Financial Leverage, CEO Compensation and Corporate Hedging: Evidence from Real Estate Investment Trusts

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ABSTRACT

This paper studies the determinants of corporate hedging practices in the REITs industry between 1999 and 2001. We find a positive significant relationship between hedging and financial leverage, indicating the financial distress costs motive for using derivatives in the REITs industry. Using estimates of the Black-Scholes sensitivity of CEO's stock option portfolios to stock return volatility and the sensitivity of CEO's stock and stock option portfolios to stock price, we find weak evidence to support managerial risk aversion motive for corporate hedging in the REITs industry. Our results indicate that CEO's cash compensation is a significant determinant of both the probability and the extent of the derivative use in REITs. We also find that probability of hedging is related to economies of scale in hedging cost. Our study finds a positive significant relationship between the growth opportunities and the extent of hedging providing evidence for the hypothesis related to investment policy.

I. Introduction

In this study we examine hedging practices in the real estate industry through equity real estate investment trusts (Equity REITs) for 1999 to 2001. The primary objectives of our study are: (i) To document the hedging activities within the REITs industry; (ii) To identify the relevant motives for hedging activities for REITs; (iii) To empirically test the extent and likelihood of hedging by REITs.

We observe a steady increase in hedging activities of Equity REITs over time. The Horng and Wei study reports approximately 38% of equity REITs being hedgers for 1995.[1] In our sample, however, the percentage of hedgers is 46% for 1999, 45% for 2000, and 56% for 2001. For the study period 1999-2001, the average notional amount of derivatives used by hedgers is about $200 million. When scaled by the amount of debt hedger REITs have, this number amounts to about 20% of their debt.

Horng and Wei (1999) is the first study that analyzes corporate hedging practices in the REITs industry. However, our study is substantially different than Horng and Wei's in at least three respects. First, unlike Horng and Wei's one-year study for 1995, we study the industry for three years from 1999 to 2001. As such, this makes our results more robust than only one-year study results. Second, we worked only with equity REITs, while the Horng and Wei study includes mortgage REITs. Because of their asset structure, mortgage REITs might have different motives for hedging than equity REITs. Specifically, the Horng and Wei study finds prepayment risk as the major factor for hedging in mortgage REITs, while controlling financing costs is the major motive for equity REITs to hedge. Finally, as laid out in Smith and Stulz (1985), agency related motives, particularly risk aversion of the firm's managers, can be an important determinant for corporate hedging. Although Horng and Wei (1999) exclude agency-related motives for hedging, we incorporate them in our study in order to have a more complete analysis of corporate hedging practices in the REITs industry.

Managerial risk aversion as the driving force of hedging is based on the premise that substantial amount of managers' human capital and wealth are tied to the performance of the

firm. Thus, managers have strong incentive to reduce firm risk more than a well diversified shareholder. Smith and Stulz (1985) model predicts that managers with greater stock ownership of the firm would prefer more risk management. However, managers with more stock options would prefer less risk management: As the volatility of firm's stock price increases the value of the stock options managers hold would also increase. To test these hypotheses, for example, Tufano (1996) uses dollar value of stocks and number of stock options managers held. However, these variables are insufficient proxies to test the risk aversion motive for hedging because incentive scheme which consists of mainly stock portfolio and option portfolio, can influence the value of the manager's wealth through two channels: slope affect (stock price) and convexity effect. Slope effect is related to the change in the wealth as a result of the change in stock price (∂Wealth/∂Stock price). The convexity effect, however, is related to the sensitivity of manager's wealth to the volatility of the stock return (∂Wealth/∂ Volatility). Although there is not sufficient public information to measure these sensitivities, Core and Guay (2002) developed one-year approximation (OA) method to calculate these sensitivities using available information in proxies of publicly held companies.

In this study, we use this newly developed set of proxies to test the managerial risk aversion hypotheses: the sensitivity of the CEO's wealth to stock price and stock return volatility. To our knowledge, there are only three studies using these new proxies to test the impact of managerial compensation on corporate hedging. Knopf, Nam and Thornton (2002) analyze 260 non-financial S&P 500 companies and Rogers (2002) uses a sample of 524 firms randomly selected from 3200 10-K filings. At the industry level, Rajgopal and Shevlin (2002) employ 116 firm-year observations from the oil and gas industry to analyze whether executive stock options encourage managers to invest in risky projects and hedge less oil price risk.

The unique institutional environment in which REITs operate provides several reasons to analyze the REIT industry separately. First, distributional requirements force REITs to pay 90% of their taxable income as dividend distributions to shareholders as dividends in order to keep their non-tax paying status. This high dividend payment may have implications in agency related motives of corporate hedging. More specifically, the high dividend payout of REITs may lower the sensitivity of options granted to CEOs to stock return volatility and thus reduce CEOs'

incentives to take on risk and increase their motivation to hedge. Second, distributional requirements also mean that REITs do not pay taxes. This eliminates the tax incentive motives for hedging. Third, empirical evidence such as Geczy, Minton, and Schrand (1997), suggest wide variation among industries in risk management practices, implying an industry effect. Using data from only one industry would help control for the inter-industry effect.

Our results support several explanations for corporate hedging. First, as developed by Smith and Stulz (1985), financial distress argument holds that corporate hedging activities can increase the expected value of the firm through reducing the present value of the bankruptcy costs and increasing the debt capacity of the firm. Our finding of a positive significant relationship between financial leverage and hedging supports the financial distress costs hypothesis for hedging. This result appears to be consistent with the reasons REITs express in their explanation for using these hedging instruments. In its 10-K report, for example, Chelsea Property Group states: "*The Company is exposed to changes in interest rates primarily from its floating rate debt arrangement. In December 2000, the Company implemented a policy to protect against interest rate and foreign exchange risk. The Company's primary strategy is to protect against this risk by using derivative transactions as appropriate to minimize the variability that floating rate interest and foreign currency fluctuations could have on cash flow.*".

