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The Impact of Different Capital Gains Tax Regimes on the Lock-In Effect and New Risky Investment Decisions

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SYNOPSIS: Under current tax law the capital gains tax generally is due only when an appreciated capital asset is sold and may be avoided altogether at death. As a consequence, this tax rule is commonly believed to create a lock-in effect because it discourages investors from selling appreciated capital assets. It is also frequently contended that this lock-in effect deters investors from moving current investments with accrued gains into more productive and potentially riskier-return investments because such action would be subject to taxation. One criticism of the current capital gains tax, therefore, is that it may deter investors from undertaking new risky investment.

This paper reports the results of a laboratory experiment designed to assess the impact of five different capital gains tax regimes on the lock-in effect and new risky investment decisions. The different tax regimes investigated in the paper are ones that tax capital gains (1) at ordinary rates when an asset is sold, (2) at preferential rates (via a capital gains deduction) when an asset is sold, (3) at ordinary rates plus interest on any deferred tax applicable when an asset is sold, (4) at ordinary rates when an asset appreciates in value, and (5) at ordinary rates when the proceeds from an asset sale are not reinvested.

The experiment involved 64 experienced investors and a computerized task in which subjects were required to allocate points between a locked-in

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asset and a new risky asset for five independent investment games and one of two rate conditions. The different tax regimes were simulated in the games by varying the manner, rate, and timing of a management fee assessed on the subjects' capital gains. Differences in the portfolio allocations of the subjects were then compared for the five games and two rate conditions to assess the tax and risk-taking effects of the alternative regimes.

The study hypothesized that as the tax consequence of selling an asset became more unfavorable, subjects would exhibit a greater lock-in effect and would allocate a decreasing proportion of their capital to the new risky asset. In general, the results support the hypothesized relation. Subjects realized significantly fewer capital gains and allocated a significantly smaller portion of their portfolio to the new risky asset when they were charged the equivalent of a capital gains tax at the time of an asset sale than when their gains were taxed under the regimes based on appreciation in asset value or reinvestment of sales proceeds. The effects of those regimes that assessed the capital gains tax at the time of an asset sale also were mitigated when the tax rate was either reduced by means of a capital gains deduction or increased to include an interest charge on any deferred tax.

Key Words: *Capital Gains, Lock-In Effect, Investments, Taxation.*

Data Availability: *The data upon which this paper is based may be obtained from the author on request.*

THE United States has one of the few advanced economies that imposes a tax on capital gains (Price Waterhouse 1989), and there is a growing concern that this tax may discourage investment in new risky ventures. Perhaps the most frequent criticism of the capital gains tax relates to its alleged "lock-in" effect, whereby investors subject to income taxation are deterred from moving current investments with accrued capital gains into more productive and potentially riskier-return investments because they would realize their gains and be subject to taxation (e.g., Auerbach 1989; Esenwein 1988).[1] Theoretically, wealth-maximizing investors alter the composition of their portfolios when alternative investments have a higher after-tax expected yield or a more preferable risk-return combination than current holdings. The differential between the yield of the current investment and that of the alternative, however, must be of such a magnitude as to overcome the impediment resulting from the capital gains tax and other transaction costs.

With the elimination of the capital gains deduction in the Tax Reform Act of 1986, Congress enacted the largest capital gains tax rate increase in history.

[1] Although several studies have indicated that as much as 50 percent of organized venture capital commitments come from pension funds and other tax-exempt entities not affected by capital gains taxation (Poterba 1989; Venture Economics 1988), other studies have shown that private taxable investors provide on an informal basis two or three times as much funding as the organized venture capital industry (Gaston and Bell 1988; Walker and Bloomfield 1989). The economic consequences associated with the taxation of capital gains for individual investors, therefore, are potentially significant.

Congress justified this increase on the grounds of tax simplification, distributive equity, and revenue neutrality (Joint Committee on Taxation 1987). The controversial long-term effects of the change on new risky investment and Treasury revenues were assumed to be mitigated by the overall rate reduction on ordinary income (U.S. Congress 1986). These potential long-term effects, however, sparked much debate over three separate but equally important issues: The extent to which the imposition of a tax on the realization of capital gains induces a lock-in effect, whether such an effect impedes investment in new risky ventures, and whether the effect can be reduced sufficiently by lower capital gains tax rates to result in a permanent increase in Treasury revenues.

While considerable econometric research exists relating to the revenue effects of changes in the capital gains tax rate, the results of these studies indicate a wide range of estimated responses. In particular, no consensus has emerged as to whether the tax changes enacted in recent years have caused revenues to move in the same direction as the rate changes or in the opposite direction (for reviews see Congressional Budget Office 1988; Toder and Ozanne 1988). Similarly, the evidence regarding the lock-in effect and investment in new risky ventures is inconclusive due to the sensitivity of the results to the specification of the empirical models (Poterba 1989; Slemrod and Shobe 1989).

The focus of this paper is the impact of the capital gains tax on the lock-in effect and new risky investment decisions.[2] In keeping with much of the previous research, the class of assets examined is corporate common stock. However, this study departs from earlier work in that it addresses the issue at the microeconomic level through the use of an experimental economics research design (for reviews see Davis and Swenson 1988; Smith 1987). By employing such a design, the study circumvents the methodological problems encountered in econometric research of isolating the effects of economic, political, social, and tax variables on the market for risky capital and instead examines investor behavior in a controlled setting. The use of such a design, moreover, allows for the manipulation of various aspects of the capital gains tax and for a comparison of the specific impact of alternative tax regimes on the lock-in effect and new risky investment decisions.

The remainder of this paper is organized into five sections. The first section explains the tax treatment of capital gains and the potential impact of capital gains taxation on the lock-in effect and new risky investment decisions. The second section develops the theoretical framework and hypotheses of the study. The third and fourth sections describe the experimental design and results, respectively. The final section discusses the study's findings and limitations.

[2] Proponents of preferential capital gains taxation argue that new risky investment is critical to economic growth and that favorable tax treatment of capital gains is necessary to encourage such investment. In support of their position they cite the growth in venture capital commitments that occurred after capital gains taxes were cut in 1978 (e.g., Tannenbaum and Gupta 1989; Walker and Bloomfield 1989). Opponents of preferential capital gains taxation, however, claim that since 1978 private savings has declined to the lowest level since the end of World War II and that productivity growth has remained depressed. In addition, they argue that there is no evidence linking the capital gains tax with new risky investment and that investment decisions should be free of the economic distortions generated by tax law (e.g., Halperin 1989; Pechman 1989).

I. Tax Treatment of Capital Gains

Under current tax law, most sources of income are taxed on an annual basis as they are earned. Capital gains, however, generally are taxed only when realized (i.e., by sale) and may escape income taxation entirely if the underlying assets are transferred by bequest.[3] One consequence of this preferential treatment is that taxpayers with accrued capital gains are effectively allowed to receive an interest-free loan from the Treasury in the amount of their deferred tax payment simply by postponing realization. More important, however, this deferral aspect of the capital gains tax is believed to create a lock-in effect by making the realization of capital gains more sensitive than other sources of income to changes in the tax rate.

