

## **Hedging Employee Stock Options, Corporate Taxes, and Debt**

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### **Abstract**

This study explores two effects of employee stock options on tax incentives to issue debt. The deduction of option exercise gains from taxable income creates a non-debt tax shield, reducing the incentive to issue debt. In contrast, the grant of options also creates a demand for hedging unexpected stock price increases, and firms have a tax-based incentive to hedge by borrowing to repurchase shares. Empirical tests for a sample of large S&P 500 firms from 1995 to 2001 present evidence consistent with both effects, and the increase in debt through hedging more than offsets the effect from reducing marginal tax rates for high tax rate firms.

## **Hedging employee stock options, taxes, and debt**

### **Introduction**

Employee stock option grants grew dramatically in the late 1990s. Firms not only increased option grants to top executives, but expanded them to many employees below the very senior ranks (Hall and Liebman, 1998; Murphy, 2003). Estimates of the value of options granted annually became substantial, rising from about 5 percent of operating earnings in 1995 to about 15 percent in 2000 and 2001 (Bear Stearns, 2002; Liang and Weisbenner, 2002; Schlesinger, 2002). This substantial growth in grant values rivals the explosion in the gains realized by employees from exercising stock options as equity prices soared. Jacquette, Knittel, and Russo (2003) report that exercises at a sample of about 600 firms reached \$111 billion in tax year 2000, up from \$43 billion in 1997, and Sullivan (2002) documents that tax savings to corporations from the deduction of options rose from \$12 billion in 1997 to \$56 billion in 2000.

For tax purposes, gains from the exercise of stock options are treated as compensation expense at the time they are realized, even as the expense of options at either time of grant or exercise is never recorded on financial statements.<sup>1</sup> Thus, the tax consequences of stock options and cash wages differ in two respects. First, firms that grant options in lieu of cash wages defer the tax savings of compensation until the options are exercised, typically four to five years after they are granted. This feature is especially valuable to firms that face a low tax rate in the current period and expect their tax rate to rise in the future (Core and Guay, 2001). In addition, the value of options-based compensation depends on when employees choose to exercise their options and the stock price at that time, both of which are outside the direct control of the firm.

While this makes tax savings from option compensation less certain, the generally positive correlation between firm's profits and its stock price suggests that stock-options-based compensation reduces the volatility of firm's taxable income.

By altering taxable income and the expected stream of tax payments, employee stock options could affect debt financing and capital structure. In recent years, many firms have considerably reduced their taxable income by deducting exercise gains, and a few have exhausted their income and reduced their marginal tax rate to zero. Recent research (see Graham, Lang, Shackelford, 2002; and Kahle and Shastri, 2002) has emphasized the substantial non-debt tax shield (NDTS) value of option gains deductions in the spirit of DeAngelo and Masulis (1980). Using data for a sample of top S&P and Nasdaq firms in 2000, Graham et al find that a marginal tax rate that incorporates the tax benefits of exercise gains, as well as the expected benefits from new grants, is positively related to debt ratios, while a tax rate that ignores the effects of employee stock options is not. They argue that their results indicate that firms that have large non-debt tax shields in the form of options tend to have lower debt ratios.

However, this characterization does not consider an offsetting effect of options on debt that arises from the practice of hedging option grants through debt-financed share repurchases. Anecdotal evidence suggests that concerns about uncovered short call positions generated by option grants prompt some firms to engage in a number of hedging strategies to manage their exposure to higher-than-expected stock price gains. One such arrangement that involves the common practice of share repurchases is a dynamic delta-hedging strategy, as posited by Mozes and Raymar (2001). Under dynamic delta-hedging, firms buy back shares and issue debt in proportion to the number of options granted, and adjust their hedging portfolio in response to

changes in the value of stock options. This hedging strategy is self-financing, but the deductibility of interest payments on the debt component of hedging portfolio generates additional tax shield value for the firm and thus serves as a key motivation for the hedge. Consequently, dynamic delta-hedging has greatest appeal for firms that face high marginal tax rates and are thus able to take advantage of the additional tax shield.

In sum, there exist (at least) two theoretical predictions for effects of employee stock options on corporate debt policy. The first – the NDTS prediction – suggests that higher options lead to a lower marginal tax rate and thus to less debt. The second – the dynamic hedging prediction – implies that options trigger hedging and thus increase debt. While both of these predictions ultimately link stock options to debt through the marginal tax rate, they point in different directions.

This paper tests these opposing effects of employee stock options on firm debt decisions through non-debt tax shields and hedging. We use panel data from 1995 to 2001 for a set of large nonfinancial firms in the S&P 500 Composite index to examine how increases in debt and share repurchases are affected by option grants. We confirm a substantial increase in compensation from option gains deductions during this period. We find some evidence that options serve as a non-debt tax shield and lead to less debt financing, but results for the effect through the current marginal tax rate are weak, perhaps reflecting little variation among our sample of large firms. We also find that firms that face high current marginal tax rates significantly boost debt financing and share repurchases in a manner consistent with tax-efficient hedging of option grants. On net, our estimates suggest that the boost to debt finance from hedging options outweighs the effect on debt from a reduced marginal tax rates through exercise

gains for high tax rate firms, but the effects are roughly offsetting at other firms.

The second section discusses the offsetting effects of options on debt through taxes and issues concerning measurement of marginal tax rates. The third section details stock option activity and measures of marginal tax rates at our sample of large companies, while the next section presents empirical tests of the effects of options on debt finance and repurchases. The fifth section contains a short conclusion and offers direction for future research.

### **Analytical framework**

The deductibility of interest expenses from firm's tax liabilities has played a key role in capital structure research (Modigliani and Miller, 1963). An immediate consequence of this feature of the U.S. tax code is that the effective cost of debt is given by the *after-tax* interest rate, commonly denoted as  $(1-t)r$ . Thus firms that face different marginal tax rates (MTR) will face different costs of debt, and profitable firms will have lower costs than unprofitable firms (DeAngelo and Masulis, 1980). However, even profitable firms may be subject to lower than statutory MTR if they maintain sufficient levels of non-debt tax shields such as R&D expenditures and investment tax credits.<sup>2</sup> If such non-debt tax shields have the potential to lower the firm's marginal tax rate, they will crowd out debt by increasing its price.

Within the framework of DeAngelo and Masulis (1980), employee stock options have a readily identifiable effect on corporate debt policy. More option grants lead to higher expected exercise gains, which raise the likelihood of reducing the marginal tax rate of a firm. In turn, lower MTR raises the relative price of debt and, *ceteris paribus*, lowers its share in firm capital structure.

