FINANCIAL SERVICES REVIEW

Financial Services Review 16 (2007) 41–54

The effect of credits on optimal tax-deferral strategies

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Abstract

This paper examines how the Saver's Tax Credit changes optimal tax-deferral choices of individuals. We identify optimal tax-deferral strategies in the presence of tax-deferral credits and changing tax regimes. We also develop equations for the rate of return at which investors will be indifferent between taxed and tax-deferred investment. The results indicate that tax credits and the timing of future tax changes have a large impact on optimal tax-deferral choices. Individuals can use the results presented here to make more informed tax-deferral choices. The results also provide insight into optimal individual behavior when employers match pension contributions. © 2007 Academy of Financial Services. All rights reserved.

JEL classification: D14

Keywords: Tax deferral; Retirement planning; Individual retirement account

1. Introduction

Investors develop portfolios to help them achieve their financial goals. Achieving an optimal portfolio helps the individual enhance returns while reducing risk. However, finding this optimal portfolio is no simple task. Individuals must select from an endless list of investment candidates including stocks, bonds, and real estate to achieve an optimal portfolio for their circumstances. Complicating the optimal portfolio choice is the decision of the optimal method of holding investments. Tax-deferred investments have become a popular method of saving for retirement goals. About 45 million U.S. households (40.4% of U.S.

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households) have some Individual Retirement Account (IRA) holdings (Holden, Ireland, Leonard-Chambers, & Bogdan, 2005). Holden and VanDerhei (2006) note that about $2.8 trillion are invested in 401(k)s and $3.7 trillion are invested in IRAs. Given the important role of tax-deferred investments in the economy, it is important to analyze the many issues associated with making these investments. Portfolio optimization is the subject of a plethora of academic articles. In this paper, we extend the literature by examining how tax-credits affect the decision to make tax-deferred investments.

Tax considerations have a large impact on the optimal portfolio of an individual. By postponing the payment of taxes, an individual has more money to invest. Individuals pay taxes on these funds when they remove them from the retirement account. If the individual faces reduced taxable income in his retirement years, the individual also benefits by shifting income to a lower tax rate. Despite the attractiveness of tax-deferred investments, Jalbert, Rask and Jalbert (2007) have identified four potential risks associated with tax-deferred investments. The first risk is that losses on investment in a deferred account are not deductible against current income. This is in contrast to non-deferred accounts where losses are tax deductible against current income.[1] The second risk is that the individual needs access to the funds before reaching age 59.5 years, requiring payment of an early withdrawal penalty. The third risk is an increase in tax rates between the time of deposit and withdrawal, resulting in deferral to a higher tax rate. The fourth risk is that the individual's income increases to the extent that it moves the individual to a higher tax bracket. This paper is primarily concerned with the risk of fluctuating tax rates and changing tax brackets.

Marginal tax rates have taken on widely varying values throughout the history of the U.S. Wilson and Jordan (2002), provide a historical analysis of the highest marginal tax rates in the U.S. from 1913 through 2002. We use data provided by Wilson and Jordan (2002), supplemented with data from federal tax tables after 2002, to create Fig. 1. Fig. 1 shows the highest marginal tax rate for individuals started at 7% in 1913 and gradually increased to 94% by 1944. The rate declined to 28% by 1988 then gradually increased to 39.6% by 1993. After 1993, the rate declined to 35% in three steps where it remains at the time of this writing. The highest marginal tax rate remained at or above 70% during the entire 44-year period between 1936 and 1980. This historical evidence clearly shows instability in marginal tax rates throughout the history of the United States. Given this historical tax rate instability, we expect that investors have differing views about the future course of tax rates. Each individual uses their own estimate of future tax rates to determine if tax deferral is an optimal choice given their personal financial circumstances.

The decision to defer taxes became more complicated in light of recent tax credit legislation. In 2001, Congress passed the Economic Growth and Tax Relief Reconciliation Act (EGTRR) to promote the retirement savings of lower income workers. The Saver's Tax Credit of the EGTRR is available to individuals whose taxable income does not exceed $50,000. The non-taxable credit is available to those eligible individuals who contribute to a traditional or Roth IRA, a 401(k), 403(b), governmental 457, a SEP, or a SIMPLE plan. Additionally, individuals must be taxpayers who are at least 18 of age before the end of the taxable year, not classified as full time students, and not claimed as a dependent on another individual's tax return to qualify for the credit.

The Saver's Tax Credit is limited to a maximum contribution of $2,000 per individual and