From 1922 to 1986, one device used to reduce the tax rate sensitivity associated with the capital gains tax was the capital gains deduction, whereby only a portion of the gain on a capital asset held for a specified period of time was includable in taxable income. Like other preferences in tax law, however, the capital gains deduction was subject to several criticisms. Among these were the contentions that it caused a larger erosion of the upper-income tax base and more complexity than any other tax provision. It also was claimed to encourage tax shelter activity and to distort choices among financial instruments and real assets. Arguments in favor of the deduction were that it promoted savings and investment, provided an approximate adjustment for inflation, mitigated the progressive tax effects associated with the bunching of gains in a single tax year, and contributed to economic growth by channeling resources into new risky ventures (Congressional Budget Office 1988; Joint Committee on Taxation 1989).

Evidence of a lock-in effect arising from the preferential treatment accorded capital gains is reported in numerous econometric studies. For example, studies of the impact of the capital gains deduction on the timing of asset sales have shown investors, particularly those in the higher-income brackets, to be sensitive to a tax rate differential between short-term and long-term capital gains and, as a result, to postpone sales of appreciated capital assets in order to qualify for the lower rates applicable to long-term gains (Auten and Clotfelter 1980; Fredland et al. 1968; Hinrichs 1963; Seltzer 1950). Similarly, higher-income investors also have been found to sacrifice an annual return of approximately 1.5 percent of the value of their locked-in stockholdings (Yitzhaki 1979), as well as to increase their realizations of capital gains in the presence of lower tax rates (e.g., Auten et al. 1989; Congressional Budget Office 1988; Darby et al. 1988; Gillingham et al. 1989; Jones 1989; Kiefer 1988; Lindsey 1987a, 1987b; Slemrod and Shobe 1989). These findings, however, have differed greatly with respect to both the magnitude of the lock-in effect and the impact of changes in the capital gains tax rate on Treasury revenues.

Despite evidence of a lock-in effect, the link between this effect and investment in new risky ventures is more tenuous. In principle, the lock-in effect is

[3] Although the realization requirement applies to all assets other than regulated futures contracts, foreign currency contracts, nonequity options, and dealer equity options, it primarily affects capital assets since most other assets are either trade receivables, inventory, or depreciable business assets subject to depreciation recapture.

believed to retard investment in new risky ventures by inducing investors to postpone sales of appreciated assets simply because the rate of return on these ventures is not sufficient to offset the payment of the capital gains tax. An implicit assumption underlying this argument, however, is that the proportion of an investment's return that is paid in the form of asset appreciation increases with the riskiness of the investment. The argument further assumes that investors rearrange their portfolios solely to maximize expected return. While neither of these assumptions is universally true (Kotlarsky 1988), evidence does exist to suggest that a large component of the return on new risky ventures accrues in the form of capital gains and that investors typically prefer those portfolios with the highest expected return for a given risk level (Lorie et al. 1985; Venture Economics 1988). Consequently, it is possible that the mitigation or elimination of the lock-in effect may increase the supply of capital to new risky ventures by lowering the tax costs and, hence, the expected rate of return required on these ventures.

Another argument frequently made concerning the lock-in effect and decisions regarding new risky investments is that the capital gains tax operates to lock investors into both safe and risky assets. Any impediment to investment in new risky ventures arising from the tax, therefore, is believed to be offset by the dual impact of the lock-in effect. The fallacy of this argument is that most investments in new risky ventures, if successful, become safer over time as the risk associated with the underlying assets declines. Moreover, for those investments that do become riskier and depreciate in price, the deductibility of capital losses[4] provides an incentive for investors in these ventures to sell their investment so as to receive the tax benefit of the loss. Thus, to the extent that the lock-in effect hinders the transfer of capital, it does so in a unidirectional manner from existing businesses to new risky ventures.

Notwithstanding the unidirectional impact of the lock-in effect, it is possible that several other factors may affect the relation between the effect and investment in new risky ventures. For example, investors may shun new risky investments because of the rules limiting the deductibility of capital losses (Auten 1983). Likewise, new risky investments may be avoided because the size of the required capital commitment is of such a magnitude as to preclude sufficient diversification (Gravelle and Lindsey 1988). In addition, either a psychological preference for the status quo (Thaler 1980) or a tendency to overweigh certain outcomes relative to risky prospects (Tversky and Kahneman 1986) may interact with tax considerations and affect investors' decisions to undertake new risky investments.

[4] In a given year, noncorporate taxpayers may deduct against ordinary income a maximum of $3,000 in capital losses in excess of capital gains, with losses in excess of this limitation allowed as a carryforward to future tax years. Losses from passive activities in excess of passive income generally are not deductible except against future passive income. Losses on small businesses of $1 million capitalization or less, however, are deductible on an annual basis against ordinary income of up to $50,000 for single taxpayers and $100,000 for married taxpayers filing a joint return.

II. Theory and Development of Hypotheses

To illustrate how the deferral aspect of the capital gains tax theoretically creates a lock-in effect and discourages investment in new risky assets, consider an investor subject to a proportional tax with limited deductibility of losses[5] who purchases asset x in period 0 at a price of x_0. Assuming that in period 1 the asset is valued at x_1 and has an annual expected appreciation rate of i, the before-tax expected value of the asset in period n is:

$$E(x_n)=x_1(1+i)^{n-1}. \tag{1}$$

If the investor sells x in period 1 for a new riskier asset y having an annual expected appreciation rate of j, the gain on the sale will be subject to a capital gains tax at the rate of t, leaving $x_0+(x_1-x_0)(1-t)$ after-tax to be invested in y. Assuming that prices remain constant,[6] that k is the rate of appreciation required to accept the additional risk associated with y, and that the investor wishes to maximize his or her wealth in period n, asset y will be preferred over x only when:

$$(1+j)^{n-1}>(1+i+k)^{n-1}+\frac{t(x_1-x_0)(1+i)^{n-1}}{x_0+(x_1-x_0)(1-t)}. \tag{2}$$

As shown, the ability of the investor to defer the capital gains tax causes the return on x to be inflated by the untaxed appreciation. The wealth-maximizing investor, therefore, is locked into his or her investment in x until the expected future value of each dollar invested in y, or $(1+j)^{n-1}$, is greater than the expected future value of each dollar invested in x and the risk premium required on y, or $(1+i+k)^{n-1}$, plus the expected future value of the potential capital gains tax incurred on the sale of x per dollar invested in y, or $[t(x_1-x_0)(1+i)^{n-1}]/[x_0+(x_1-x_0)(1-t)]$. Irrespective of the investor's risk preferences, this lock-in effect consequently diminishes the incentive to invest in new risky assets simply because it increases the total return required for such investment. Stated in terms of the primary research hypothesis:

H1: The deferral aspect of the capital gains tax induces a lock-in effect and decreases investment in new risky assets.

