Investor Reactions to CEOs' Inside Debt Incentives

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Abstract

Pensions and deferred compensation represent substantial components of CEO incentives. Limited disclosure requirements hindered research into these widely used "inside debt" compensation contracts until SEC reforms in 2007 greatly increased their transparency. We study stockholder and bondholder reactions to companies' initial reports of their CEOs' inside debt positions. We find that bond prices rise, equity prices fall, and the volatility of both securities drops upon disclosures by firms whose CEOs have sizeable defined benefit pensions or deferred compensation. Similar changes occur for credit default swap spreads and exchange traded options. The results indicate a reduction in firm risk, a transfer of value from equity toward debt, and an overall destruction of enterprise value when a CEO's deferred compensation holdings are large.

Keywords: deferred compensation, inside debt, executive compensation disclosure

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I. Introduction

Defined benefit pensions and deferred compensation play significant roles in the compensation of top U.S. managers. These incentive plans are known to economists as "inside debt," since they represent fixed obligations for the company to make future payments to corporate insiders. In the large majority of U.S. companies, inside debt obligations are unsecured and unfunded, exposing managers to the same default risks and insolvency treatment as outside creditors. Large inside debt contracts might therefore cause CEOs to manage their firms conservatively, avoiding risk and preserving liquidity in patterns that would appeal to the company's other lenders (Jensen and Meckling (1976, pp. 352-354); Edmans and Liu (2010)). This hypothesis has become quite timely as many firms seek to dampen their managers' risk-taking incentives in the aftermath of the global financial crisis.

Inside debt compensation represents a potential method of reducing the agency costs of debt in a levered firm. Agency costs of debt arise from strategies in which managers change the firm's investment policy, payout policy, or capital structure in ways that reallocate wealth from debtholders to stockholders, usually through some increase in the overall risk of the firm. To counteract this potential problem, Jensen and Meckling suggest an optimal incentive structure under which the manager's personal holdings of the firm's debt and equity should occur in a ratio

that mimics the firm's overall external capital structure. However, excessive inside debt compensation could cause problems. Jensen and Meckling elaborate on this point, noting that if a manager's inside debt holdings exceed the amount implied by the condition above, he might manage the firm too conservatively, reducing overall risk in ways that transfer wealth from stockholders to debtholders. These hypotheses are derived formally in a recent paper by Edmans and Liu (2010).

Research into these and other inside debt hypotheses has been almost nonexistent due to limited reporting requirements. A comprehensive Securities and Exchange Commission (SEC) disclosure reform in 2007 greatly increased the transparency of pensions and deferred compensation, and we use the data produced by this regulatory change to study investor reactions to the first reports of CEOs' inside debt positions. We identify 299 companies whose CEOs have positive inside debt holdings that are disclosed in proxy statements filed in 2007 when the SEC's new rules took effect. We examine changes in the value of company stocks and bonds, the implied volatility of exchange traded options, and the spreads of credit default swap derivative securities. In line with theory, we find evidence of transfers of value away from equity and toward debt upon revelations that top managers hold large pension and deferred compensation claims. Our results show that bond prices rise, equity prices fall, and the volatility of both securities drops at the time of disclosures by firms whose CEOs have large inside debt. Changes in the prices of derivative securities are consistent with these results.

Figure 1, a tabulation of monthly regression coefficient estimates, illustrates the overall pattern of results that we observe for corporate bonds. The figure shows the outcome of a series of ordinary least squares regressions over a sample of 299 publicly traded bonds, representing the

most heavily traded bonds issued by each of the companies in our sample. The dependent variable equals the yield spread for each bond, or the difference between the bond's yield to maturity at month-end and the yield on a U.S. Treasury bond of similar maturity. The coefficient displayed in the figure is the estimate for the association between bond yield spreads and the CEO's "relative incentive ratio," a statistic that plays a key role in our analysis. The relative incentive ratio estimates how a unit increase in the value of the firm raises the value of the CEO's inside debt vs. inside equity claims, scaled by a similar measure of how the same unit increase in firm value would cause changes in the company's external debt vs. external equity claims; it is similar to the *k* ratio derived in the model of Edmans and Liu (2010). A CEO with a relative incentive ratio of 1 would hold a mix of claims perfectly aligned with the firm's capital structure, so that he had no incentive to pursue risk-shifting strategies that would transfer value to equity at the expense of debt or vice versa. If the CEO's relative incentive ratio exceeds 1, he would be expected to pursue conservative policies that enhance the value of the firm's debt claims, and if the ratio is below 1, he would follow risky strategies that favor equity investors. We estimate the monthly regressions in a piecewise specification, and the chart shows the estimated slope of the CEO's relative incentive ratio for the segment above the critical value of 1.00.[1] Regressions are estimated on a monthly basis in event time, where month 0 is the month when each company files its proxy statement disclosing the CEO's inside debt holdings. As shown in the chart, the CEO's relative incentive ratio, which was unknown to investors prior to

[1] The regressions include a full range of additional control variables: firm leverage, firm size (log of assets), return on assets, interest coverage, equity volatility, bond time to maturity, bond coupon rate, the amount of the bond issue outstanding, indicator variables for secured status, callable status, and credit ratings A, Baa, Ba, B, and Ca and lower, and macro credit market variables including the term spread (Treasury 10-year rate minus 1-year rate) and credit spread (Moody's Baa yield - Aaa yield). Significance levels are determined by robust standard errors.

the first disclosures in month 0, had no significant impact on corporate bond yields up to that time. After the initial CEO inside debt disclosures, our cross-sectional estimates of the influence of the CEO's relative incentive ratio upon bond prices become consistently negative and statistically significant as theory would predict, for those observations in which the CEO's internal incentives tilt more heavily toward inside debt than does the firm's external leverage ratio.

By showing that investors take close account of managers' large inside debt positions when pricing a firm's external claims, our results extend a nascent empirical literature that illuminates the importance of inside debt as an incentive mechanism. Up to now most studies of CEO risk-taking have focused solely upon the vega, or change in value of equity incentives with respect to risk, and have overlooked altogether the interplay between inside equity and inside debt incentives. For example, Coles, Daniel and Naveen (2006) find connections between CEOs' equity vegas and firms' capital spending patterns, while Tchistyi, Yermack and Yun (2009) find that CEOs with large equity vegas are more likely to use performance sensitive debt, a contract in which the coupon rate increases if the firm's credit rating deteriorates and vice versa. The only empirical paper published to date on the incentives from inside debt is Sundaram and Yermack (2007), which finds that when managers hold large inside debt positions, the expected probability of the firm defaulting on its external debt is reduced, consistent with a hypothesis that these managers operate the firm conservatively in order to protect debt values. Additional cross-sectional studies of inside debt appear in recent working papers by Gerakos (2010) and Cen (2010), while a study by Bebchuk and Jackson (2005) documents the magnitude of CEO pensions.

Several recent working papers have developed valuation results related to the balance between the CEO's inside debt and equity incentives, many of them using the analytical framework introduced in this paper. Anantharaman, Fang, and Gong (2010) study a sample of 1,462 bank loans from the Dealscan database in 2006-08. After controlling for a range of loan attributes, the authors find that firms face a lower cost of debt when the CEO has a high ratio of inside debt to inside equity compensation, a result that is completely consistent with our Figure 1 and various other regression results below. The authors find a parallel result for a sample of 511 new public bond issues in 2006-2008. Wang, Xie, and Xin (2010) obtain very similar results for a smaller sample of Dealscan private loan contracts in 2007. They also find a variety of other debt contract variables are set less stringently when the CEO holds larger amounts of inside debt: firms are permitted to post lower collateral, debt contracts have fewer covenants, and loans are syndicated less widely. However, the authors find that their pricing results do not extend beyond 2007 to the financial crisis period of 2008-09. They conjecture that all but the most creditworthy borrowers may have been screened out of the loan market during 2008-09, and that inside debt holdings by management may have been unimportant in this subclass of companies. Chen, Dou, and Wang (2010) find a similar pricing pattern for yields on public bond issues from 2007-09, but the paper does not find a significant result within a sample of bank loan contracts drawn from Dealscan. Chava, Kumar and Warga (2010) find a lower incidence of bond covenants when CEOs receive more of their compensation in the form of a pension, the most important type of inside debt.

The banking sector offers an important setting in which to examine the potential for inside debt to reduce agency problems. Regulators and analysts have voiced widespread concern

about a link between equity-based incentive compensation and excessive risk-taking by financial institutions during the global financial crisis. Tung and Wang (2010) use the framework developed in this paper to test whether inside debt compensation has helped mitigate risk-taking by CEOs in the banking industry. The authors conclude that bank CEOs with large amounts of inside debt compensation exposed their firms to less risk and as a result performed better during the crisis. A related paper by Bolton, Mehran and Shapiro (2010) provides a theoretical model of how inside debt compensation can reduce risk-taking by bank CEOs, suggesting that these managers be compensated partly based on the value of credit default swaps tied to their banks' capital structure. The authors find event study evidence similar to ours, with a bank's credit default swap spreads becoming more narrow when it discloses large pension and deferred compensation holdings by its management.

In many ways our empirical results are the mirror image of those reported in the classic event study by DeFusco, Johnson and Zorn (1990). In that paper the authors examine announcement effects of executive stock option plans introduced by more than 400 firms between 1978 and 1982. On average these firms' stock prices rise, bond prices fall, and equity volatility rises around the time of the plan disclosures. The authors interpret these results as consistent with a pattern of risk shifting, in which both equity and debt investors expect firms to pursue riskier investment strategies due to the managers' option-based incentive compensation. In our study, the implication of the results is exactly the opposite: to the extent that managers have large unfunded deferred compensation claims against their firms, outside investors expect them to manage conservatively, implying lower-risk investment strategies that would tend to make debt safer and equity less attractive.