However, stock options and debt policy may also be linked through another channel because the grant of options creates a demand for hedging. It may be optimal from a tax perspective for firms to engage in dynamic hedging of stock options by borrowing to buy back shares (Mozes and Raymar, 2001), since firms can deduct the interest expenses and are not taxed on trading in their own securities. Such a trading strategy is known as dynamic delta-hedging where delta refers to the change in option value in response to a change in price of the underlying security (see e.g., Hull 1997). This strategy allows a firm to lock in the ultimate cost of an option grant at its estimated grant value. Upon granting  $q$  new options with delta value of  $\delta_0$ , a firm borrows to buy back  $q \cdot \delta_0$  shares. As time goes by, a firm adjusts its hedging position by buying shares when the value of the option increases, and selling shares (and paying down debt) when the option loses value. This trading strategy mimics the standard Black-Scholes option pricing analysis, and so it is self-financing. However, since interest payments on debt used to finance this strategy are tax-deductible, delta-hedging effectively allows the firm to fix its cost of issuing stock options at below their fair value.<sup>3</sup> The enterprise that consists of granting options and hedging them can thus be considered a self-financing subsidiary of the firm that passes back the tax shield generated by hedging (Mozes and Raymar, 2001). The corresponding increase in firm value provides a rationale for stock option grants to be accompanied by dynamic hedging policies and, by extension, *higher* debt.<sup>4</sup>

Earlier studies that demonstrated a positive relationship between share repurchases and stock option grants have attributed it to a desire by firms to avoid dilution from option exercises (Kahle, 2002; Weisbenner, 1999), or to protect the value of options by substituting repurchases for dividends (Fenn and Liang, 2001). Both Kahle and Weisbenner examine the timing of share

repurchases and find evidence that shares are bought back before the time options are exercised, though neither tests for hedging. Kahle finds that repurchases are related to options outstanding, particularly those that are exercisable, and Weisbenner documents that shares outstanding increase one-for-one with the exercise of options, but decline with a sequence of previous option grants. Weisbenner also shows that options lead to a higher payout rate, consistent with options leading to higher debt ratios. Mozes and Raymar find support for hedging, though they do not have explicit data on option grants or outstandings and use a proxy for options outstanding based on shares reserved for option grants.

The benefits of dynamic hedging are directly proportional to a firm's marginal tax rate, since loss-generating firms that face a zero marginal tax rate derive no current value from such hedging strategies. This suggests that the positive relationship between debt issuance and stock option grants (as well as between repurchases and grants) should be concentrated among firms with high MTRs. Thus, both NDTs and dynamic hedging strategies link employee stock options to corporate debt policy through marginal tax rates. However, these two channels point in opposite directions and thus have the potential to confound empirical results. In order to disentangle these effects in the data, we need to give operational meaning to the concept of the marginal tax rate.

A key issue is whether the *current* marginal tax rate is sufficient to characterize the relevant tax rate for debt finance, which often is long-term and generates tax-deductible interest expense over multiple time periods. A single rate would suffice if debt issues were frictionless or if marginal tax rates were invariant over time. Debt issues, however, involve substantial transaction costs of underwriting and rating processes, as well as the danger of inviting additional

scrutiny. In addition, although Altshuler and Auerbach (1990) found that the tax status of firms is highly persistent over time, it is likely that this persistence has lessened in recent years because of increased stock option activity. The uncertain time of realization and considerable volatility of tax deductions from option exercises has allowed even highly profitable firms, such as Microsoft, to have little or no taxable income in some years.

Consequently, the appropriate measure of the firm's tax environment may include some expectation of *future* tax burdens, i.e. tax liability of a marginal dollar of income in future years. Accounting for the dynamic features of the tax code through loss carrybacks and carryforwards in the computation of MTRs, as in Graham et al (2002), goes a very long way towards incorporating the future effects of stock option exercises into current-period debt choices. However, by considering only the current MTR, Graham et al restrict the effects of future option exercises to those allowed by the dynamic features.<sup>5</sup> Yet it seems reasonable that future exercise-induced losses beyond the carryback period would affect firm's decision-making by lowering its expected marginal tax rate. As long as debt adjustment is costly, changes in the future expected MTR will affect the current debt policy.

Therefore, we adopt a hybrid approach, which does not restrict the effect of options to the current marginal tax rate. We approximate the effect of stock options on *current* MTR by adjusting taxable income for contemporaneous option exercises and by incorporating firm net operating loss (NOL) carryforwards that can influence its MTR dynamically (the construction of current MTR measures is described in detail below). We also implicitly allow stock option grants to affect *expected* MTR in future periods by including their expected values as a separate explanatory variable. Jointly, these two measures approximate the effects of stock options on

marginal tax rates relevant for debt policy choices.

### **Stock options and marginal tax rates**

Our primary data on employee stock options are collected from company 10-k reports for a sample of about 150 of the largest S&P 500 firms from 1994 to 2001. For each year, we sorted firms in the S&P 500 at the end of calendar year by market value. Starting with the largest US firms in 1996, we collected data from the 10-k report, including data for 1994 and 1995 if available. If the option data for a company were not usable because they were not complete, we skipped the firm and continued down the list ranked by market value until we had data for 150 firms. For each subsequent year, we collected new data for the firms already in the sample, but because a number of firms failed or were acquired each year, we supplemented the list to include some of the firms that had moved into the list of largest 150 firms based on market cap. For each firm, we collected data on number of option grants, exercises, cancellations, and outstandings, average grant prices, average strike price for options exercised, and average price of options outstanding. We also collected inputs used to estimate the value of the option grants, including the expected term, expected volatility, expected dividend yield, and the risk-free rate.

Balance sheet and income data for our sample of firms are from Compustat. Because we are interested in debt policy, we restrict our sample to nonfinancial firms, and are left with between 120 and 130 firms each year. While our sample size is fairly small, due to the labor-intensive nature of the data collection, the firms in the sample account for a large share of economic activity. In particular, these firms accounted for between 62 and 70 percent of the market value of all US publicly-traded nonfinancial corporations between 1995 and 2001, and

roughly 44 percent of total debt and assets of public nonfinancial corporations (table 1). Similarly, these firms account for more than one-half of all share repurchases by public nonfinancial companies annually. Between 24 and 32 firms each year are in the computer-related technology sector. While this constitutes a small fraction of the total number of tech firms, the firms in our sample represent about two-thirds of that sector's market value.

***Stock options.*** Our data indicate that option activity increased dramatically since the mid 1990s, and despite the downturn in the stock market since early 2000, remained substantial in 2001 (table 2). The average number of employee stock options granted, expressed to shares outstanding, grew from about 1-1/4 percent in 1995 to more than 2 percent in 2000 and 2001. The average rate of option exercises also grew sharply, reaching its peak in 2000 before dropping in 2001. Option cancellation rates also rose, but not by enough to offset the higher rate of grants, and options outstanding trended up throughout the sample period, reaching 8.3 percent of shares outstanding in 2001.

Option-based compensation is better characterized by option values, whether at grant or exercise. Conceptually, the value at exercise measures the realized gains to employees and is defined simply as the difference between the market price at the time the option is exercised and the strike price. However, because the 10-k forms do not provide precise data on the gains received by employees from the exercise of options, we estimate the value of exercises by the difference between a firm's average market price for the year less the average exercise price of options exercised, multiplied by the number of options exercised. The average market price is defined as an average of beginning and end of year stock prices. As shown in table 2, this portion of the rate of option exercises doubled to 1 percent between 1997 and 2000. Its

complement, the proceeds to the firm from option exercises, was more stable through most of this period.