Although capital gains currently are taxed under a deferral regime similar to that illustrated above, the disincentives to trading assets inherent in such a regime could be partially or fully eliminated in one of five ways. First, a capital gains deduction could be reinstated to lessen the tax costs associated with realization. Second, an interest charge could be assessed to offset the tax benefits of

[5] The assumption of proportional taxation can be justified in light of the changes to the tax rate schedule enacted by the Tax Reform Act of 1986. This act compressed the number of individual income tax rates from 15 in 1986 to five in 1987 and two in 1988 and later years. The assumption of limited loss deductibility also can be defended on the grounds that the tax law has restricted, in one form or another, the deduction of capital losses since 1924.

[6] In theory, the price of existing and competing assets change in response to changes in the tax law and/or market environment (Kotlarsky 1988). For purposes of this paper, however, this aspect of the investment decision is held constant in order to provide a comparative test of the impact of different capital gains tax regimes on the lock-in effect and new risky investment decisions.

deferral. Third, a mark-to-market system could be employed to tax all capital gains annually as they accrue. Fourth, a rollover provision could be adopted to postpone taxation so long as the proceeds from the sale of a capital asset are appropriately reinvested. Fifth, a uniform tax rate reduction could be enacted to reduce the influence of the tax regime on capital asset sales.

While reinstatement of a capital gains deduction would continue to allow the investor to defer payment of the accrued tax until the time of realization, it also would lessen the exchange impediment associated with capital gains taxation at ordinary rates by reducing the amount of the tax liability arising from the disposition. Accordingly, a tax regime permitting a capital gains deduction of p would motivate the wealth-maximizing investor to unlock his or her gain on x and invest in y when:

$$(1+j)^{n-1} > (1+i+k)^{n-1} + \frac{t(1-p)(x_1-x_0)(1+i)^{n-1}}{x_0+(x_1-x_0)(1-t+tp)}. \tag{3}$$

Because the effect of such a capital gains deduction is to reduce the appreciation required on the new riskier asset y by $[(x_1-x_0)pt]$ as compared to that required when gains are taxed at ordinary rates, the wealth-maximizing investor consequently would be willing to invest in y at a lower expected rate of appreciation than otherwise would be the case. Stated in terms of the second research hypothesis:

H2: The inclusion of only a portion of realized capital gains in the tax base mitigates the lock-in effect arising from deferral taxation and increases investment in new risky assets.

An alternative tax regime to alleviate the lock-in effect would require that the investor pay both a capital gains tax and an interest charge on the deferred tax at the time a capital asset is transferred by sale, gift, or bequest. Because such a regime would reduce the tax benefits of deferral by obligating the investor to pay a higher effective tax the longer an asset is held, it would decrease the incentive of the investor to hold the asset solely for tax deferral purposes. The regime, therefore, would lessen the risk-return distortions otherwise prevalent under deferral taxation by forcing both existing and new assets to compete for capital on the basis of pretax returns. Referring to the previous example, if r_n is the compounded interest rate assessed on the capital gains tax deferred over n periods, the expected values of x and y in period n will be:

$$E(x_n) = x_0 + [x_1(1+i)^{n-1} - x_0](1-t-tr_n). \tag{4}$$

$$E(y_n) = [x_0+(x_1-x_0)(1-t-tr_1)]\{1+[((1+j)^{n-1}-1)(1-t-tr_{n-1})]\}. \tag{5}$$

Equating these two expressions shows that the extent to which such a regime counteracts the lock-in effect will depend upon the interest rate assessed on the deferred capital gains tax. When $r \geq i$, the wealth-maximizing investor will unlock his or her gain on x and invest in y whenever $j > i+k$. Under these conditions, the regime eliminates the lock-in effect completely. However, when $r < i$, the wealth-maximizing investor will continue to be locked into his or her invest-

ment in x until the expected future value of each dollar invested in y, or $(1+j)^{n-1}$, is greater than the expected future value of each dollar invested in x and the risk premium required on y, or $(1+i+k)^{n-1}$, plus the differential between the expected future value of the potential capital gains tax arising from the sale of x and the interest charge associated with the deferral of this tax per dollar invested in y, or $\{t(x_1-x_0)[(1+i)^{n-1}-(1+r_{n-1})]\}/[x_0+(x_1-x_0)(1-t-tr_1)]$. While the regime, therefore, might not offset the lock-in effect entirely, it nevertheless would lessen the effect by reducing the incentive to defer realization. It also would enhance the attractiveness of investment in new risky assets by decreasing the rate of appreciation required on such investment. Stated in terms of the third research hypothesis:

H3: The imposition of an interest charge at the time capital assets are transferred alleviates the lock-in effect arising from deferral taxation and increases investment in new risky assets.

In comparison to the previous three deferral regimes of capital gains taxation, neither an accrual nor a rollover regime would impose a capital gains tax on the sale of assets. As a consequence, neither regime would induce a lock-in effect. To illustrate, an accrual regime would replace the realization requirement with an annual tax assessment on all capital gains, both realized and unrealized. The expected values of x and y in period n, therefore, would be:

$$E(x_n)=[x_0+(x_1-x_0)(1-t)](1+i-it)^{n-1}. \tag{6}$$

$$E(y_n)=[x_0+(x_1-x_0)(1-t)](1+j-jt)^{n-1}. \tag{7}$$

Alternatively, a rollover regime would assess the capital gains tax only when the proceeds from the sale of a capital asset are not reinvested (i.e., consumed) or the asset is passed to others at death. Assuming that one of these events occurs in period n, the expected values of x and y under such a regime, therefore, would be:

$$E(x_n)=x_0+[x_1(1+i)^{n-1}-x_1](1-t). \tag{8}$$

$$E(y_n)=x_0+[x_1(1+j)^{n-1}-x_1](1-t). \tag{9}$$

As can be seen, because both an accrual and a rollover regime allow the investor to exchange x for y without incurring additional tax, neither regime produces a lock-in effect. However, the two regimes differ in that an accrual regime continues to prohibit the deduction of losses against past gains, whereas a rollover regime allows unlimited loss offset against past, present, and future gains. To elaborate, when gains are taxed under an accrual regime, losses sustained in the current period may be offset only against current and future gains; the carryback of such losses is disallowed. In comparison, losses sustained under a rollover regime may be offset against all gains since only the net gain or loss accrued at the time of consumption or death is subject to taxation. Under a rollover regime, therefore, the risk associated with y is reduced and the rate of appreciation required by the investor to hold y declines by some amount, identified for illustrative purposes as m. The wealth-maximizing investor subject to a rollover

regime consequently is motivated to exchange x for y when $j>i+k-m$, whereas he or she requires that $j>i+k$ under an accrual regime. Stated in terms of the fourth research hypothesis:

H4: Neither the taxation of accrued capital gains nor the tax-free rollover of realized capital gains induces a lock-in effect. However, the ability to rollover realized capital gains without tax consequence increases investment in new risky assets relative to accrual and deferral taxation.