Our research adds to an increasing list of studies using the SEC's recent disclosure expansion to illuminate aspects of executive compensation that could not be researched previously. Papers in this category include Grinstein, Weinbaum and Yehuda (2008) and Andrews, Linn and Yi (2009) (executive perquisites); Murphy and Sandino (2010) and Cadman, Carter and Hillegeist (2010) (the influence of compensation consultants); and Faulkender and Yang (2010) and Cadman, Carter, and Semida (2009) (peer groups used for benchmarking executive incentives). We also contribute to the small but growing literature that uses event study methods to examine the impact of corporate disclosures upon the value of debt securities. While many hundreds of stock price event studies have been published, only several dozen papers have included event studies using publicly traded corporate bonds (see Bessembinder et. al, 2008, for a list of these studies), while only a small handful of papers have conducted event studies using credit default swap spreads (Jorion and Zhang, 2007; Imbierowicz and Wahrenburg, 2009).

The remaining sections of this paper are organized as follows. Section II describes the sample selection process and the resulting dataset. Section III contains the main event study analysis of price changes of company stocks and bonds, spread changes for credit default swaps, and implied volatility changes for exchange traded options. Section IV presents a discussion of the results and conclusion.

II. Hypotheses, Sample Selection and Data Description

A. Aspects of inside debt

Although not used by all companies, inside debt compensation for executives generally

consists of two pieces: defined benefit pensions and deferred compensation. Pension benefits may sometimes be negotiated, but they usually accrue to managers under company-wide formulas established by each firm, often based upon each executive's years of service and average level of cash compensation. When an executive retires, he can draw the pension in the form of a life annuity or as a single lump sum, equal to the actuarially calculated present value of expected lifetime benefits. Deferred compensation, in contrast, accrues if the executive makes a discretionary investment decision that involves him lending money back to his firm by foregoing cash compensation that he would otherwise be entitled to receive in the current period (in some cases, these deferral decisions are mandatory). Deferred compensation may often be invested either at a fixed rate of return, or in the company's stock, or in a menu of stock or bond mutual funds chosen by the firm. Many companies allow managers to make frequent changes in how their deferred compensation is invested. Deferred compensation is generally paid out to the executive at retirement, although earlier withdrawals are permitted by some firms under certain limited circumstances. In addition to the incentive implications of these plans, a major motivation for executives to receive inside debt compensation is that its taxation is almost always deferred until the executive receives payouts when retired.

The incentive benefits from inside debt compensation arise because the manager generally bears the same default risk that is faced by a company's other unsecured creditors, and also has the same incentives to preserve firm value in bankruptcy. If a firm is solvent, a manager's pension and deferred compensation claims have fixed payoffs that are independent of equity value. If the firm becomes bankrupt, the manager's pension and deferred compensation receive the same recovery rates as the debts of other unsecured lenders. While occasional

exceptions exist at firms that place assets into special "secular" trust funds to secure pension benefits, these cases are rare because such transactions negate valuable tax benefits for the firm and its executives. In the very large majority of companies, executive pension plans are funded and secured only up to modest limits, which are typically a small fraction of the amount due to top executives, and only a minor amount of a CEO's pension will be insured by the federal Pension Benefit Guaranty Corporation (PBGC).[2] Deferred compensation plans may or may not be funded by devices such as "rabbi" trusts, but these assets are unprotected if the firm faces claims from other creditors.

If a firm files for bankruptcy, executives who are due lifetime pension benefits stand in line and negotiate alongside other unsecured creditors. In practice, this can lead to at least two moral hazard problems. Managers who expect a firm to fail may take early retirement and request lump-sum settlements of their pensions (when available), causing a run on a firm's liquid assets and possibly accelerating its descent into bankruptcy. Once a firm enters Chapter 11, managers may slow down the reorganization process in order to bargain for favorable recovery rates for their pension liabilities, especially if the firm is in negotiations to be sold. To our knowledge these interesting issues, which are beyond the scope of this paper, remain largely

[2] Most top executives participate in two pension plans operating in parallel, a "tax-qualified" component that is generally obtained from the company's ordinary pension plan for all employees, and a "non-qualified' portion that is obtained from a supplemental executive retirement plan (SERP) that is open only to selected top managers. In most cases these plans pay life annuities to retired executives. Section 415(d) of the U.S. Internal Revenue Code limits the annual tax-qualified pension to $195,000 per executive (in 2010 dollars), while the balance of an executive's pension, which may amount to millions of dollars per year, will be paid by the company's SERP. Assets in an ordinary pension plan are protected from other creditors, but assets (if any) in a SERP plan are not. If a company defaults on its pension obligations the PBGC assumes responsibility for the ordinary pension component only, and then only at a reduced rate that is currently limited to $54,000 per executive per year.

unexplored and appear to be excellent topics for future research.[3]

Inside debt values can be large for certain top managers, sometimes exceeding $100 million for a CEO and occasionally amounting to a greater sum than a manager's equity investments in his firm's stock or stock options.[4] However, until 2007 managers' inside debt values were almost never disclosed under the SEC's executive compensation reporting requirements previously in effect. Companies were required to provide certain details about the pension benefits due to an executive, but calculating the expected present value of an individual manager's pension required combining the disclosed data with information from a number of external sources and making sophisticated actuarial computations, a task probably beyond the skills of most investors and even Wall Street analysts (see Sundaram and Yermack, 2007). Even less was disclosed about other forms of deferred compensation; most firms did not even have to report whether their executives even participated in a deferred compensation plan, and in the few cases in which these disclosures were required,[5] the balances held by individual managers were never given. When the SEC announced a pending revision of its executive compensation disclosure rules in 2006, providing more transparency about pensions and deferred compensation

[3] In the high-profile bankruptcies of General Motors and Chrysler in 2009, news reports indicated that GM's executive pension payments would be reduced by approximately two-thirds, while Chrysler's would disappear almost entirely. See, for example, "Ex-GM CEO Wagoner Retires With Reduced Benefits," Reuters, July 14, 2009, and Joseph Szczesny, "Iacocca Among 450 Former Execs Suing Daimler, Cerberus Over Lost Pensions," *The Oakland Press*, September 11, 2010. A recent story reporting the wipeout of executives' deferred compensation claims in bankruptcy is Peg Brickley, "Nortel Moves to Retrieve Retirement Savings," *The Wall Street Journal*, December 23, 2010.

[4] Seven CEOs on the the ExecuComp database had inside debt balances exceeding $100 million at fiscal year-end 2006. More than two-thirds of the CEOs in the database had nonzero inside debt, with a mean value of $5.7 million. In general inside debt compensation is more common among larger firms in slower-growth sectors of the economy such as manufacturing, utilities, and transportation.

[5] Companies had to report only those cases in which the executive received a fixed rate of interest on his deferred compensation, and then only if the fixed rate exceeded the "applicable federal rate," an estimate of the risk-free rate specified by the Internal Revenue Service. In practice, very few plans had this structure, as most firms do not offer high fixed-rate interest as an investment option.

was a priority.

B. Key hypotheses

The initial reports of managers' pension and deferred compensation balances in early 2007 were highly anticipated by the community of executive compensation analysts, consultants, and researchers. We therefore hypothesize that stock and bond prices should have reacted significantly for companies in which these inside debt balances were revealed to be large. Our hypotheses about inside debt compensation are closely related to ideas articulated in a brief section of the classic paper by Jensen and Meckling (1976). Surprisingly, not until Edmans and Liu (2010) did researchers develop these ideas into a formal model with detailed comparative statics predictions, even though the role of incentive compensation in mitigating the agency costs of debt has been the subject of many papers (see Edmans and Liu, 2010, for a survey). We study several of the ideas that represent central predictions of both Jensen and Meckling's (1976) discussion of inside debt and Edmans and Liu's (2010) model.

Edmans and Liu define the ratio $k = \beta / \alpha$, where α and β are the fractions of the firm's equity and debt, respectively, owned by the manager, and $k = 1$ represents the point at which Jensen and Meckling conjecture that the agency costs of debt should vanish (much of Edmans and Liu's paper is involved in generating richer predictions implying that $k = 1$ is not optimal for all firms). Proposition 3, part vii of Edmans and Liu's paper shows that when β increases, the firm's market value of debt rises while its market value of equity falls, due to more conservative project selection by the manager, as shown by the authors' equation (10).

Edmans and Liu's ratio k is analogous to the "relative incentive ratio" that we define

below. In our event study analysis, the variable α, the CEO's equity ownership, was already well known by investors, but the variable β, the CEO's inside debt ownership, was unknown until the first disclosures of it began in early 2007. In line with Edmans and Liu's model, we expect that high values of β, which imply high values of k, should lead to a value transfer from equity to debt, due to a revision of investor expectations about future project selection. Because investors expect CEOs with high β values to select low-variance investments (analogous to a higher cutoff point in Edmans and Liu's equation (10)), their expected distributions of future cash flows become less extreme, leading to more certainty in firm value and less volatility in the trading of debt and equity claims against the firm, a conjecture we elaborate upon below.

C. Sample selection

Our research strategy uses standard event study methods to assess stock and bond investors' immediate reactions to inside debt disclosures. Therefore, we focus upon listed firms that also had publicly traded long-term debt outstanding at fiscal year-end 2006, the time at which the SEC's new disclosure regulations became effective. We begin by identifying all non-financial Compustat firms with fiscal years ending in December 2006 or later for which Moody's provides a senior bond rating. After discarding a small number of companies with faulty or incomplete compensation disclosures, we look at those firms that have fixed-rate publicly traded bonds listed on the Mergent Fixed Investment Security Database in the form of either non-convertible debentures, medium-term notes or zero-coupon bonds. The requirement for firms to have publicly traded debt vastly reduces our sample size, but it is necessary for our daily event study analysis. We then require each company to have daily bond pricing data in the Reuters

database, to have non-missing data for the bond rating, amount outstanding, and time to maturity as of the proxy statement filing date, to have a minimum maturity of one year, and at least 60 end-of-day bond pricing quotes in the 90-day period before the filing date. Finally, we eliminate firms in which the 2007 proxy statement indicates that the CEO has neither a defined benefit pension plan nor a deferred compensation plan, i.e., those in which the CEO's inside debt holding is fixed at zero, in order to keep the costs of data collection manageable. These screens give us a sample of 299 companies, most of which have several bond issues outstanding. For each company we choose one bond to analyze, selecting the issue with the highest trading volume in the 12 months prior to the proxy statement filing date.

