Tax Planning and the Exercise of Employee Stock Options†

by

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This paper analyzes tax planning by holders of employee stock options and examines their response to a proposed tax rate increase. Consistent with tax planning, the frequency of exercise is greater for employees affected by the tax change than for (i) employees unlikely to be affected by the tax increase who contemporaneously held identical options, and (ii) employees with comparable incomes who held similar options in other years. Consistent with a reluctance to act in anticipation of tax law changes, less than one third of the option holders who would benefit most from exercise for tax reasons chose to exercise early.

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1. Introduction

Huddart and Lang (1996) describe the exercise behavior of over 50,000 employees who hold long-term options on employer stock at eight corporations. Among their findings is the surprising result that a dummy variable intended to capture the effects on exercise of a change in personal tax rates is not systematically related to exercise, as it should be if this change accelerated exercise across a broad class of option holders. While this suggests tax factors were not relevant to the majority of stock option exercises under study, tax factors nevertheless may contribute a great deal to the exercise decisions of certain individuals with respect to particular options, since the benefit from exercising an option prior to a tax rate change depends on both the tax position of the individual and characteristics of the option. Taking careful account of both individual tax positions and option characteristics is necessary for a thorough examination of the relationship between taxes and exercise decisions.

This study uses the detailed option grant and exercise data from four of the companies analyzed by Huddart and Lang (1996). These four companies are the only ones that also provided the 1993 salary of substantially every employee who received options. The individuals in this study have lower incomes and face less sharp distinctions between 1992 and 1993 expected tax rates than executives who are obliged to make public disclosure of their options exercises. Consequently, the sample is more useful in delimiting the significance of tax factors in decision-making than a sample comprising very high income CEOs holding options whose extreme moneyness makes early exercise an obvious choice.

First, this paper characterizes situations where changes in tax rates make it worthwhile for holders of employee stock options to accelerate option exercise to benefit from favorable tax treatment. Then the paper examines whether the exercise decisions of 30,285 employees at four corporations are consistent with an analysis of proposed tax increases that received wide press coverage in late 1992. There is a statistically significant increase in the likelihood of exercise by high-income employees affected by the proposed tax increase relative to (i) employees unlikely to be affected by the tax law change who contemporaneously held identical options and (ii) employees with comparable incomes and holding similar options in other years when no tax rate change was anticipated. The

paper further documents that less than one third of employees who would have benefited from early exercise for tax reasons alone in fact chose to exercise their options. For those employees who did not exercise early, the mean (median) expected net-of-tax value to early exercise is estimated to be $9,852, ($6,820) after-tax dollars, or about 2.5 (2.1) percent of pretax salary. This result is surprising because there do not appear to be significant frictions that prevent employees from exercising these options and realizing the tax benefit. Thus, while the paper shows tax factors to be significant in explaining exercise decisions, it also documents that many individuals did not act to mitigate the effects of anticipated tax law changes.

Huddart and Lang (1996) aside, research into tax and other determinants of employee stock exercise decisions has been hampered by a paucity of accessible data. Hamill and Sternberg (1994) classify forty-four events drawn from press accounts as either consistent or inconsistent with the tax planning motive imputed to them in the press account.[1] Four factors that cloud analysis of individual responses to a tax planning opportunity using their publicly disclosed data are absent or minimized in this study. First, capital market signaling considerations may dominate tax planning concerns for very senior executives whose option exercise activity must be publicly disclosed (Seyhun, 1992). Second, material non-public information in the hands of these executives also may affect exercise decisions. Third, data gathered from public sources do not include those who held, but did not exercise their options, so it is difficult to assess the significance of factors alleged to affect exercise decisions. Fourth, the cross-sectional variation in sample observations is limited because all individuals in their sample have very high taxable income and so face the same marginal tax rate before the tax law change and the same change in tax rate.

The sample in this paper includes all employees who held exercisable options, including those who chose not to exercise.[2] Also, the data include employees whose marginal tax rates were not anticipated to change. Furthermore, the data in this study include lower-level employees not subject to section 16 filing requirements and less likely

[1] Their classification method differs from the one used in this paper.

[2] In spirit, this study is similar to Landsman and Shackelford (1995) in that detailed non-public records of individuals' asset positions are used to measure the impact of taxation on portfolio choice in an uncertain environment.

to be in possession of material non-public information. Thus, the prevalence and magnitude of the tax effect can be established in an environment relatively uncontaminated by capital market signaling and private information.[3]

An understanding of tax planning with stock options is important on several levels. First, stock options are an increasingly common form of compensation. How, whether, and to what extent employees exercise options to reduce taxes in the face of changing tax rates affects the net-of-tax cost of such compensation to employers and the net-of-tax benefit to employees. This, in turn, informs compensation planners seeking efficient compensation structures. How, whether, and to what extent taxpayers adjust their affairs in response to proposed tax law changes is also important to tax policy makers. Knowledge of taxpayer responses to tax law proposals is necessary, for instance, to forecast tax revenues. Often, the exact nature and timing of the changes are uncertain when taxpayers must take action. This paper offers direct evidence on individuals' responses to one such proposal. One explanation consistent with low exercise frequency when the tax advantages to exercise are substantial is that employees' decision heuristics differ from the normative prescription presented here. Thus, at a more general level, the paper presents rare evidence from a natural experiment in which a large number of people are faced with similarly structured decision-problems in an uncertain environment where thousands of dollars of personal wealth are at stake.