Table 1 summarizes the major features and hypothesized effects of these five capital gains tax regimes. Not presented in the table, but also likely to influence the lock-in effect and decisions to invest in new risky assets, is the rate at which the tax is assessed. When the gain on the sale of x is subject to a high tax rate, the after-tax proceeds available for investment in y are reduced. Consequently, the investor is likely to exhibit a greater lock-in effect and an associated reluctance to commit risk-taking capital under a higher tax rate than under a lower one. Stated in terms of the fifth research hypothesis:

H5: The taxation of capital gains at higher rates produces a greater lock-in effect than lower rates and decreases investment in new risky assets.

III. Method

Subjects

The subjects were 72 investors, 61 of whom volunteered to participate based on a letter of invitation mailed to them from their CPA, financial consultant, or real estate broker and 11 of whom agreed to participate as a result of a referral from another subject. Before being invited to participate in the study, potential subjects were screened to eliminate those who did not actively invest in financial securities, real estate, limited partnerships, or small business ventures. No other restrictions were imposed.[7] The initial pool of potential subjects consisted of 112 investors, with 54 percent responding favorably to the letter of invitation. The additional 11 investors who participated in the study also were screened for similar investment activity, as well as being pretested to ensure that none had discussed the experiment in any detail with their referral source. Comparisons of the data both including and excluding these 11 subjects revealed no significant differences in the results.

The responses of eight participants were excluded from the analysis, resulting in a usable sample of 64 subjects.[8] Demographic data on the subjects indi-

[7] Since the purpose of experimental economics is to test economic theory in the abstract and not to address questions regarding the reasonableness of theory as an abstraction of the real world, the choice of subjects generally is not a critical issue (Plott 1982). In this study, investors were selected as subjects because three pilot studies conducted with individuals having various degrees of investment experience indicated that subjects who lacked real-world investment exposure were unable in many instances to distinguish between the manipulated variables.

[8] Of the eight subjects who were excluded from the data analysis, one did not complete the task, two did not respond knowledgeably to the manipulation checks, and four did not make a sufficient number of investment decisions during the experiment to provide reliable data. A final subject was excluded because he did not undertake any investment risk and, therefore, was deemed not to be representative of those investors who fund new risky ventures

Table 1
Major Features of Five Capital Gains Tax Regimes

Tax Regime	*Time of Taxation*	*Treatment of*		*Hypothesized Effect on*	
		Gains	*Losses*	*Lock-In Effect*	*New Risky Investment*
Deferral taxation at ordinary rates	Upon realization	Taxed in full at ordinary rates	Deductible against gains and limited amount of ordinary income; carryforward allowed	Strong	Weak
Deferral taxation with a capital gains deduction	Upon realization	If short-term, taxed in full at ordinary rates; If long-term, a percentage of total taxed at ordinary rates with remainder not taxed	Deductible against gains and limited amount of ordinary income; long-term losses reduced by a percentage when deducted against ordinary income; carryforward allowed	Weak	Moderate
Deferral taxation with an interest charge	Upon realization, gift, or death	Taxed in full at ordinary rates with an interest charge on the deferred tax	Deductible against gains and ordinary income with an interest credit on the deferred tax benefit	Weak	Moderate
Accrual taxation	Annually as accrued	Taxed in full at ordinary rates	Deductible against gains; carryforward allowed	Not applicable	Moderate
Rollover taxation	Upon consumption or death	Taxed in full at ordinary rates	Deductible against gains; carryback and carryforward effectively allowed	Not applicable	Strong

cated that the median age was 42 years, the median income category was $50,000–75,000, and the median net worth category was $100,000–150,000. Sixty-four percent of the subjects were male, 70 percent were married, and 82 percent held college or postgraduate degrees. All of the subjects were employed, 88 percent held jobs in business, and 53 percent were involved in the funding of small start-up enterprises.

Task

The task consisted of five investment games administered individually to the subjects via a personal computer. The subjects were free to perform the task at the time most convenient for them and were permitted to use either their own computer or one located at an office site. Implementation of the dominance, salience, and privacy precepts[9] generally required of experimental economics studies (Smith 1987) was achieved by privately awarding each subject a cash payment based on the total number of points accumulated during the five games. The amount of this payment ranged from $7.32 to $69.41, with a mean of $23.29 for an average time commitment of 110 minutes. The precept of nonsatiation, whereby a subject prefers more money to less, and the criterion of expected utility maximization (Forsythe 1986) were assumed to be satisfied.[10]

Before beginning the task, the subjects were asked to complete a pretest questionnaire designed to gather information about their personal background, work experience, annual income, and net worth. After completing this questionnaire, the subjects were asked to read the instructions to the investment games and to interact with the computer in a brief training session. At the start of each game, the subjects were given 1,000 points. They then were required to allocate these points among the six different investment options offered by two mutual funds, the ABC and XYZ Funds. As shown in figures 1 and 2, these funds were represented as circles consisting of three profitable and one or two unprofitable sectors.[11] The subjects were asked to imagine that spinners were centered on these circles, and that in each trial the result of two spins would determine which sectors were to be labeled as the ABC and XYZ Outcome Sectors.

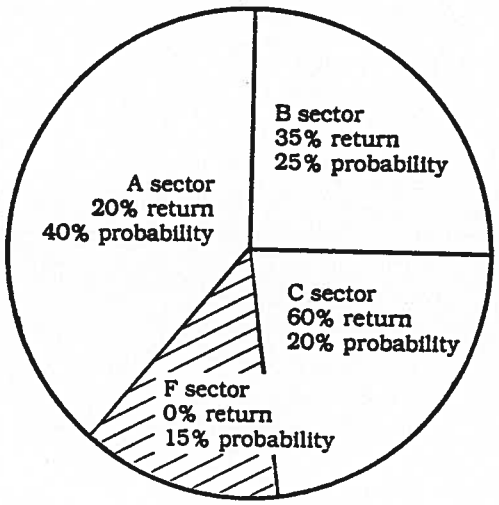
The subjects began each game with their initial 1,000 points invested in the ABC Fund. They were told that of these 1,000 points, 750 points represented accrued gain on an earlier investment of 250 points in that fund. The subjects also were informed that in each game a management fee would be levied on their gains, but that the method of assessing the fee would differ across games. Because this management fee represented the capital gains tax, the timing and rate

[9] In general, the precepts of dominance, salience, and privacy require that each subject receive a dominant reward, that this reward is linked to performance, and that no information regarding this reward is revealed to other participants.

[10] Although several tactics have been adopted to address the criterion of expected utility maximization in experiments involving uncertain reward structures, serious doubt has been cast upon the effectiveness of these methods (see Davis and Swenson 1988). Thus, many experimental economics studies have conceded the unobservability of subject utility functions and assumed that subjects behave so as to maximize expected utility.

[11] Four to five sectors having various risk and return characteristics were included within each fund to allow for differences among subjects in risk preferences without confounding the effect of these preferences with the lock-in effect.