We augment our data about corporate debt issues by collecting information about credit default swap (CDS) spreads for our sample companies. These data are available for 235 of our 299 sample firms from Markit CDS Pricing, which maintains the most widely used data source for these contracts. We use daily spread data for five year, senior unsecured credit default swaps, the most liquid and common CDS contracts, and we collect spreads classified under the "modified restructuring" document clause, a contract term that enumerates the contingencies under which settlement of a CDS contract would be triggered.

Proxy statements filed in connection with firms' annual shareholder meetings provide detailed data about each company's pension and deferred compensation plans. SEC regulations require firms to file proxy statements no later than 120 days after fiscal year-end, though most companies tend to comply well before this deadline. We use each firm's filing date as the event date in our analysis, as the SEC always posts incoming documents on its EDGAR website for public viewing within hours of their receipt. Figure 2 shows a month by month timeline of the

proxy statement filing dates for the 299 firms that we study. In 268 cases, the information about CEOs' inside debt holdings was revealed in a definitive proxy statement, while in 31 cases firms filed a preliminary proxy statement with full compensation data several weeks in advance of their final proxy filing, with the preliminary document available for public viewing. In these 31 cases we use the earlier date as the event date, with the first of these disclosures coming on January 18, 2007. Figure 2 shows that the first wave of compensation disclosures under the new rules occurred largely during the months of March and April, with 225 (or 75%) of our observations during those two months; these observations are for the majority of firms whose fiscal years end in December.

Table 1 presents descriptive statistics about the 299 firms that we study, including information about their CEOs and the bond issues that we select for each of them. Most of our sample companies are large, well-known firms with moderate leverage and investment grade credit ratings. Although we consider all Compustat firms for inclusion in our study, inside debt compensation plans are much more common among larger firms than smaller ones, and most of our sample companies are well-known S&P 500 firms. The typical CEO in our sample is 56 years old and has held his position for five to six years, although he was likely accumulating inside debt while holding other management positions prior to becoming CEO.

To value each CEO's holdings of inside debt and equity, we use information in each proxy statement. For inside debt, we take the present value of pension benefits and deferred compensation balances as reported by the company. For inside equity, we take the sum of the values of direct stock holdings, stock option holdings, unvested restricted stock, and synthetic or performance shares. We calculate stock ownership value by multiplying shares held (including

restricted and performance shares) times the stock price at fiscal year end. We value stock options by applying the Black-Scholes formula to each individual tranche of options held by the CEO and summing the tranche values to an aggregate total.

An interesting data issue arises in firms that permit the CEO to invest his deferred compensation in the firm's common stock. These investment allocations are made synthetically, as is done with phantom stock compensation plans, so that the CEO is credited with the rate of return earned by common stock holders without obtaining voting rights or other formalities of actual ownership. Whether companies must disclose the deferred compensation investment choices of individual managers is unclear, but many firms elect to do so.[6]

We read proxy statements carefully to determine which CEOs have invested their deferred compensation in the firm's common stock. Of the 299 CEOs in our sample, 58 have zero deferred compensation, so the issue is moot. In 91 additional firms, the compensation plans do not permit deferred compensation to be invested in common stock, while four firms take the opposite approach, with mandatory provisions that require all of the CEO's deferred compensation to be held as synthetic shares. For the majority of the remaining observations, we are able to obtain enough information to fix the amount of the CEO's deferred compensation that is allocated to common stock; we ultimately identify this total for 248 of the 299 CEOs in the

[6] Item 402(i)(3) of Regulation S-K, the SEC's executive compensation disclosure rules, states that firms must "Provide a succinct narrative description of any material factors necessary to an understanding of each plan," but it does not enumerate more specific requirements. Separately, the SEC requires the proxy statement's ownership table to list in a footnote shares held by a manager as "phantom stock units held in a nonqualified deferred compensation plan," but only if these phantom stock units may ultimately be settled in shares rather than in cash. See the SEC's guidance to Item 403 of Regulation S-K, posted at http://www.sec.gov/divisions/corpfin/guidance/execcomp403interp.html. Still another SEC regulation, Rule 16b-3(f), requires reporting on Form 4 under Code I of executives' transactions that involve moving deferred compensation balances into or out of company stock funds, whether or not the underlying stock funds are purely synthetic or may ultimately lead to the delivery of shares to the manager.

sample. For the remaining CEOs our default assumption is that the amount invested in common stock is zero. This assumption seems reasonable since most CEOs in this group have $1 million or less in deferred compensation and the vast majority of their inside debt is held in the form of defined benefit pensions. Still, we have some concerns about this data issue. Many firms permit CEOs to change their deferred compensation allocations often, some as frequently as daily. Some CEOs may shift their investments briefly into common stock around the date of the proxy statement to create an illusion of high performance incentives for window-dressing reasons, and then shift their funds back to other investments.

As a result of these and other uncertainties, we re-estimate all of our results using four different sets of assumptions about how to treat deferred compensation that may be invested in synthetic company shares. In our base case, as outlined above, we reduce the CEO's inside debt total by the amount which is reported as being invested in the firm's common stock (in most cases, these holdings are already counted as part of the manager's equity ownership as "stock units" in the ownership table of the proxy statement), and we make no reduction in the inside debt totals for the 51 CEOs for which the amount invested in common stock may be greater than zero but cannot be determined. In an alternative case, we assume that instead of investing zero deferred compensation in the firm's stock, these 51 CEOs invest all of their deferred compensation in synthetic shares. In a third case, we assume that they invest the same proportion as is done on average by the CEOs for whom we have clear data. Finally, in a fourth case we treat all deferred compensation as inside debt, even if we know that some of it is invested in shares. None of the three alternative assumptions has a meaningful impact on our reported results. The most obvious explanation is that, as shown in Table 2, the median CEO has more

inside debt held in pension plans than in deferred compensation, so the allocation of some of the deferred compensation to equity is relatively unimportant for most of them.

Table 2 indicates that the CEOs in our sample hold a mean (median) of $10.0 million ($5.0 million) of inside debt in their firms, with the majority in the form of pension benefits. The personal inside debt-equity ratio, comparing the value of a CEO's inside debt over his inside equity, has a mean of 0.22 and median of 0.15.

Figure 3 shows a scatter plot of the CEO's personal inside debt-equity ratio against the external debt-equity ratio of the firm. Many observations cluster near the 45-degree line, where the ratio between the two values equals the Jensen-Meckling (1976) optimum of 1.00. Observations in the upper left part of the chart are those in which the CEO may have relatively high equity incentives in a firm with a levered capital structure. In this area, one would expect the CEO to pursue very risky investments and the agency costs of debt to be large. In the lower right of the chart, the opposite situation prevails, with the CEO having a high inside debt position in a relatively unlevered firm. In this area one would expect a CEO to manage the firm conservatively even though external claimholders would have little reason to be concerned about risk-shifting between equity and debt.

D. Measurement of CEO incentives

Our hypotheses about CEOs' inside debt and equity incentives based upon Jensen and Meckling (1976) and Edmans and Liu (2010) all focus upon an optimal incentive balance, in which the CEO's mix of debt and equity incentives is identical to the mix of debt and equity in the firm's capital structure. Edmans and Liu propose the statistic *k*:

$$k = (D_{CEO} / D_{FIRM}) \div (E_{CEO} / E_{FIRM}) \\ = (D_{CEO} / E_{CEO}) \div (D_{FIRM} / E_{FIRM}) \quad (1)$$

where D_{CEO} and E_{CEO} are the manager's inside debt and inside equity, and D_{FIRM} and E_{FIRM} are the total debt and equity claims against the company, including those held internally by the CEO. We call k the "CEO's relative debt-equity ratio," and Table 1 contains information about its distribution in our sample. If $k = 1$, the manager should have no incentive to engage in risk-shifting strategies that transfer value from debt to equity or vice versa.[7]

A limitation of the CEO's relative debt-equity ratio is that it captures levels but not changes in the values of debt and equity. In a simple capital structure with only plain vanilla debt and equity, this distinction should be unimportant. However, managers tend to hold much of their equity in stock options that have finite expirations and convex slopes with respect to firm value, while much of the firm's equity takes the form of shares that have unlimited lives and linear slopes with respect to firm value. Moreover, the manager's inside debt may have a different duration than the debt securities issued externally by the firm. Therefore, we are more interested in the following statistic:

$$k^* = (\Delta D_{CEO} / \Delta D_{FIRM}) \div (\Delta E_{CEO} / \Delta E_{FIRM}) \quad (2)$$

We call k^* the "CEO's relative incentive ratio," and it captures the marginal change in the CEO's inside debt over the marginal change in his inside equity holdings, given a unit change in

[7] Much of Edmans and Liu (2010) is devoted to investigating when this simple identity between the manager's personal debt-equity ratio and the firm's external capital structure is no longer optimal, and issues such as the manager's disutility for effort may require shading his contract toward either equity or debt incentives. These considerations are beyond the scope of this paper.

the overall value of the firm, scaled by the ratio of the marginal change in the firm's external debt over the marginal change in its external equity, given the same unit change in the overall value of the firm. To estimate ΔE_{CEO} and ΔE_{FIRM} we recognize that the firm's equity and the CEO's equity are comprised of both shares and options, and that:

$$\begin{aligned} \Delta E_{CEO} &= S + N(\Delta N) \\ &= S + \sum_i N_i(\Delta N_i) \end{aligned} \tag{3}$$

where S and N are the number of shares and options held by the CEO, and ΔN is the option delta, or slope with respect to the stock price (the delta of a share of stock is assumed to be 1). The CEO's options are broken into tranches, indexed by the subscript i, that have different exercise prices and times to maturity. The equation (3) is sometimes called the "total delta" of a manager, because it captures the overall slope of his equity holdings per $1.00 change in stock price. We estimate this equation using share and option information from the firm's proxy statement, including data for each of the CEO's individual option tranches, and using the stock price and remaining option life as of the end of the prior fiscal year. We input these data into the Black-Scholes option value formula, along with U.S. Treasury risk-free rates and stock volatility calculated with daily data over the prior fiscal year. We use an identical approach to calculate ΔE_{FIRM}, except that we cannot observe all of the outstanding option tranches issued by the company. Instead we use data from the company's Form 10-K equity compensation footnote that gives the total number of employee stock options outstanding and their average exercise price, both of which are available from Compustat. We assume that the average remaining life of each

firm's options, which is not included on Compustat, is four years. We use these data to calculate the delta of a representative option outstanding at each firm and include this delta in an expression analogous to equation (3).