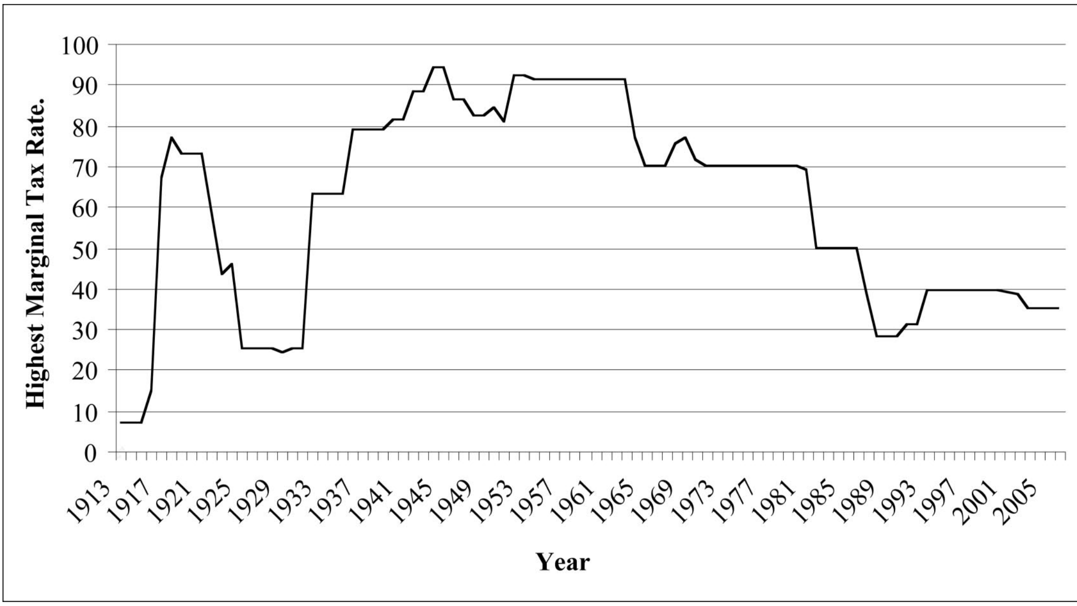

Fig. 1. The history of United States marginal tax rates from 1913 through 2006.

is dependent on the individuals filing status. Table 1 shows the credit rate percentages allowed for various filing status under the code for the 2005 tax year. For example, a married couple that has earned a combined taxable income of $35,000, each having contributed $2,000 to an IRA account, will receive a credit of $400 (10% of $4,000) against their federal income tax. This bonus is in addition to reducing the couple's taxable income by $4,000. Clearly, the credit is a strong motivation for individuals to place income into qualifying accounts.

As originally enacted, the retirement tax credit was subject to three important limitations, in addition to those noted above. First, Congress enacted the EGTRR as a temporary measure. Many of the provisions of the EGTRR were originally set to expire in 2010. The Savers Tax Credit however, was set to expire in 2006. The second limitation is that the tax credit is nonrefundable. That is, the credit can only be used to reduce taxes that an individual

Table 1 Tax credit rates

Savings credit guidelines			
Single, married filing separately, or qualifying widow(er)	Married filing jointly	Head of household	Tax credit rate
Up to $15,000	Up to $30,000	Up to $22,500	50%
$15,001 to $16,250	$30,001 to $32,500	$22,501 to $24,375	20%
$16,251 to $25,000	$32,501 to $50,000	$24,376 to $37,500	10%
Above $25,000	Above $50,000	Above $37,500	0%

Note: This table shows the Saver's Tax Credit percentage rates allowed for various filing status under the tax code for the 2005 tax year. The credit applies up to a maximum contribution of $2,000 per individual.

is scheduled to pay. Thus, individuals with low incomes may not be able to realize the full benefit of the credit noted in Table 1. The third limitation is that distributions from retirement plans may affect an individual's eligibility for the credit. The Pension Protection Act of 2006 (PPA), signed into law by President Bush on August 17, 2006, made permanent the Saver's Tax Credit. In addition, for tax years after 2006, the PPA extended the provisions of the EGTRR by indexing the adjusted gross income amount used to calculate the credit to inflation. The PPA did not change the second and third limitations of the credit noted above.

The question addressed in this paper is the extent that these credits make tax-deferred investment desirable when it previously was undesirable. Although the focus in this paper is on tax credits, the analysis is also applicable to analyzing 401(k) contributions with an employer matching contribution. In the case of a contribution match, the employer provides the credit as opposed to the U.S. taxpayer. The findings in this paper will help investors make better decisions about tax deferral. In addition, the results will provide lawmakers a quantifiable measure of how the tax credit motivates various individuals. Armed with this information, Congress might elect to make modifications to the credit. In Section 2, we discuss the relevant literature. In Section 3, we discuss the methodology used and the results. Finally, Section 4 provides some concluding comments.

2. Literature review

A number of articles have examined the desirability and effects of tax deferral. However, no known academic research has specifically examined how the recently enacted tax-deferral credit influences these decisions. Thus, we discuss the general literature in the tax-deferral area. Horan, Peterson and McLeod (1997) analyze the extent to which declining marginal tax rates affect tax-deferral choices. They find that increases in marginal tax rates favor taxable investments and decreases in marginal tax rates favor nondeductible investments in the presence of constant marginal capital gain rates. Burgess and Madeo (1980) consider tax withdrawal penalties in their break-even investment horizon computations.

Randolph (1994) finds that IRAs perform better if invested in high turnover, high distribution mutual funds and the inverse holds true for taxable investments. Crain and Austin (1997) improve on Randolph's work by taking into account differences in capital gains and ordinary income tax rates. They find that deductible IRAs are more favorable for individuals who expect to be in a lower tax bracket upon retirement, while Roth IRAs are more favorable for those expecting to be in a higher tax bracket upon retirement. This finding is particularly interesting when taken together with the findings of Bernheim, Skinner and Weinberg (1997) that individual incomes drop by approximately 36% after retirement.