Figure 1
The ABC Fund Circle



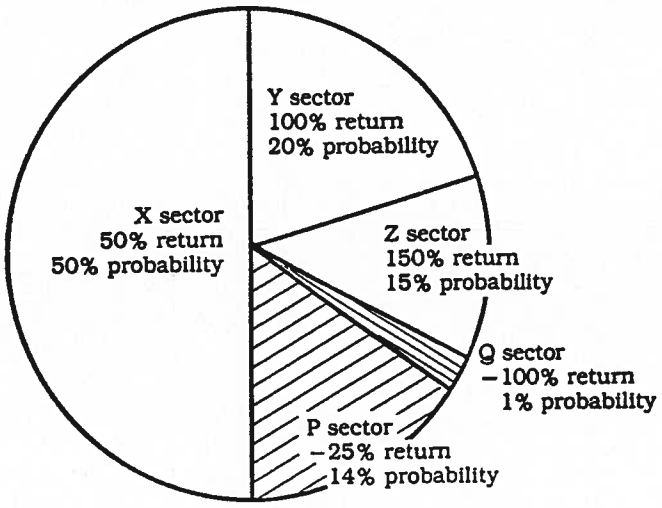
When the ABC Outcome Sector is "A," those points allocated to the A sector earn a 20 percent return, while those points allocated to the B and C sectors earn a ten percent return. When the ABC Outcome Sector is "B," those points allocated to the B sector earn a 35 percent return, while those points allocated to the A or C sectors earn a ten percent return. When the ABC Outcome Sector is "C," those points allocated to the C sector earn a 60 percent return, while those points allocated to the A or B sectors earn a ten percent return. When the ABC Outcome Sector is "F," none of the points allocated to the ABC Fund earns a return.

at which it was assessed varied with each game in order to capture the key aspects of the five tax regimes under investigation. However, to avoid biasing the subjects with respect to the research issues addressed by the study, as well as to reduce the likelihood of contaminating the results with the effects of the subjects' predispositions toward taxation, no information was disclosed concerning the disguised nature of the tax.

The format of each game was the same. Before each spin, the computer prompted the subjects to determine if they would like to transfer points from either the ABC or XYZ Fund. If a subject responded positively, he or she was queried as to the amount of the transfer and was shown any management fee that would result from such action. The subject then was given an opportunity to cancel the transfer or to change the number of points involved. Following the decision to transfer points, the subject was asked to allocate his or her points among the six profitable sectors of the two funds. This allocation procedure also provided the subject with several opportunities to cancel prior decisions. However, once the subject was satisfied with the composition of his or her portfolio, all decisions were finalized and the ABC and XYZ Outcome Sectors were randomly selected and displayed on the screen. The subject's current earnings, cumulative gains, and total points also were displayed at this time.

Although the subjects were told that each of the five investment games

Figure 2
The XYZ Fund Circle



When the XYZ Outcome Sector is "X," those points allocated to the X sector earn a 50 percent return, while those points allocated to the Y and Z sectors earn a 20 percent return. When the XYZ Outcome Sector is "Y," those points allocated to the Y sector earn a 100 percent return, while those points allocated to the X and Z sectors earn a 20 percent return. When the XYZ Outcome Sector is "Z," those points allocated to the Z sector earn a 150 percent return, while those points allocated to the X and Y sectors earn a 20 percent return. When the XYZ Outcome Sector is "P" or "Q," 25 or 100 percent, respectively, of the points allocated to the XYZ Fund are lost.

would consist of seven to ten randomly determined trials, they were allowed to terminate a game at the end of any trial. Before the subjects made such a decision, however, they were shown the amount of any management fee that would be assessed, as well as the effects of this decision on their ending points and cash payment. After finishing all five games, the subjects were asked to answer a post-test questionnaire. This questionnaire was used to assess the effectiveness of the manipulated variables, as well as to ensure that the experimental economics precepts of dominance, salience, and privacy were satisfied. Responses to this questionnaire indicated that 92 percent of the subjects considered their cash payment to be adequate (dominance), 84 percent perceived their cash payment to be related to performance (salience), and 95 percent had no knowledge of another subject's cash payment (privacy). Questions designed to assess the precept of nonsatiation and the criterion of expected utility maximization were not included on this questionnaire since, as previously discussed, these aspects of the experiment were assumed to be satisfied.

While the experimental task was, by necessity, an oversimplification of tax reality, several features were incorporated into the design to increase the validity of the results. First, to provide the subjects with an economic incentive to unlock their investment in the ABC Fund, the expected return at the end of each game was always higher if in the first trial the subjects transferred their entire 1,000

points from the ABC Fund to the XYZ Fund than if they left their points in the ABC Fund. Second, to allow the subjects to unlock their gains without reinvesting the proceeds, each game could be terminated at the end of any trial. Third, to mitigate end-of-game effects, the subjects were not told when a game would terminate but instead were informed that each game would end after seven to ten trials. Although this range was selected on the basis of pilot studies in which subjects were found to stabilize their point allocations after six trials,[12] it also corresponded closely with data on the average holding period of common stocks and venture capital investments (Kiefer 1988; Perez 1986).

To simulate historical differences between the yields on locked-in and new risky assets, the returns offered by the six sectors of the two funds were based on actual data. More specifically, the returns generated by the ABC Fund, which represented a locked-in asset, were based on the returns of the 65 stocks comprising the Dow Jones indices during the seven-year period from 1980 to 1986. Similarly, the returns produced by the XYZ Fund, which represented a new risky asset, were derived from the returns on the three largest publicly held venture capital investment companies in existence during this same seven-year period. Additional details regarding the returns on the two funds are presented in the Appendix.

Independent Variables

The independent variables in this study were two rate conditions and five tax treatments. The rate conditions were manipulated using a between-subjects design, with subjects randomly assigned to either a 50 or 30 percent management fee condition.[13] These two rates were selected to correspond with the maximum federal tax rate on ordinary income before and after the Tax Reform Act of 1986. Maximum rates were used rather than average rates since realizations of capital gains historically have been concentrated among upper-income groups (Congressional Budget Office 1988; Reischauer 1989). State and local taxes were ignored because of the wide variation in the taxation of capital gains at these levels.

To control for individual risk preferences, the tax treatments were manipulated using a within-subject design. This design required subjects in both rate conditions to make investment decisions under five methods of assessing a management fee on their gains. The five methods were structured to represent the alternative capital gains tax regimes previously discussed and were received by each subject in random order.

Deferral treatment at ordinary rates. At the time points were transferred from one fund to another, a 50 or 30 percent management fee was assessed on that portion of the gain, net of losses, allocated to the new fund (i.e., the realized gain). Gains accrued but unrealized at the end of the game were not assessed a management fee. However, a decision to end the game early triggered the man-

[12] Data from the actual experiment also indicated that the subjects stabilized their point allocations within the first seven trials of each game.

[13] Although the 50 or 30 percent rate used is considerably higher than that of a typical management fee, most subjects did not indicate on the posttest questionnaire that the rates were objectionable or unrealistic.

agement fee on the total amount of accrued gains in both funds. Losses sustained on the XYZ Fund were allowed to offset gains on the ABC Fund only to the extent that they were transferred to that fund. Losses transferred to the ABC Fund in excess of current gains were carried forward and offset against subsequent realized gains. Unused loss carryforwards expired at the end of the game.