Estimating ΔD_{CEO} and ΔD_{FIRM} are more problematic. Since the large majority of our firms are not financially distressed, each of these quantities will be small and difficult to estimate, although we are interested in their ratio compared to one another and not their overall magnitudes. Moreover, we have less information about the firm's maturity structure of debt than we need, since the maturity details of debt with a remaining life over five years are not disclosed by U.S. companies. We therefore make a simplifying assumption that:

$$\Delta D_{CEO} / \Delta D_{FIRM} \approx D_{CEO} / D_{FIRM} \tag{4}$$

so that

$$k^* \approx (D_{CEO} / D_{FIRM}) \div (\Delta E_{CEO} / \Delta E_{FIRM}) \tag{5}$$

We use equation (5) as our estimate of the CEO's relative incentive ratio. Summary statistics for this variable appear in Table 1. For our 299 CEOs, the statistic has a mean of 0.54 and median of 0.37, indicating that the typical CEO has lower incentives from inside debt than would be required to reach the optimal value of 1.00. However, for 51 CEOs out of 299, or about one-sixth of the sample, the relative incentive ratio exceeds 1.00, implying excessive incentives from inside debt.

III. Analysis

A. Univariate analysis of abnormal returns

We begin our analysis by examining the unconditional abnormal returns to debt and

equity securities of all 299 firms in our sample around the dates of their proxy statement filings. We calculate equity abnormal returns using the Fama-French-Carhart four-factor model, with a 120-day parameter estimation period ending 10 days prior to the event day and the S&P 500 index as the market index. Our results below are insensitive to changes in the abnormal return methodology, such as using the CRSP equal weighted or value weighted market indexes or using a one-factor model instead of a four-factor model. Bond abnormal returns, using the most heavily traded public bond for each company, are based upon a two-factor model, using the Citigroup Investment-Grade and Speculative-Grade corporate bond indexes and a 90-day parameter estimation period. We combine the abnormal stock and bond returns into an overall "firm abnormal return" for each of our 299 companies. Firm abnormal returns equal weighted averages of the abnormal returns to the stocks and bonds issued by each company, with the weights equal to the total outstanding market value of each security. If a firm also has debt that is not publicly traded, we include it in the weighted average, with the weight equal to the difference between the book value of total debt and the book value of traded debt, and the abnormal return of non-traded debt assumed to equal zero. We test the sensitivity of our results to these assumptions by changing the abnormal return on non-traded debt to equal the abnormal return on traded debt, and also by changing the weight for non-traded debt to equal the book value of long-term debt minus the book value of traded debt. In all cases the estimated firm CAR is virtually identical in size and significance, so we use the assumptions above in the analysis throughout the paper.

Our computations for bond returns and volatility rely on end-of-day pricing quotes provided by Reuters, which gathers the data each day based upon market quotes. Actual bond

transaction prices are infrequent, because most corporate bonds do not trade regularly even if they are publicly listed. We therefore rely upon Reuters' daily closing price quotes, which the data vendor gathers for corporate bonds throughout each trading day, even if those bonds do not trade. At the end of each day Reuters posts provisional prices for individual bonds and then allows for a "market challenge" period in which clients can submit evidence to dispute Reuters' pricing, with the vendor making adjustments to its posted prices if warranted. We investigate the alternative, described in Bessembinder et. al (2008), of relying upon daily pricing data from actual bond trades on the TRACE database as the basis for calculating abnormal returns. This method vastly reduces the number of available observations, making it impractical for our study. Further, we validate the accuracy of the Reuters data by running a simple regression of Reuters quotes against TRACE prices, for all observations that appear on both sources. In various test regressions we obtain R^2 statistics of .96 to .98, indicating a very close concurrence between the two sources. Bessembinder et. al (2008) use the same method to validate the similarities of bond prices from TRACE and the Lehman Brothers Bond Database.

We also tabulate daily changes in credit default swap spreads for the 235 companies in our sample for which we can obtain CDS data. To adjust for market-wide CDS spread movements, we normalize these price changes by the changes in the Markit North American investment grade CDS index for five-year maturities.

Table 2 shows the mean cumulative abnormal returns for the samples of stocks, bonds, and firms overall, as well as CDS spread changes, all measured over a two-day event window that includes the SEC filing date and the subsequent trading date; we use a two-day window because some filings occur late in the afternoon after the markets close. The overall pattern of

returns in the entire sample seems uninteresting, but we find significant differences in the returns to bondholders after partitioning the sample based upon whether the CEO's relative incentive ratio is less than or greater than one. In the former case, shown in Panel B of Table 2, we find negative though insignificant bondholder returns upon the disclosure of the CEOs' relatively low inside debt incentives. In the latter case, shown in Table C, we find positive and significant bondholder returns, an average of 75 basis points or 0.75% per bond, when high CEO inside debt incentives are disclosed. These results are in line with our expectations, although we do not find significant results in either subsample for returns to equityholders, to the firm overall, or to CDS investors.

B. Regression analysis of abnormal returns

Table 3 presents seemingly unrelated regression estimates that explore the cross-sectional determinants of the cumulative abnormal returns for stocks, bonds, and firms overall, with the dependent variables defined as in Table 2 above. The main control variable in the regressions is the CEO's relative incentive ratio. In the right half of the table, we use this variable in a piecewise specification, with the estimated slope allowed to vary above the below the critical value of 1.00. In the left half of the table, the variable enters the model with a single slope estimated over its entire range.

We include a variety of control variables in our regressions, because the compensation disclosures that we study occur in a lengthy document, the proxy statement for the annual shareholder meeting. A very large number of event studies over the past 30 years have used proxy statement filing dates as the basis for studying investor reactions to CEO pay, changes in

the board of directors, shareholder resolutions, and numerous other topics. Due to the comprehensive nature of these proxy statements, CEOs' inside debt holdings will sometimes be disclosed simultaenously with other important corporate governance information (Brickley, 1986). We therefore read each of the 299 proxy statements in our sample and identify those that report other events likely to be important to shareholders. After tabulating these data, we use nine indicator variables as controls for our regressions in Table 3. These control variables include an indicator that equals one for 33 firms that nominate new independent directors (Rosenstein and Wyatt, 1990) and an additional indicator for four firms that disclose nominations of new grey directors who have conflicts of interest (Shivdasani and Yermack, 1999); an indicator for 35 firms that disclose personal aircraft use by the CEO as a perquisite, after never having made such disclosures in the past (Yermack, 2006); indicator variables for firms in which management proposes shareholder-friendly governance changes, including rescinding super-majority voting requirements (10 firms), introducing majority voting in director elections (12 firms), and declassifying a staggered board of directors (14 firms) (Faleye, 2007); and indicators for firms that receive shareholder resolutions related to the areas of executive compensation (52 firms), other corporate governance issues (64 firms), and social or environmental issues (45 firms) (Karpoff, Malatesta, and Walkling, 1996). Finally, we include two more control variables, an indicator for whether the firm's debt is rated as speculative grade (BB+ or below), and a further indicator for whether the firm operates primarily in the utility industry (SIC code 49), since a large number of these companies appear in our sample. We test the statistical significance of our estimates using robust standard errors.

Estimates in the left half of Table 3 indicate that the abnormal two-day returns to

bondholders are positively related to the inside debt incentives of the CEO, as shown by the estimate for the CEO's relative incentive ratio. This result is consistent with our prediction, as it implies that revelations of CEOs holding large inside debt positions (those in the lower right region of Figure 3) are welcomed by bondholders, who expect these managers to pursue conservative, low-risk operating strategies. We also find negative but insignificant estimates for the abnormal returns to equityholders as a function of the CEO's relative incentive ratio, and insignificantly negative returns to the firm overall.

In the right half of Table 3, we seek more insight into these findings by decomposing the CEO's relative incentive ratio into two pieces, with the slope allowed to vary at the critical value of 1.00. Bonds appreciate significantly in value on both segments of the slope. In addition, when the CEO's inside debt incentives are high and the relative incentive ratio exceeds 1.00, we find that this variable exhibits a negative and significant association with stockholder abnormal returns and for the firm overall. Together, these results indicate that when large inside debt positions are disclosed, stock prices fall and bond prices rise, but the negative impact on equity value exceeds the positive gains to bondholders. In other words, a heavy reliance on inside debt compensation appears to reduce the overall value of the firm, apparently by providing incentives for overly conservative management. An alternative explanation for the overall loss of value at firms with high inside debt is that shareholders react negatively to the sheer size of the CEO's pension or deferred compensation package, viewing it as a deadweight loss.

Of the control variables, none of those displayed in Figure 3 has a significant estimate, and the large majority of the proxy statement indicator variables have insignificant estimates as well. We therefore find little evidence that simultaneous disclosures of other news affect our

abnormal returns. As a further check, we analyze subsamples of event days on which bond market volatility increases relative to the prior day, as well as event days on which bond market volatility decreases. We find that abnormal returns are very similar in each of these subsamples, as are cross-sectional regression estimates using the specification in Table 3.

To evaluate the magnitude and economic significance of the estimates in Table 3, we refer to calculations of the estimated agency costs of debt by Parrino and Weisbach (1999). That paper analyzes capital budgeting decisions in a levered firm. A representative investment project is characterized by its standard deviation of future cash flows, and debt in the firm's capital structure introduces both benefits from interest tax shields and possible costs of future default. Project selection is controlled by a manager hired by the equityholders, and the manager adopts only those projects that increase the value of equity rather than those that increase the value of the firm overall. In our framework, the manager selects projects after considering their impact on his holdings of both inside equity and inside debt. The distortions from suboptimal project selection should narrow and ultimately disappear as the manager's relative incentive ratio moves from 0.00 (if he is compensated entirely by equity) to the optimal level of 1.00, when his compensation mirrors the firm's capital structure.