Second, we find a *positive* relationship between the *decision to hedge* and the size of the REIT. This is consistent with the notion that large companies can take advantage of informational scale economies, particularly in setting up a hedging program. This result also supports the argument that swap and other over-the-counter hedging instruments exhibit significant scale economies in terms of transaction costs. On the other hand, with respect to extent of hedging, we found that smaller REITs tend to hedge more. This negative relationship between size and the *extent of hedging* is consistent with the financial distress costs hypothesis for hedging.

Third, we also find a positive relationship between the growth opportunities and the extent of hedging, supporting the investment policy hypotheses for hedging. By reducing the volatility of cash flows, hedging can increase firm value, since it helps ensure that the firm has sufficient

cash flow to take advantage of value-increasing investment opportunities (Froot, Scharfstein and Stein (1993)). Moreover, as argued by Bessembinder (1991), hedging can decrease underinvestment costs. The companies with more growth opportunities benefit more from hedging since underinvestment costs are more severe for them.

The remainder of the paper is organized as follows. The following section reviews the theories of corporate risk management and develops the hypotheses for corporate hedging for REITs. Also in this section, the proxies that are developed to test the hypotheses are discussed. The next section describes the data and provides descriptive statistics of the sample. We then explain the methodology to test the hypothesis and the results of regression analysis of the decision to hedge and the extent of hedging. The final section summarizes our conclusions.

II. Theories of Corporate Hedging and Hypothesis Development

The Modigliani-Miller (1958) world with no market frictions and perfect capital markets hedging will not increase firm value because shareholders of a company using derivative securities can easily hedge on their personal accounts. However, real world does not resemble the Modigliani-Miller world. Corporate finance provides theories that explain circumstances under which corporate hedging can create value and thus warrants its use. These theories, however, are not developed for specific industries and this study examines the determinant of hedging practices in REITs industry. Thus, the institutional constraints in which REITs operates require some discussion of the effects of these constraints on the theories of hedging that can be applied to explain hedging practices in REITs industry. This section briefly summarizes the theories of corporate hedging and develops the hypotheses for corporate hedging for REITs. Proxies used to test the hypothesis are also discussed. Table 1 depicts all the independent variables used in the analysis with their expected signs.

A. Financial Distress Costs

Financial distress is costly to a firm. Cost can range from direct cost of bankruptcy to indirect cost of deterioration of relationship with customers and suppliers. Smith and Stulz (1985) develop a model whereby reducing the probability of financial distress hedging adds value to the firm. This increase in value comes through an increase in debt capacity to the firm and reduction in agency cost of free cash flow. Thus, the financial distress argument predicts a positive relationship between hedging activity and leverage.

Application of financial distress argument for hedging to a regular firm implies that as the firm has more debt in its capital structure, hedging would be beneficial by reducing the probability of financial distress while the firm takes advantage of tax shelter of debt. However, REITs do not pay corporate tax and thus the tax advantage of debt can not be applied for REITs. Howe and Shilling (1988) argue that REITs are in a disadvantage position in capital markets because REITs pays the same cost of debt as regular firms while not benefiting the tax shelter of debt. They suggest that REITs should not use debt. However, Chan, Ericson, and Wang (2003) documents that REITs have higher leverage ratio than other companies traded in NYSE, Amex, and Nasdaq, both in market value and book value. For example, for 1990-2000 period, REITs have 50 percent leverage and other companies 45 percent in book value terms. In market value terms these numbers are 44 percent for REITs and 26 percent for other companies.

Most real estate has high level of operating cost and the real estate market is cyclical.[2] When these two features coupled with high debt and no tax shelter benefit of debt can negatively impact the cash flow and earnings of REITs significantly during a down market. Therefore, we expect REITs having more debt in their capital structure to hedge more. To test this hypothesis we use two proxies. The first proxy is the ratio of book value of short-term debt and long-term debt to the market value of assets and is denoted by DEBT. We expect a positive relationship between DEBT and hedging activities of REITs. The second proxy is the earnings before interest and taxes over interest expense, and is denoted by COV. We expect to have a negative relationship between COV and hedging activities of REITs.

Nance, Smith, and Smithson (1993) argue for size to be a determining variable for hedging. Warner (1977) and Weiss (1990) find that direct costs of financial distress and the bankruptcy costs are proportionally less for large firms than small ones. These findings imply that smaller firms benefit from hedging more than large ones. However, Nance, Smith, and Smithson (1993) also argue that larger firms may have more incentives to hedge than small ones due to informational scale economies associated with hedging and scale economies associated with the cost of hedging instruments: Large firms can hire managers with expertise in financial risk management instruments and pay less transaction cost for hedging instruments. These arguments imply that the relation between size and hedging can not be determined apriory and the relation is an empirical question. To test the relation between size and hedging for REITs, we employ the log of market value of assets as a proxy for size and denote it by SIZE.

B. Investment Policy

Myers (1977) shows the underinvestment problem caused by agency problems between equity holders and debt holders when firm faces financial distress. Bessembinder (1991) argues that redistribution of cash flows from the states with high cash flows to the states with low cash flows, hedging allows firms to meet their commitments in those states with insufficient cash flows. Thus, hedging reduces incentives for equity holders to underinvest. Bessembinder also shows that to the extent that hedging reduces the cash flow volatility, it will increase the probability that the firm will be able to meet its commitments arising from its contracts with its creditors. As a result, hedging will improve the contracting terms with the firm's creditors. Stulz (1990) also argues that more volatile cash flows make under- and over-investment more likely and thus reduces the firm value. To the extent that hedging reduces the volatility of cash flows, hedging will increase the value of the firm through decreasing the costs of managerial discretion, i.e. under- and over-investment costs.

