A. Comparison of Deductible IRA and Roth IRA

An investment in a deductible IRA allows the investor an income tax deduction for the investment plus deferral of income tax on the earnings. An individual who wishes to make the maximum contribution to a deductible IRA has a net investment in the deductible IRA of one minus his marginal tax rate times the amount of the investment. For example, a taxpayer in a 31% income tax bracket may contribute $2,000 to a deductible IRA. However, he or she would have an immediate tax savings of $620. Therefore, we assume that the investor funds $2,000 of investment in the deductible IRA with the $620 in tax savings and $1,380 in funds from other sources. In developing our formula we grow the investor's net investment of $1,380 divided by one minus his or her marginal tax rate (to gross the investment to the $2,000 that the investor contributed) for a period of n years at a rate of r. The deductible IRA grows as follows:

$$A_{pt} = (1 + r)^n / (1 - t_o) \tag{2}$$

When funds are withdrawn from a deductible IRA, income tax is assessed against the withdrawal. If the individual is in the same ordinary income tax bracket when the funds are withdrawn as when the investment in the deductible IRA is made (t_o at the time of investment equals t_o when the funds are withdrawn), the after-tax accumulation in the deductible IRA is

$$A_{at} = (1 - t_o)((1 + r)^n / (1 - t_o)) \tag{3}$$

which reduces to

$$A_{at} = (1 + r)^n \tag{4}$$

If t_o at the time of withdrawal is less than t_o at the time of the investment, then A_{at} will be greater than $(1 + r)^n$. On the other hand, if t_o at the time of withdrawal is greater than t_o at the time of the investment, then A_{at} will be less than $(1 + r)^n$.

Next, we compute the accumulation in the Roth IRA. The initial investment in a Roth is not deductible when made by the investor. However, the earnings of the Roth IRA are excludable from taxable income. Therefore, after-tax accumulation in the IRA is

$$A_{at} = (1 + r)^n \tag{5}$$

The after-tax accumulation of the Roth IRA is not dependent on the investor's income tax rate, but remains constant at $(1 + r)^n$. However, as shown above, the change in the investor's ordinary income tax rate affects the accumulation in the deductible IRA. If the investor's ordinary income tax rate is greater when the funds are withdrawn from the deductible IRA than it was when the investment in the IRA was made, the accumulation will be less than $(1 + r)^n$. On the other hand, if the investor's ordinary income tax rate is less when the funds are withdrawn from the deductible IRA than when the investment in the IRA was made, the accumulation will be greater $(1 + r)^n$.

B. Comparison of Nondeductible IRA with Deductible IRA and Roth IRA

For the nondeductible IRA, all earnings are tax deferred and an investment of one for a period of n years results in a pre-tax accumulation as shown in equation (6).

$$A_{pt} = (1 + r)^n \tag{6}$$

All returns are tax deferred and all income is taxed at the ordinary income tax rate (t_o) when the money is withdrawn from the nondeductible IRA. Therefore, the after-tax accumulation in a nondeductible IRA is

$$A_{at} = 1 + \{(1 - t_o)\,[(1 + r)^n - 1]\} \tag{7}$$

For all $t_o > 0$, the after-tax accumulation in a nondeductible IRA is less than the accumulation in either a deductible IRA (equation 4) or a Roth IRA (equation 5). Therefore, individuals who qualify for either a deductible IRA or a Roth IRA should invest in either one before investing in a nondeductible IRA.

C. Comparison of Outright Investment in Mutual Fund with Nondeductible IRA

As shown in Table 1, many higher income individuals do not qualify for either a deductible IRA or a Roth IRA. These individuals may select between a nondeductible IRA, which does provide tax deferral on earnings, or they may select to invest in a non tax-sheltered manner. Randolph (1994) compares nondeductible IRAs (invested in mutual funds) and outright investments in mutual funds and finds that nondeductible IRAs outperform

outright investments. However, Randolph assumes that the ordinary income tax rate and the capital gain tax rate are equal. Recent changes in the tax law have increased the spread between the ordinary tax rate and the capital gain tax rate. We extend Randolph (1994) by examining the impact of differentially taxing ordinary income and long-term capital gain on the decision to invest in a mutual fund either outright or through a nondeductible IRA.