Parrino and Weisbach's (1999) Table 2, column 3, contains estimates most relevant to our exercise. The representative project illustrated in that column has a standard deviation of future cash flows equal to 80%, which is close to the authors' estimate of 72% for their cross-sectional sample of U.S. companies, and the firm's leverage is 20%, also very close to the cross-sectional average. In its zero-NPV state this project is not accepted by the equityholders, because it causes a transfer of value from equity to debt. However, the project would be accepted by a

manager with a relative incentive ratio of 1.00. The change in the manager's incentive ratio would reduce the value of equity by 10 basis points, or 0.10%, according to estimates in the table, while increasing the value of debt by 58 basis points, or 0.58%, The firm value overall would increase by about 8 basis points, or 0.08%.[8] These estimates should be compared to the regression coefficients in the right three columns of our Table 3, for the line in which we estimate the impact of increasing the CEO' relative incentive ratio from 0.00 to 1.00. Our estimated changes in equity value, debt value, and firm value, respectively, are +38 basis points, +8 basis points, and +27 basis points. All of these regression estimates are of the same order of magnitude as the agency costs of debt implied by Parrino and Weisbach (1999), and given their standard errors, they all have magnitudes reasonably close to the benchmarks.

We repeat the same calculations for the upper segment of the regression line, which gives the marginal effect on investors' values if the CEO's relative incentive ratio rises from 1.00 to 2.00, meaning that the manager's investment choices would be over-weighted in favor of the debtholders. In this situation, we would expect the manager to reduce the firm's risk exposure by accepting projects with standard deviations of future cash flows below the 80% base case. In the limit, the debtholders would prefer the risk-free investment with 0% standard deviation shown in the left column of Parrino and Weisbach's Table 2. If the manager accepted this project, equity would drop in value by 22 basis points, or -0.22%, and debt would rise in value by 134 basis points, or 1.34%. However, the managers would be willing to accept the project at a loss, given

[8] The estimated changes in debt and equity value are calculated by dividing $5.78, the amount of value which is shifted from equity to debt, by the starting values of debt and equity, which are $997.14 and $6029.42, respectively. The rise in firm value is the same $5.78 (which otherwise would be required as a subsidy to induce equity to accept the project) divided by the sum of the two starting values. Similar calculations are used in the paragraph below, with the project's value to equity being discounted to the point where the gains to the manager's inside debt just balance the losses to his inside equity.

its benefits to the debtholders, and the breakeven point would occur if equity fell in value by 50 basis points, or -0.50%, and firm value overall fell by 22 basis points, or -0.22%. The respective regression estimates in our Table 3 are -57 basis points, +3 basis points, and -44 basis points, again quite close to those implied by Parrino and Weisbach's model. The only significant deviation between our estimates and theirs lies in our estimated changes of the value of debt, which have the correct sign but are closer to zero than predicted.

Because the signs and magnitudes of our estimates approximate those impled by Parrino and Weisbach (1999), we believe that agency costs of debt stemming from investor expectations of risk-shifting investment distortions represent a plausible explanation for our results. The magnitude of the associated wealth effects, which represent some fraction of 1% of the value of various securities and the firm overall, are relatively modest in percentage terms. However, given that many of our sample firms have enterprise values in the billions of dollars, the effects may be large in dollar terms for many companies, greatly exceeding the cost to shareholders of the managers' compensation incentives.

We also note the pattern shown in Figure 1, which implies that the relation between bonds' yield spreads and the CEO's relative incentive ratio widens over a period of several months after the proxy statement filing date for the subsample of 51 companies whose CEOs have high inside debt incentives. This pattern is consistent with inefficiency in the corporate bond market, with under-reaction by investors to the proxy statement disclosures. We investigate this question further and find that daily cumulative abnormal bond returns do continue to drift positively for 60 trading days, or almost three months, after which they level off after a cumulative gain of about 0.4% or 40 basis points, much larger than the regression estimates

shown in Table 2, and close to what one might explain simply by the risk-shifting benchmarks in Parrino and Weisbach (1999). A very similar pattern of post-announcement drift appears for credit default swaps as well, as the spreads continue to narrow before the cumulative effect levels off over a similar horizon. We do not find any similar pattern of post-announcement drift for the stocks of these companies, however, ruling out any type of intra-company capital structure arbitrage trading strategy.

Investigating the abnormal returns to holders of credit default swaps provides a robustness check for our findings about the returns to bondholders. Table 4 presents an analysis of two-day CDS spread changes, in a regression format very similar to that used in Table 3. We use the unadjusted CDS spread as the dependent variable and include the change in the Markit North American Investment Grade CDS Index as an explanatory variable. Results for CDS spreads in Table 4 are quite similar to those observed for corporate bond prices in Table 3. The change in CDS spreads is inversely related to the CEO's relative incentive ratio in the overall sample, though the estimate is not quite significant. The effect is much stronger and significant at the 5% level when the CEO's relative incentive ratio exceeds 1.00. These results reinforce the findings in Table 3 and Figure 1, which suggest that public investors significantly revalue a firm's debt securities upon learning details of the managers' deferred compensation and related inside debt holdings.

C. Changes in volatility for debt, equity, and the firm overall

Our analysis above shows a general pattern of gains to bondholders and losses to equityholders when firms disclose large inside debt holdings by their CEOs. These

rearrangements of value are consistent with investors expecting a more conservative, lower-risk operating strategy for this cohort of CEOs. A further prediction is that these adjustments in investor expectations should lead to lower dispersion in daily stock and bond returns in trading by public investors. We test this hypothesis by examining changes in security price volatility before and after the proxy statement filing date on which the CEO's inside debt holdings are first disclosed.

The rationale for our prediction is similar to a hypothesis in Clayton, Hartzell and Rosenberg's (2005) study of how stock return volatility changes around the time of forced CEO turnover. Among the three theories considered in that paper, the authors' "strategy" hypothesis conjectures that share price volatility should rise after involuntary replacement of a CEO, due to "increased uncertainty about the nature of the strategy that will be implemented by the new CEO (p. 1783)." We view the disclosure of large inside debt holdings by a CEO as the opposite situation. This knowledge of the manager's debt incentives increases the certainty that the CEO will select low-variance projects with more certain cash flows, which should lead to less dispersion of beliefs among investors about the future strategy of the firm and lower volatility in the pricing of the firm's public securities.

Nothwithstanding the disclosures of managers' inside debt in early 2007, it is possible that investors could have inferred the firm's future strategy earlier by decoding the CEO's project selections. However, investment spending is a noisy signal that investors observe only with delay, and transparency about the manager's compensation provides a lens that helps resolve uncertainty about future strategy. Note that we would not necessarily expect volatility to fall for firms that disclose low inside debt holdings for their top managers, even though such a disclosure

reduces investor uncertainty by unambiguously implying an aggressive future investment policy. In these companies, the CEO will have incentives to select projects with high variances of future cash flows (DeFusco, Johnson, and Zorn, 1990), exposing investors to a wider range of possible outcomes, a higher risk of default, and a greater probability that the company may need to reconsider its strategy or even replace the manager at some point in the future. Therefore, we expect that disclosures which confirm that the CEO's incentives are tilted away from inside debt and toward inside equity could increase uncertainty about the company's future path and raise the volatility of the firm's public debt and shares.

To study changes in volatility, we estimate the time series volatility of all stocks and bonds during the period 90 days prior to the proxy statement filing date, and again for the period 90 days after. For bonds, some of which have irregular trading histories, we require at least 60 days of trading data within each 90-day window in order for the security to be in the sample. After estimating the volatilities for each stock and bond in the sample, we calculate a volatility change ratio for each security by dividing its post-filing volatility into its pre-filing volatility and taking the natural log of this ratio. Finally, we estimate the asset volatility for the firm overall pre- and post-filing. Asset volatility cannot be observed directly, so we use the KMV method to estimate it by a numerical iteration algorithm.[9] We then calculate a firm volatility change ratio that is analogous to the change ratios for debt and equity volatility. Regression analysis of these volatility change ratios appears in Table 5. The control variables, standard error calculations, and

[9] The approach is very similar to that used in Sundaram and Yermack (2007). We assume that each firm has a default point equal to the face value of short-term debt plus half the face value of long-term debt. Equity is treated as a Black-Scholes call option on the assets of the firm, with maturity of one year and exercise price equal to the default point. Using the risk-free rate, the firm's market capitalization of equity, and its volatility of equity as additional inputs, it is straightforward to solve for the volatility of cash flows to the firm's assets.

other aspects of the regressions are the same as used in the models of abnormal returns that appear above in Tables 3 and 4, except that we add an additional control variable to each regression, the contemporaneous volatility change ratio for either the equity or bond market index.

For both stocks and bonds, we find reduced volatility after those proxy statement filings that indicate large inside debt holdings by CEOs. In the left half of Table 5, we show negative and significant estimates for the relations between the relative incentive ratio of the CEO and the volatilities of debt securities, with insignificant results for equity volatility and firm volatility overall. In the right half of the table, we again decompose the relative incentive ratio of the CEO into two segments, with the slope allowed to vary above and below the critical value of 1.00. In the upper segment with the relative incentive ratio exceeding 1.00, we find negative and significant relations between the CEO's inside debt incentives and all three variables measuring debt volatility, equity volatility, and asset volatility. These results show a consistent pattern, that investors react to large inside debt disclosures not only by revaluing debt and equity claims against the firm, but also by trading these claims in a pattern that exhibits lower price variability.

To refine our results, we examine changes in the implied volatility of exchange traded options that are associated with 218 of our sample firms. We obtain data from the OptionMetrics Ivy database, which features implied volatilities calculated in a Cox, Ross and Rubinstein (1979) binomial model adjusted for dividends. Some firms have large numbers of exchange traded options, and we impose a number of widely used sample restrictions. Patell and Wolfson (1981) note that several studies have found that implied volatility estimates behave erratically during the last two to four weeks before expiration, and also that options with a very long time to expiration

are less sensitive to volatility changes. We therefore study only those options with expiration dates between 28 and 100 days away from the event day, with the latter criteria due to Deng and Julio (2005), and we require each option to have non-zero trading volume between the proxy statement filing day and the end of the event window. We calculate weighted average implied volatilities at the firm level, using each option's vega as the weight (Latané and Rendleman, 1976). We then compute our variable for analysis, which equals the log of the ratio of implied volatility measured two days after the proxy statement filing date, divided by the implied volatility measured one day before the filing.