Froot, Sharfstein and Stein (1993) develop a model in which external financing is more costly than internally generated funds. A firm's cash flows generated by its assets will have variability from period to period. This internally generated cash flows in turn cause a variability in both externally generated cash flows and firm's investments, either of which is costly for a

firm. To the extent hedging can reduce the volatility of cash flows, hedging can increase firm value by ensuring that the firm has sufficient less costly internally generated cash flows to take advantage of value-increasing investment opportunities. Their model predict that the value provided by hedging will be greater for firms with value-enhancing investment opportunities and high costs of external financing.

To test the investment policy hypothesis for REITs, we use the ratio of market value of assets to book value of assets as a proxy for growth opportunities and denote it by MB. The market value of assets is defined as the total of market value of equity, book value of debt and preferred stock. We expect REITs with high MB value to hedge more.

C. Taxes

Smith and Stulz (1985) formalize tax related hedging idea that under a convex tax structure firms can reduce expected taxes through hedging. However, for REITs tax related arguments for hedging are not compelling because REITs do not pay corporate taxes, as long as they comply with the distributional requirement of REITs corporate structure.

D. Managerial Risk Aversion

Smith and Stulz (1985) develop a model in which risk averse manager coupled with substantial amount of their wealth tied to the firm's performance generates agency cost related hedging incentives for managers: Managers have strong incentives to reduce firm's risk more than well diversified shareholders of the firm would like to. They propose an incentive scheme that is a convex function of the firm's value as a solution to mitigate this conflict. Expected wealth of the manager is an increasing function of the firm's risk when the incentive scheme has securities with convex payoffs, such as stock options, which increase in value as the firm risk increases. Bonus plans, which make a payment to managers only if the accounting earnings exceed some target number, can also increase the convexity of the incentive scheme. Their

model implies that managers with greater stock ownership portfolio would have more incentive to hedge while managers with more stock options would have less incentive to hedge.

To measure the effect of the level of CEO's stock ownership on the decision and the extent of hedging, we use the log of the number of shares owned by the CEO multiplied by the share price at the end of the year as a proxy and denote it by OWNER.[3] We expect a positive relationship between OWNER and hedging activities by REITs. To measure the effect of the level of CEO's stock options on the decision and the extent of hedging we use two proxies: number of exercisable options and is denoted by EXEPORT and the total number of options held by a CEO and is denoted by TOTALOPT. We expect a negative relationship between hedging and both proxies for stock options CEO held. These proxies can be considered more traditional and earlier studies of Tufano (1996), Geczy, Minton, and Schrand (1997), and Haushalter (2002) also use them. We include these proxies in our analysis only to compare them with the recently developed proxies based on sensitivities of CEO's wealth to stock price and stock price volatilities.

An incentive scheme consisting mainly of stock portfolio and option portfolio can influence the value of the manager's wealth through two channels: slope affect (stock price) and convexity effect. Slope effect is related to the change in the wealth as a result of the change in stock price (∂Wealth/∂Stock price). The convexity effect, however, is related to the sensitivity of manager's wealth to the volatility of the stock return (∂Wealth/∂ Volatility). Although there is not sufficient public information to measure these sensitivities, Core and Guay (2002) developed one-year approximation (OA) method to calculate these sensitivities using available information from proxies of publicly held companies. Knopf, Nam and Thornton (2002) and Rogers (2002) using OA method find that the sensitivity of manager's wealth to the stock price and to the volatility of the stock return are better proxies to test the relationship between managerial incentives and hedging. A manager will induce the firm to hedge more as the sensitivity of his/her wealth to stock price increases, and will induce the firm to hedge less as the sensitivity of his/her wealth to stock return volatility increases.

We also use OA method developed by Core and Guay (2002) to calculate the sensitivity of a manager's wealth to stock price and to the stock return volatility separately. More specifically, we estimate the sensitivity of the CEO's option portfolio to a 0.01 change in the annualized standard deviation of the firm's stock returns, denoted as SENVOLAT, based on Black-Scholes formula for valuing European call options, as modified by Merton (1973) to account for dividend payouts. We calculate SENVOLAT for only CEO's option portfolio. We expect to find a negative relationship between hedging and SENVOLAT.

Common stock can be treated as a call option on the value of the firm's assets with an exercise price of the face value of deb. In this case, a CEO's stock portfolio value will also be sensitive to return volatility. However, Guay (1999) finds that effect of return volatility on the value of stock portfolio is economically insignificant.[4] Therefore, in this study we also assume that this effect is zero.[5] We calculate the sensitivity of CEO's wealth to stock price as the change in CEO's option portfolio resulting from one percent change in the firm's stock price plus the change in the value of CEO's stock portfolio from a one percent change in the firm's stock price. We denote this variable by SENPRICE. We expect a positive relationship between hedging and SENPRICE. The details of OA method and the sensitivity calculations are explained in Appendix 1.

We use the ratio of CEO's salary and bonus compensation to total compensation to control for CEO's outside wealth and denote it by CEOCOMP. We define total compensation as the total of salary, bonus, long-term compensation, and Black-Scholes value of option grants for the year-end. Higher cash compensation relative to the total compensation will make it easier for the CEO to build wealth that is not tied to firm value. As a result, higher cash compensation will increase the degree of diversification of CEO's wealth.[6] Since diversified wealth should decrease CEO's risk aversion, we expect a negative relationship between hedging and CEOCOMP.

Poorly diversified managers with large stock ownership are more likely to implement a hedging policy. However, since institutional investors are more diversified, firms with high percentage of institutional ownership firms should hedge less (Tufano, 1996). We use the

percentage of shares held by institutions as a proxy for institutional ownership and denote it by INST. We expect a negative relationship between hedging activities of REITs and INST.