Krishnan and Lawrence (2001) introduce a "break-even tax rate," the tax rate at withdrawal where alternate investments will produce the same future value for a given investment horizon and rate of return. That is, the tax rate that would make the individual indifferent between investing in a taxable and tax-deferred account. They conclude that investors will benefit from deductible IRAs if they are in a low tax bracket at the time of the first withdrawal and Roth IRAs if they have longer investment horizons.

Horan and Peterson (2001) improved on the Horan, Peterson and McLeod (1997) model.

They assume the investment of tax savings in taxable investments, and allow for changes in tax brackets. They find that IRAs perform better if individuals invest the tax savings in instruments taxed at capital gain levels. Horan (2002) extends his prior work by introducing valuations based on annuitized patterns instead of single cash flow withdraws. Sibley (2002) uses capital investment theory to develop a more complex model to assist individuals' in valuing their asset mix. Specifically, he determined the current non-deferred tax dollar equivalent of assets held in tax-deferred retirement accounts.

Jalbert et al. (JRJ) (2007) analyze the attractiveness of contributing to tax-deferred and non-deferred accounts in times of fluctuating tax rates. They note that the decision to defer taxes is dependent upon the current and future tax rates of the individual, the amount of time until the withdrawal of funds from the account, and the rate of return that the individual earns on his investments. In addition, differing ordinary and capital gains tax rates complicate the decision. They introduce the concept of an indifference return on investment (IROI), the rate of return at which the investor is indifferent between deferring taxes and not deferring taxes. They provide tables and formulas for computing the indifference rate of return at various current and future tax rates, as well as for different times to retirement. To complete their analysis, JRJ (2007) make three assumptions about the future courses of tax rates. The first assumption is that taxes will make a permanent one-time shift in the year following the investment and remain at that new level through the retirement years. The second assumption is that taxes will make a permanent one-time shift, after earning the last amount of interest, but before the removal of funds from the account. The third assumption, which requires a solver program for a solution, involves a gradual shift from the current tax rate to some new tax rate.

JRJ (2007) define *TOf* to be the future ordinary income tax rates, *TC* the current tax rate of the investor, *TGf* the future tax rate of the investor on non-deferred income and *n* the number of years until retirement. With these definitions JRJ (2007) model the IROI of an investor by the following equations for tax assumptions one and two respectively:

$$IROI = \frac{\left(\frac{(1-TOf)}{(1-Tc)}\right)^{\frac{1}{n}} - 1}{1 - TGf - \left(\frac{(1-TOf)}{(1-Tc)}\right)^{\frac{1}{n}}} \tag{1}$$

$$IROI = \frac{\left(\frac{(1-TOf)}{(1-Tc)}\right)^{\frac{1}{n}} - 1}{1 - Tc - \left(\frac{(1-TOf)}{(1-Tc)}\right)^{\frac{1}{n}}} \tag{2}$$

Among other items, the authors note that the timing of future tax rate shifts has a large impact on the IROI. For an investor with a current tax rate of 15%, a future tax rate on non-deferred income of 20% and a future ordinary income tax rate of 25%, the timing of the tax rate shift makes a 563 basis point difference in the IROI. In addition, they demonstrate that in many instances, especially when an investor has a shorter amount of time to retirement, tax deferral is not appropriate.

The work in this paper relates most closely to the work of JRJ (2007). This paper extends the analysis of JRJ (2007) by incorporating the effects of tax credits for opening certain tax-deferral accounts. This paper also extends the work of Krishnan and Lawrence (2001), Sibley (2002), and Horan (2002). Krishnan and Lawrence (2001) solve for the break-even tax rates and investment horizons. The research in this paper extends this line of literature by identifying the break-even return on investment.

3. Methodology and results

In this paper, we extend the analysis of JRJ (2007) by incorporating the effects of tax-deferral credits when computing the IROI. Like JRJ (2007), the IROI in this case is dependent upon the current tax rate, future tax rate, and time to retirement. In addition, when tax credits are available, the IROI is dependent upon the amount of funds deferred and the amount the tax-deferral credit. As future tax rates are unknown, it is necessary to make estimations about the future course of tax rates. In a manner similar to JRJ (2007), we make three assumptions about the future course of taxes. We also demonstrate a method to solving the problem for any other future tax rate and investment horizon combinations. As such, this work is applicable to investors with any current tax rate as well as any expectation about the future course of tax rates and years to retirement. Implicit in each of the three tax assumptions outlined above is an additional assumption. We assume that investors deposit any tax credits received into a tax-deferred account. Thus, the credit also benefits from tax-deferred growth.[2]

The first tax assumption is that tax rates will make a permanent one-time shift. The shift will occur in the year following the initial investment and remain at that level through retirement. The second assumption is also that tax rates will make a permanent one-time shift. However, the second assumption is that the shift will occur after earning the last amount of interest, but before the funds have been withdrawn from the accounts. The third assumption is that tax rates will remain constant at their current level for one year. After one year, rates will increase in equal annual increments to the new higher or lower rate. These three assumptions are not exhaustive. Future research will certainly examine other assumptions about the future course of tax rates. We provide analytical tools to assist the investor in computing IROI under any other tax rate assumption not specifically solved for here. Table 2 illustrates the three tax assumptions where current tax rates in 2007 are 10% and expected to increase to 20% by 2010.