The estimated gains realized from the exercise of stock options for our sample firms, and thus the deductions to corporate taxable income, were substantial. Gains rose from about \$8 billion in 1995 to \$80 billion in 2000. The sharp rise represented dramatic stock price increases for many firms, and was most pronounced for relatively option-intensive tech firms.

In contrast, valuation of an employee stock option at the time of grant is perhaps more difficult, and it certainly has been a subject of fierce debate. Many, most notably the Financial Accounting Standards Board (FASB), argue that models used to price traded options can be used to approximate the value of employee stock options provided some adjustments are made to account for their differences with traded options. In particular, employee stock options are non-transferable, which could lead to early exercise of options because holders cannot realize gains by selling their options.<sup>6</sup> To account for this difference, FASB permits firms to replace the statutory life of the option with its expected life in the option valuation model. FASB also allows firms to reduce option grants by those that are not expected to vest, because employees forfeit their options when they leave.

For our estimations, we adopt the recommended approach of FASB for non-transferability and vesting. We estimate a value for employee stock options by using a standard pricing model for American options (the Barone-Adesi and Whaley analytic approximation). These values are very similar to those provided by the more familiar Black-Scholes estimation method, which is used to price European options. As in other papers, we assume that options are granted at-the-money, the most common practice. The median stock price volatility increased

steadily from about 25 percent prior to 1999 to 34 percent in 2001, and the typical dividend yield fell from 2.0 percent in 1995 to 1.2 percent in 2001 – trends that would boost option values.

In addition, while the median expected time to exercise was 5 years for nearly every year of the sample, there was substantial variation across firms, mostly between 2 and 7 years. These terms are consistent with previous studies that have found that employees tend to exercise their options early.<sup>7</sup> We also adjust for vesting restrictions by reducing option grants by those not expected to vest, approximated by the average cancellation rate during the previous three years for each firm. For our sample, average cancellation rates grew to about 0.4 percent of shares outstanding (nearly 20 percent of annual option grants) in 2001.

Similar to the trend in the number of grants, option values with the FASB-allowed adjustments showed a sharp increase. The estimated value of option grants adjusted for expected cancellations rose tenfold from \$6.6 billion in 1995 to \$66.9 billion in 2000.

*Measures of marginal tax rates.* We construct proxies for current marginal tax rates using financial statement data from Compustat and from 10-k reports. Earlier studies have discussed the difficulties of inferring firm tax status from financial statement data. We follow the best-practice advice outlined in Plesko (2003) and incorporate additional information on option exercises. In the absence of an elaborate simulation mechanism required to accommodate the dynamic features of tax code (e.g. Graham 1996(a,b)), Plesko recommends using a three-state tax proxy based on current taxable income and existence of net operating loss carryforwards (NOL). The marginal tax rate is set at the top statutory level (34%) when the firm has positive taxable income and does not have any NOL carryforwards. The marginal tax rate is set to zero if taxable income is negative and the firm has NOL carryforwards. If only one of these conditions

holds, the firm's MTR is set at an intermediate value of 17%.

As a first step, we compute taxable income as total pretax income (Compustat item #170) plus deferred taxes (item #126) grossed up by the top statutory rate, less gains realized from option exercises. Following Graham (1996b), we substitute the change in deferred taxes from the balance sheet (item #74) if the deferred taxes entry is missing. The exercise gains are estimated from number of options exercised and the weighted average strike price reported on the 10-K filings, which allows us to avoid the problematic figures for "tax benefits from stock options" that some firms report (see Hanlon and Shevlin, 2002).

To determine whether a firm has NOL carryforwards, we attempted to differentiate between carryforwards generated by firm's own net operating losses from others, such as those from acquisitions or operating losses of foreign subsidiaries. As discussed in detail by Mills, Newberry, and Novack (2003), carryforwards from these other sources are often poor indicators of corporate tax status since tax losses of a foreign subsidiary cannot be used to reduce U.S. taxable income, and those from acquisitions are subject to a number of significant restrictions. This problem is especially acute for our sample of large S&P 500 firms, nearly all of which have foreign subsidiaries or have been involved in merger activities. Thus, we hand-collected the details of the carryforwards from the financial statements and adjusted for acquisitions and foreign subsidiaries whenever possible.<sup>8</sup>

The distribution of the ratio of contemporaneous exercise gains to taxable income (when positive) shows that for the majority of firms, exercise gains are relatively small (figure 1). Given our sample of large, mostly profitable firms, this skewness is not surprising. Even so, more than 10 percent of the observations record a ratio of more than 30 percent. When we

deduct exercise gains from the sum of pre-tax income and deferred tax assets, the number of observations with net negative taxable income after exercise gains increases slightly from 49 to 73.

We designate a low MTR if net taxable income is negative and the firm has operating loss carryforwards. For our sample, only 40 firm-year observations meet these criteria. At the other end of the spectrum, 537 firm-year observations are designated as facing the top marginal rate, defined if net taxable income is positive and there are no operating loss carryforwards. The remaining observations fall in the middle.

## **Empirical Methodology and Results**

*Dependent and independent variables.* We characterize debt decisions with changes in debt, deflated by beginning of period assets. This focus on incremental debt financing, rather than debt levels, helps us avoid potential endogeneity problems between cumulative debt and marginal tax rates. In particular, firms with high debt levels may generate enough interest expenses to lower their MTR, which could give rise to a spurious negative relationship between marginal tax rates and debt ratios (MacKie-Mason, 1990 and Graham, 1996(a)). Cumulative debt ratios also reflect debt choices made when a firm faced potentially different tax circumstances. In order to better identify tax rate and hedging effects, we exclude years in which firms undertook significant mergers or acquisitions because such transactions often have a substantial effect on debt structure.

As shown in table 3, firms have been increasing debt at an average rate of about 3 percent of beginning of period assets. Figure 2 summarizes the time-series pattern of mean and median

changes in debt. Mean changes in debt were relatively higher in 1998 to 2000 than in the first few years of the sample period; median ratios show greater increases only in 1998 and 1999. As can also be seen, exercise gains and net option grant values were highest in 1998 to 2000. These data suggest that the link between options and debt financing may reflect more than just the NDTs feature of options, as the average firm in our sample has acquired more debt, not less, as option activity has accelerated.

To measure repurchases, we use the dollar amount spent to buyback common and preferred shares from the cash flow statement, deflated by market value at the beginning of the year. Because firms are more likely to buyback common shares for hedging purposes, as opposed to preferred shares which are less liquid, we reduce repurchases for redemptions of preferred stock, estimated as a substantial decline in preferred equity (see Kahle, 2002). The mean repurchase yield was 1.8 percent of shares during our sample period. The 25<sup>th</sup> percentile indicates that more than one-quarter of the firm-year observations involved no repurchases. This pattern reflects the substantial lumpiness in repurchases – many firms did not buyback shares in every year, though nearly all of the firms engaged in repurchases in at least some of the years of our sample.