E. Hedging Substitutes

Firms may also engage in alternative financial policies rather than using financial instruments to hedge. For example, firms can increase debt to control agency problems. Alternatively, as suggested by Nance, Smith, and Smithson (1993), firms can also use convertible debt to reduce the conflict of interest between stockholders and bondholders. They can also use preferred stock to reduce the probability of financial distress.

Tufano (1996) suggests the possibility of adapting conservative financial policies such as carrying large cash balances. The use of any or all of these financial policies should lead firms to use less hedging. However, this argument may not be compelling for REITs because they must distribute 90 percent of their taxable income as dividend leaving them with less cash than regular firms. Due to this institutional constraint, one should expect that REITs can not adapt a conservative financial policy relative to other firms. However, Wang, Ericson, and Gau (1993) find that for 1988 the average ratio of dividends to income was 1.65. Bradley, Capozza and Senguin (1998) report a dividend payout as much as twice of net income for their study period of 1985-1992, during which the legal required payout ratio was 95 percent. This discrepancy is the result of high depreciation value of REITs' assets allowing REITs to have much higher cash flows than their taxable income. These results indicate that REITs have a somewhat less restrictive payout policies that anticipated due to its cash distribution requirement.

To test the hedging substitutes hypothesis for REITs, we employ two proxies. First proxy is related to the use of convertible and preferred stock. We use the total value of convertible bonds and preferred stock scaled by the market value of assets and is denoted by CONVPREF. A negative relation between hedging activities of REITs and CONVPREF is expected. However, firms that are more financially constraint are more exposed to underinvestment costs (Froot, Scharfstein, Stein (1993)). Since convertible bonds and preferred stock may reflect additional

leverage and thereby constrain the firm's access to external sources of funds, it is possible to observe a positive relationship between CONVPREF and hedging activities of REITs.

Second proxy we employ is to test for conservative financial policy. We use the ratio of the total of cash and cash equivalents to the market value of assets and is denoted by CASH. High cash holding can be an important source of funds for firms when the internal sources of capital fall short and the external sources of capital are costly. We expect a negative relation between hedging activities of REITs and CASH.

IV. Data Characteristics

A. Data and Descriptive Statistics

We constructed the initial sample of equity REITs using National Association of Real Estate Investment Trusts (NAREIT) REIT Index for 1999 to 2001. The index includes 167, 158 and 151 equity REITs for 1999, 2000 and 2001, respectively. Using NAREIT REIT Index enables us to focus on the companies that have REIT status and thus are exempt from corporate taxes.

To gather information on derivatives use of REITs, we search each REIT's 10-K filings using the following keywords: derivatives, derivative, hedge, hedging, swap, futures, forward, options, cap, collar and interest rate protection agreements. For each REIT, we collected the data on the notional amount of derivatives. To find the total notional amount of derivatives used by each REIT, we aggregated the notional amount of swaps, caps, options, collars, forwards and interest rate protection agreements.

We use SNL Securities Database for accounting and the REIT type data. The institutional ownership data compiled by Vickers Stock Research Corporation from 13-F filings[7] are obtained from SNL Securities Quarterly. We gather the information on the number of shares owned by the CEO[8], CEO option awards including the number of newly granted options, their exercise prices and maturity dates, number of exercisable and unexercisable options and their realizable values

from individual REIT's proxy statements. Salary, bonus, restricted stock awards and other compensation data of the CEO are obtained from SNL Executive Compensation Review's 2002 issue.

Table 2 Panel A presents the distribution of hedger and non-hedger equity REITs used in estimations. Due to missing independent variables, the initial sample of 167, 158 and 151 dropped to 100, 100 and 112 REITs for 1999, 2000 and 2001, respectively. Panel A also indicates that although the hedgers are about 45 percent of the sample in 1999 and 2000, this number increases to 56% in 2001.

Table 2 Panel B shows the distribution of type of derivative instruments used by the hedger REITs. By far the most commonly used type of derivative instrument is interest-rate swaps: They make up about 73 percent of total derivative use in 1999 and 2000 and 86 percent in 2001. Interest rate caps are second to swap use by REITs: about 30 percent of hedgers use them. To a much lesser extent the REITs also use interest rate protection agreements[9] and collars to hedge against interest rate movements. The forward contract used in 1999 is a treasury forward agreement to hedge against interest rate risk.[10] The other forward used in 2001, is a foreign currency forward contract. The options listed in Panel B for 1999, 2000 and 2001 are foreign currency put options. Appendix 2 provides some excerpts from the hedger REITs' 10-Ks to show the reasons REITs give as to why they use derivative instruments.

Table 3 presents the descriptive statistics for the pooled sample. REIT companies have been in the small to medium size category. Only recently two REITs have been included in S&P 500.[10] We can see the size difference when we compare our sample with Knopf, Nam and Thornton (2002) and Rogers (2002)[12] studies; the median size of our sample is much smaller. This makes our study the analysis of the hedging policies of medium to small firms.

The mean value for the total number of options held by the CEO is smaller for our sample than Knopf, Nam, Thornton study, although the reverse is true for the median number. The market value of stock ownership of the CEO (OWNER) is considerably less in our sample than Knopf, Nam, Thornton sample. For example, mean value for stock ownership of the CEO is

about $11.6 million for REITs while it is about $157.7 million in their study. These numbers are expected because size plays an important role in CEOs' compensation packages.

Table 4 presents the correlation of the independent variables for the pooled sample. Sensitivity of CEO's option portfolio to return volatility is highly correlated with the number of exercisable options and the total number of options. Sensitivity of CEO's option and stock portfolio to stock price, on the other hand, is highly correlated with the market value of CEO's stock ownership. Table 4 also shows that the sensitivity variables are highly correlated with each other and with size.[13] Size is also correlated with institutional ownership.