Consider a mutual fund that invests only in growth stocks that pay no dividends and the mutual fund makes no capital gain distributions. Regardless of whether the investment in the mutual fund is outright or through a nondeductible IRA, the investment grows to the same amount after n years. However, when the funds are withdrawn from the mutual fund, the outright investment is afforded capital gain treatment, while the nondeductible IRA is subject to the higher ordinary income tax. Therefore, in this situation, the outright investment in the mutual fund would provide greater after-tax funds.

Next consider a mutual fund that pays a dividend and has no appreciation. An individual who makes an outright investment pays tax on the dividend currently at ordinary rates and reinvests the after-tax amount in the mutual fund. However, with a nondeductible IRA the individual defers the tax and reinvests the entire dividend. Therefore, the nondeductible IRA grows to a larger amount after n years. Due to the difference in the taxation of a nondeductible IRA and an outright investment in a mutual fund, the after-tax accumulations will differ.

Section 851(b) of the Internal Revenue Code requires a mutual fund to distribute dividends and capital gains to avoid having an income tax assessed against the mutual fund. Therefore, an individual who makes an outright investment in a mutual fund must pay tax annually on his or her share of the fund's dividend and capital gain distributions. Short-term capital gains, interest income, and dividend income are distributed to the investor as dividends, and taxed at the ordinary income tax rate. Capital gain distributions, which may be the result of either the mutual fund manager selling off a stock which he or she no longer wishes to hold or may result from rebalancing the portfolio, are taxed to the investor as long-term capital gains.

For the outright investment in the mutual fund, we assume that all dividends and capital gain distributions are paid out in cash. The investor pays the income tax on the dividends at the ordinary income tax rate (t_o) and on the capital gain distributions at the capital gain tax rate (t_{cg}), and reinvests the after-tax amount in the mutual fund. After n years the accumulation (after tax on distributions but before tax on liquidations) is shown in equation (8).

$$A_{pt} = [(1 + r) - rp_o t_o - rp_{cg} t_{cg}]^n \tag{8}$$

When the mutual fund shares are sold, the investor pays tax at the long-term capital gain tax rate (t_{cg}) on the gain. We determine the gain by subtracting the adjusted basis in the shares in the mutual fund from the sales price. The adjusted basis is composed of the initial investment (which is 1) plus the dividend distributions and capital gains distributions less the income tax on those distributions, as shown in equation (9).

$$\begin{aligned} \textit{Adjusted basis} = \; & 1 + [(rp_o)(1 - t_o)] \{[1 - (1 + r - rp_o t_o - rp_{cg} t_{cg})^n] / \\ & [rp_o t_o + rp_{cg} t_{cg} - r]\} + [(rp_{cg})(1 - t_{cg})] \\ & \{[1 - (1 + r - rp_o t_o - rp_{cg} t_{cg})^n] / [rp_o t_o + rp_{cg} t_{cg} - r]\} \end{aligned} \tag{9}$$

Next, the capital gain tax is determined by subtracting the adjusted basis as determined in equation (9) from the pre-capital gain tax accumulation in equation (8) and multiplying by t_{cg} to get the capital gain tax as shown in equation (10).

$$\begin{aligned} \textit{Capital gain tax} = \; & t_{cg}\{[(1 + r) - rp_o t_o - rp_{cg} t_{cg}]^n - \{1 + [(rp_o)(1 - t_o)] \\ & \{[1 - (1 + r - rp_o t_o - rp_{cg} t_{cg})^n] / [rp_o t_o + rp_{cg} t_{cg} - r]\} + \\ & [(rp_{cg})(1 - t_{cg})] \{[1 - (1 + r - rp_o t_o - rp_{cg} t_{cg})^n] / \\ & [rp_o t_o + rp_{cg} t_{cg} - r]\} \end{aligned} \tag{10}$$