Table 6 presents our regression analysis of changes in implied volatility. Results are quite similar to the changes in the volatility of equity securities displayed in Table 5. We find that the implied volatility of exchange traded options is reduced as a function of the CEO's inside debt incentives, with the effect concentrated among the subsample of firms in which the CEO's relative incentive ratio exceeds 1.00. While the changes in equity volatility shown in Table 6 are computed over 90-day event windows, the analysis in Table 6 shows that the volatility change occurs in a very narrow period, from just one day before to two days after the proxy statement filing. We examine results for other windows in the vicinity of the event date and found the strongest volatility changes over the (t-1, t+2) four-day period.

IV. Conclusions

In this paper we examine the impact of companies' first required disclosures of their CEOs' deferred compensation and other inside debt holdings in early 2007. Although pensions and deferred compensation represent important aspects of executive compensation, very little

information was available about them prior to the SEC's expansion of disclosure requirements at the end of 2006.

We find that investors react significantly when a company reports that the CEO holds a large amount of inside debt relative to his equity investment in the firm. Under these conditions, equity prices tend to fall while debt values tend to rise. The net effect appears to destroy enterprise value for these firms overall, as the gains to bondholders appear to be more than offset by losses to stockholders. These valuation changes appear to persist in corporate bond prices for many months after the disclosure date, and their magnitude is consistent with estimates in other studies about the agency costs of debt that arise from risk-shifting investment distortions. In addition to the valuation effects that we observe, we find that the volatility of both stocks and bonds falls when large CEO inside debt positions are revealed.

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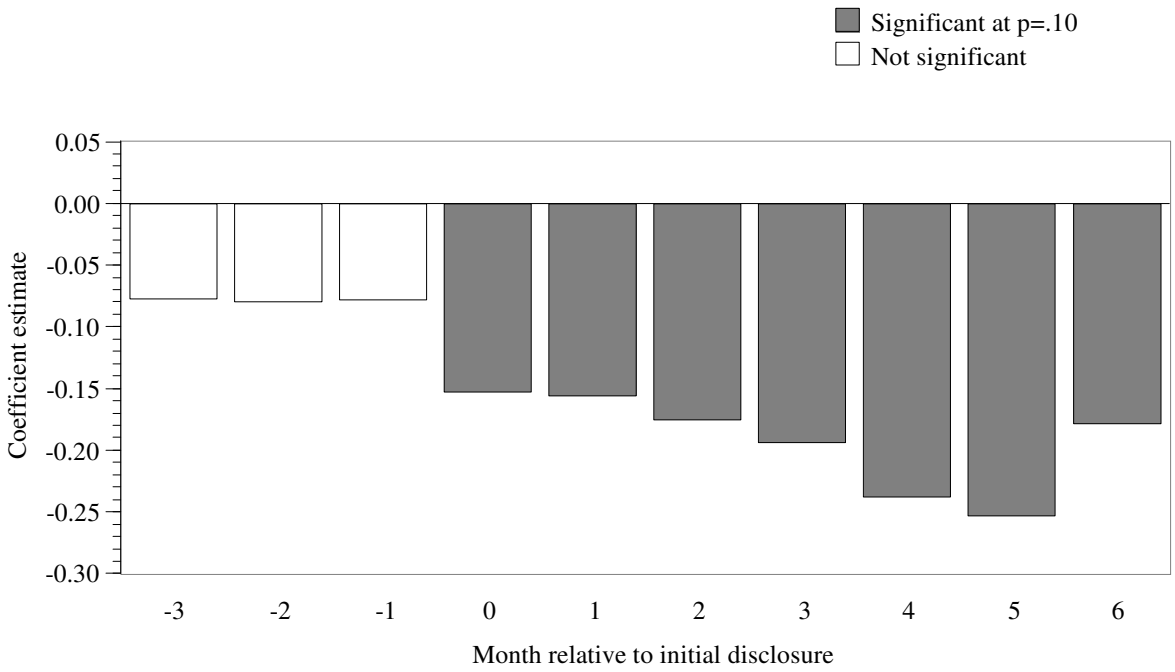

Figure 1
Influence of CEO's relative incentive ratio on corporate bond yield spreads

The figure shows monthly ordinary least squares regression coefficient estimates for the association between a CEO's relative incentive ratio and the yield to maturity of a firm's corporate bonds, measured as the spread above the yield of a U.S. Treasury bond of equal maturity at month-end. Regressions are estimated for a sample of 299 bonds, representing the most heavily traded public debt securities issued by each of the 299 firms in our sample. The CEO's relative incentive ratio, defined fully in the text, is based upon the CEO's and firm's changes in debt and equity value for a unit change in the value of the firm. The regression uses a piecewise linear specification for this variable, with the slope permitted to change above and below the value of 1. The coefficients displayed in the graph are for the segment above 1. Pension and deferred compensation values are reported by firms in their annual proxy statements filed mostly in March and April 2007, and stock option values are calculated using the Black-Scholes method from data reported in the same filings. Other control variables in each regression include firm leverage, firm size (log of assets), return on assets, interest coverage, equity volatility, bond time to maturity, bond coupon rate, the amount of the bond issue outstanding, and indicator variables for secured status, callable status, and credit ratings A, Baa, Ba, B, and Ca and lower.

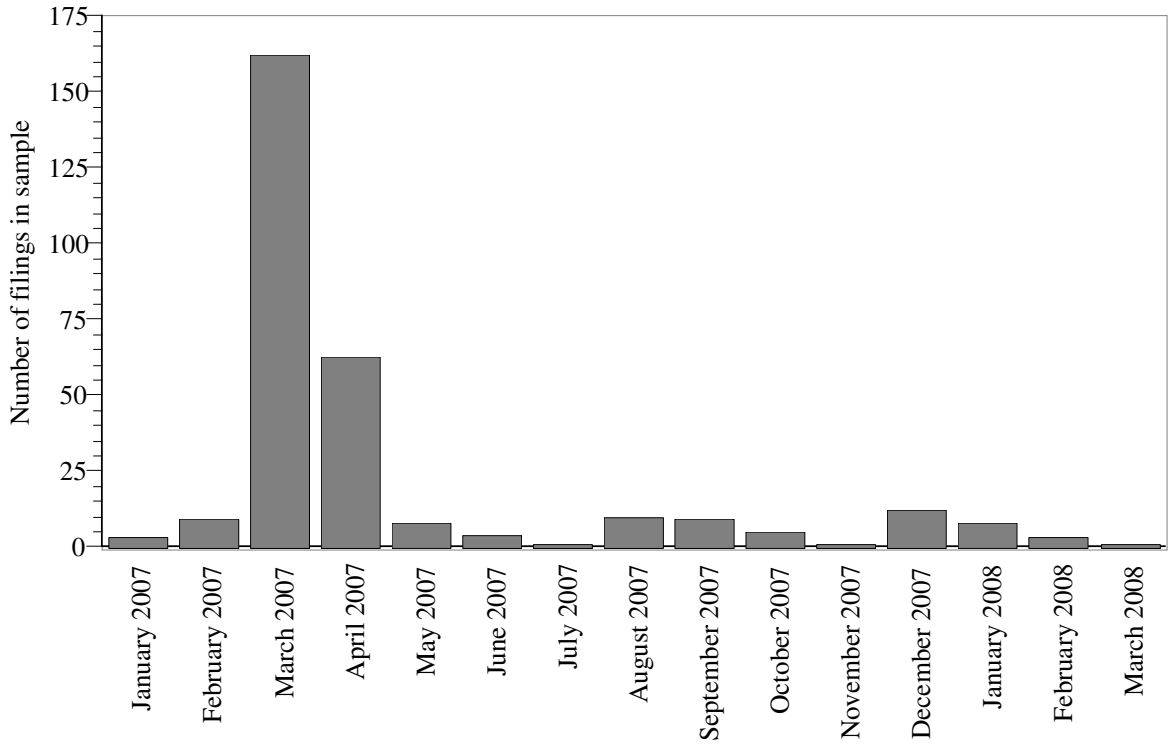

Figure 2
Sample company filing dates by month

The chart shows the months in which the first proxy statements were filed with the Securities and Exchange Commission by 299 Compustat firms with publicly traded bonds outstanding whose CEOs held nonzero inside debt. These 299 firms comprise the sample for analysis in this paper.