Deferral treatment with a capital gains deduction. The treatment of gains and losses was the same as under deferral treatment at ordinary rates, except that the management fee was reduced by 60 percent to a 20 or 12 percent rate when the realized gain resulted from points that had been invested in a particular fund for two or more trials (i.e., long-term gain). Similarly, when a loss resulted from points that had been invested in a given fund for two or more trials (i.e., long-term loss), it was permitted to offset only long-term gains in full; the offset amount was reduced by one-half for short-term gains. This use of a 60 percent deduction and two-for-one loss offset was based, with some modification, on the rules governing the taxation of long-term capital gains and losses prior to the Tax Reform Act of 1986.[14] The determination of which points were transferred was made on a FIFO basis.

Deferral treatment with an interest charge. With three exceptions, the treatment of gains and losses was the same as under deferral treatment at ordinary rates. First, to reflect both an ordinary management fee of 50 or 30 percent and an interest charge on this deferred fee approximately equivalent to the ten percent minimum positive return available on the ABC Fund, the management fee was levied at an increasing rate according to the number of trials over which the gain was accumulated. Second, to simulate the elimination of the transfer at death provision, the management fee was assessed on both gains realized during the game and gains accrued but unrealized at the end of the game. Third, to allow for an interest credit on realized losses, any losses transferred from the XYZ Fund to the ABC Fund were multiplied by the rate applicable to the holding period of the lost points, and this amount was treated as an offset against management fees otherwise due in future trials.

Accrual treatment. At the end of each trial of this game, a 50 or 30 percent management fee was assessed on the gains, net of losses, earned during that trial. Losses in excess of current gains were carried forward and offset against subsequent gains. Unused loss carryforwards expired at the end of the game.

Rollover treatment. In the final trial of this game, a 50 or 30 percent management fee was assessed on the gains, net of losses, earned over the entire course of the game.

Dependent Variables

The first of the dependent variables, the lock-in effect, was measured as the sum of the ratios of a subject's unrealized gains on the ABC Fund to his or her cumulative realizable gains on that fund. Realizable gains were defined as all

[14] Although the tax law governing the deductibility of long-term capital losses sustained prior to 1987 permitted such losses to be offset in full against short-term gains and on a two-for-one basis against ordinary income, this provision was modified to require a two-for-one offset against short-term gains since the experimental task did not include ordinary income.

accrued gains on the ABC Fund that were available for realization by the subject during each of the first seven trials of a game or during those trials preceding a bankruptcy. Unrealized gains were those realizable gains on the ABC Fund that the subject had not yet realized either by means of a transfer to the XYZ Fund or by a premature termination of the game.

Measures of this variable ranged from zero to 700, with a maximum value of 100 in any given trial. When a subject transferred all of his or her points to the XYZ Fund in the first trial of a game and subsequently did not reinvest in the ABC Fund, the lock-in effect was measured as zero. Conversely, when a subject did not transfer any points to the XYZ Fund during a game, the lock-in effect was measured as 700. When a subject ended a game early, the unrealized gain on the ABC Fund was deemed to be zero for each of the trials subsequent to the termination.

The second dependent variable, new risky investment, was measured as the sum of the ratios of a subject's points allocated to the XYZ Fund to his or her total available points. As with the variable representing the lock-in effect, this measure was determined on the basis of the subject's first seven trials of a game and ranged from zero to 700. A measure of zero occurred when a subject did not allocate any points to the XYZ Fund during a game, whereas a measure of 700 resulted when a subject allocated all of his or her points to the XYZ Fund during each trial of a game. When a subject ended a game early, the number of points allocated to the XYZ Fund was deemed to be zero for each of the trials subsequent to the termination. An example of the calculation of the two dependent variables is presented in table 2.

Although it was anticipated that an inverse relation would exist between the two dependent variables, such a relation was not imposed on the variables by the experimental task. For example, by allowing the expected returns on the ABC and XYZ Funds to differ both between funds and among investment sectors, gains accrued on one fund could accumulate disproportionately to gains on the other fund. Likewise, by permitting substantial gains and losses to occur in the XYZ Fund, subjects who wished to preserve past earnings or maximize future earnings could modify their portfolio midway through a game so as to alter their risk-taking position but not their lock-in position. Finally, by allowing each game to be terminated early, if so elected, subjects could unlock all of their accrued gains without reinvesting in either fund.

IV. Results

Because the data consisted of several measures obtained from the same subject, a repeated-measures ANOVA using either univariate or multivariate procedures was appropriate. While both of these approaches result in the same test of the between-subjects effect, they differ in their tests of the within-subject effects. Tests of the assumptions underlying the two approaches indicated that all but the sphericity assumption of the univariate ANOVA were satisfied by the data. Accordingly, to avoid any positive bias in the *F*-statistics that might have resulted from this violation, the within-subject effects were tested using a multivariate approach based on Wilks's lambda criterion.

Table 2
Numeric Example of the Variables Representing the Lock-In Effect and New Risky Investment

Panel A. Measurement of the Lock-In Effect:

Trial	ABC Fund Cumulative Realizable Gains	ABC Fund Realized Gains	ABC Fund Unrealized Gains	ABC Fund Unrealized Gains to Cumulative Realizable Gains
1	750	750	0	0.00%
2	750	0	0	0.00
3	750	0	0	0.00
4	750	0	0	0.00
5	1,000	0	250	25.00
6	1,250	0	500	40.00
7	1,250	500	0	0.00
Lock-in Effect				65.00%

Panel B. Measurement of New Risky Investment:

	After Transfer			
Trial	ABC Fund Points	XYZ Fund Points	Total Points	XYZ Fund Points to Total Points
1	0	1,000	1,000	100.00%
2	0	1,300	1,300	100.00
3	0	1,600	1,600	100.00
4	0	1,900	1,900	100.00
5	1,675	0	1,675	0.00
6	1,925	0	1,925	0.00
7	0	0	0	0.00
New Risky Investment				400.00%

To illustrate the calculation of the variables, consider a subject who transfers 1,000 points (750 points of gain) from the ABC Fund to the XYZ Fund in the first trial of a game. The subject subsequently earns 300 points of gain on the XYZ Fund during the first three trials of the game, but sustains a loss of 475 points on that fund during the fourth trial. In the fifth trial, the subject transfers 1,425 points from the XYZ Fund to the ABC Fund and earns 250 points of gain on the ABC Fund. In the sixth trial, the subject earns an additional 250 points of gain on the ABC Fund, but at the end of the trial decides to end the game. As shown, the lock-in effect would be measured as 65 and new risky investment would be measured as 400.

The results of the multivariate ANOVAs for each of the dependent variables indicated a significant main effect of the tax treatments ($p=0.001$), but an insignificant interaction of the tax treatments and rate conditions (see table 3). Because these findings implied that one or more of the tax treatment means differed significantly from the others, multivariate contrasts among the treatment means were conducted (see table 4). The cell means and standard deviations of the variables are presented in table 5.