JRJ (2007), allowed for differences between capital gains and ordinary income tax rates. To simplify the analysis, it is assumed here that the capital gains and ordinary income tax rates are equal, or alternatively that all income is ordinary income. Holding the two tax rates equal simplifies the analysis, thereby allowing the reader to focus on the primary issue in this paper, the effects of tax-deferral bonuses. Although this assumption is restrictive, it is not without precedence (see Randolph, 1994). Moreover, individuals in this tax situation do

Table 2 The future course of tax rates

Year	One-time shift beginning	One-time shift end	Incremental change
2007	10%	10%	10%
2008	20%	10%	10%
2009	20%	10%	15%
2010	20%	10% (20%)	20%

Note: This table summarizes the three possible future courses of tax rates examined in this research.

indeed exist. The analysis continues by computing the IROI for each of the three tax assumptions discussed above.

3.1. One-time shift at the beginning

Recall that the first assumption is that tax rates will shift in the year following the initial investment and remains at that rate through retirement. To determine the optimal tax-deferral strategy, we compute the future values of an individual's savings as both deferred and non-deferred investments. The optimal choice is the strategy that produces the highest future value. The analysis begins by examining the tax-deferral case. The investor that defers taxes places his currently saved retirement funds in a tax-deferred account. The individual leaves the funds in this account until retirement. At retirement, the individual removes the funds from the account. Upon withdrawal, the individual pays taxes at the then prevailing tax rate. On the other hand, if the investor does not defer taxes, he or she pays taxes on the funds today, before investing the money. The investor invests the remaining funds. In addition, the investor pays taxes on earnings from the investment in each year. No taxes are due when the individual withdraws funds from the account.

Consider an investor that saves S from his current income, for retirement n years from today. The investor will receive a dollar tax credit B, on his taxes for making the deferral. The investor expects to earn a rate of return i on his investments, has a current tax rate Tc, and expects the future tax rate to be Tf. Eq. (3) equates the future value of the funds if the individual defers taxes (the left hand term) to the future value of the funds if the individual does not defer taxes (the right hand term).

$$(S + B)(1 + i)^n(1 - Tf) = S(1 - Tc)\ \{1 + [i^*(1 - Tf)]\}^n \tag{3}$$

Solving Eq. (3) for i, gives Eq. (4), the return on investment at which the individual will be indifferent between tax deferral and non-tax deferral, $IROI$, as follows:

$$IROI = \frac{\left(\dfrac{S(1 - Tc)}{(S + B)(1 - Tf)}\right)^{\frac{1}{n}} - 1}{1 - \left(\dfrac{S(1 - Tc)}{(S + B)(1 - Tf)}\right)^{\frac{1}{n}}(1 - Tf)} \tag{4}$$

Eq. (4) allows an individual to compute the IROI given his or her specific tax situation, investment horizon and tax credit percentage. An investor that expects to earn a return equal to the IROI will be indifferent about tax deferral. An investor that expects to earn a return above the IROI will be better off if he or she defers taxes. An investor that expects to earn a return below the IROI should not defer taxes. The equation is applicable to any combination of current tax rates, expected future tax rates, tax credit percentages, and time to retirement.

The following example shows the use of Eq. (4) for an investor that has contributed \$2,000 to a tax-deferred account and will receive a 50% tax credit. The current tax rate is 15%, and expected future tax rate is 25%. The investor has a five-year investment horizon. For this scenario, the solution to Eq. (4) is:

$$IROI = \frac{\left(\frac{2{,}000(1-.15)}{(2{,}000+1{,}000)(1-.25)}\right)^{\frac{1}{5}} - 1}{1-\left(\frac{2{,}000(1-.15)}{(2{,}000+1{,}000)(1-.25)}\right)^{\frac{1}{5}}(1-.25)} = -0.1874 \quad (5)$$

Thus, an individual that expects to earn a −18.74% ROI will be indifferent about tax deferral. If the individual can earn a return above −18.74%, he or she is better off by deferring taxes. If he or she earns a return below −18.74%, he or she is better off by not deferring taxes. In this case, the benefit of tax-deferred growth along with the benefit of the deferral credit exceeds the cost associated with the increase in tax rates except in the cases of extremely negative returns. This is not surprising given the large tax credit involved. The JRJ (2007) equations, which ignore the tax credit, result in indifference ROI of 10.97% for an individual in the same tax situation. Clearly, the deferral tax credit has a very large effect on the optimal strategy of an investor.

Table 3 demonstrates the computations for various combinations of tax rates and credits for an individual with 20 years to retirement. The IROI changes for varying levels of the credit. To illustrate the effects of changing credit rates, we solve the equations for 50%, 20%, 10%, and 0% credits currently allowed under the law in Panels A, B, C, and D, respectively. In instances of a 50% credit, where the current tax rate is 15% and the future tax rate is 20%, as long as the return achieved is above −8.00%, the individual is made better by tax deferral. The indifference rates of return are quite low, both for the five-year investment horizon and for the 20-year horizon examined in Table 3. Given historical average returns on the U.S. stock market of 10% to 11% (Ibbotson & Chen, 2003), the vast majority of individuals are better off by tax deferral. Only individuals with extreme expectations would elect not to defer taxes. This holds especially true for individuals with a shorter period to retirement.