The paper proceeds as follows: Section 2 describes the taxation of employee stock options. Section 3 describes the results. Section 4 links the results to other studies of taxes and trading decisions, and discusses some other factors that may influence exercise decisions. Section 5 concludes the paper.

[3] Prior research on the impact of taxation on personal tax planning has examined whether taxes affect decisions to realize capital gains on traded equities. The evidence is mixed. For instance, Poterba (1987) shows that few tax returns report capital gains realizations that are consistent with the tax minimization strategies identified by Constantinides (1984). While behavior is consistent with net-of-tax utility-maximizing behavior by some investors, many forgo tax reduction opportunities. The conclusions of this line of research may be muddied because the composition of individuals' portfolios is inferred (e.g., from summary tax return information) or because the decision to sell equities and thereby realize capital gains depends on a host of unmodeled or difficult-to-measure factors such as the extent of capital gains or losses realized elsewhere in the portfolio, the application of the alternative minimum tax, and the holding period.

2. Taxation of employee stock options

2.1 Change in Tax Rates

Taxation reduces proceeds from the exercise of employee stock options. Tax planning opportunities arise if tax rates vary over time or income levels. For U.S. nonqualified options, the difference between the stock price on the exercise date and the option's strike price is taxed at ordinary rates in the year of exercise. Subsequent appreciation of stock acquired by exercise of options is taxed at capital gains rates when the stock is sold. In the last decade, top federal personal tax rates have ranged between 28 percent and 50 percent. Since employee stock options often have terms of ten years, changes in tax rates potentially have an effect on the employee's exercise policy. Accordingly, we hypothesize that anticipation of the 1993 tax rate increase in late 1992 would have prompted early exercise for some employees.

2.2 Effects of tax on exercise—simple case

To highlight the effects of tax on the exercise decision, consider an employee who holds a non-qualified option. Assume the employee seeks to maximize expected terminal portfolio value. Further, assume (i) the employee's exercise decision is unaffected by interim liquidity needs, (ii) the employee has no private information about stock value, and (iii) the stock pays no dividends. Suppose marginal tax rates were about to change from t_1 to t_2, respectively. Let S be the current stock price; X, the strike; and W, the present value of the option assuming it is held to maturity (i.e., the Black–Scholes value). The employee favors exercise immediately before the tax rate change when the net-of-tax payment from exercise now exceeds the net-of-tax payoff from exercise after the tax rate increase, i.e.,

$$(S - X)(1 - t_1) - W(1 - t_2) > 0 \tag{1}$$

or,

$$\frac{S - X}{W} - \frac{1 - t_2}{1 - t_1} > 0. \tag{2}$$

Call $(S - X)/W$ the intrinsic ratio. When tax rates are not expected to change, $(1 - t_2)/(1-t_1) = 1$. When tax rates are expected to increase, $t_2 > t_1$, so $(1-t_2)/(1-t_1) < 1$. This implies exercise for lower values of the intrinsic ratio when tax rates are expected to increase than when tax rates are constant. Intuitively, if the employee exercises a deep-in-the-money short-maturity option before the tax rate increase, she captures a large fraction of the option's expected total value and benefits from having this value taxed at a low rate. The decision rule adopted by the employee in this stark setting takes the form of a ratio of the intrinsic value of the option (i.e., the current stock price less the exercise price) to the present value of the options if held to maturity. When this ratio exceeds a threshold established by the tax rate changes, early exercise is optimal. Note that the tax rates t_1 and t_2, and hence the threshold, vary from employee to employee and from year to year.

2.3 Effects of tax on exercise—complications

Dividends. The pretax present value of an option on dividend-paying stock held beyond the end of the year differs from the Black–Scholes value. Several of valuation methods exist for American call options on dividend paying stock. The method employed in this paper is to replace W in (1) and (2) with the analytic approximation developed by Barone-Adesi and Whaley (1987), hereafter BAW, for American options on dividend-paying stocks. This method presumes stocks pay continuous dividends in proportion to the stock price. Relative to the Black–Scholes value for an option paying no dividends, BAW adjust option value for the payment of dividends and the opportunity to exercise the option before expiration to capture dividends.

Risk aversion. An important feature of employee stock options is that they cannot be traded by the employee to whom they are granted. Thus, risk-averse employees may be expected to exercise options before expiration when the proceeds from exercise exceed the certain equivalent present value from holding the options (Huddart, 1994). The certain equivalent present value of holding the options is idiosyncratic to the employee and unobservable by the researcher. It is less than the present value of the option when employees are risk-averse because the option's payoff is risky. However, in the empirical

tests it is only necessary that the pretax value to the employee of holding the option past the year-end be correlated with the its proxy, namely the BAW value.

Liquidity needs. In the simplest case, it is worthwhile for the employee to exercise the option before the tax rate increase when (2) is satisfied. Idiosyncratic liquidity needs blur the stark representation of exercise behavior implied by (2). Because it is difficult for employees to transfer stock options or pledge them as security for a loan, employees who need cash may choose to exercise options coincident with a pressing personal need for liquidity.[4] These needs are unpredictable by the researcher, and so constitute a source of noise in the estimation of the tax effect. Assuming the likelihood that a liquidity need arises for a given employee is constant from year to year, the incremental exercise activity associated with the tax effect can be examined by comparing exercise activity just before a tax rate change with activity at other times.