B. Comparison of Hedgers with Non-hedgers

Table 5 presents sample characteristics of each of the variables used in the regression analysis for the hedger and non-hedger REITs for the pooled sample and the *t*-tests results for the differences of means and Wilcoxon rank sum test results for the differences of medians. For each year, a company is classified as a hedger if it reports any derivative instrument use in that year's 10-K and a non-hedger otherwise. Almost all variables except debt ratio and market-to-book values indicate a significant differences in means of the two samples.

Table 5 indicates that hedger REITs are significantly larger than non-hedger REITs. The sensitivities of CEO's stock and option portfolios to stock return volatility and stock price are larger for hedger REITs than non-hedger REITs. The ratio of CEO's cash compensation to total compensation, however, is smaller for hedger REITs. The univariate analysis also shows that hedger REITs have higher institutional ownership and higher amount of convertible bonds and preferred stock than non-hedger REITs.

V. Regression Analysis and Results

To examine the determinants of derivative use we estimate cross-sectional regressions using a tobit model in which the dependent variable is the percentage of debt hedged defined as the notional amount of interest rate derivative divided by total debt.[14] Following Haushalter

(2000), we also try to disentangle the decision to hedge from the extent of hedging using Cragg's model.[15] We use a probit model to examine the decision to hedge. In the probit model, the dependent variable is a dummy variable which takes value 1 if a REIT hedges and 0 otherwise. To determine the level of hedging, we use truncated regression model where the dependent variable is the percentage of debt hedged.[16]

A. Tobit Model

To investigate the characteristics of a REIT related to its hedging policy, we estimate the regressions using a tobit model. In these regressions, the proportion of total debt hedged by the REITs is regressed on variables that measure financial distress costs, investment policy, managerial risk aversion and hedging substitutes. The tobit model is used since the dependent variable is censored at zero.

Table 6 presents the tobit regression results for the pooled sample.[17] The results indicate a significant positive relationship between financial distress costs and the extent of hedging: The higher the distress costs, the higher the percentage of debt hedged.[18] Size seems to be another important variable determinant of hedging as indicated by a positive relationship between the size of the REIT and the total debt hedged by the REITs. The coefficient of market-to-book ratio is also significant in some models, consistent with the hypotheses related to investment policy. We also find significant negative relation between CEOCOMP and the extent of hedging, supporting the hypothesis that managers with more diversified wealth are likely to hedge less.

We, however, find no significant or consistent support for managerial risk aversion hypotheses. The sensitivity variables, SENVOLAT and SENPRICE, have the expected signs yet not statistically significant. EXEROPT, in contrast with the theory, has positive sign and is also insignificant.

We find mixed support for hedging substitute motives for corporate hedging practices for REITs. We found a positive relationship between CONVPREF and the extent of hedging, indicating that preferred stocks and convertible bonds reflect additional leverage, constraining

the access to external sources of funds rather than being substitutes for hedging. CASH has the expected negative sign and significant in some specifications, supporting the hypothesis that high cash levels can be used as a substitute for hedging.

We find a significant positive relationship between institutional ownership, INST, and the extent of hedging. This suggests that as institutional ownership increases, REITs hedge more of their debt. This is in contrast with the theory.[19] Finally, we also find that the self-managed REITs hedge more than REITs that are not self-managed. This supports the argument that managers in self-managed REITs are more concerned with the value of the firm and therefore hedge more (Horng and Wei, 1999).

B. Cragg's Model – Separating the Decision to Hedge from the Extent of Hedging

As recognized by Haushalter (2000), the determinants of the decision to hedge can be different from the determinants of the extent of hedging. For example, small firms may prefer not to hedge since setting up a hedging program is costly. On the other hand, because they face greater costs of financial distress, small firms can benefit more from hedging once they decide to hedge. Tobit model, however, doesn't accommodate the possibility that the decision to hedge and the extent of hedging can have different determinants. To disentangle these two affects, we employ the model proposed by Cragg (1971). In this model, the probability of the limit observation (e.g. decision to hedge) is independent of the regression model for the nonlimit data (e.g. extent of hedging). Therefore, this model is a combination of a binomial probit model and a truncated regression (Greene, 2000, p.770). We estimated the model specifications from Table 6 using Cragg's model. The results from these regressions are presented in Table 7 and 8.

It is worth to note that SIZE is consistently significantly positive in the probit model, suggesting that larger REITs do hedge more of their debt. This is consistent with the theory. However, truncated regression results in Table 8 indicate significantly negative relation between SIZE and hedging activities of REITs. This result is consistent with the financial distress costs arguments.

B1. Analysis of Decision To Hedge -Probit Model

To analyze the decision to hedge, we use probit regressions where the dependent variable is a binary choice variable that takes value of 1 if the firm is a hedger and 0 otherwise. Probit regression results on a pooled sample of REITs for 1999 through 2001 are reported in Table 7.[20]

The results in Table 9 also support the financial distress costs hypotheses of corporate derivative use: both proxies for financial distress costs, DEBT and COV, have significant expected signs. REITs with higher debt ratios and lower coverage ratios are more likely to face with financial distress and thus more likely to hedge.

Size appears to be a very important variable in decision to hedge. The positive relationship between the decision to hedge and the size of the REIT is consistent with the idea that larger companies can take advantage of the scale economies related to establishing a hedging program.

We find weak support for the managerial risk aversion hypotheses. The proxies that are used in earlier studies (number of options, fraction of shares owned and the dollar value of CEO ownership) are not significant. Moreover, the sensitivity of CEO's wealth to stock price and stock return volatility are not significant in pooled regressions. We find a negative relationship between the ratio of cash compensation to total compensation (CEOCOMP) and the likelihood of hedging. This result supports the hypothesis that managers with more diversified wealth are less likely to engage in hedging activities.