Although the full analysis here is limited to the case of an individual with 20 years to retirement; in general as the number of years to retirement increases, the IROI approaches zero. For example, in the case of an individual with a 10% current tax rate and a 20% expected future tax rate with 40 years to retirement, the IROI is 0.67%, as opposed to 1.35% for the individual with 20 years to retirement. The solution also approaches zero from the negative side. For example, an individual with a current tax rate of 20% and an expected future tax rate of 10% with 40 years to retirement has an IROI of −4.37% return as opposed to the −8.39% for the same individual with 20 years to retirement.

Table 3 Indifference ROI for a one-time tax rate shift at the beginning of the investment horizon

Panel A: 50% tax credit										
Future tax rate										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−29.06	−15.06	−8.99	−5.55	−3.28	−1.64	−0.37	0.68	1.59	2.41
10	−31.73	−17.00	−10.48	−6.75	−4.30	−2.51	−1.13	0.00	0.97	1.85
15	−34.36	−18.96	−12.01	−8.00	−5.34	−3.42	−1.93	−0.71	0.33	1.26
20	−36.94	−20.95	−13.58	−9.29	−6.43	−4.36	−2.76	−1.46	−0.34	0.65
25	−39.48	−22.97	−15.20	−10.63	−7.57	−5.35	−3.64	−2.24	−1.05	0.00
30	−41.98	−25.03	−16.87	−12.02	−8.76	−6.39	−4.56	−3.06	−1.80	−0.69
35	−44.46	−27.12	−18.59	−13.47	−10.01	−7.48	−5.53	−3.94	−2.60	−1.42
40	−46.92	−29.27	−20.39	−14.99	−11.33	−8.64	−6.56	−4.87	−3.44	−2.19
45	−49.37	−31.47	−22.25	−16.59	−12.72	−9.87	−7.66	−5.87	−4.35	−3.03
50	−51.81	−33.74	−24.21	−18.28	−14.20	−11.19	−8.84	−6.94	−5.33	−3.93
Panel B: 20% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−15.48	−6.04	−2.32	−0.26	1.09	2.09	2.88	3.56	4.18	4.76
10	−19.21	−8.39	−4.02	−1.59	0.00	1.16	2.08	2.85	3.54	4.18
15	−22.82	−10.75	−5.75	−2.96	−1.13	0.20	1.24	2.11	2.87	3.58
20	−26.33	−13.13	−7.53	−4.38	−2.31	−0.81	0.36	1.33	2.17	2.94
25	−29.73	−15.54	−9.36	−5.85	−3.53	−1.86	−0.56	0.51	1.44	2.27
30	−33.05	−17.98	−11.24	−7.37	−4.81	−2.96	−1.53	−0.35	0.66	1.56
35	−36.30	−20.45	−13.19	−8.96	−6.16	−4.12	−2.55	−1.27	−0.17	0.81
40	−39.48	−22.97	−15.20	−10.63	−7.57	−5.35	−3.64	−2.24	−1.05	0.00
45	−42.60	−25.55	−17.29	−12.37	−9.07	−6.66	−4.79	−3.28	−1.99	−0.86
50	−45.69	−28.19	−19.48	−14.22	−10.66	−8.05	−6.04	−4.40	−3.01	−1.80
Panel C: 10% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−8.72	−2.02	0.53	1.95	2.89	3.61	4.20	4.72	5.22	5.70
10	−13.04	−4.56	−1.26	0.56	1.77	2.66	3.38	4.00	4.57	5.11
15	−17.19	−7.11	−3.09	−0.86	0.60	1.67	2.52	3.24	3.89	4.50
20	−21.19	−9.68	−4.96	−2.33	−0.61	0.64	1.63	2.45	3.18	3.86
25	−25.06	−12.26	−6.88	−3.86	−1.87	−0.44	0.69	1.62	2.43	3.18
30	−28.81	−14.88	−8.86	−5.44	−3.19	−1.57	−0.30	0.74	1.64	2.46
35	−32.45	−17.53	−10.90	−7.09	−4.58	−2.76	−1.35	−0.19	0.80	1.69
40	−36.00	−20.23	−13.01	−8.81	−6.03	−4.02	−2.45	−1.18	−0.09	0.88
45	−39.48	−22.97	−15.20	−10.63	−7.57	−5.35	−3.64	−2.24	−1.05	0.00
50	−42.89	−25.79	−17.49	−12.54	−9.21	−6.78	−4.90	−3.38	−2.08	−0.95
Panel D: 0% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	0.00	2.77	3.84	4.47	4.93	5.32	5.67	6.02	6.37	6.74
10	−5.14	0.00	1.94	3.02	3.77	4.34	4.83	5.28	5.71	6.15
15	−10.03	−2.78	0.00	1.54	2.56	3.33	3.96	4.51	5.03	5.53
20	−14.72	−5.58	−1.98	0.00	1.31	2.27	3.04	3.70	4.30	4.87
25	−19.21	−8.39	−4.02	−1.59	0.00	1.16	2.08	2.85	3.54	4.18
30	−23.53	−11.23	−6.11	−3.24	−1.36	0.00	1.07	1.96	2.74	3.45
35	−27.70	−14.09	−8.26	−4.96	−2.79	−1.22	0.00	1.01	1.88	2.68
40	−31.73	−17.00	−10.48	−6.75	−4.30	−2.51	−1.13	0.00	0.97	1.85
45	−35.65	−19.95	−12.79	−8.64	−5.88	−3.89	−2.34	−1.08	0.00	0.96
50	−39.48	−22.97	−15.20	−10.63	−7.57	−5.35	−3.64	−2.24	−1.05	0.00

Note: This table shows the indifference return on investment (IROI) for various combinations of tax rates and tax credits for an individual with 20 years to retirement. The computations assume a one-time tax rate shift that occurs at the beginning of the investment horizon.