Given the unobservability of employee-specific risk aversion and liquidity needs, the strongest empirical prediction that can be made is that the frequency of exercise increases as the left hand side of (2) increases.

Employee expectations. Another factor an employee must consider in deciding whether to exercise options is the likelihood that future tax rates will differ from current tax rates. If tax rates are unlikely to increase, then the attractiveness of early exercise is reduced commensurately. If tax rates were to rise only temporarily, so that the option expires after the temporary tax rate hike reverses, then there is no tax benefit to early exercise because the employee could postpone exercise until after the reversal.

Following the election of President Clinton on November 3, 1992, there was widespread expectation that personal income tax rates for high levels of income would increase in 1993. Option exercise by insiders putatively motivated by tax factors was widely reported in the business press.[5] But, there was still some uncertainty about the details of tax law changes for 1993:

[4] Michael S. Malone (February 18, 1996) "Nerds' Revenge: A How-To Manual" *New York Times* describes the difficulties associated with borrowing against employee stock options.

[5] In the *Wall Street Journal*, see David J. Jefferson (December 2, 1992) "Disney Officials Get $187 Million From Stock Sale"; Alexandra Peers (December 2, 1992) "Insiders Are Being Urged to Exercise Their Stock Options Before Taxes Rise"; Rhonda L. Rundle (December 3, 1992) "Mirage's Wynn Cashes In Options, Gets $23.3 Million"; Michael Siconolfi (December 11, 1992) "Street Scrambles to Beat a Likely Tax Bite"; Alexandra Peers and Jeffrey A. Tannenbaum (December 16, 1992) "Insiders Race to Exercise Stock Options,"; Alexandra Peers and Tom Herman (December 23, 1992) "The Year-End Rush is On: Corporate Chiefs Run to Exercise Stock Options Before Feared Tax Rise"; and, Georgette Jasen (December 30, 1992) "Executives Still Playing Beat the Clock with Options". None of these articles offers advice regarding the identification of options for which the capture of tax savings may offset the sacrifice of option value.

> Income taxes will be going up under President-elect Clinton and the new Congress: That's a foregone conclusion. The hows and the whens are still unclear. However, there are things you can do right now to minimize the blow to your wealth and income... None but Clinton's most believing supporters take seriously his promise to limit tax hikes to the "rich"—defined as those making over $200,000. People in this category will be hit, but so will others further down the scale.[6]

The passage above suggests there was little uncertainty whether tax rates would increase, but there was considerable uncertainty over the income level at which tax higher tax rates would apply and whether the increase would be effective January 1, 1993. Since more than one quarter of all option grants in the sample and more than half of the option grants for which the instrinsic ratio exceeds .90 expire within four years, it seems unlikely that employees could benefit from holding them until a hypothetical future tax rate reduction. Legislative proposals circulated in the last quarter of 1992 would increase the federal rate of tax for some individuals for 1993 from 31 percent to 36 percent. In addition, a 10 percent surtax would apply to individuals with high incomes. The surtax would create a top federal tax bracket of 39.6 percent. There was no suggestion that the tax rate increase would be in place for a period shorter than Clinton's term as President. Since two new tax brackets would be created, but the income cutoffs for those brackets were uncertain, one should expect the data to reflect higher rates of exercise associated with higer levels of income.

In fact, tax rates did rise effective January 1, 1993. Moreover, the tax rate rise affected more people than 1992 press reports suggested because the 36 percent bracket applied to taxable income over $115,000, and the 39.6 percent bracket (which embodied the Clinton proposal of a 10 percent surtax on millionaires) applied to taxable income over $250,000 for individuals filing jointly.

Since the Bush and Clinton election campaign platforms contained different tax proposals, beliefs about 1993 tax law changes only became concentrated on the tax rate increases in Clinton's platform following the election. Tax-motivated behavior is

[6] Lara Saunders (December 7, 1992) "Tax strategies for Clintonomics" *Forbes* p. 141.

expected to be concentrated in the period after the election and before year's end (i.e., November 4 to December 31).[7]

Deduction and exemption phaseouts. In the empirical tests, 1990, 1991, and 1993, are included as control years against which exercise patterns in 1992 are compared. Tax rate calculations after 1990 are complicated by phaseouts. Federal deduction and exemption phaseouts are difficult to estimate because they depend on the specifics of the family status and personal expenditures of employees. However, since the underlying family status and expenditure patterns are likely to be stable from one year to the next, and since the application of the phaseouts was approximately constant over the years 1991 to 1993, the impact of the phaseouts can be thought of as a shift in the marginal rate of tax faced by an individual employee. At a given level of income, the shift is approximately the same in every year. Hence, the incentive to accelerate the recognition of income is largely unaffected by the phaseouts.

One might also question the inclusion of 1990 as a control year because the Omnibus Budget Reconciliation Act of 1990 (OBRA) increased the top marginal tax rate from 28 percent in 1990 to 31 percent in 1991.[8] While the effects of deductions and exemptions vary across taxpayers, many commentators considered OBRA tax law changes to have had little effect on the marginal tax rate of taxpayers at the income levels considered in this study. Reported results are not sensitive to the deletion of observations from 1990.