All firms in our sample granted options, and on average, grants adjusted for expected cancellations were 1.7 percent of shares outstanding; median values were a bit lower at 1.2 percent. The estimated delta for an option granted at the money averaged about .7 for our sample. Thus, firms that adopt a delta-hedging strategy would issue debt and repurchase shares in the amount of  $\delta$  \* number of net option grants (adjusted for taxes). Thus, option grants translated to hedging demands averaged 1.3 percent of shares outstanding.

To calculate marginal tax rates, as discussed above, we allow realized option gains to reduce taxable income and, if large enough, the marginal tax rate. For our sample, the median firm faced the top marginal tax rate, while the firm at the 25<sup>th</sup> percentile faced a lower tax rate, though not zero, designated as 17 percent. We select a set of firms that can be characterized as persistently facing a high marginal tax rate because firms may not greatly alter their behavior in response to short-run fluctuations in tax status. This variable, *highMTR*, indicates that 38 percent of the firms in our sample faced the top marginal rate in every period. The expected value of options granted but not yet exercised can also affect current marginal tax rates because they create the possibility that gains realized in the future will create losses that can be carried back. Options not yet granted also can affect future marginal tax rates. We proxy for these two future effects by the estimated *value* of new option grants, net of expected cancellations. The value of net option grants averaged about 1.9 percent of assets for our sample.

Firm characteristics that are relevant to debt policy relate to need and ability to raise debt and investment opportunities. Excess cash flow, defined by operating income before depreciation less capital spending, reflects both need and financial ability to raise funds. Firms with higher excess cash flow are expected to issue less debt. We also include proceeds to the firm from the exercise of options, which represent a source of funds to the firm but do not boost operating income. As in other studies of debt financing, we control for growth options, fixed assets, and size. Growth options are proxied with market-to-book assets (Smith and Watts, 1992).<sup>9</sup> Firms with more growth options are expected to use less debt to avoid the underinvestment problem that arises when risky debt claimants might benefit at the expense of shareholders (Myers, 1977). Firms with more fixed assets, measured by the ratio of property,

plant, and equipment to total assets, have more assets available to secure debt, and thus could raise more debt. Size is measured with sales, and is expected to be positively related to debt, because of its correlation with information availability and access to markets.

***Changes in debt, tax rates, and option grants.*** This section discusses empirical results of tests of whether new option grants would increase debt financing through a hedging motive, and whether options (through their realized and expected gains) lead to less debt financing by reducing current and future tax rates. Changes in debt are regressed on variables that capture hedging motives, effects of future exercises of option grants on expected MTR, current marginal tax rates, and a number of controls.

We evaluate two alternative measures for hedging motives – number of option grants and  $\delta$  \* number of option grants, as suggested by theory. The latter proxy allows us to introduce heterogeneity on the basis of firm's stock volatility and expected option lifetime, which vary substantially across firms and over time. As shown in column (1) of table 4, the estimated coefficient on net option grants (new option grants adjusted for expected cancellations), is positive and significant. Similarly, the coefficient on the other hedging proxy, net option hedge (column (4)), is positive and significant. These coefficients indicate that debt increases are larger at firms that grant more options, consistent with hedging behavior.

Because a key motivation for hedging is tax savings from debt, the effects of hedging on debt should be greater for firms that face persistently high marginal tax rates. As noted above, we define high MTR firms as those that faced the top statutory tax rate in each year of our sample. As shown in columns (2) and (5), the coefficients on the interaction of the high tax

status and number of net new grants, or the number required for hedging, are positive and significant. That is, firms appear to hedge option grants, and those that consistently face high tax rates hedge by substantially more.

Measures of the effects of option grants on marginal tax rates also appear to affect changes in debt. The effects of option grants on expected marginal tax rates are proxied by the expected value of new grants normalized by firm's assets. The coefficient on the value of new option grants is negative and generally significant, suggesting that firms that anticipate large compensation expenses from option grants have smaller debt increases. The relationship is consistent with the hypothesis that option exercises create a large non-debt tax shield that could reduce current tax rates through loss carrybacks or future tax rates by exhausting future taxable income. However, we do not find evidence in this sample that a measure of the lagged marginal tax rate has much effect on debt (columns 3 and 6); this measure is lagged to reflect the firm's MTR at the beginning of the decision period and to alleviate endogeneity concerns. The estimated coefficient, while positive, is not significant, somewhat in contrast to Graham et al (2002) who find that a measure of current marginal tax rate that accounts for possible tax loss carrybacks and carryforwards is positively related to debt.

The negative coefficient on exercise proceeds, defined as the amount of funds the firm receives when the employees exercise their stock options, is negative and significant in every specification. Because exercises are effectively a sale of securities to employees at a discount, it is not considered income for tax purposes and does not affect the marginal tax rate. However, the proceeds raise cash flow, and a dynamic hedging strategy would predict that the proceeds would be used to pay down debt to unwind the hedge at exercise. Our results indicate that

greater exercise proceeds correspond to smaller increases in debt, consistent with hedging behavior.

Other control variables have the expected signs, as in Graham (1996a). Increases in excess cash flow (operating income less capital expenditures) reduce debt increases, while an increase in fixed plant and equipment is related to stronger debt issuance. An increase in market-to-book ratios, a measure of investment opportunities, is negatively correlated to debt increases. This is consistent with firms using less debt to avoid the underinvestment problem, which is more severe for high growth firms. Finally, the results show that firms with fast sales growth also have greater debt increases, perhaps reflecting greater access to debt markets.

*Share repurchases and option grants.* We next examine share repurchases to assess whether firms are buying back shares in a manner consistent with hedging option grants. Because the dependent variable is bound from below by zero, we use a one-sided tobit model to estimate the repurchase regression. As shown in table 5, column 1, the coefficient on net option grants, adjusted for expected cancellations, is positive and significant, as is the coefficient on the interaction of new option grants and high marginal tax rates. Thus, as we found for net debt finance, firms appear to buyback shares in conjunction with net new option grants, and those with the highest MTR buyback even more. We find similar results based on a measure of the options needed to initiate a dynamic hedging program (column 2). The coefficients on the hedge variables suggest that firms are buying back shares, but by less than would be expected if they strictly followed a dynamic hedging strategy. We address the potential concern that the coefficient on high MTR firms simply reflects high cash flow at the firms by including as a

control variable (lagged) excess cash flow, defined as operating earnings less capital expenditures, which has the predicted positive effect (Fenn and Liang, 2001; Grullon and Michaely, 2000). We also find that lagged sales are positively related to share repurchases, and lagged market-to-book is negatively related to share repurchases.