The pooled results show a positive relationship between institutional ownership and likelihood of hedging contrary to our expectations.[21] The positive relationship between the likelihood of hedging and institutional ownership can be explained based on the agency theory. If hedging benefits the shareholders of the company (increase the value through decreasing financial distress costs, for example), then shareholders would want the firm to hedge. Institutional ownership will decrease agency costs. Managers' actions would be more aligned with the goals of the shareholders. If we assume that firms with higher institutional ownership are likely to be managed more in the interest of shareholders (as compared to managers), then

their practices will aim at maximizing the value of the company rather than maximizing the utility of managers.

The pooled regression results show a positive relationship between value of convertible bonds and preferred stock (CONVPREF) and the decision to hedge. This result contradicts with the hypothesis that convertible bonds and preferred stock reduce the agency costs between shareholders and bondholders and therefore are hedging substitutes. However, this result supports the argument that convertible bonds and preferred stock reflect additional leverage and constrain the access to external sources of funds.

B2. Analysis of the Extent of Hedging – Truncated Regression Model

Table 8 presents the truncated regression model estimates for the determinants of the extent of hedging. The differences between the results of the truncated regression model and the probit model support our argument that the determinants of hedging decision can be different from the determinants of the level of hedging.

An important difference between the truncated regression and probit regression results is related to the size of the REIT. The probit regression results showed that larger REITs are more likely to hedge. This is consistent with the hypothesis that larger companies can take advantage of the scale economies related to establishing a hedging program. The truncated regression results show a negative relationship between size and the level of hedging. This result is consistent with the argument that since the costs of financial distress are likely to be more than that of larger companies, smaller companies would hedge more.

The truncated regression results also suggest that REITs with more growth opportunities hedge more, although probit results show no significant relationship between the growth opportunities and probability of hedging.

The results for the CEO compensation and ownership variables are also quite different from probit results. In contrast with the theory, the level of hedging is positively correlated with

the number of options granted to CEO and negatively correlated with the market value of CEO ownership. However, the sensitivity variables (i.e. SENPRICE and SENVOLAT) are not significant. Like the results from the probit and tobit regressions, the coefficient of the ratio of cash compensation to total compensation is negative.

The regression results, contrary to our expectation, provide evidence that the higher the institutional ownership, the higher the level of hedging. Finally, the operating partnership dummy is negative and significant, indicating that among the hedgers, operating partnership REITs hedge less.

VI. Conclusions

In this study we examine the determinants of corporate risk management activities in REITs industry for 1999 to 2001. We document a positive relationship between hedging and financial leverage. More specifically, we find REITs with higher debt ratios and lower coverage ratios are more likely to hedge than the REITs with lower debt ratios and higher coverage ratios. This result is consistent with financial distress costs motive for corporate risk management.

We find that larger REITs are more likely to hedge. This result supports scale economies associated with hedging programs. However, among the hedging REITs, smaller REITs hedge more. Our results also indicate that REITs with more growth opportunities hedge more than the REITs with fewer growth opportunities. However,

We find weak evidence to support managerial risk aversion hypotheses. Using Core and Guay (2002) to measure the sensitivity of a CEO's wealth to stock price and stock return volatility, we couldn't find a significant positive relationship between the sensitivity of CEO's wealth to price in the regressions. One possible explanation may be due to relatively high dividend yields of REITs: Dividends decreases the sensitivity of CEO's option portfolio to stock price and stock return volatility. This way high dividend yields may mitigate the agency costs related to managerial risk aversion.

Notes

1. The number is calculated from Table 2 of Horng and Wei (1999), p. 571.
2. Chan, Erickson, and Wang (2003).
3. In measuring the impact of managerial compensation on hedging we focus on CEO's compensation package as a representative of the entire management team of a REIT.
4. Guay (1999) analyzes the compensation of 278 CEOs. His analysis shows that the median change in per-share stock price for a 0.01 change in the stock-return volatility is $0.00005, compares to $0.156 per option. Even when multiplied by the quantity of stock held, median of the total sensitivity of common stock is only $2.
5. Knopf, Nam and Thornton (2002) and Rogers (2002) also assume that the sensitivity of the stock portfolio to stock return volatility is zero.
6. Wealth in empirical studies on managerial risk aversion necessarily has a drawback because managers' total wealth is not public information. However, in some countries such as Sweden individual's wealth is in public domain. Holmes, Knopf, and Peterson (2004) uses Swedish data to assess the effect of the manager's entire wealth and their diversification on managerial control, private benefit, and small shareholders.
7. 13F filings report institutional investors managing more than $100M in each company's stock.
8. When a REIT did not have a CEO, we used the compensation information for the president or the chairman of the REIT.
9. Some REITs reported using "interest rate protection agreements" to fix the variable interest rate within a range.
10. Unlike the other REITs that use swap, caps and collars, however, this company faces basis risk.
11. See Deutsche Banc Alex. Brown (2002), p.3.
12. Knopf, Nam and Thornton (2002) have a sample of 260 non-financial S&P 500 firms. Rogers (2002) uses a sample of 524 firms selected randomly from 3,200 10-K filings. Both studies are for 1995.
13. Despite the high correlation of sensitivity variables with each other and with size, we used all of them in the same regressions. We calculated the condition number (Greene p.57) for all the regression specifications and found that the condition number was less than 10 for each specification.
14. In most of the other studies the dependent variable is the notional amount of derivative used scaled by the market value of assets (e.g. Horng and Wei (1999), Knopf et.al.(2002)). We chose to scale the notional amount of derivatives used by the value of debt since most of the companies in our sample are using interest rate derivatives.
15. Details of Cragg model are explained in section IV.
16. In both the tobit and truncated regressions, the notional amount of foreign exchange derivatives was subtracted from total notional amount of derivatives because we use the percentage of debt hedged as dependent variable. There were two REITs using foreign exchange derivatives in 1999 and 2001 and only one REIT in 2000.
17. In all of the tobit, probit, and truncated regression results we found the qualitatively similar results with both EXEROPT and TOTALOPT variables. Therefore we reported regression results with only EXEROPT.
18. There may be a positive relationship between debt ratio and hedging simply because the firms with higher debt levels have more liabilities to hedge. However, this shouldn't be a concern in our analysis since we scaled the notional amount of interest rate derivatives used by the total debt.
19. Geczy et.al.(1997), and Rogers (2002) also find a positive relationship between institutional ownership and hedging.
20. For both probit and tobit models, we test the null hypothesis of homoscedasticity using a likelihood ratio test. We estimate the probit and tobit models with a correction for heteroscedasticity of the form $Var[\varepsilon]=[\exp(z'\gamma)]$ where z is vector of independent variables. The test statistics of [(The likelihood ratio of the restricted model assuming heteroscedasticity – the likelihood ratio of the unrestricted model assuming homoskedasticity)*2] follows a chi-square distribution with degrees of freedom equal to the number of restrictions. See, Greene (2000), p. 682 and p. 768. We used several restrictions and computed the test statistics above. Only for tobit models, the statistics was significant at 95% level for size. Therefore, all the reported tobit model specifications are corrected for heteroscedasticity of the form $Var[\varepsilon]=[\exp(\gamma size)]$.
21. Institutional ownership is highly correlated with size, but the condition number test did not indicate a multicollinearity problem.
22. If more than one option is granted during the current year, then the time to maturity of the unexercisable and exercisable options are set equal to one year less than the <u>average</u> time to maturity of the newly granted options