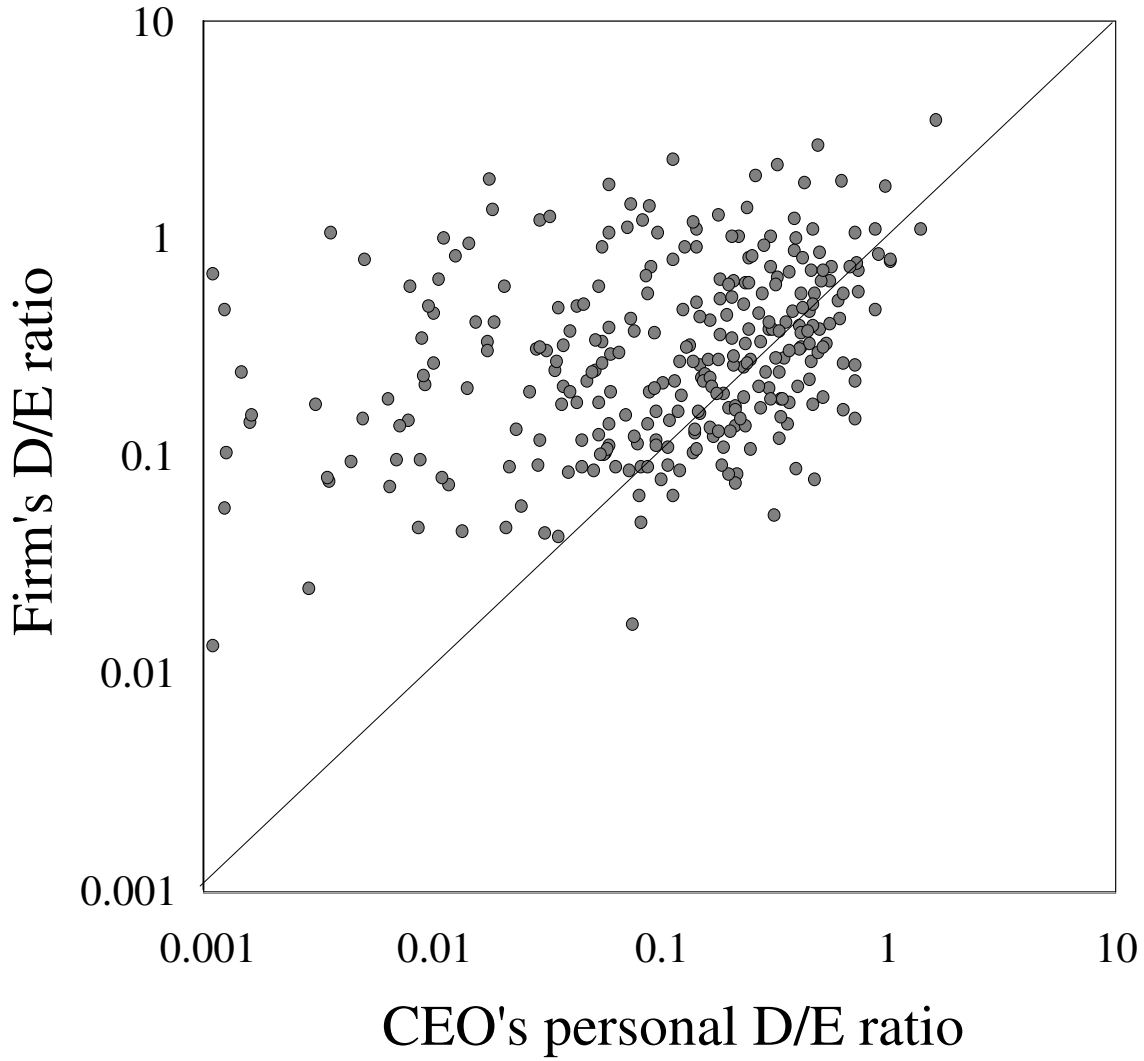

Figure 3
Firm leverage and CEO personal leverage

The figure shows a scatter plot of the CEO's personal leverage on the x-axis and the firm's external leverage on the y-axis. The sample includes 299 observations for firms with publicly traded bonds outstanding whose CEOs held nonzero inside debt. Data for the CEO's personal leverage are taken from the first proxy statement filed in compliance with new disclosure regulations that went into effect in 2007. The CEO's personal leverage equals the value of inside debt claims (pension and deferred compensation) divided by the value of equity ownership (shares and stock options). The firm's leverage equals the book value of total debt divided by the market capitalization of common stock and fair market value of outstanding stock options. The value of the CEO's inside debt position is reported in proxy statement filings. The value of stock options is based upon Black-Scholes calculations using characteristics of individual option holdings as disclosed in proxy statements.

Table 1
Descriptive Statistics

Descriptive statistics for a sample of 299 firms in which the CEO holds a nonzero amount of inside debt. The sample includes all Compustat firms with public debt outstanding in 2007 and bond data available on the Moody's Rating Database and the Mergent Fixed Investment Security Database. All dollar values are in millions. The three sections of the table show information for each company's CEO, for the firm overall, and for one of the firm's publicly traded bonds. CEO compensation data for fiscal year 2006 is based upon information disclosed in proxy statements filed in 2007, with option values based upon Black-Scholes estimates using data for each individual option tranche outstanding. Company financial data for fiscal year 2006 are based upon Compustat information, and bond data are shown for each firm's public debt issue with the largest trading volume over the 12 months prior to the proxy statement filing. The CEO's inside debt-equity ratio equals the value of inside debt (pension + deferred compensation) divided by the value of inside equity (stock + options). The CEO's relative debt-equity ratio equals his personal debt-equity ratio divided by the firm's external debt-equity ratio. The CEO's relative incentive ratio is a similar statistic based upon the CEO's and firm's changes in debt and equity value for a unit change in the value of the firm. Leverage equals total debt (book value) over total assets. Return on assets equals EBITDA over total assets. Equity volatility is calculated from daily return data over the 180 days prior to the proxy statement filing date. Bond volatility is calculated from daily return data over the 90 days prior to the filing date. The investment grade indicators for each bond and each firm equal 1 based the Standard & Poor's rating is BB+ or higher as of the proxy statement filing day. Each bond's time to maturity as measured as of the filing date.

CEO characteristics	**N**	**Mean**	**Std.Dev.**	**25th %ile**	**Median**	**75th %ile**
Age	299	56.1	5.8	52	56	60
Years as CEO	286	6.4	6.1	3	5	8
Pension indicator	299	0.81	0.40	1	1	1
Deferred comp. indicator	299	0.84	0.37	1	1	1
Pension value	299	$5.5	$8.8	$0.1	$2.5	$7.9
Deferred comp. value	299	$4.5	$9.7	$0.1	$1.2	$4.2
Total inside debt	299	$10.0	$15.7	$1.6	$5.0	$11.1
Stock value	299	$98.7	$447.2	$7.6	$18.7	$40.8
Option value	299	$29.6	$49.1	$4.3	$12.3	$32.6
Total equity	299	$128.3	$466.5	$15.7	$37.3	$79.8
CEO inside debt-equity ratio	299	0.22	0.24	0.05	0.15	0.33
CEO relative debt-equity ratio	299	0.76	0.90	0.14	0.51	1.08
CEO relative incentive ratio	299	0.54	0.58	0.11	0.37	0.77

Firm characteristics	**N**	**Mean**	**Std.Dev.**	**25th %ile**	**Median**	**75th %ile**
Total assets	299	$20,393	$51,765	$3,394	$7,362	$20,600
Net sales	299	$16,205	$32,095	$2,906	$6,449	$14,270
Return on assets	299	0.138	0.072	0.097	0.126	0.170
R&D / sales	299	0.018	0.056	0	0	0.018
PPE / total assets	299	0.355	0.237	0.151	0.303	0.535
Leverage	299	0.294	0.139	0.194	0.270	0.375
Market capitalization	299	$17,909	$36,504	$2,986	$6,851	$16,282
Equity volatility	299	0.235	0.101	0.169	0.218	0.280
Investment grade indicator	299	0.74	0.44	0	1	1

Bond characteristics	**N**	**Mean**	**Std.Dev.**	**25th %ile**	**Median**	**75th %ile**
Amount outstanding	299	$419	$540	$200	$276	$500
Coupon rate (%)	299	6.57	1.50	5.50	6.63	7.50
Time to maturity (years)	299	9.0	7.8	3.92	5.75	9.67
Investment grade indicator	299	0.65	0.48	0	1	1
Callable indicator	299	0.83	0.38	1	1	1
Senior indicator	299	0.90	0.30	0	0	0
Senior secured indicator	299	0.05	0.23	1	1	1
Bond volatility	299	0.062	0.028	0.042	0.061	0.078

Table 2
Abnormal Returns Around Dates of Inside Debt Disclosures

Cumulative abnormal returns to securities associated with 299 firms upon disclosures of their CEOs' inside debt holdings in the proxy statements filed under new disclosure rules effective in 2007. The sample includes all Compustat firms with publicly traded bonds and data available on the Moody's Rating Database and the Mergent Fixed Investment Security Database. All cumulative abnormal returns are calculated over a two-day window that includes the proxy filing date and the subsequent date. Equity abnormal returns are calculated using the Fama-French-Carhart four-factor model with the S&P 500 index as the market index. Bond abnormal returns are based upon a two-factor model using the Citigroup Investment-Grade and Speculative-Grade corporate bond indexes and are shown for the bond issued by each firm with the highest trading volume over the prior 12 months. The Firm abnormal return is based upon a weighted average of the returns to each firm's equity and debt securities, with the weights equal to the market value of the amount outstanding for each traded security and the book value of non-traded debt. We assume that the abnormal return to non-traded debt is zero. The CDS spread change, market adjusted, equals the two-day change in the spread of credit default swaps for a firm's five-year senior unsecured debt, normalized by the change in the Markit North American investment grade CDS index. Panel A shows results for the entire sample. Panel B shows results for the subsample of CEOs whose personal debt-equity incentive ratio is below a similar ratio for the firm's external capital structure. Panel C shows results for the subsample of all other observations.

Panel A: All observations	**Firms**	**Mean**	***t*-statistic**
Equity CAR (0, 1)	299	0.125%	0.98
Bond CAR (0, 1)	299	0.001%	0.18
Firm CAR (0, 1)	299	0.080%	0.95
CDS spread change, market adjusted (0, 1)	235	0.019%	0.03

Panel B: CEO relative incentive ratio <=1	**Firms**	**Mean**	***t*-statistic**
Equity CAR (0, 1)	248	0.114%	0.77
Bond CAR (0, 1)	248	-0.008%	-0.48
Firm CAR (0, 1)	248	0.069%	0.73
CDS spread change, market adjusted (0, 1)	205	0.111%	0.17

Panel C: CEO relative incentive ratio >1	**Firms**	**Mean**	***t*-statistic**
Equity CAR (0, 1)	51	0.175%	0.82
Bond CAR (0, 1)	51	0.075%	2.67
Firm CAR (0, 1)	51	0.130%	0.72
CDS spread change, market adjusted (0, 1)	30	-0.610%	-0.93

Table 3
Regression Estimates of Cumulative Abnormal Returns
Seemingly unrelated regression estimates of the cumulative abnormal returns to investors in 299 firms around the dates of proxy statement filings in 2007. The Equity CAR is the cumulative abnormal stock return estimated from the market model. The Bond CAR is the cumulative abnormal return to holders of publicly traded bonds, obtained for the bond issued by each firm over the 12 months prior to the filing date, and also estimated from the market model. The Firm CAR is a weighted average of the Equity and Bond CARs calculated using assumptions given in the text. All CARs are estimated over a two-day interval including the event day and subsequent trading day. The CEO's relative incentive ratio is an approximation of the unit change in value of the CEO's inside debt holdings (pension plus deferred compensation) divided by the unit change in value of his inside equity holdings (stock plus stock options), for each $1.00 change in the value of the firm. The relative incentive ratio is disaggregated into two components based upon whether the ratio is greater than or less than 1. The speculative grade rating indicator equals 1 if a bond is rated BB+ or lower for the debt regressions, and if the firm's S&P long-term debt rating is BB+ or lower for the equity and firm regressions. The nine proxy statement control variables are dummy variables that equal 1 when certain corporate governance events, described more fully in the text, are reported in the proxy statement used in the analysis. *z*-statistics based upon robust standard errors appear in parentheses below each estimate.