Even at high tax rate firms the total effect of net option grants on repurchases is not high enough to make the case that firms are strictly adhering to a formal dynamic hedging strategy, (nor do we think that firms follow such a strategy to the letter). Yet, there is ample evidence that share repurchases are motivated by hedging considerations. When we also add a measure of options outstanding at the beginning of the period, the coefficient, though positive, is insignificant (columns 3 and 4). In contrast, both Kahle and Weisbenner found significant coefficients on options outstanding, but neither of those studies controlled for new option grants. These results suggest that the bulk of option-related repurchases occurs in the year when the options are granted. This timing is consistent with hedging behavior, because a hedge is most valuable when it is put on before options go into the money. Subsequent purchases of stock in a hedging program are incremental, as the estimated delta starts at a value of about .7 on average, and cannot exceed 1. Moreover, though the passage of time would tend to boost repurchases, interim price fluctuations can lead to both purchases and sales of stock.

Both Kahle and Weisbenner argue that repurchases are a mechanism to manage dilution from the granting of employee stock options, pointing to studies that suggest that measures such as EPS are important for stock price valuation. Our findings indicate that share repurchases are more closely related to new grants, not outstandings. This finding suggests a motivation for share repurchases that puts less weight on the importance of the number of shares, and is more

consistent with classical finance theory of firms protecting their value by hedging exposures to unexpected stock price gains, and with creating value with the tax savings from the additional debt.

***Robustness checks.*** This section evaluates the robustness of results. One puzzling finding in the previous set of results is the insignificance of the marginal tax rate. A possible explanation is that our sample does not permit enough variation in this rate; indeed, 72 percent of the firm-year observations are designated as high tax rate. In part, this concentration of high tax rate firms owes to our focus on large firms, which tend to be profitable, and also because we hand-collect data on operating loss carryforwards and thus are able to exclude carryforwards from foreign subsidiaries and acquisitions. To explore the possibility that lack of variation can help to explain the weak finding on the current marginal tax rate, we construct a dataset from Execucomp that contains information on more firms, but less rich data on option activity. This data source has been used by a number of studies that have examined option activity (see e.g. Liang and Weisbenner, 2002; Murphy, 2003, for descriptions of this database). While this database allows us to substantially expand our sample cross-sectionally to firms in the S&P 1500, it does not contain information on option exercises or cancellation rates; nor are we able to code mergers and acquisitions. Moreover, since we are not able to check the accuracy of NOL carryforward data by hand, we impose data screens suggested by Mills et al (see footnote 8) to reduce the noise from foreign or acquisition-generated carryforwards. Thus, we trade off precision in estimating the current marginal tax rate and net option grants for a much broader cross section. About 58 percent of the firm-year observations are defined as high tax rate, less

than in our original sample.

Table 6 presents results for changes in debt based on the larger sample. First, debt increases are higher when options are granted, as in the previous results, consistent with hedging behavior. However, the coefficient on the interaction with high MTR is not significant, suggesting that while debt increases with option grants, the effect is not stronger for the firms with persistently high tax rates. The coefficient on the value of new option grants is negative and significant, suggesting that expected exercise gains could reduce marginal tax rates and temper debt increases. More importantly, we find a strong positive effect of the lagged marginal tax rate on debt changes. These results lend some support to our hypothesis that our lack of significance could derive from inadequate variation in the measured tax rate, (though additional work is needed to fully understand this link).<sup>10</sup> We also repeat the estimation for the sample excluding firms with no debt (354 observations) since they are a relatively substantial fraction of the Execucomp sample. The reported results are similar to those based on the sample of all firms.

Tobit estimates of share repurchases based on the larger sample are shown in table 7. Share repurchases are less frequent, and on average, smaller than for the bigger sample. As we found for the previous sample, the coefficients are positive for new option grants and options needed for hedging, though we are not able to control for expected cancellation rates. The coefficient estimates for the option grant and option hedge, each interacted with the marginal tax rate, are also positive and significant. Coefficients on control variables are similar to the previous results, though the negative coefficient on the industry dummy variable for technology firms reaches significance. These results for the larger sample of firms support the hypothesis

that firms buyback shares in conjunction with granting options, especially those that face high marginal tax rates, consistent with hedging activity to limit exposures to option grants from greater-than-expected stock price increases.

*Offsetting effects and net implications for debt.* Our empirical results identify two offsetting effects of options on changes in debt through the role played by option gains in creating NDTs and hedging demands. The relative magnitudes of these effects are a strictly empirical matter. While it may be difficult to characterize a typical firm for which both effects are important, it is easier to describe two extreme cases. On the one hand, there exist highly profitable firms, for which the chance that their MTRs would be reduced by the NDTs of options is quite small; it is precisely these firms that would increase debt by hedging their option grants and enjoy the current tax savings of interest deductions. In contrast, there are firms for which profits are sufficiently low that it is likely that grants will reduce MTRs and give the firms sufficient incentives not to take on debt. These firms are also likely to have much weaker incentives to engage in hedging strategies that generate current tax savings such as dynamic delta-hedging.

Nonetheless, we attempt to provide some view of the offsetting effects of stock options on incremental debt. To do so, we examine the net effect of new option grants on changes in debt by evaluating coefficients on three variables – net grants, net grants \* high MTR, and net grant values. From table 4, column (1), estimates indicate that the partial effect on changes in debt is:

$$\partial (\Delta \text{debt}) / \partial (\text{net grants}) = .32 + .48 * \text{high MTR} - .277 * (\text{option value} * \text{csho} / \text{at})$$

where *csho* is shares outstanding and *at* is the value of firm's assets. The first two effects reflect hedging behavior and the third effect reflects the reduction in MTR from an increase in option grant values. Firms that currently face a high MTR and would gain the most by hedging will, on net, increase debt as a result of options. To see this, the first two effects indicate that an increase in net grants will raise incremental debt by 0.8 (= .32 + .48). At the same time, however, the increase in the net value of option grants raises the possibility of reducing MTRs. This offset is relatively small, especially because option values times shares outstanding are less than assets. Given a mean (median) value of .9 (.5) for the term in brackets, the negative effect could be as much as -.25. Nonetheless, the expected net effect on debt is still positive. In contrast, the effect of options on debt changes is more ambiguous for firms that are not classified as high MTR. An increase in net grants would increase the incremental debt of such firms by only .32, but the NDTs feature of options could reduce new debt by .25, leaving a net change close to zero. While we have too few firms in our sample that consistently face a low MTR to conduct a meaningful comparison (and they have a low MTR for a wide range of reasons, ranging from start-ups to approaching bankruptcy), these firms are the least likely to be concerned with tax benefits of hedging, and thus the effect on debt change would be simply captured by the third effect. For these, we would expect that options reduce debt because of the NDTs benefit.

Graham et al (2002) document that simulated MTRs for S&P 100 firms are basically unaffected after incorporating grants. That is, these firms do not benefit from the NDTs because their taxable income before deducting exercise gains is too large. These results are roughly

consistent with our results for high MTR firms, though we identify another channel through which options may influence debt policy.

## **Conclusions**

We have explored two channels through which the tax treatment of employee stock options and debt can affect debt financing and capital structure choices. The first channel functions through the non-debt tax shields from the realization of option gains which can exhaust taxable income, reducing a firm's marginal tax rate, and new grant values that raise the possibility of this event in the future. At the same time, the tax deductibility of interest payments on debt provides firms an incentive to hedge their option grants with a strategy of repurchasing shares and issuing debt in proportion to the options granted.