The after-tax accumulation in the outright investment in the mutual fund is determined by subtracting the capital gain tax in equation (10) from the pre-capital gain tax accumulation in equation (8). This result is shown in equation (11).

$$\begin{aligned} A_{at} = \; & [(1 + r) - rp_o t_o - rp_{cg} t_{cg}]^n - t_{cg}\{[(1 + r) - rp_o t_o - rp_{cg} t_{cg}]^n - \\ & \{1 + [(rp_o)(1 - t_o)] \{[1 - (1 + r - rp_o t_o - rp_{cg} t_{cg})^n] / \\ & [rp_o t_o + rp_{cg} t_{cg} - r]\} + [(rp_{cg})(1 - t_{cg})] \{[1 - (1 + r - rp_o t_o - \\ & rp_{cg} t_{cg})^n] / [rp_o t_o + rp_{cg} t_{cg} - r]\} \end{aligned} \tag{11}$$

To compare the nondeductible IRA with the outright investment, we set equation (7) equal to equation (11). With this condition, the after-tax accumulations of the two alternatives will be equal. The investor may substitute his or her marginal ordinary income tax rate for t_o and marginal long-term capital gain tax rate for t_{cg}. In selecting t_o for our analysis, we consider that individuals who qualify for one of the more tax-favored IRAs (either the deductible IRA or the Roth IRA) will not invest in a nondeductible IRA. As shown in Table 1, single individuals who are covered by another retirement plan qualify for a Roth IRA unless their adjusted gross income exceeds $110,000 ($160,000 for married individuals filing jointly). After reducing the adjusted gross income limit of $110,000 for single taxpayers ($160,000 for married taxpayers) by exemptions and either the standard deduction or itemized deductions, the resulting taxable income is in the 31% bracket. Therefore, we use $t_o = .31$.

Most investors will have a long-term capital gain tax rate of 20% for 1998. While the Taxpayer Relief Act of 1997 provides for a reduction in the long-term capital gain rate to 18% for tax years beginning after December 31, 2000, there is no certainty that this scheduled reduction will take place. Therefore, we use 20% in our analysis. The reduction of the rate to 18% would lower the indifference points. The investor may select n equal to the number of years until he or she wishes to liquidate the investment and r, the return rate of the investment.

We demonstrate the use of the formula for $r = 12\%$, $n = 20$ years, $t_o = 31\%$, and $t_{cg} = 20\%$. For a given r, n, t_o, and t_{cg}, there are two unknowns, p_o, which is the portion of the annual return that is a dividend and taxed at ordinary income tax rates, and p_{cg}, the portion of the annual return that is a long-term capital gain distribution and taxed at the more favorable long-term capital gain tax rates. With two unknowns we cannot solve for a unique p_o and p_{cg}. Instead, we have to fix a value for either p_o or p_{cg} and solve for the other variable. We select $p_o = .20$, that is, 20% of the 12% return for the year is distributed and taxed at the ordinary income tax rates, to demonstrate our formula. Substituting these values into equation (11), and setting equation (11) equal to equation (7), yields equation (12), a polynomial with one unknown, p_{cg}.

$$6.965942 = [1.11256 - .024p_{cg}]^{20} - .20[1.11256 - .024p_{cg}]^{20} - \{1 + .01656 \{[1 - (1.11256 - .024p_{cg})^{20}] / [.024p_{cg} - .11256]\} + [.096p_{cg}] \{[1 - (1.11256 - .024p_{cg})^{20}] / [.024p_{cg} - .11256]\} \quad (12)$$

We use *Mathematica*, a microcomputer program by Wolfram (1996), to compute the numerical solutions for p_{cg} for the polynomial equation. Since the equation is of the 21st degree, there are 21 solutions for p_{cg}. However, only one of the solutions, 0.123688, is in the relevant range between zero and one. Where $p_{cg} = 0.123688$, the accumulations in the nondeductible IRA and the outright investment in the mutual fund are equal. If $p_{cg} > 0.123688$, the nondeductible IRA accumulates a larger amount and if $p_{cg} < 0.123688$, the outright investment accumulates a larger amount. Using equation (11), we may compare after-tax accumulations in outright investments in mutual funds with investments in mutual funds through a nondeductible IRA.