A comparison of the panels in Table 3 shows how the size of the credit affects the results. For an investor with a 15% current tax rate, a 20% future tax rate, 20 years to retirement, that does not qualify for the deferral credit, the IROI is 1.54%. Although still relatively low, it is substantially higher than the −8.00% required of an individual that will receive a 50% tax credit.

3.2. One-time shift at the end

Recall that the second tax assumption is that tax rates remain constant during the years leading up to retirement, but make an abrupt shift before the investment funds are withdrawn. In this case, and following the same procedures noted above, the IROI is:

$$IROI = \frac{\left(\dfrac{S(1-Tc)}{(S+B)(1-Tf)}\right)^{\frac{1}{n}} - 1}{1 - \left(\dfrac{S(1-Tc)}{(S+B)(1-Tf)}\right)^{\frac{1}{n}}(1-Tc)} \tag{6}$$

For the investor discussed above with a 15% current tax rate, a 25% future tax rate, and a five-year investment horizon, the solution to Eq. (6) is:

$$IROI = \frac{\left(\dfrac{2{,}000(1-.15)}{(2{,}000+1{,}000)(1-.25)}\right)^{\frac{1}{5}} - 1}{1 - \left(\dfrac{2{,}000(1-.15)}{(2{,}000+1{,}000)(1-.25)}\right)^{\frac{1}{5}}(1-.15)} = -0.2558 \tag{7}$$

The result indicates that it is better to defer taxes at rates of return above −25.58%. Investors should avoid deferring taxes if their expected ROI is below −25.58%. Table 4 shows the computations of this formula for varying current tax rates and future tax rates. Panels A, B, C, and D show the solutions for 50%, 20%, 10%, and 0% tax credits, respectively. Once again, tax deferral would be optimal for all individuals, except those with extreme expectations about future tax rates and returns on investment.

A comparison of Tables 3 and 4 shows the effects of differences in the timing of a tax rate change. The evidence clearly indicates that a difference in the timing of a tax rate change has a substantial impact on the IROI. Consider an individual with a 15% current tax rate, a 20% expected future tax rate, and a 50% tax credit. If the tax rate change occurs at the beginning of the investment horizon, the IROI is −8.00%, versus −10.39% if the tax rate change occurs at the end of the horizon. The difference of 239 basis points is considerable for any investor.

3.3. A gradual shift in tax rates

Finally, we complete the analysis for the situation where tax rates make a gradual shift over time. In the above analysis, we developed specific formulas to compute the IROI. In

Table 4 Indifference ROI for a one-time tax rate shift at the end of the investment horizon