State taxes. State and local taxes apply at rates that are roughly constant from year to year over the period under study. Interpreting t_1 and t_2 as federal rates, state

[7] Theory suggests a risk neutral individual should exercise the option immediately before the tax rate increase, on the last trading day of the year. Using a wider window in which to examine early exercise allows for the possibility that employees are subject to some restrictions on the dates they may exercise their options. For instance, some attorneys claim that exercising options in the period beginning on the third day following an earnings announcement and ending twenty days after the announcement reduces the likelihood that the employee could stand accused of trading based on inside information. Such considerations may cause employees to exercise on days other than last day of the year.

[8] Coincident with the tax rate increase, OBRA replaced the "bubble" that resulted in a marginal rate of tax of 33 percent for joint filers with taxable income between $150,000 and $275,000 with a reduction of itemized deductions to the extent of 3 percent of adjusted gross income exceeding $100,000 (effectively an increase in the marginal rate of tax of .93 percent) *and* a phaseout of personal exemptions beginning at $150,000 for joint filers. In 1991, the phaseout results in an increase in the marginal tax rate of 0.53 percent for each exemption claimed. For instance, an itemizing taxpayer claiming three exemptions and facing the 33 percent "bubble" rate in 1990 could face a marginal tax rate of 33.52 percent (i.e., $31 + .93 + 3 \times .53$) in 1991.

taxes amount to multiplying each term in (1) by a factor of $1 - t_s$, where t_s is the state tax rate. Ignoring phaseouts, the effect of state taxes is multiplicatively separable from the computation of benefits from exercise in (1). State taxes also cancel from (2), so they can be disregarded.

Alternative minimum tax. Alternative minimum tax (AMT) is levied on a definition of income that is more inclusive than the computation of taxable income. Since the AMT base is broader than the base for the regular income tax, the alternative minimum tax may be larger than the regular income tax though the AMT rate (24 percent in 1992) is lower than the marginal rate of regular income tax faced by taxpayers subject to AMT. For persons subject to AMT, the tax advantage from exercising non-qualified options in 1992 is larger than the benefit calculated here since the gap between the current tax rate and the expected future tax rate is larger.[9] Since it is not possible to identify taxpayers subject to the AMT in the sample, calculations of benefits from early exercise are computed using the ordinary marginal tax rate. This tends to understate the tax benefit associated with exercise late in 1992.

Asset return distributions and capital gains tax. Dammon et al. (1989) argue that imprecision in the modeling of the distribution of asset returns and the capital gains tax payable at the end of the investment horizon resulted in overestimates by some researchers of the value of the tax option associated with holding equity securities when long- and short-term capital gains tax rates differ. Similarly, a divergence between employee and market expectations about future stock returns might be important in explaining employees' decisions to exercise options. There are two cases to consider. An employee who believes the stock is over-priced should exercise the option and sell the stock. The analysis is more complex when the employee believes the stock is under-priced.[10]

[9] Incentive stock options are a preference item for purposes of the AMT. There are no incentive stock options in the sample studied here.

[10] Briefly, the rationale for early exercise in anticipation of good news is as follows. Consider an employee who believes the stock is under-priced. The employee secures a tax benefit by exercising her option before the tax rate increase. If the employee holds the stock acquired on exercise until the stock price rises, a further benefit of this strategy is that subsequent stock price appreciation is taxed at the capital gains tax rate. The cost associated with this strategy is the early payment of the strike price and tax on the difference between the market price on the date of exercise and the strike. Because it is not possible to know whether individual employees are bullish or bearish on their employer's stock, the empirical tests presume option holder expectations do not differ from those of the market at large.

3. Data and results

The analysis is based on option grant and exercise records of 30,285 employees who held exercisable stock options late in 1990, 1991, 1992, or 1993. Additionally, the companies provided us with the 1993 salary of each of these employees.[11] An employee may appear in the data more than once because she holds options from several different grants or because she holds exercisable options in more than one of the four years. An individual option grant held by an employee may appear in the data more than once because the employee holds the option for several years.

[**Table 1**]

In all, the data comprise 203,319 distinct observations of whether an employee exercised in-the-money options from a given grant between November 4 and December 31 of 1990, 1991, 1992, and 1993. Table 1 descriptive statistics of option characteristics and employee salary. Panel A of table 1 reveals substantial variation in the characteristics of the options: the interquartile ranges of time to expiration, market-to-strike, volatility, and dividend yield are 4.8 years, 41 percent of the stock price,[12] and 22.2 percent per year, and 2 percent, respectively. Accordingly, we expect to be able to distinguish between options for which early exercise in 1992 is attractive for tax reasons and those for which it is not. Most of these options have long times to maturity (the median time to maturity is 5.929 years), and many are near-the-money (for one fourth of the options the current market price is less than 30 percent higher than the strike). The upside potential from continuing to hold the option outweighs the benefit from early exercise in such cases, because the intrinsic value is much less than the option value, i.e., the intrinsic ratio is low. Thus, the frequency of exercise in the data as a whole should be small. Indeed, exercise occurs in just 3.2 percent of the observations. If, for every observation, all

[11] The companies supplying data requested anonymity. Accordingly, they are identified by a letter code only. Each company has more than 10,000 employees. Companies A–C are listed on the NYSE. They each have 1992 market capitalization over $1 billion and net income over $50 million. Company A is diversified. Company B is an electronics company. Company C is a financial institution. The stock of Company D is traded at a price established by formula only (i) among employees and (ii) between the corporate treasury and employees. The market capitalization indicated by the formula price in 1992 is less than $1 billion. In 1992, net income of company D was less than $50 million.