We empirically test these offsetting effects on debt on a sample of about 120 to 130 large nonfinancial S&P 500 firms from 1995 to 2001, and find evidence consistent with both effects. We find supporting results for the role of options as a non-debt tax shield through the expected marginal tax rate, but effects through the current marginal tax rate are weaker. Results for a broader cross-section of firms, but for which option data are less precise, suggest that expanding the data set to get more variation in the tax rate could help to more precisely identify the effect through the current marginal tax rate. We also find strong evidence of hedging behavior for firms that face high marginal tax rates, and thus most able to benefit from the tax savings, though the coefficient estimates do not indicate a strict adherence to a dynamic hedging strategy. These effects, nonetheless, are significant, and indicate that option grants increase debt issuance. Using our coefficient estimates, we construct a simple illustration of the two effects of option grants

and show that for high tax rate firms, the effect on debt through hedging more than offsets the reduction in debt from reducing expected marginal tax rates. Our results also suggest a link between share repurchases and option grants, which, contrary to the desire to offset dilution, is more consistent with classical finance theory of firms protecting their value by hedging exposure to unexpected stock price gains and creating value by generating additional tax shields.

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## Endnotes

1. Only gains from exercising non-qualified employee stock options are deductible from corporate taxable income, but these types of options are estimated to account for the vast majority of options. Based on information from Jacquette et al (2003), we would expect that our estimates of gains would be overstated by between 5 and 10 percent. However, because we have no information on the cross-sectional variation in types of options, we treat all options as nonqualified.

2. In the US, firms with operating/taxable income of less than \$18.3 million are subject to a progressive tax schedule with a number of phase-ins that can push marginal tax rates as high as 38 and 39 percent. For taxable income above \$18.3 million, the marginal tax rate is flat at 34 percent (increased to 35 percent in 1993-94). In this paper we assume that firms effectively face two marginal tax rates – 0 percent if they have no taxable income and 34 percent otherwise.

<sup>3</sup> This argument implicitly assumes that employees do not realize that the firm may derive the additional tax-shield value from issuing and hedging an option. That is, in selling their labor services the employees value the stock option using a standard Black-Scholes model. In this case, stock-option issuance becomes a pure tax arbitrage and one needs to introduce new modeling features to prevent firms from paying for their labor services exclusively with stock options.

4. Following the argument of Smith and Stulz (1985), an important advantage of stock options grants lies in their ability to reduce the volatility of firm (taxable) income, since option gains are likely to be positively correlated with profits. By locking in the cost of an option grant, dynamic hedging appears to reduce this benefit. However, in evaluating the benefits of dynamic hedging one needs to consider the tradeoff between an increase in the *level* of taxable income (via a reduction in labor costs through hedging) and a reduction in its *volatility* (via unhedged option grants).

5. For example, a firm that faces a statutory MTR today may expect its stock options to generate exercise gains that exceed its taxable income in the future. If such gains do not occur within the next two years, the firm will not be able to carry back those losses, and so its current MTR will remain at the statutory rate.

6. Another related issue is that the choice to exercise an option or leave a firm may be related to the stock price, leading to a relationship between the time to exercise and stock price. When prices rise, employees may exercise their options to rebalance their portfolios since they cannot just sell them (Kulatilaka and Marcus, 1994). This negative correlation between stock price returns and life of the option would lead to option values lower than ones that simply adjusted for an average expected option term. On the other hand, employees may be less likely to leave a firm when prices rise, leading to higher option values than one based on past departures (Cuny and Jorion, 1995; Jennergren and Naslund, 1993).

7. Employee stock options typically expire in 10 years and vest ratably over time. However, for a sample of employees at five firms, Huddart and Lang (1996) found the average time to exercise was less than 4 years, and Carpenter (1998) found for a sample of executives at 40 firms that the average time was 5.7 years.

8. For instances where collection of detailed data on carryforwards is too expensive, Mills et. al. propose a solution that involves screening Compustat reported NOLs on either the absence of U.S. paid income tax or negative pretax income. We use this method to construct measures of marginal tax rates for a larger sample of S&P 1500 firms used for robustness checks later in the paper. We do not employ this method for our sample of large S&P 500 firms because the US paid income tax variable is missing for a number of firms, and would force us to throw out a large number of observations.

9. We do not use R&D as in Graham et al (2002) because that Compustat variable is missing for many firms in our sample.

10. Our discussant at the conference, Matthew Knittel of the Office of Tax Analysis, was able to look at confidential tax return for large S&P 500 firms and agreed with our assessment that many of the firms in our sample faced the highest marginal tax rate in recent years, suggesting our algorithm for determining high and low MTRs was reasonable.

Table 1

**Size, debt, and share repurchases of sample firms**

The sample includes the largest 120 to 130 nonfinancial corporations based on market value in the S&P 500 Composite index each year. Market value is the market value of the common stock at the end of the fiscal year. Share repurchases are repurchases of common stock (Compustat share repurchases adjusted for declines of preferred stock). Percent of nonfinancial corps is the value for the sample firms as a fraction of the value for all US nonfinancial corporations in Compustat.

	1995	1996	1997	1998	1999	2000	2001
<b>Market Value</b>							
Sample firms (\$ billions)	2,471	3,070	4,319	5,903	7,642	7,779	6,231
Percent of public nonfinancial corps.	62	62	65	70	67	67	63
<b>Assets</b>							
Sample firms (\$ billions)	2,506	2,727	3,048	3,307	3,831	4,305	4,674
Percent of public nonfinancial corps.	43	43	44	44	44	44	48
<b>Debt</b>							
Sample firms (\$ billions)	826	868	976	1,068	1,243	1,341	1,516
Percent of public nonfinancial corps.	43	43	43	42	41	43	43
<b>Share Repurchases</b>							
Sample firms (\$ billions)	35	47	76	88	94	100	86
Percent of public nonfinancial corps	49	50	59	51	55	60	66

Table 2

**Employee stock options at sample firms**

The sample includes the nonfinancial corporations among the largest 150 companies based on market value in the S&P 500 Composite index each year. Option data are collected from company 10-k reports. Ratios are weighted by market value. Employee gains are estimated as the difference between market price, proxied with the grant price of options in that year, less the strike price multiplied by the number of options exercised. Proceeds to firm are the strike price multiplied by the number of options exercised.

	1995	1996	1997	1998	1999	2000	2001
Number of options (percent of shares outstanding)							
Grants	1.25	1.40	1.45	1.66	1.78	2.39	2.17
Exercises	.77	.94	.98	1.24	1.33	1.37	.91
Employee gain	.37	.50	.56	.82	.96	1.02	.59
Proceeds to firm	.40	.44	.42	.42	.37	.35	.32
Cancellations	.18	.24	.23	.26	.31	.43	.46
Outstandings	5.08	5.48	5.72	6.64	7.46	8.03	8.31
Exercise gains (\$ billions)	7.9	13.5	20.8	39.4	62.3	80.5	34.4
Net grant values (\$ billions)	6.6	9.7	14.2	22.0	33.5	66.9	43.5

Table 3

**Sample distribution of changes in debt and repurchases, options and tax rates, and firm characteristics**

The sample includes the nonfinancial corporations among the largest 150 companies based on market value in the S&P 500 Composite index each year. Option data are collected from company 10-k reports. Financial data are from Compustat. See text for variable definitions.