In order to further examine the issue, we select annual rates of return from .01 to .20 and time periods from five years to 40 years, in five-year increments. We hold p_o constant at 0.07 (which is approximately equal to the mean p_o for growth funds computed in our analysis of a sample of mutual funds in Section V) and solve for p_{cg}. As shown by the asterisks in Table 2, there are no indifference points for p_{cg} for a five-year time horizon. If $p_o = 0.07$, and the investment is held for five years, the investor will accumulate a greater amount in the outright investment than in the nondeductible IRA.

Two additional observations can be made from the information presented in Table 2. First, the higher the rate of return, the lower the indifference point. For example, given a

TABLE 2

Selected Returns (r) and Time Horizons (n) for Indifference Point for Percentage of Investment Currently Taxed as Capital Gain with Ordinary Income (p_o) = .07 Outright Investment in Mutual Fund Vs. Nondeductible IRA

	INVESTMENT HORIZON (IN YEARS)							
r	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*
.01	*	*	*	*	*	*	*	*
.02	*	*	*	*	*	*	*	*
.03	*	*	*	*	*	*	*	.921503
.04	*	*	*	*	*	*	.762527	.632603
.05	*	*	*	*	.905998	.705428	.565712	.463357
.06	*	*	*	*	.718072	.552278	.437307	.353464
.07	*	*	*	.804866	.585683	.444888	.347692	.277123
.08	*	*	*	.678566	.487860	.365908	.282084	.221470
.09	*	*	.877317	.581400	.412962	.305711	.232293	.179394
.10	*	*	.770245	.504579	.354011	.258537	.193424	.146654
.11	*	*	.683311	.442486	.306573	.220731	.162380	.120575
.12	*	*	.611445	.391385	.267702	.189866	.137111	.099390
.13	*	*	.551139	.348694	.235359	.164272	.116207	.081892
.14	*	.910578	.449890	.312572	.208097	.142761	.098673	.067231
.15	*	.839303	.445861	.281670	.184857	.124471	.083787	.054790
.16	*	.777226	.417679	.254980	.164850	.108758	.071012	.044117
.17	*	.722712	.384291	.231732	.147474	.095136	.059945	.034870
.18	*	.674490	.354883	.211331	.132265	.083229	.050276	.026788
.19	*	.631559	.328810	.193307	.118859	.072746	.041763	.019668
.20	*	.593116	.305559	.177287	.106967	.063453	.034216	.013352

Note: * No indifference point - outright investment accumulates a greater after-tax amount.

TABLE 3

Selected Returns (r) and Time Horizons (n) for Indifference Point for Percentage of Investment Currently Taxed as Capital Gain with Ordinary Income (p_o) = .20 Outright Investment in Mutual Fund Vs. Nondeductible IRA

	INVESTMENT HORIZON (IN YEARS)							
r	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*
.01	*	*	*	*	*	*	*	*
.02	*	*	*	*	*	*	*	*
.03	*	*	*	*	*	*	.734651	.582689
.04	*	*	*	*	*	.598008	.445051	.332488
.05	*	*	*	*	.569444	.395644	.274580	.185887
.06	*	*	*	.629372	.406662	.262981	.163343	.090679
.07	*	*	*	.481958	.291975	.169944	.085698	.024526
.08	*	*	.661742	.372629	.207222	.101509	.028842	&
.09	*	*	.544928	.288350	.142324	.049343	&	&
.10	*	*	.452148	.221784	.091238	.008457	&	&
.11	*	*	.376814	.167975	.050124	&	&	&
.12	*	.729710	.314533	.123688	.016431	&	&	&
.13	*	.645804	.262268	.086687	&	&	&	&
.14	*	.574192	.217848	.055375	&	&	&	&
.15	*	.512402	.179685	.028587	&	&	&	&
.16	*	.458584	.146587	.005488	&	&	&	&
.17	*	.411321	.117644	&	&	&	&	&
.18	*	.369513	.092148	&	&	&	&	&
.19	*	.332289	.069543	&	&	&	&	&
.20	*	.298956	.049383	&	&	&	&	&