[12] Stock price is the highest daily close in the period November 4 to December 31 of observation year. Using other definitions of price, such as the average of daily closing prices over the period November 4 to December 31 does not materially alter the results results.

available options were exercised, the employee would receive, before tax, stock worth an average of $11,672. The average BAW value of these same options is $14,302, or about 23 percent more. The distribution of the intrinsic ratio exhibits wide variation in the fraction of a grant's value that would be realized if it were exercised. The interquartile range of the ratio is .36. For half the observations, the intrinsic value exceeds 73 percent of the options' pretax value. For five percent of the observations, the intrinsic value exceeds 98 percent of the options' pretax value. It is for such options in the hands of high income employees that exercise in 1992 is predicted to be high.

Panel B of table 1 further shows that there is wide variation in the but-for options level of employee income as measured by employee salary. For five percent of the observations, employee salary exceeds $195,000. The frequency of exercise in this group of employees of options for which the intrinsic ratio is near one should be high in 1992. For one quarter of the observations, employees' salaries are less than $68,200. The frequency of exercise in this group of employees should not differ much between 1992 and other years.

[Table 2]

Table 2 breaks the options down according to the year, the ratio of intrinsic value to Black–Scholes value, and the employee's tax status. Additionally, the frequency with which employees exercise at least some of the options they hold is reported for each cell.[13] In total, 64,914 observations from 1992 are reported in panel A and 138,405 observations from 1990, 1991, and 1993 combined are reported in panel B. Overall exercise frequencies are 4.8 percent and 2.5 percent for observations in panels A and B, respectively. The Chi-square statistic for a test of differences in the frequency of exercise across these two groups is a highly significant 747. The breakdown by income and intrinsic ratio reveals that this difference largely reflects high income individuals exercising options for which the intrinsic ratio is near its maximum value of one. In particular, individuals with salaries over $250,000 exercised 31.4% of options for which

[13] When employees exercise options, they typically exercise all available options from a given grant. In three fourths of the exercise events, the employee exercises all of the vested options. Conditional on exercising some options, the mean fraction exercised is .944.

the intrinsic ratio exceeds .90. This is more than ten times the rate for similar options held by individuals with similar income in other years. The overall pattern conveyed by the table is consistent with the tax hypothesis: in 1992, high income individuals exercise options where the intrinsic value is a large fraction of the option value (i) more frequently than individuals with similar incomes who hold similar options in other years and (ii) more frequently than options for which the intrinsic ratio is less in the same year. For options where the intrinsic ratio is above .80, the frequency of exercise increases sharply and monotonically with income in 1992. At every income level, the frequency of exercise in 1992 is higher for options with intrinsic ratio above .90 than for options where this ratio is between .80 and .90, which frequencies in turn are higher than for options where the ratio is between .70 and .80. These patterns are consistent with the tax hypothesis for 1992 and do not hold for the data for other years. Indeed, in the other years the frequency of exercise *decreases* with income when the intrinsic ratio exceeds .90. In sum, this analysis of frequency of exercise is strongly consistent with tax factors having an important impact on the exercise decisions of employees who plausibly are affected by the anticipated tax change.

The statistical significance of the results reported above may be affected by some dependencies in the observations. In particular, one employee may simultaneously hold options granted in different years. These options typically will have different strike prices and different times to expiration and so are counted as distinct observations. It is possible that decisions by the same employee to exercise options from different grants are not independent. Also, using all the data means that certain other factors that plausibly cause exercise may be influencing the results reported in table 2. In particular, employees who are about to terminate employment (e.g., due to resignation, retirement, or death) may exercise options before they are canceled by the employer. Also, some exercise activity may be associated with dividend capture. To examine whether the taxes are significant while controlling for these matters, table 3 presents the same type of analysis as table 2 on a subset of the observations where (i) for employees who hold options from more than one grant in the same year, only the observation for which the intrinsic ratio is greatest is retained in the subset, (ii) observations where

exercise takes place in the week before a stock goes ex-dividend are excluded, and (iii) observations that relate to an employee whose options are canceled in the period starting on November 4 of the observation year and ending on the ninetieth day of the next year are excluded.

[Table 3]

There are 77,254 remaining after these exclusions are effected. Consistent with deleting exercise observations preceding ex-dividend dates, the absolute frequencies of exercise are smaller in table 3 than in table 2, but otherwise the same general relationships emerge and are significant. The overall frequency of exercise in 1992, 1.8 percent, is significantly higher than in other years, 0.7 percent. The difference is driven primarily by a higher rate of exercise of deep-in-the-money short maturity options by high income individuals. In particular, the frequency of exercise in 1992 of options for which the intrinsic ratio exceeds .90 by employees with salaries over $250,000 is five times higher than in other years. The frequency of exercise of options for which the intrinsic ratio exceeds .90 is significantly higher at the one percent level in 1992 than in other years and monotonically increasing in the employee's income.