Variable	Mean	Standard Deviation	Percentile		
			<u>25<sup>th</sup></u>	<u>50<sup>th</sup></u>	<u>75<sup>th</sup></u>
<i>a. Debt and repurchases</i>					
Change in debt/assets <sub>(t-1)</sub>	.030	.12	-.012	.009	.050
Repurchases/market value	.018	.03	.000	.008	.025
<i>b. Options and tax rates</i>					
Net option grants/shares outstanding	.017	.02	.007	.012	.020
Net grants for hedge/shares outstanding	.013	.01	.005	.009	.014
Marginal tax rate	.282	.09	.17	.34	.34
High MTR	.384	.49	.0	.00	1.0
Net option grant values/assets	.019	.07	.002	.005	.013
Exercise proceeds/assets	.009	.01	.002	.005	.011
<i>c. Firm characteristics</i>					
Excess cash flow/assets	.104	.09	.049	.097	.156
Fixed assets/assets	.349	.21	.180	.304	.512
Market-to-book assets	2.71	2.23	1.42	2.0	3.04
Sales	20.76	28.72	6.61	12.52	22.69

Table 4

**Regression estimates of determinants of changes in debt**

The sample has nonfinancial corporations among the largest 150 companies based on market value of equity each year in the S&P 500 composite index. The dependent variable is changes in debt relative to beginning-of-period assets. Excess cash flow, fixed assets, market-to-book, and sales are annual changes, and the marginal tax rate is lagged. All regressions are estimated with year dummies and industry dummies for tech, utilities, and other.

	(1)	(2)	(3)	(4)	(5)	(6)
Net option grants	.315** (.149)	.299** (.145)	.315** (.148)			
Net option grants * high MTR		.578** (.281)	.479* (.293)			
Net option hedge				.44** (.222)	.424* (.226)	.449** (.220)
Net option hedge * high MTR					.815** (.385)	.682* (.402)
Value of option grants	-.298* (.155)	-.291* (.153)	-.277* (.127)	-.311** (.158)	-.308** (.156)	-.294* (.159)
Marginal tax rate			.029 (.033)			.029 (.033)
Exercise proceeds	-.007** (.002)	-.007*** (.002)	-.007*** (.002)	-.007*** (.002)	-.007*** (.002)	-.007*** (.002)
Δ Excess cash flow	-.155*** (.058)	-.164*** (.06)	-.167*** (.059)	-.156*** (.059)	-.165*** (.059)	-.168*** (.059)
Δ Fixed assets	.190*** (.034)	.189*** (.033)	.186*** (.034)	.189*** (.033)	.188*** (.033)	.185*** (.034)
Δ Market-to-book	-.002 (.002)	-.002 (.002)	-.002 (.002)	-.002 (.002)	-.002 (.002)	-.001 (.002)
Δ Log (Sales)	.076*** (.021)	.077*** (.021)	.077*** (.021)	.077*** (.021)	.077*** (.021)	.077*** (.021)
Constant	.003 (.008)	.000 (.008)	.009 (.013)	.003 (.008)	.001 (.008)	.008 (.013)
N	627	627	627	627	627	627
R <sup>2</sup>	.168	.172	.173	.168	.172	.173

Table 5

**Tobit estimates of determinants of share repurchases**

The sample has nonfinancial corporations among the largest 150 companies based on the market value of equity each year in the S&P 500 composite index. The dependent variable is repurchases of common stock relative to beginning of period market value. Excess cash flow, market-to-book assets, and log (sales) are lagged values. All regressions are estimated with year dummies and industry dummies for tech, utilities and other.

	(1)	(2)	(3)	(4)
Net option grants	.195*** (.07)		.193** (.08)	
Net option grants * high MTR	.268** (.13)		.265* (.14)	
Net option hedge		.274*** (.10)		.260** (.11)
Net option hedge * high MTR		.314* (.19)		.307* (.19)
Excess cash flow	.001*** (.00)	.001*** (.00)	.001*** (.00)	.001*** (.00)
Market-to-book assets	-.003*** (.00)	-.003*** (.00)	-.003*** (.00)	-.003*** (.00)
Log Sales	.007*** (.00)	.007*** (.00)	.007*** (.00)	.007*** (.00)
Exercise proceeds			-.001 (.00)	-.001 (.00)
Outstanding options			.000 (.00)	.000 (.00)
Constant	-.071*** (.01)	-.071*** (.01)	-.071*** (.01)	-.072*** (.01)
N	729	729	729	729

Table 6

**Regression estimates of determinants of changes in debt for larger sample**

The sample has nonfinancial corporations in Execucomp that granted options to at least one top executive during 1995 to 2001. The dependent variable is changes in debt relative to beginning-of-period assets. Option grants are derived from options granted to top executives divided by the share granted to all employees. Excess cash flow, fixed assets, market-to-book assets and log (sales) are annual changes and the marginal tax rate is lagged. All regressions were estimated with year dummies and industry dummies for tech, utilities and other.

	<u>All Firms in Execucomp</u>		<u>Firms with Debt &gt; 0</u>	
	(1)	(2)	(3)	(4)
Option grants	.308** (.13)		.487*** (.17)	
Option grants * high MTR	-.075 (.13)		.045 (.17)	
Option hedge		.300* (.16)		.504** (.21)
Option hedge * high MTR		-.168 (.16)		-.038 (.21)
Value of option grants	-.133* (.08)	-.113 (.07)	-.390*** (.14)	-.350*** (.13)
Marginal tax rate	.112*** (.02)	.114*** (.02)	.125*** (.03)	.128*** (.03)
Δ Excess cash flow	-.102*** (.04)	-.102*** (.04)	-.119*** (.03)	-.119*** (.03)
Δ Fixed assets	.336*** (.03)	.336*** (.03)	.313*** (.03)	.313*** (.03)
Δ Market-to-book	-.013*** (.00)	-.013*** (.03)	-.023*** (.00)	-.024*** (.00)
Δ Log (Sales)	.065*** (.02)	.065*** (.02)	.115*** (.02)	.114*** (.02)
Constant	-.033*** (.01)	-.031*** (.01)	-.043*** (.01)	-.041*** (.01)
N	3917	3917	3563	3563
R <sup>2</sup>	.225	.225	.256	.254

Table 7

**Tobit estimates of determinants of share repurchases for larger sample**

The sample has nonfinancial corporations in Execucomp that granted options to at least one top executive during 1995 to 2001. The dependent variable is repurchases of common stock relative to beginning of period market value. Option grants are derived from options granted to top executives divided by the share granted to all employees. Excess cash flow, market-to-book assets and log (sales) are lagged values. All regressions were estimated with year dummies and industry dummies for tech, utilities and other.