Panel A: 50% tax credit										
Future tax rate										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−29.06	−26.17	−22.86	−19.03	−14.51	−9.12	−2.53	5.71	16.36	30.72
10	−18.86	−17.00	−14.94	−12.65	−10.09	−7.18	−3.86	0.00	4.54	9.98
15	−14.86	−13.50	−12.01	−10.39	−8.60	−6.61	−4.39	−1.87	1.00	4.34
20	−12.77	−11.70	−10.55	−9.29	−7.92	−6.41	−4.73	−2.87	−0.76	1.64
25	−11.54	−10.66	−9.71	−8.69	−7.57	−6.36	−5.02	−3.53	−1.87	0.00
30	−10.76	−10.01	−9.21	−8.35	−7.41	−6.39	−5.27	−4.04	−2.68	−1.14
35	−10.26	−9.61	−8.92	−8.17	−7.36	−6.48	−5.53	−4.48	−3.31	−2.01
40	−9.95	−9.38	−8.76	−8.10	−7.39	−6.62	−5.79	−4.87	−3.86	−2.73
45	−9.77	−9.26	−8.71	−8.12	−7.49	−6.81	−6.06	−5.25	−4.35	−3.36
50	−9.71	−9.24	−8.75	−8.21	−7.64	−7.03	−6.36	−5.63	−4.83	−3.93
Panel B: 20% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−15.48	−11.40	−6.65	−1.04	5.71	13.98	24.41	37.99	56.48	83.25
10	−10.63	−8.39	−5.91	−3.13	0.00	3.57	7.68	12.48	18.19	25.11
15	−8.97	−7.43	−5.75	−3.91	−1.87	0.40	2.94	5.83	9.15	13.01
20	−8.20	−7.03	−5.76	−4.38	−2.87	−1.21	0.64	2.70	5.03	7.69
25	−7.80	−6.86	−5.84	−4.73	−3.53	−2.22	−0.78	0.82	2.62	4.64
30	−7.60	−6.81	−5.96	−5.04	−4.04	−2.96	−1.78	−0.47	0.99	2.63
35	−7.53	−6.84	−6.11	−5.33	−4.48	−3.56	−2.55	−1.44	−0.22	1.15
40	−7.54	−6.94	−6.30	−5.61	−4.87	−4.07	−3.20	−2.24	−1.18	0.00
45	−7.62	−7.09	−6.52	−5.91	−5.25	−4.54	−3.77	−2.92	−1.99	−0.96
50	−7.76	−7.28	−6.77	−6.22	−5.63	−4.99	−4.30	−3.55	−2.72	−1.80
Panel C: 10% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−8.72	−3.96	1.62	8.27	16.36	26.42	39.31	56.48	80.56	116.99
10	−6.97	−4.56	−1.87	1.14	4.54	8.42	12.92	18.19	24.47	32.14
15	−6.47	−4.85	−3.09	−1.14	1.00	3.40	6.09	9.15	12.66	16.76
20	−6.30	−5.08	−3.77	−2.33	−0.76	0.96	2.88	5.03	7.45	10.23
25	−6.27	−5.30	−4.25	−3.11	−1.87	−0.52	0.96	2.62	4.46	6.56
30	−6.32	−5.51	−4.63	−3.69	−2.68	−1.57	−0.35	0.99	2.48	4.16
35	−6.42	−5.73	−4.98	−4.18	−3.31	−2.37	−1.35	−0.22	1.03	2.43
40	−6.57	−5.96	−5.31	−4.61	−3.86	−3.04	−2.15	−1.18	−0.10	1.10
45	−6.76	−6.22	−5.64	−5.02	−4.35	−3.63	−2.85	−1.99	−1.05	0.00
50	−6.98	−6.50	−5.98	−5.42	−4.83	−4.18	−3.48	−2.72	−1.88	−0.95
Panel D: 0% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	0.00	5.71	12.48	20.64	30.72	43.48	60.23	83.25	116.99	171.49
10	−2.64	0.00	2.94	6.24	9.98	14.27	19.25	25.11	32.14	40.77
15	−3.58	−1.87	0.00	2.06	4.34	6.88	9.75	13.01	16.76	21.15
20	−4.14	−2.87	−1.50	0.00	1.64	3.44	5.45	7.69	10.23	13.14
25	−4.54	−3.53	−2.45	−1.28	0.00	1.40	2.94	4.64	6.56	8.73
30	−4.88	−4.04	−3.15	−2.18	−1.14	0.00	1.25	2.63	4.16	5.89
35	−5.19	−4.48	−3.71	−2.90	−2.01	−1.05	0.00	1.15	2.43	3.87
40	−5.49	−4.87	−4.21	−3.50	−2.73	−1.90	−0.99	0.00	1.10	2.32
45	−5.80	−5.25	−4.66	−4.03	−3.36	−2.63	−1.83	−0.96	0.00	1.07
50	−6.12	−5.63	−5.10	−4.54	−3.93	−3.28	−2.57	−1.80	−0.95	0.00

Note: This table shows the indifference return on investment (IROI) for various combinations of tax rates and tax credits for an individual with 20 years to retirement. The computations assume a one-time tax rate shift that occurs at the end of the investment horizon.

some instances, involving complex changes in tax rates, developing a simple formula may be difficult or impossible. A gradual shift in tax rates falls into this category. In these instances, it may be easier to solve for the IROI using an optimization program. The optimization program demonstrated here is Microsoft Solver as included with Microsoft Excel. To use Microsoft Solver for computing the IROI, we compute the future value of the tax-deferred and non-tax deferred cash flows for a certain number of years to retirement, current tax rate, future tax rate, deferral credit, and return on investment. Next, we compute the difference in future values. Finally, we use Microsoft Solver to vary the return on investment until the difference in future values is zero. As shown in Table 5, the results fall in between the results from the two previous analyses.

4. Concluding comments

This paper examines the extent to which tax-deferral credits affect the decision of an individual to defer taxes. Specifically, we compute the rate of return at which an investor will be indifferent about tax deferral in the presence of tax-deferral credits. The results indicate that the presence of deferral credits has a substantial impact on the optimal deferral choices of the investor. The evidence here indicates that the timing of any future tax rate changes have a substantial impact on the optimal deferral decision. Moreover, the evidence indicates that the tax credit reduces the IROI substantially. For nearly any combination of current tax rates, future tax rates, and times to retirement, deferral is optimal if the investor qualifies for the Saver's Tax Credit. If the goal is to motivate individuals to place their savings in tax-deferred accounts, it appears that the law accomplishes its objective. Future research might examine if it is possible to produce the desired motivation with a smaller credit.

Although the analysis here assumes a single deposit and that the individual removes the funds from the account upon retirement, the analysis is also relevant for individuals who wish to make multiple deposits, delay withdrawal of the funds until some time after retirement, or make multiple withdrawals. To complete such an analysis, it is necessary to compute the solution to the problem once for each deposit and withdraw combination. The findings here are also relevant for individuals considering 401(k) contributions with an employer match. To complete such an analysis, one would simply replace the tax credit with the employer-matching amount in the above analysis. Although this paper represents a step forward in understanding optimal tax-deferral choices, a number of questions remain unresolved, such as empirical tests to determine if investors behave as indicated in the above analysis. These unanswered questions suggest the need for additional research.

Notes

1 Capital losses are deductible only against capital gains and up to $3,000 in ordinary income. Investors may carry forward capital losses exceeding this limitation.

2 An alternate approach to handling the tax credit would be to assume that these funds are not tax deferred. Future research will examine this issue.