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TABLE 1
Variable Definitions and Summary of Hypotheses

This table presents the independent variables for the analysis of hedging in REITs. It provides the variable's definition, source of data and the predicted relationship with the dependent variable. Market value of assets is calculated as the sum of market value of equity, book value of debt and book value of preferred stock. The number of shares owned by the CEO includes operating partnership units. Long-term compensation includes restricted stock awards and long-term incentive plan awards and other long-term compensation.

Independent Variable	Definition [Source]	Predicted Sign
Financial Distress Costs		
DEBT	(Book value of short-term and long-term debt / Market value of assets) [SNL Securities Database]	+
COV	(EBIT / Interest expense) [SNL Securities Database]	-
SIZE	The log of market value of assets [SNL Securities Database]	+, -
Investment Policy		
MB	(Market value of assets/ Book Value of assets) [SNL Securities Database]	+
Managerial Risk Aversion		
OWNER	Log of: (Number of shares owned by CEO * End of year share price) [Proxy Statements]	+
EXEROPT	Number of exercisable options held by the CEO [Proxy Statements]	-
TOTALOPT	The total number of options held by the CEO [Proxy Statements]	-
CEOCOMP	(Salary + Bonus) / (Salary + Bonus + long-term compensation + Black - Scholes value of stock option grants) [SNL Executive Compensation Review 2002, Proxy Statements]	-
SENVOLAT	Sensitivity of CEO's option portfolio to volatility [Calculated using One-year Approximation (OA) method]	-
SENPRICE	Sensitivity of CEO's option and stock portfolio to stock price [Calculated using One-year Approximation (OA) method]	+
INST	Percentage of shares held by institutions [SNL Securities Quarterly]	-
Hedging Substitutes		
CASH	(Cash and cash equivalents / Market value of assets) [SNL Securities Database]	-
CONVPREF	(Value of convertible bonds and preferred stock / Market value of assets) [SNL Securities Database]	+, -
Other Variables (Dummy)		
OPDUMMY	=1 if REIT is an operating partnership, 0 otherwise [SNL Securities Database]	?
SMDUMMY	=1 if REIT is self-administered, 0 otherwise [SNL Securities Database]	?

Table 2
Hedging by REITs

Panel-A: Number of Hedgers

This panel presents the number of hedger and non-hedger REITs in the sample for years 1999, 2000 and 2001.

	1999	Percentage of sample (%)	2000	Percentage of sample (%)	2001	Percentage of sample (%)
Hedgers	46	46	45	45	63	56.25
Non-hedgers	54	54	55	55	49	43.75
Total	100		100		112	

Panel-B: Types of Derivative Instruments

This panel presents different types of derivative instruments used by the Real Estate Investment Trusts (REITs) in the hedger sample.. The "fraction indicating use" refers to the fraction of hedging REITs that report using that instrument. Some REITs use more than one type of derivative instrument during the year. The number of hedging firms in 1999, 2000 and 2001 are 46, 45 and 63, respectively.

Type of Derivative Instrument	1999	Fraction indicating use (1999)	2000	Fraction indicating use (2000)	2001	Fraction indicating use (2001)
Swap	34	73.91%	33	73.33%	54	85.71%
Caps	14	30.43%	17	37.78%	18	28.57%
Interest rate protection agreements	4	8.70%	4	8.89%	1	1.59%
Collars	3	6.52%	2	4.44%	2	3.17%
Forward	1	2.17%	0	0.00%	1	1.59%
Options	1	2.17%	1	2.22%	1	1.59%

Table 3

Real Estate Investment Trust Descriptive Statistics: Pooled Sample

This table presents descriptive statistics for the pooled sample of Real Estate Investment Trusts for 1999 to 2001. The percentage of debt hedged is defined as the notional amount of interest rate derivative instruments reported as of the year-end divided by the total of long-term and short-term debt. Market value of assets is defined as the sum of market value of equity, book value of debt and book value of preferred stock.