Dependent variable: Cumulative abnormal return $_{t(0, 1)}$	Equity CAR	Bond CAR	Firm CAR	Equity CAR	Bond CAR	Firm CAR
Intercept	0.0017	-0.0003	0.0012	0.0002	-0.0003	0.0001
	(0.68)	(0.93)	(0.68)	(0.07)	(1.05)	(0.04)
CEO relative incentive ratio	-0.0007	0.0006 [a]	-0.0007			
	(0.34)	(2.71)	(0.45)			
CEO relative incentive ratio < 1.00				0.0038	0.0008 [c]	0.0027
				(0.86)	(1.91)	(0.88)
CEO relative incentive ratio > 1.00				-0.0057 [b]	0.0003 [c]	-0.0044 [b]
				(2.18)	(1.73)	(2.04)
Speculative grade rating indicator	0.0026	0.0005	0.0012	0.0031	0.00004	0.0015
	(0.69)	(1.58)	(0.55)	(0.80)	(0.19)	(0.67)
Utility industry indicator	0.0019	0.0004	0.0011	0.0015	0.0004	0.0008
	(0.84)	(0.93)	(0.70)	(0.66)	(0.88)	(0.50)
Observations	299	1,147	299	299	1,147	299
Adjusted R^2	0.020	0.063	0.020	0.030	0.065	0.030
Proxy statement control variables (9)	Yes	Yes	Yes	Yes	Yes	Yes

Significant at 1% (a), 5% (b), and 10% (c) levels.

Table 4
Regression Estimates of Changes in Credit Default Swap Spreads
Ordinary least squares regression estimates of the two-day change in credit default swap spreads for 235 firms around the dates of proxy statement filings in 2007. Spread data are obtained from Markit CDS Pricing, and the table uses data for five-year senior unsecured debt. The CEO's relative incentive ratio is an approximation of the unit change in value of the CEO's inside debt holdings (pension plus deferred compensation) divided by the unit change in value of his inside equity holdings (stock plus stock options), for each $1.00 change in the value of the firm. The relative incentive ratio is disaggregated into two components based upon whether the ratio is greater than or less than 1. The Markit Spread is the value of the Markit North American investment grade CDS index for five-year maturities. The speculative grade rating indicator equals 1 if a bond is rated BB+ or lower for the debt regressions, and if the firm's S&P long-term debt rating is BB+ or lower for the equity and firm regressions. The nine proxy statement control variables are dummy variables that equal 1 when certain corporate governance events, described more fully in the text, are reported in the proxy statement used in the analysis. *z*-statistics based upon robust standard errors appear in parentheses below each estimate.

Dependent variable: Log (CDS Spread $_{t-1}$ / CDS Spread $_{t+1}$)		
Intercept	0.0092	0.0073
	(1.42)	(1.01)
CEO relative incentive ratio	-0.0064	
	(1.34)	
CEO relative incentive ratio < 1.00		-0.0005
		(0.05)
CEO relative incentive ratio > 1.00		-0.0141 [b]
		(2.01)
Log (Markit Spread $_{t-1}$ / Markit Spread $_{t+1}$)	0.3074 [a]	0.3037 [b]
	(2.58)	(2.53)
Speculative grade rating indicator	-0.0184 [b]	-0.0179 [b]
	(2.25)	(2.17)
Utility industry indicator	0.0256	0.0248
	(0.73)	(0.71)
Observations	235	235
Adjusted R^2	0.030	0.030
Proxy statement control variables (9)	Yes	Yes
Robust standard errors	Yes	Yes

Significant at 1% (a), 5% (b), and 10% (c) levels.

Table 5
Regression Estimates of Changes in Volatility
Seemingly unrelated regression estimates of the changes in volatility around the dates of proxy statement filings for securities issued by 299 firms in 2007. All volatility changes equal the log of the ratio of volatility estimated over the 90-day period after the filing date, divided by the volatility measured in the 90 prior to the filing date. Asset volatility is determined in the KMV framework using numerical solutions. The CEO's relative incentive ratio is an approximation of the unit change in value of the CEO's inside debt holdings (pension plus deferred compensation) divided by the unit change in value of his inside equity holdings (stock plus stock options), for each $1.00 change in the value of the firm. The relative incentive ratio is disaggregated into two components based upon whether the ratio is greater than or less than 1. The speculative grade rating indicator equals 1 if a bond is rated BB+ or lower for the debt regressions, and if the firm's S&P long-term debt rating is BB+ or lower for the equity and firm regressions. The nine proxy statement control variables are dummy variables that equal 1 when certain corporate governance events, described more fully in the text, are reported in the proxy statement used in the analysis. *z*-statistics based upon robust standard errors appear in parentheses below each estimate.

Dependent variable: log (Volatility $_{[t+1, t+90]}$ / Volatility $_{[t-90, t-1]}$)	Equity volatility change	Bond volatility change	Asset volatility change	Equity volatility change	Bond volatility change	Asset volatility change
Intercept	0.0611 [b]	-0.1893	0.0522 [b]	0.0373	-0.2154 [c]	0.0279
	(2.33)	(1.53)	(1.96)	(1.24)	(1.68)	(0.91)
CEO relative incentive ratio	-0.0070	-0.1613	0.0009			
	(0.31)	(2.35)	(0.04)			
CEO relative incentive ratio < 1.00				0.0586	-0.0897	0.0677
				(1.19)	(0.79)	(1.35)
CEO relative incentive ratio > 1.00				-0.0798 [b]	-0.2437 [c]	-0.0731 [b]
				(2.51)	(1.77)	(2.26)
CRSP equal-weighted market index volatility change	0.5567 [a]		0.4888 [a]	0.5733 [a]		0.5059 [a]
	(5.26)		(4.66)	(5.52)		(4.93)
Merrill Lynch corporate bond index volatility change		1.8048 [a]			1.8205 [a]	
		(4.28)			(4.35)	
Speculative grade rating indicator	0.0736 [c]	0.0845	0.0356	0.0792 [b]	0.0846	0.0414
	(1.95)	(1.22)	(0.97)	(2.10)	(1.23)	(1.13)
Utility industry indicator	0.2353 [a]	-0.0993	0.2265 [a]	0.2306 [a]	-0.1060	0.2218 [a]
	(5.90)	(1.19)	(5.85)	(5.74)	(1.26)	(5.68)
Observations	299	1,147	299	299	1,147	299
Adjusted R^2	0.192	0.080	0.168	0.198	0.079	0.173
Proxy statement control variables (9)	Yes	Yes	Yes	Yes	Yes	Yes

Significant at 1% (a), 5% (b), and 10% (c) levels.

Table 6
Regression Estimates of Changes in Implied Volatility

Seemingly unrelated regression estimates of changes in implied volatility of exchange traded options around dates of proxy statement filings by 218 firms in 2007. The dependent variable is the log of the ratio of implied volatility two days after the filing, divided by implied volatility one day before the filing. Implied volatility is measured at the firm level, as the weighted-average implied volatility of all exchange-traded options with maturities between 28 and 100 days. We include all options with non-zero trading volume during the event window and use vega as the weight for each option. The CEO's relative incentive ratio is an approximation of the unit change in value of the CEO's inside debt holdings (pension plus deferred compensation) divided by the unit change in value of his inside equity holdings (stock plus stock options), for each $1.00 change in the value of the firm. The relative incentive ratio is disaggregated into two components based upon whether the ratio is greater than or less than 1. VIX is the level of the Chicago Board Options Exchange volatility index. The speculative grade rating indicator equals 1 if a bond is rated BB+ or lower for the debt regressions, and if the firm's S&P long-term debt rating is BB+ or lower for the equity and firm regressions. The nine proxy statement control variables are dummy variables that equal 1 when certain corporate governance events, described more fully in the text, are reported in the proxy statement used in the analysis. *z*-statistics based upon robust standard errors appear in parentheses below each estimate.

Dependent variable: log (Implied Volatility $_{t+2}$ /Implied Volatility $_{t-1}$)	Put options	Call options	Put options	Call options
Intercept	0.0080	0.0022	-0.0150	-0.0103
	(0.67)	(0.20)	(1.30)	(0.81)
CEO relative incentive ratio	-0.0365	-0.0229		
	(1.63)	(1.60)		
CEO relative incentive ratio < 1.00			0.0324	0.0145
			(1.64)	(0.62)
CEO relative incentive ratio > 1.00			-0.1453 [a]	-0.0821 [a]
			(3.40)	(3.25)
Log (VIX $_{t+2}$ /VIX $_{t-1}$)	0.2734 [a]	0.3576 [a]	0.2929 [a]	0.3683 [a]
	(4.85)	(5.73)	(5.25)	(6.04)
Speculative grade rating indicator	0.0086	-0.0348 [c]	0.0120	-0.0329 [c]
	(0.47)	(1.84)	(0.67)	(1.74)
Utility industry indicator	-0.0090 [a]	-0.0132 [c]	-0.0120	-0.0149
	(0.55)	(0.70)	(0.76)	(0.79)
Number of firm-observations	218	218	218	218
Adjusted R^2	0.191	0.221	0.256	0.234
Proxy statement control variables (9)	Yes	Yes	Yes	Yes

Significant at 1% (a), 5% (b), and 10% (c) level