Table 3
Multivariate ANOVA Tests of Differences Between-Subjects in the 30 and 50 Percent Rate Conditions and Within-Subject for the Five Tax Treatments

Source	*df*	*Sum of Squares*	*Wilks's Lambda*	*F-statistic*	*p-value*
Panel A. Dependent Variable is the Lock-In Effect:					
Between-Subject:					
Tax rate	1	191,960		1.86	.178
Error	62	6,401,316			
Within-Subject:					
Tax treatment	4	2,447,511	.379	24.14*	.001
Interaction of tax treatment with tax rate	4	87,103	.893	1.76*	.148
Error	248	4,248,918			
Panel B. Dependent Variable is New Risky Investment:					
Between-Subject:					
Tax rate	1	405,994		4.23	.044
Error	62	5,944,489			
Within-Subject:					
Tax treatment	4	1,935,869	.417	20.59*	.001
Interaction of tax treatment with tax rate	4	41,954	.974	.39*	.817
Error	248	5,160,090			

* *F*-statistic based on Wilks's lambda criterion with $df_e = 59$.

With respect to hypothesis H1, the multivariate contrasts revealed that the deferral treatments induced significantly larger mean measures of the lock-in effect ($p=0.008$) than the rollover and accrual treatments, but significantly smaller mean measures of new risky investment ($p=0.001$). These findings support hypothesis H1 and suggest that when investors with accrued gains are allowed to defer payment of the capital gains tax simply by postponing realization, the mobility of capital is impaired and a tax bias against new risky ventures results.

Support for hypotheses H2 and H3 also was provided by the multivariate contrasts. Comparisons among the three deferral treatments showed significantly smaller mean measures of the lock-in effect ($p=0.001$) and correspondingly larger mean measures of new risky investment ($p=0.009$) for the treatments involving the capital gains deduction and interest charge than for the treatment involving ordinary rates. No significant differences, however, were detected between the two modified deferral treatments.

One possible explanation for the lack of significant differences between the two modified deferral treatments is that the selected parameters of the two treatments were not perceived by the subjects as differentially reducing the tax bene-

Table 4
Multivariate Contrasts Between Adjacent Levels of the Five Tax Treatments

Source	Mean	Standard Deviation	df	Sum of Squares	F-statistic	p-value
Panel A. Dependent Variable is the Lock-In Effect:						
Accrual	238	173				
Rollover	284	186	1	141,695	7.79	.007
Error			62	1,128,069		
Deferral with interest charge	347	197	1	248,263	7.60	.008
Error			62	2,024,510		
Deferral with deduction	388	181	1	105,241	2.63	.110
Error			62	2,478,090		
Deferral at ordinary rates	491	193	1	687,814	28.07	.001
Error			62	1,519,416		
Panel B. Dependent Variable is New Risky Investment:						
Rollover	436	182				
Accrual	386	204	1	156,309	5.99	.017
Error			62	1,618,720		
Deferral with deduction	292	183	1	568,769	13.17	.001
Error			62	2,678,457		
Deferral with interest charge	292	188	1	17	0.00	.985
Error			62	2,793,856		
Deferral at ordinary rates	216	199	1	371,416	7.26	.009
Error			62	3,170,603		

fits of deferral. For example, the deferral treatment with the capital gains deduction encouraged an early transfer of points to the XYZ Fund by reducing the effective tax rate on such a transfer after two or more trials. In a similar manner, the deferral treatment with the interest charge also encouraged an early transfer of points to the XYZ Fund by assessing an increasingly larger effective tax rate on deferred gains. However, because the rate of the interest charge was less than the expected return on the ABC Fund, subjects still could receive some tax benefit from deferring realization. Detection of significant differences between the two treatments consequently may have required the use of a different rate for the interest charge or a different percentage for the capital gains deduction.

Regarding hypotheses H4, the multivariate contrasts indicated that the roll-

Table 5

Cell Means and Standard Deviations of the Five Tax Treatments for the 30 and 50 Percent Rate Conditions

	30% Condition		*50% Condition*	
Tax Treatment	*Mean*	*Standard Deviation*	*Mean*	*Standard Deviation*
Panel A. Dependent Variable is the Lock-In Effect:				
Accrual	244	196	232	147
Rollover	261	206	309	162
Deferral with interest charge	319	215	376	176
Deferral with deduction	345	176	431	179
Deferral at ordinary rates	459	224	524	149
Panel B. Dependent Variable is New Risky Investment:				
Rollover	458	207	412	151
Accrual	409	221	363	185
Deferral with deduction	328	189	255	172
Deferral with interest charge*	342	219	240	134
Deferral at ordinary rates	260	224	169	158

* Bonferroni *t*-test indicates significant difference between the 30 and 50 percent rate conditions at the 0.05 level.

over treatment induced significantly larger mean measures of both the lock-in effect ($p=0.007$) and new risky investment ($p=0.017$) than the accrual treatment. Although this first result was not anticipated, the latter finding supports hypothesis H4. Investors consequently may be more willing to accept risk when losses can be carried back and offset against past gains than when loss deductions are limited, as under accrual and deferral taxation. In addition, because accrual taxation reduces the after-tax return on an investment by eliminating the compounding effects available under rollover and deferral taxation, investors may be motivated to exchange assets more frequently since such trading allows them to both increase their net return and to minimize their exposure to potentially nondeductible losses.

In contrast to the above findings, hypothesis H5 was not supported by the univariate tests of the between-subjects effect. As reported in table 3, the difference between the 50 and 30 percent rate conditions was significant only for the

measures of new risky investment ($p=0.044$)[15] and not for the measures of the lock-in effect ($p=0.178$). The cell means presented in table 5, nonetheless, generally support hypothesis H5, with larger measures of the lock-in effect and smaller measures of new risky investment observed in the 50 percent rate condition than in the 30 percent condition. The sole exception to this pattern occurred for the lock-in effect in the accrual treatment, where the greater frequency with which subjects in the 50 percent rate condition terminated this game may have distorted the relation.[16] Thus, one explanation for the lack of significant findings regarding the effects of a uniform tax rate reduction is that the between-subjects design reduced the power of the analysis by treating individual differences as random error entering the error term.

Correlation tests also were conducted to investigate potential order effects. These tests revealed no significant relations between the order in which each subject received the five tax treatments and the mean measures of either the lock-in effect or new risky investment. Similarly, no significant relations were detected between the frequency with which subjects terminated each of the five games and the order in which these games had been received or the tax rate condition to which subjects had been assigned. However, significant differences were detected between the frequency of the terminations and the tax treatments ($p=0.01$). *Post hoc* multiple comparison tests further revealed that significantly more terminations occurred in the deferral treatment involving the interest charge than in either of the other deferral treatments or the rollover treatment.