Notes: * No indifference point - outright investment accumulates a greater after-tax amount.
& No indifference point - nondeductible IRA accumulates a greater after-tax amount.

20-year investment horizon, a mutual fund with a seven percent annual rate of return would have to pay out more than 0.804866 of its annual return as a capital gain before the nondeductible IRA would accumulate a greater after-tax amount than the outright investment. On the other hand, the value of p_{cg} at the indifference point for a mutual fund with a 20-year investment horizon and a 20% annual rate of return decreases to 0.177287. Secondly, the compounding of returns for longer time periods favors the deferral provided by a nondeductible IRA. For example, holding the return constant at 0.12, the value of p_{cg} at the indifference point for an investment horizon of 15 years is 0.611445, while the value of p_{cg} at the indifference point for an investment horizon of forty years decreases to 0.099390.

Next, we select $p_o = 0.20$ (which is approximately equal to the mean p_o for growth and income funds computed in our analysis of a sample of mutual funds in Section V). We compute p_{cg} for earnings rates from 0.01 to 0.20 and for time horizons from five years to 40 years, in five-year increments. Indifference points for $p_o = 0.20$ are shown in Table 3. We use an asterisk to indicate earnings rates and time horizons where no indifference point exists and the outright investment accumulates a larger after-tax amount.

The indifference points for $p_o = 0.20$ (growth and income funds) are attained at lower values of r and n than they were for $p_o = 0.07$ (growth funds) due to the larger tax drag on the increased dividend income. Combinations of high earnings and long time horizons (e.g., $r = 0.19$ and $n = 30$) result in the nondeductible IRA generating the larger after-tax accumulation. We denote cases where the nondeductible IRA generates the larger after-tax accumulation by an ampersand (&) sign.

V. ANALYSIS OF MUTUAL FUNDS

In this section, we examine actual returns and distributions from mutual funds to determine which mutual funds would be more suitable for an outright investment versus an investment through a nondeductible IRA. Our previous analysis suggests that, for a given r and n, an investment through a nondeductible IRA would be more beneficial if the mutual fund pays out large dividend distributions or capital gain distributions. An outright investment is more advantageous if the mutual fund does not pay out large distributions (dividends or capital gains).

The American Association of Individual Investors (1997) classifies mutual funds as aggressive growth, growth, growth and income, and balanced, based on the objective of the mutual fund. Aggressive growth funds generally invest in stocks that pay little or no dividends. These funds tend to stay fully invested in stock, may use financial leverage, and carry a greater amount of risk than other mutual funds. Growth mutual funds also invest primarily in growth stocks that pay little or no dividends. However, they generally do not use leverage and are less risky than aggressive growth funds. The third category of mutual funds, growth and income funds, generally invests in stocks that pay cash dividends. Their objective is to provide some income and some growth for investors. Finally, balanced funds consist of investments in dividend paying stocks and interest paying bonds. Therefore, if the outright investment is to outperform the nondeductible IRA, it will most likely occur for aggressive growth funds, and will least likely occur for balanced funds.

For our sample, we use a random number generator to select ten low-load mutual funds with at least five years of data from each of the categories designated as aggressive growth funds, growth funds, growth and income funds, and balanced funds by American Association of Individual Investors (1997). We do not select bond funds since the goal of the bond fund is to generate interest income which favors the nondeductible IRA over the outright investment.