Table 5 Indifference ROI for a gradual tax rate shift

Panel A: 50% tax credit										
Future tax rate										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−29.06	−18.87	−12.64	−8.37	−5.20	−2.69	−0.62	1.17	2.78	4.28
10	−23.97	−17.00	−12.22	−8.69	−5.91	−3.64	−1.70	0.000	1.55	3.01
15	−21.18	−15.90	−12.01	−8.98	−6.52	−4.44	−2.63	−1.01	0.49	1.90
20	−19.48	−15.24	−11.95	−9.29	−7.06	−5.14	−3.44	−1.90	−0.46	0.91
25	−18.40	−14.84	−11.98	−9.61	−7.57	−5.79	−4.18	−2.71	−1.33	0.000
30	−17.70	−14.64	−12.10	−9.94	−8.06	−6.39	−4.87	−3.46	−2.13	−0.85
35	−17.27	−14.57	−12.28	−10.30	−8.55	−6.97	−5.53	−4.18	−2.89	−1.65
40	−17.04	−14.61	−12.52	−10.68	−9.04	−7.55	−6.17	−4.87	−3.63	−2.42
45	−16.96	−14.75	−12.82	−11.10	−9.55	−8.13	−6.81	−5.56	−4.35	−3.18
50	−17.02	−14.98	−13.18	−11.57	−10.10	−8.74	−7.46	−6.25	−5.08	−3.93
Panel B: 20% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−15.48	−7.78	−3.36	−0.41	1.77	3.50	4.96	6.25	7.44	8.60
10	−13.89	−8.39	−4.74	−2.08	0.00	1.71	3.18	4.50	5.73	6.91
15	−13.18	−8.87	−5.75	−3.35	−1.39	0.26	1.71	3.03	4.26	5.45
20	−12.86	−9.30	−6.57	−4.38	−2.54	−0.96	0.46	1.75	2.98	4.16
25	−12.75	−9.71	−7.28	−5.26	−3.53	−2.02	−0.64	0.62	1.83	3.00
30	−12.79	−10.11	−7.91	−6.04	−4.42	−2.96	−1.64	−0.40	0.78	1.93
35	−12.92	−10.53	−8.51	−6.77	−5.23	−3.83	−2.55	−1.34	−0.19	0.94
40	−13.14	−10.97	−9.10	−7.46	−5.99	−4.66	−3.41	−2.24	−1.11	0.00
45	−13.44	−11.44	−9.70	−8.14	−6.74	−5.45	−4.25	−3.10	−1.99	−0.91
50	−13.81	−11.95	−10.31	−8.83	−7.49	−6.24	−5.07	−3.95	−2.87	−1.80
Panel C: 10% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	−8.72	−2.64	0.78	3.06	4.75	6.11	7.29	8.35	9.36	10.36
10	−9.23	−4.56	−1.49	0.74	2.49	3.94	5.20	6.35	7.44	8.50
15	−9.63	−5.82	−3.09	−0.98	0.74	2.20	3.49	4.68	5.80	6.89
20	−9.99	−6.77	−4.31	−2.33	−0.68	0.76	2.05	3.24	4.37	5.47
25	−10.35	−7.55	−5.31	−3.46	−1.87	−0.47	0.80	1.98	3.10	4.20
30	−10.73	−8.23	−6.18	−4.44	−2.93	−1.57	−0.32	0.84	1.96	3.05
35	−11.12	−8.87	−6.97	−5.33	−3.87	−2.56	−1.35	−0.20	0.90	1.98
40	−11.54	−9.48	−7.71	−6.15	−4.76	−3.49	−2.30	−1.18	−0.10	0.97
45	−12.00	−10.09	−8.43	−6.95	−5.61	−4.37	−3.22	−2.12	−1.05	0.00
50	−12.51	−10.72	−9.15	−7.73	−6.44	−5.24	−4.11	−3.03	−1.98	−0.95
Panel D: 10% tax credit										
Current tax rate	5	10	15	20	25	30	35	40	45	50
5	0.00	3.67	5.72	7.11	8.20	9.11	9.94	10.74	11.53	12.36
10	−3.54	0.00	2.31	4.00	5.35	6.48	7.50	8.44	9.36	10.28
15	−5.41	−2.26	0.00	1.75	3.18	4.41	5.51	6.54	7.52	8.50
20	−6.65	−3.85	−1.72	0.00	1.44	2.71	3.85	4.91	5.93	6.94
25	−7.58	−5.08	−3.08	−1.42	0.00	1.26	2.41	3.49	4.53	5.55
30	−8.37	−6.09	−4.22	−2.64	−1.25	0.00	1.15	2.23	3.27	4.30
35	−9.07	−6.98	−5.23	−3.71	−2.36	−1.13	0.00	1.07	2.11	3.13
40	−9.73	−7.80	−6.14	−4.68	−3.37	−2.18	−1.06	0.00	1.03	2.05
45	−10.38	−8.58	−7.00	−5.60	−4.33	−3.16	−2.07	−1.02	0.00	1.01
50	−10.38	−9.34	−7.85	−6.50	−5.26	−4.12	−3.04	−2.01	−1.00	0.00

Note: This table shows the indifference return on investment (IROI) for various combinations of tax rates and tax credits for an individual with 20 years to retirement. The computations assume a gradual tax rate shift over the investment horizon.

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