To examine whether the statistical relation between the dependent variables was affected by the differential termination patterns among the tax treatments, a subset of data consisting of those 38 subjects who had not terminated any of their five games was analyzed separately. Results similar to those of the full data set were found for the within-subjects effects. However, contrary to the full data set, significant differences were detected between the rate conditions for the measures of both the lock-in effect ($p=0.035$) and new risky investment ($p=0.014$). Bonferroni *t*-tests of the variables further revealed that these differences arose in the deferral treatment with the capital gains deduction, where the mean measures of the lock-in effect and new risky investment were significantly larger and smaller, respectively, in the 50 percent rate condition than in the 30 percent rate condition. This finding provides modest support for hypothesis H5 and may indicate that investor behavior is more sensitive to changes in the tax rate at lower levels than at higher levels.

One interesting behavior observed in this study is that even though the expected returns on the ABC and XYZ Funds could be calculated and appropriate reductions made for the capital gains tax, subjects still exhibited some measure of the lock-in effect under all five tax treatments. While such behavior appears inconsistent with expected utility theory, it is understandable when interpreted

[15] Bonferroni *t*-tests indicated that the significant difference between the two rate conditions occurred only for the deferral treatment with the interest charge, where subjects in the 30 percent rate condition were found to invest significantly more in the new risky asset than those in the 50 percent rate condition.

[16] Of the games representing accrual treatment, 25.8 percent were terminated in the 50 percent rate condition versus 15.2 percent in the 30 percent rate condition.

in light of prospect theory (for reviews see Kahneman and Tversky 1984; Tversky and Kahneman 1986). As research on prospect theory has shown, individuals accept a gamble at even odds only when the possible gain from the gamble is substantially larger than the possible loss. Moreover, individuals overweigh small probabilities and underweigh intermediate and high probabilities relative to certainty. In this study, the one percent chance of incurring bankruptcy in the XYZ Fund may have been overweighed by the subjects to such an extent that they sought to diversify their points between the two funds in each game, irrespective of the rate or method of assessing the tax. However, as changes in the tax treatment increased the relative return on the XYZ Fund, subjects may have viewed the gamble more favorably and undertaken greater risk.

The endowment effect described by Thaler (1980) also may have caused subjects to exhibit some measure of the lock-in effect under all five treatments. According to this theory, individuals are biased in favor of retaining the status quo and, as a consequence, are reluctant to part from assets that belong to their endowment. Subjects in this study, therefore, may have exhibited a preference for investment in the ABC Fund because it represented the status quo.

V. Conclusions

The findings of this study suggest that the deferral aspect of capital gains taxation induces a lock-in effect and an averison to new risky investment. Mitigating these effects, however, are tax regimes that provide for a capital gains deduction, an interest charge on deferred taxes, a tax-free rollover of realized capital gains, or a periodic tax assessment on accrued capital gains. The findings regarding the effects of lower tax rates are inconclusive and imply a need for additional research to more fully examine the sensitivity of new risky investment decisions to both lower tax rates and changes in the rates.

As discussed by Davis and Swenson (1988), the advantages of experimental economics methods over field empirical techniques in public policy research are knowledge and control over the economic environment, well-defined predictions in that environment, replicability, and low cost of creating and comparing different allocative institutions. Principal among the limitations, however, is the potential lack of generalizability of results to the field. Because this study utilized an experimental economics design, several limitations exist regarding interpretation of the results. First, the results do not indicate the incidence of the lock-in effect, the degree of its influence on decisions to fund new risky ventures, or the efficiency with which different capital gains tax regimes stimulate investment in such ventures. Rather, the study simply provides qualitative evidence of a relation between the capital gains tax, the lock-in effect, and new risky investment.

Second, the results do not necessarily generalize to capital assets other than corporate common stock. As noted by Gravelle and Lindsey (1988), the lock-in effect is likely to be more pronounced for corporate common stock than other capital assets because a larger proportion of the total return on stock may be deferred and taxed as capital gain when realized. Additionally, the lock-in and risk-taking effects associated with corporate common stock may differ from those associated with other capital assets because of differences in the liquidity of the assets.

Third, the study does not address the effect of different capital gains tax regimes on the market equilibrium prices of existing and competing assets. Prices in this study were set exogenously and did not change in response to changes in the tax regimes. The results consequently do not indicate whether market adjustments in asset prices could serve to mitigate or eliminate the impact of a particular tax regime on the lock-in effect and/or investment in new risky ventures.

A fourth limitation is that the study assumes wealth-maximization as the dominant motive for undertaking new risky investment and, therefore, does not reflect the mitigating effects of nonfinancial considerations. For example, Blake (1986) reports that investors may fund new risky ventures for the opportunity to participate in a company's growth, develop a socially useful technology, or create new jobs in the community. A fifth limitation is that because the assets offered to the subjects yielded random returns, the results may include some artificial shifting that would not arise in an environment where investors are able to personally select and control their portfolios. Moreover, to the extent that investors behave differently about taxes than about charges that reflect actual services, the study's use of a disguised tax assessed in the form of a management fee may limit the generalizability of the results.

Despite these limitations, the study provides useful insights into the impact of the capital gains tax on the lock-in effect and decisions to undertake new risky investment. In particular, the study suggests that the present practice of taxing capital gains upon realization at ordinary rates is inconsistent with the tax policy goal of promoting investment in new risky ventures.[17] Any attempt to increase investment in new risky ventures by reducing the lock-in effect, however, also would need to be evaluated along several other dimensions. For example, the extent to which the limitation on the deductibility of capital losses impedes risk taking would need to be considered, as well as the effect of any tax law change on the amount and distribution of capital income and implicit taxes throughout the economy. Additional research that assesses these economic and behavioral aspects of the capital gains tax, therefore, appears warranted.

[17] Evidence that policymakers wish to encourage investment in new risky ventures can be found in the tax proposals of President Bush; Senators Armstrong, Boschwitz, Bumpers, Cranston, Heinz, Kasten, Kerry, and Symms; and Representatives Archer, Crane, Jenkins, Morrison, Rhodes, and Strangeland. Additional evidence can be found in prior legislation, such as the Revenue Act of 1978 and the Economic Recovery Tax Act of 1981.

Appendix
Returns on the ABC and XYZ Funds

Fund Sector	*Expected Return*	*Standard Deviation*	*Historical Data Source (1980–1986)**	*Annualized Return***	*Standard Deviation*
The ABC Fund			*Dow Jones Index*		
A	12.5%	7.0%	Utilities	14.5%	7.7%
B	14.8	12.2	Industrials	14.8	13.6
C	18.5	21.0	Transportation	19.6	22.1
The XYZ Fund			*Venture Capital Firm*		
X	27.5%	28.7%	Capital Southwest	25.9%	28.7%
Y	28.5	40.4	Allied Capital	28.5	40.8
Z	32.0	53.1	Greater Washington Investors	32.8	48.8

* For the seven-year period from 1 January 1980 to 31 December 1986.
** Includes reinvestment of dividends, net of 50 percent tax.

Sources: *Venture Capital Journal*. 1987. (January): 22.
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