We use equation (7) to determine after-tax accumulations for investments in mutual funds through a nondeductible IRA and equation (11) to determine after-tax accumulations for outright investments in mutual funds. As shown in Tables 2 and 3, results differ for different investment time horizons. Most individuals first qualify for an IRA in their early to mid twenties, when they have approximately 40 years until they begin to withdraw their funds from the IRA. Individuals may continue to invest in IRAs until the time of retirement. Therefore, we select 20 years since it is in the center of the investment horizon (from zero years to 40 years).

We use five-year annual returns for each of the sample mutual funds as shown in American Association of Individual Investors (1997) as our return (r). For each mutual fund, we estimate p_o and p_{cg} by decomposing returns into dividend distributions, capital gain distributions, and unrealized appreciation over the five-year period from 1992 through 1996. For example, assume a mutual fund has a five-year return of 12% with a dividend of one dollar, capital gains distributions of two dollars, and appreciation of seven dollars. The total return of \$10 includes \$1 of dividends, \$2 of capital gain distributions, and \$7 of unrealized appreciation. Therefore, p_o = \$1/\$10 X .12 = 0.012 and p_{cg} = \$2/\$10 X .12 = 0.024.

In Tables 4 through 7, we provide lists of the randomly-selected mutual funds. Table 4 lists the aggressive growth funds, Table 5 the growth funds, Table 6 the growth and income funds, and Table 7 the balanced funds. For each mutual fund, we compute the after-tax accumulation of one dollar invested outright in the mutual fund and the after-tax accu-

TABLE 4
Accumulation of Outright Investment Vs. Nondeductible IRA
Invested in Aggressive Growth Funds

Aggressive Growth Funds	*r*	p_o	p_{cg}	*Outright*	*IRA*
Fidelity Select Air Transportation*	0.1200	0.0000	0.2707	7.4168	6.9659
Fidelity Select Automotive*	0.1700	0.0214	0.2994	16.4035	16.2529
GIT Equity Trust Special Growth	0.0890	0.0794	1.8833	3.4111	4.1067
INVESCO Emerging Growth	0.1670	0.0068	0.5372	14.4655	15.4549
INVESCO Strategic Portfolio - Health Science*	0.0710	0.0086	0.7806	3.0808	3.0304
Janus Twenty	0.1130	0.1941	0.5894	5.6496	6.1815
Janus Venture	0.1100	0.1910	0.6133	5.3836	5.8730
Legg Mason Special Investment Trust*	0.1440	0.0117	0.2283	11.0946	10.4811
Sit Mid Cap Growth	0.1140	0.0067	0.7257	6.0566	6.2880
Wasatch Aggressive Equity*	0.1270	0.0000	0.4225	8.0112	7.8492
Mean	0.1225	0.0520	0.6350	8.0973	8.2484

Note: * Outright investment exceeds nondeductible IRA

TABLE 5
Accumulation of Outright Investment Vs.
Nondeductible IRA Invested in Growth Funds

Growth Funds	*r*	p_o	p_{cg}	*Outright*	*IRA*
Acorn Investment Trust: Acorn	0.1760	0.0487	0.3938	17.0372	17.9702
Fidelity Select Insurance*	0.1710	0.0076	0.3183	16.7133	16.5276
Gradison McDonald Established Value	0.1500	0.1031	0.3189	11.2298	11.6029
IAI Regional	0.1170	0.0688	0.8071	6.0531	6.6183
IAI Value	0.1340	0.0349	0.6322	8.3062	8.8432
Scout Regional	0.0980	0.1818	0.3459	4.7268	4.7861
Sentry	0.1200	0.1058	0.4449	6.7613	6.9659
Sound Shore	0.1860	0.0540	0.5308	18.6919	21.2291
Twentieth Century Heritage	0.1260	0.0498	0.4848	7.5645	7.7166
Vanguard PRIMECAP*	0.1800	0.0440	0.1463	20.1269	19.2112
Mean	0.1458	0.0699	0.4423	11.7211	12.1471

Note: * Outright investment exceeds nondeductible IRA

mulation of one dollar invested in a nondeductible IRA. It is anticipated that, if the outright investment is to outperform the nondeductible IRA, it will most likely occur for aggressive growth funds and growth funds. These funds have lower dividends that are subject to current income taxation at the higher ordinary income tax rates.