	(1)	(2)
Option grants	.603*** (.09)	
Option grants * high MTR	.270** (.10)	
Option hedge		.475*** .12
Option hedge * high MTR		.472*** (.13)
Excess cash flow	.236*** (.02)	.232*** (.02)
Market-to-book-assets	-.007*** (.00)	-.007*** (.00)
Log (sales)	.012*** (.00)	.011*** (.00)
Constant	-.145*** (.01)	-.138*** (.01)
N	5,286	5,286

Figure 1  
Contemporaneous Exercise Gains as a Percent of Taxable Income

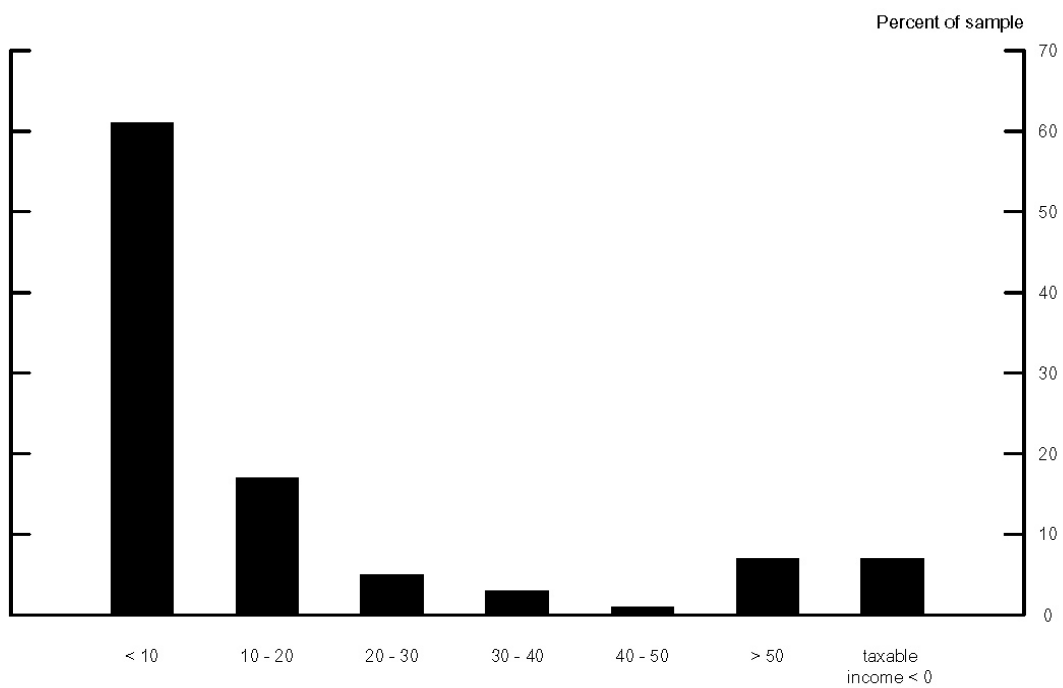
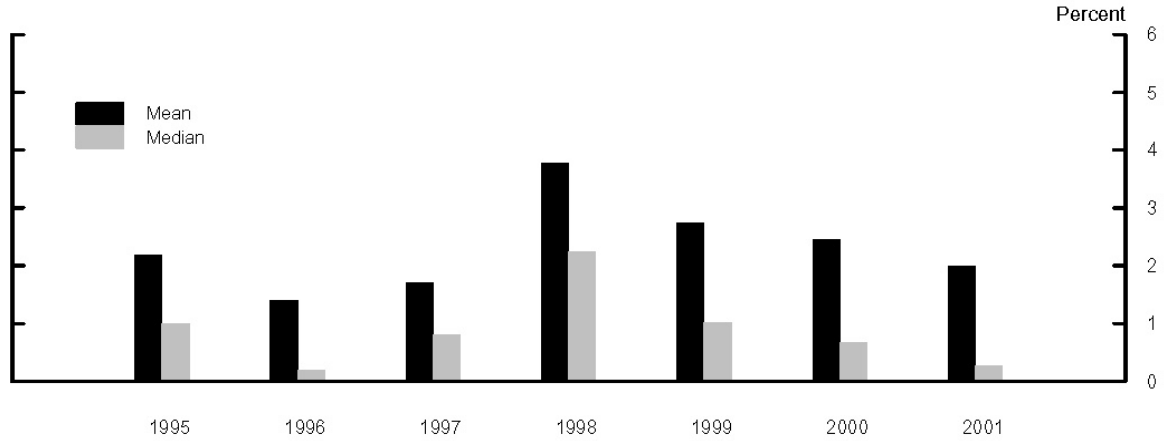


Figure 2

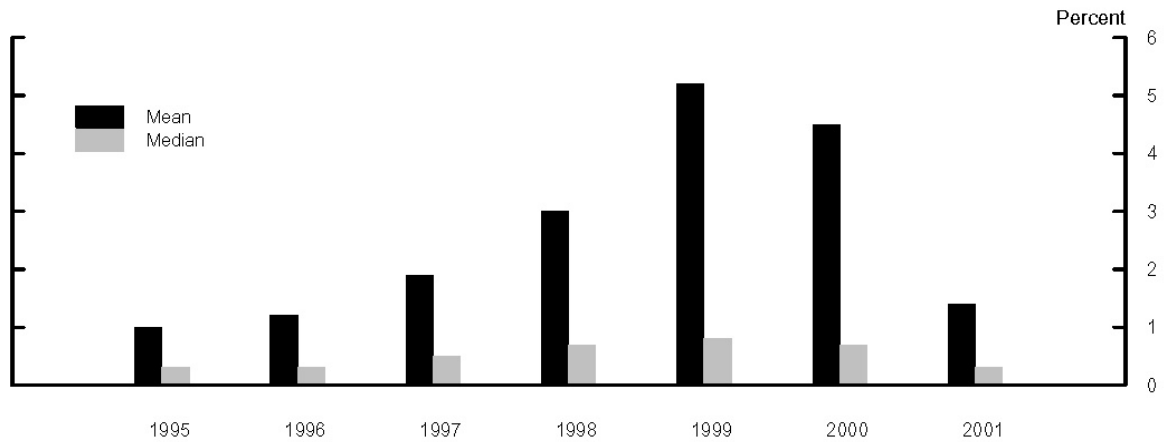
**Changes in Debt and Option Values, 1995-2001**

The sample has nonfinancial corporations among the largest 150 companies based on the market value of equity each year in the S&P 500 Composite Index. Changes in debt are relative to beginning of period assets. Exercise gains are the difference between the average stock price and the weighted average strike price of options exercised, times the number of options exercised. Net value of new grants is the estimated value of new option grants from the Barone-Adelsi-Whaley approximation, less expected cancellations.

Changes in Debt to Assets



Exercise Gains to Assets



Value of New Grants to Assets