[Table 4]

Now consider situations where tax considerations appear paramount, yet the employee does not exercise her options. Table 4 presents descriptive statistics on the 426 observations from 1992 where the intrinsic ratio exceeds .90 and salary exceeds $250,000 and the employee exercised no options. The median time to expiration is four years. These options are far into the money since the median stock price is twice the strike. The value of the option holdings are quite large—the means of the intrinsic and BAW values are both above $240,000—which is quite substantial in relation to the mean employee salary of $389,924. Consistent with the high intrinsic ratios (mean value of .973), dividend yields are somewhat higher than that of the full data set, and the underlying stock is somewhat less volatile. While both of these factors tend to reduce the BAW value, the opportunity of not exercising is sizeable. From (1), a conservative estimate of the median net-of-tax benefit from exercising these options in 1992 rather than in a

later year is $n\,[(S-X)(1-.31)-W(1-.36)]$ where n is the number of vested, unexercised options on hand plus the number of options that vest before December 31.[14] The median value of this expression for the sub-sample is $6,820.[15] Panel C of table 4 indicates the mean (median) net-of-tax benefit is 2.5 (2.1) percent of salary, while for 20 observations it exceeds 7 percent of salary. The effort required to exercise these options is minimal—a signature is required and broker must be contacted. Despite the apparent ease with which these options could be exercised and the size of the benefits available to be captured, none of these employees chose to exercise the options. Thus, it appears that most of these individuals were influenced less by anticipated changes in the tax law than by other factors in deciding when to exercise their options. The following section identifies some of those factors.

4. Discussion

In seeking evidence of tax-motivated trading of equity securities, researchers have offered several reasons why individuals may not take advantage of (i) the opportunity to defer the realization of gains and accelerate the realization of losses or (ii) the tax options created by the differential treatment of long- and short-term capital gains. These factors, which limit tax planning in other contexts, cannot explain the low rate of exercise observed here:

Diversification. Badrinath and Lewellen (1991), who examine the equities trading of a panel of investors over several years, offer portfolio rebalancing and consumption needs as forces that limit exploitation of tax planning opportunities. In contrast, the wealth of employees who hold options is likely to be under-diversified because it is concentrated in assets (pension, future salary, stock, and options) tied to the employer. Early exercise of options, and sale of the stock acquired on exercise, permits the employee to achieve

[14] A less conservative evaluation would be $n\,[(S-X)(1-.31)-kW(1-.396)]$ for some $k<1$. That is, the higher tax rate proposed by Clinton is used and the present value of options held past the year end is reduced to reflect risk aversion and the possibility of sub-optimal exercise occasioned by liquidity needs.

[15] The estimate is conservative because it assigns (i) no weight to the possibility future options income will be taxed at 39.6 percent rather than 36 percent, and (ii) no cost to the risk the employee bears from continuing to hold the options when the proceeds from exercise could be used to achieve a more diversified portfolio.

a better-diversified portfolio sooner. Thus, the diversification motive encourages early exercise.

Transactions costs. The individuals studied in this paper hold non-transferable deep-in-the-money options. If these employees do not exercise their options in the window preceding the anticipated tax increase, they almost surely will exercise them at or before expiration. Failure to act before the tax increase only postpones rather than avoids transactions costs. In any event, costs associated with exercising employee stock options are trivial. At the companies represented in this sample, option holders are eligible to participate in "cashless exercise" programs where brokers (or the employer) immediately sell the shares the employee receives on exercise of the option and pay the employee the difference between the market price of the stock and the strike, net of withholding tax.

Disposition effect. Shefrin and Statman (1985) suggest behavioral factors may explain the reluctance of individuals to realize losses and thereby admit an investment was a mistake—the so-called disposition effect. With stock options, a profit is realized on exercise, so the disposition effect cannot explain a reluctance to exercise.

Signaling role of options within the firm. The signaling role of option exercise in the firm's internal labor market is less easily dismissed. Many employers require option holders to report their positions in company stock and options. Low stock and option holdings may be interpreted by superiors as an unfavorable signal about employee commitment to the firm. However, exercise of these short-maturity, deep-in-the-money options some time before expiration is nearly certain. Employees who exercise before the end of 1992 can offer their employers a compelling justification for their action, namely: exercise captures a probable tax benefit for the employee and accelerates recognition of a tax deduction for the employer. Exercise in this case therefore should be seen more favorably than exercise at any other time. Moreover, the employee may choose to hold stock acquired on exercise. Since employers view stock ownership at least as favorably as option ownership, it seems doubtful that internal signaling strongly inhibits exercise.

Thus, the foregoing motives do not explain why two thirds of the sub-sample of employees who would appear to benefit most from early exercise did not seek the

expected tax advantage of early exercise. Other factors that may contribute to a low exercise rate include:

Mismeasurement of income. The inference that these employees should exercise is based on the assumption that salary approximates taxable income in the event no options are exercised. The available data from 1991 individual tax returns supports this assertion.[16] If the employee's tax position for 1993 includes large loss carry-forwards that can offset the income triggered by exercise of the options, then there is no tax reason to exercise the options in 1992. Of course, it is also plausible that the employee has other income (from a spouse, for example) that increases taxable income.