Table 4 contains the results for the ten randomly-selected aggressive growth funds. While these funds generally have fairly low dividend distributions (mean $p_o = 0.0520$), they often have significant capital gain distributions (mean $p_{cg} = 0.6350$). However, the lower tax rate on capital gain distributions does not provide as large a tax drag as the ordinary tax on dividend distributions. The accumulation of the outright investment exceeds the accumulation in the nondeductible IRA for five of the ten mutual funds. For the five

TABLE 6
Accumulation of Outright Investment Vs. Nondeductible IRA
Invested in Growth and Income Funds

Growth and Income Funds	*r*	p_o	p_{cg}	*Outright*	*IRA*
Dreyfus	0.0900	0.1996	1.2332	3.6386	4.1770
Fidelity Convertible Securities	0.1410	0.4200	0.3536	8.0365	9.9608
Harbor Value	0.1370	0.2018	0.6086	7.9806	9.3062
Hotchkis & Wiley Equity Income	0.1490	0.2045	0.3428	10.3054	11.4081
Schwab 1000*	0.1450	0.1280	0.0000	11.2814	10.6604
Selected American Shares	0.1420	0.0903	0.6481	9.0479	10.1313
Sit Large Cap Growth	0.1250	0.0489	0.4691	7.4788	7.5861
T. Rowe Price Equity Index*	0.1470	0.1627	0.0758	11.1446	11.0281
USAA Income Stock	0.1260	0.4226	0.1720	6.7669	7.7166
WPG Growth & Income	0.1420	0.1671	0.6332	8.6940	10.1313
Mean	0.1344	0.2046	0.4536	8.4375	9.2046

Note: * Outright investment exceeds nondeductible IRA

TABLE 7
Accumulation of Outright Investment Vs. Nondeductible IRA
Invested in Balanced Funds

Balanced Funds	*r*	p_o	p_{cg}	*Outright*	*IRA*
BB&K Diversa	0.0890	0.3177	0.4023	3.8869	4.1067
Dodge and Cox Balanced	0.1370	0.2964	0.0822	8.7673	9.3062
Fidelity Asset Manager: Growth	0.1440	0.1453	0.2440	10.1909	10.4811
Greenspring	0.1480	0.2600	0.3184	9.8867	11.2165
Maxus Income	0.0720	0.9572	0.0963	2.5865	3.0817
Strong Asset Allocation	0.0940	0.4596	0.5722	3.8833	4.4710
T. Rowe Price Balanced	0.1140	0.3508	0.1904	5.8195	6.2880
Value Line Income	0.0930	0.3628	0.7866	3.8326	4.3956
Vanguard Asset Allocation	0.1330	0.3040	0.2384	7.8637	8.6939
Vanguard Wellington	0.1340	0.3390	0.1393	8.0460	8.8432
Mean	0.1158	0.3793	0.3070	6.4763	7.0884

funds where the outright investment exceeds the nondeductible IRA, the mean p_o is 0.0083 and the mean p_{cg} is 0.4003. For the remaining five funds, where the nondeductible IRA accumulation is greater, the mean p_o is 0.0956 and the mean p_{cg} is 0.8698.

In Table 5, we show the accumulations for investments in ten randomly-selected growth mutual funds. The mean dividend distribution (p_o = 0.0699) is slightly larger than for the aggressive growth funds. However, the mean capital gain distribution (p_{cg} = 0.4423) is considerably smaller than for the aggressive growth funds. The accumulation in the outright investment exceeds that in the nondeductible IRA in only two of the ten funds. For the two funds where the outright investment exceeds the nondeductible IRA, the mean p_o is 0.0258 and the mean p_{cg} is 0.2323. For the eight funds, where the nondeductible IRA accumulation is greater, the mean p_o is 0.0809 and the mean p_{cg} is 0.4948.

Next we examine ten randomly-selected growth and income mutual funds. The mean dividend distribution (p_o = 0.2046) is much larger than for the aggressive growth funds or for growth funds. As shown in Table 6, the outright investment exceeds the nondeductible

IRA for only two of the ten mutual funds. For the two funds where the outright investment exceeds the nondeductible IRA, the mean p_o is 0.1454 and the mean p_{cg} is 0.0379. For the remaining eight funds where the nondeductible IRA accumulation is greater, the mean p_o is 0.2194 and the mean p_{cg} is 0.5575.

Finally, as shown in Table 7, the accumulation in the outright investment does not exceed the accumulation in the nondeductible IRA for any of the balanced mutual funds. This was expected since a large portion of the returns for balanced funds is dividend income that is taxed currently and at the ordinary income tax rates. The dividend distributions (mean $p_o = 0.3793$) for this group of funds is much higher than for the other three groups of funds we examined. Also, the capital gain distributions (mean $p_{cg} = 0.3070$) remains fairly high.

VI. CONCLUSIONS AND LIMITATIONS

The Taxpayer Relief Act of 1997 created the new Roth IRA, adding another retirement investment alternative. We compare the Roth IRA to the deductible IRA and conclude that where an individual remains in the same ordinary income tax bracket when the investment is withdrawn as when the investment is made, the two types of IRAs will accumulate like amounts. On the other hand, an individual who expects to be in a lower tax bracket after retirement will accumulate a larger after-tax amount through a deductible IRA while an individual who expects his or her tax bracket to decrease after retirement will accumulate a larger after-tax amount in a Roth IRA. However, it should be emphasized that while both types of IRAs allow a maximum annual investment of $2,000, the investor in a deductible IRA has only a net investment of one minus his or her marginal tax rate times the investment. Therefore, the Roth IRA generally allows an individual to shelter a greater amount.

We also compare the tax-favored IRAs (Roth IRA and deductible IRA) to a nondeductible IRA. The tax-favored IRAs allow an investor to accumulate a greater after-tax amount than does the nondeductible IRA. However, many high income taxpayers do not qualify for either the deductible IRA or the Roth IRA. Therefore, the nondeductible IRA remains a viable investment alternative for high income taxpayers. As an alternative to a nondeductible IRA, an individual may make an outright investment in a mutual fund. The analysis to compare an outright investment in a mutual fund to a nondeductible IRA (also invested in a mutual fund) is more difficult. Randolph (1994) demonstrates that the nondeductible IRA outperforms the outright investment. However, he makes no distinction between ordinary income and capital gains. We extend his research to show that differential tax rates between ordinary income and capital gains affect the performance of the investments. Mutual funds having little or no income distributions accumulate larger amounts when held outright instead of in a nondeductible IRA. The greater the differential in the ordinary tax rate and capital gain tax rate, the greater the likelihood that this will occur. Our research is very timely because Congress has recently reduced the tax rate on long-term capital gains from 28% to 20% and the rate is scheduled to be decreased to 18% in 2001. Investors who want to examine the effect of the change in the long-term capital gain tax rate may do so with our model which allows an investor to change any of the parameters, such as the long-term capital gain tax rate, and compare after-tax accumulations of the two investments.

We have presented a model that aids an investor in comparing an outright investment in a mutual fund with an investment in the same mutual fund through a nondeductible IRA. The model incorporates the investor's ordinary income tax rate and long-term capital gain tax rate. However, a limitation in tax planning is that future income tax rates cannot be predicted with certainty. Also, the investor is uncertain about future dividend distributions, capital gain distributions, and per share values of mutual funds. Therefore, the investor must make his or her decision based on imperfect information.

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