Inappropriate decision model. Seyhun and Skinner (1994) suggest either individual tax minimization strategies are not worthwhile given transactions costs or individuals do not understand complex tax minimization strategies. The advantages of exercising a particular option depend on a host of factors (the time remaining to expiration, the moneyness of the option, stock price volatility, etc.) that interact nonlinearly. Exercise decisions are informed by option valuation theory. This theory may be unfamiliar to the employees under study. It is therefore possible that employees' decision processes differ from the decision framework proposed in this paper.

The possibility that employees do not understand the tax planning opportunity cannot be dismissed. Option administrators and senior financial officers we consulted are loath to provide advice to their employees about option exercise strategies because the future stock price path is uncertain. These individuals report that a recommendation, for example, to exercise an option early in anticipation of a tax rate increase might be worthwhile based on ex-ante expectations, but could easily prove to be incorrect ex-post because of upward stock price movement after year-end. Independent tax counselors were reluctant to advise these employees for the same reasons.

[16] The mean taxable income reported on personal tax returns with salary between $200,000 and $210,000 is $204,000. For salary above this level, taxable income typically exceeds salary. Below this level, salary exceeds taxable income. These statements are based on tabulations from the IRS 1991 Individual Public Use Tax File compiled by the Office of Tax Policy Research at the University of Michigan.

5. Conclusions

This article offers direct evidence on the extent to which employees who hold options act to benefit from expected changes in the tax law. A test constructed from a probable tax rate increase (subsequently enacted as part of the Revenue Reconciliation Act of 1993) indicates the framework predicts exercise decisions. The exercise decisions of employees who held options that were exercisable in the months following the 1992 federal election conform to behavior implied by a stark model of exercise based on the tradeoff between tax savings and option value. The evidence is strongly consistent with a significant role for taxes in the exercise decisions of employees at four corporations.

Economically significant probable tax benefits are associated with a meaningful increase in exercise frequency. The rate of exercise by employees who held deep-in-the-money, short-maturity options following President Clinton's election in 1992 is ten times greater than in the corresponding fifty-seven day periods of 1990, 1991, and 1993. As well, there are significant differences across employees in 1992. Employees identified as facing the strongest tax incentives to exercise options in 1992 are nearly twice as likely to exercise as employees estimated to have little or no tax incentive. However, the response to the tax planning opportunity was far from universal: Only one third of the employees for whom the estimated benefit was largest chose to exercise their options. It is a strong possibility that employees failed to exploit the tax planning opportunity because they did not understand it, although measurement issues may play some part.

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Variable	Mean	Standard Deviation	25^{th} Percentile	Median	75^{th} Percentile	95^{th} Percentile
Panel A: Option characteristics						
Time to expiration	5.638	2.735	3.074	5.929	7.901	8.901
Market-to-strike	1.600	.448	1.292	1.462	1.705	2.559
Volatility	.250	.127	.147	.311	.369	.394
Dividend yield	.014	.011	.009	.012	.029	.032
Intrinsic value: $S - X$	11.672	51.538	1.017	2.969	7.796	36.265
Option value: W	14.302	55.882	1.771	4.594	10.772	45.824
Intrinsic ratio: $(S - X)/W$	.695	.213	.516	.730	.876	.982
Panel B: Employee characteristic						
Salary	99.665	69.646	68.200	84.540	108.700	195.000

Table 1. Descriptive statistics. There are 203,319 observations. Time to expiration *is the time from December 31 of the observation year to the expiration of the option, in years.* Market-to-strike *is the ratio of stock price to the strike.* Volatility *of the stock is computed over the 250 trading days preceding November 4 of the observation year.* Dividend yield *is the annualized yield implied by the fourth quarter dividend divided by the stock price.* Intrinsic value *is the number of exerciseable options multiplied by the difference between the price of the stock and the strike, in thousands of dollars.* Option value *is the number of exercisable options multiplied by the Barone-Adesi and Whaley value of one option.* Salary *is the 1993 salary of the employee, in thousands of dollars.*

$\frac{S-X}{W}$	≤ $100,000		$100,001 to $150,000		$150,001 to $200,000		$200,001 to $250,000		> $250,000	
	Optionees	Fraction Exercising	Optionees	Fraction Exercising	Optionees	Fraction Exercising	Optionees	Fraction Exercising	Optionees	Fraction Exercising
Panel A: Year 1992										
0.00 to 0.40*	2,001	**.000**	959	.007	157	.013	46	.000	24	.000
0.40 to 0.50	881	**.051**	467	**.071**	98	.031	21	.000	14	.000
0.50 to 0.60	4,842	.016	1,331	.015	143	.049	18	.000	12	.083
0.60 to 0.70*	13,257	.026	4,037	.028	832	.056	268	.086	366	.079
0.70 to 0.80	7,154	**.048**	2,358	**.053**	490	**.049**	133	.060	138	.029
0.80 to 0.90*	11,801	**.054**	3,349	**.071**	868	**.119**	325	**.142**	459	**.172**
0.90 to 1.00*	4,336	**.032**	1,929	**.088**	799	**.186**	380	**.253**	621	**.314**
Total*	44,272	**.036**	14,430	**.049**	3,387	**.099**	1,191	**.145**	1,634	**.188**
Panel B: Years 1990, 1991, and 1993										
0.00 to 0.40	13,885	.007	4,825	.008	903	.007	246	.000	285	.004
0.40 to 0.50	9,596	.016	2,787	.014	393	.013	92	.011	77	.013
0.50 to 0.60	11,383	.018	3,647	.018	1,043	.021	392	.031	607	.018
0.60 to 0.70*	5,760	.024	1,714	.034	429	.051	170	.035	232	.052
0.70 to 0.80	19,944	.021	5,902	.016	1,290	.017	455	.018	561	.007
0.80 to 0.90*	14,628	.019	5,004	.020	1,296	.046	454	.055	667	.057
0.90 to 1.00*	18,821	.054	6,555	.043	2,096	.042	908	.023	1,358	.027
Total*	94,017	.025	30,434	.022	7,450	.030	2,717	.027	3,787	.027

Table 2. Number of option positions and fraction of options exercised. This table presents the number of optionees who exercised at least some of their options and the total number of optionees, broken down by (i) year; (ii) $(S-X)/W$, the ratio of the option's intrinsic value to its Barone-Adesi and Whaley value; and (iii) employee salary. Panel A presents data from 1992, when a tax rate increase was anticipated. Panel B presents data from years 1990, 1991, and 1993, when no tax rate changes were anticipated. Boldface fractions in panel A denote significant (at the one percent level using a Chi-square statistic or Fisher's exact test for subtables with few observations in some cells) differences in frequency of exercise compared to the frequency of exercise in the corresponding cell in panel B. Asterisks indicate rejection (at the one percent level using a Chi-square statistic) of the hypothesis that the frequency of exercise is independent of the employee's income level, for the indicated levels of the intrinsic ratio, $(S-X)/W$.

$\frac{S-X}{W}$	≤ $100,000		$100,001 to $150,000		$150,001 to $200,000		$200,001 to $250,000		> $250,000	
	Optionees	Fraction Exercising	Optionees	Fraction Exercising	Optionees	Fraction Exercising	Optionees	Fraction	Optionees	Fraction
Panel A: Year 1992										
0.00 to 0.40	378	.000	98	.000	15	.000	8	.000	4	.000
0.40 to 0.50	220	.005	71	.014	11	.000	3	.000	NA	NA
0.50 to 0.60	1,143	.002	37	.000	7	.000	1	.000	NA	NA
0.60 to 0.70	2,899	**.001**	186	.000	35	.000	20	.000	30	.000
0.70 to 0.80	3,225	.016	462	.011	42	.024	13	.000	7	.000
0.80 to 0.90	7,618	**.022**	1,428	.025	227	.044	68	.029	80	.063
0.90 to 1.00*	2,617	**.004**	1,006	**.031**	346	**.078**	155	**.097**	212	**.118**
Total*	18,100	**.013**	3,288	**.022**	683	**.056**	268	**.063**	333	**.090**
Panel B: Years 1990, 1991, and 1993										
0.00 to 0.40	4,050	.001	834	.002	95	.000	40	.000	33	.000
0.40 to 0.50	3,828	.009	469	.004	37	.000	11	.000	6	.167
0.50 to 0.60	3,149	.003	595	.008	200	.000	69	.000	99	.000
0.60 to 0.70	3,279	.021	712	.031	117	.026	52	.038	62	.016
0.70 to 0.80	10,066	.012	1,487	.010	318	.006	107	.000	165	.006
0.80 to 0.90*	4,939	.003	881	.012	256	.023	108	.046	143	.063
0.90 to 1.00*	13,323	.001	3,310	.004	855	.022	377	.016	510	.024
Total*	42,634	.006	8,288	.009	1,878	.016	764	.017	1,018	.024

Table 3. Number of option positions and fraction of options exercised. This table presents the same analysis as in table 2 for a subset of the data which excludes multiple observations for the same employee in a single year, observations corresponding to employees who are terminated between November 4 and the nintieth day following the year end, and exercise events that fall in the week prior to a stock's ex-dividend date. Boldface and asterisk have the same meanings as in table 2.

Variable	Mean	Standard Deviation	25^{th} Percentile	Median	75^{th} Percentile	95^{th} Percentile
Panel A: Option characteristics						
Time to expiration	4.002	1.634	2.893	3.910	5.885	5.880
Market-to-strike	2.078	.394	1.934	1.994	2.215	3.100
Volatility	.211	.074	.180	.180	.180	.390
Dividend yield	.027	.006	.029	.029	.029	.030
Intrinsic value: $S - X$	242.512	329.855	70.781	173.650	308.425	672.000
Option value: W	246.064	331.033	72.226	177.786	311.125	672.720
Intrinsic ratio: $(S - X)/W$	.973	.033	.982	.982	.999	1.000
Panel B: Employee characteristic						
Salary	389.924	239.044	279.500	336.875	414.000	728.750
Panel C: Tax benefits						
Forgone value	9.852	16.380	1.636	6.820	13.780	27.588
Forgone value divided by Salary	.025	.030	.005	.021	.035	.070

Table 4. Descriptive statistics on options not exercised. There are 426 observations for which the intrinsic ratio exceeds .90, salary exceeds $250,000 and no options were exercised in 1992. Data definitions are as in table 1 except for Forgone value, *which is defined in the text and reported in thousands of dollars.*