*Variables**	*Number of observations*	*First Quartile*	*Mean*	*Median*	*Third Quartile*	*Minimum*	*Maximum*	*Std Dev*
Percentage of debt hedged (%)	312	0	0.11	0	0.17	0	1.02	0.16
DEBT (%)	312	0.41	0.49	0.48	1	0	0.81	0.13
COV	312	2.50	3.76	3.08	4	-0.68	77.68	6.05
MB (%)	312	0.93	1.05	1.01	1	0.52	2.21	0.23
Market Value of Assets ($000,000)	312	659.15	2,165.76	1,290.04	2,571.96	15.76	27,833.08	3,025.30
OWNER ($000)	312	2,590	11,590	5,920	14,643	0	103,006	15,212
EXEROPT (000)	312	62.69	293.42	168.17	372.07	0	3,357.64	436.76
TOTALOPT (000)	312	139.14	487.97	331.35	685.55	0	3,357.63	547.99
CEOCOMP (%)	312	0.22	0.41	0.36	1	0	1	0.25
SENVOLAT ($000)	312	8.15	50.75	23.73	70.44	0	386.25	63.40
SENPRICE ($000)	312	43.00	160.41	97.96	200.46	0	1,064.32	183.77
INST (%)	312	20.13	42.79	41.11	65	0.06	99.76	25.06
CASH (%)	312	0	0.01	0.01	0.01	0	0.17	0.02
CONVPREF (%)	312	0	0.06	0.04	0.09	0	0.42	0.06

* See Table 1 for definition of variables

Table 4

Pearson Correlation Coefficients for the Pooled Sample for 1999-2001

This table presents the correlation of the independent variables for the pooled sample. Correlation coefficients with Asterisk (*) are significantly different from zero at the 1 percent level.

Variables**	***DEBT***	***COV***	***MB***	***EXEROPT***	***TOTALOPT***	***CASH***	***SENVOLAT***	***SENPRICE***	***INST***	***OWNER***	***CONVPREF***	***SIZE***
DEBT	1.0000	-0.4476*	-0.2596*	0.0347	0.0448	-0.0495	-0.1746*	-0.1475*	-0.2876*	-0.1879*	0.2729*	-0.2767*
COV		1	0.0145	-0.0409	-0.0672	0.1081	-0.0205	-0.0116	0.0397	0.0283	0.0084	0.02475
MB			1	-0.1093	-0.1714*	0.0692	0.0113	0.1876*	0.0653	0.2207*	-0.3726*	0.06953
EXEROPT				1	0.8671*	-0.0136	0.6692*	0.3272*	0.2754*	0.2676*	0.1316	0.2388*
TOTALOPT					1	0.0147	0.7949*	0.3425*	0.3405*	0.2739*	0.1495*	0.3735*
CASH						1	-0.0699	0.0344	-0.0729	0.0134	0.0696	-0.1509*
SENVOLAT							1	0.5398*	0.4880*	0.3902*	0.0249	0.5604*
SENPRICE								1	0.3223*	0.6044*	-0.0558	0.4125*
INST									1	0.2749*	-0.1249	0.6234*
OWNER										1	-0.0023	0.3472*
CONVPREF											1	-0.00617
SIZE												1

** See Table 1 for definition of variables.

Table 5
Sample Characteristics of Hedgers and Non-hedgers: Pooled Sample

This table presents mean, standard deviation and median values of the variables used of hedger and non-hedger REITs. For each year, a REIT is classified as a hedger if it reported the use of derivative instrument in that year's 10K, and non-hedger if it did not. The table also reports the *p*-values from *t*-tests of the differences of means and the Wilcoxon rank sum test for the differences of the medians. *p*-values that are less than 10 percent are in bold. Market value of assets is defined as the sum of market value of equity, book value of debt and book value of preferred stock.

	Non-hedgers				Hedgers				Non-hedger vs. Hedger p-values	
Variables*	Number of Observations	Mean	Std Dev	Median	Number of Observations	Mean	Std Dev	Median	Mean	Median
DEBT (%)	158	0.48	0.15	0.48	154	0.50	0.11	0.50	0.1604	0.1913
COV	158	4.38	8.40	3.12	154	3.12	1.09	3.04	**0.0637**	0.4755
MB (%)	158	1.06	0.26	1.00	154	1.04	0.19	1.02	0.5433	0.5468
Market Value of Assets ($000,000)	158	1,537.23	1,938,890	921,357	154	2,810,606	3,730,951	1,662,798	**0.0002**	**<0.0001**
OWNER ($000)	158	10,139.78	14,514.74	4,183.07	154	13,077.66	15,804.57	8,093.47	**0.0881**	**0.0009**
EXEROPT (000)	158	236.09	298.79	139.82	154	352.24	537.84	199.07	**0.0186**	**0.0042**
TOTALOPT (000)	158	386.14	440.69	224.88	154	592.43	624.04	405.52	**0.0008**	**0.0001**
CEOCOMP (%)	158	0.45	0.27	0.41	154	0.37	0.23	0.34	**0.0060**	**0.0127**
SENVOLAT ($000)	158	38.98	55.15	14.4	154	62.83	68.99	34.85	**0.0008**	**<0.0001**
SENPRICE ($000)	158	132.05	169.59	68.99	154	189.51	193.54	122.83	**0.0057**	**<0.0001**
INST (%)	158	35.87	25.85	30.51	154	49.88	22.16	50.64	**0.0001**	**<0.0001**
CASH (%)	158	0.01	0.03	0.01	154	0.01	0.01	0.00	**0.0219**	**0.0991**
CONVPREF (%)	158	0.05	0.07	0.02	154	0.06	0.06	0.06	**0.0647**	**0.0008**
OPDUMMY	158	0.69	0.46	1.00	154	0.85	0.36	1.00	**0.0007**	**0.0009**
SMDUMMY	158	0.80	0.40	1.00	154	0.91	0.29	1.00	**0.0053**	**0.0055**

* See Table 1 for definitions

Table 6
Tobit Results – Analysis of Hedging for the Pooled Data: 1999-2001

This table presents tobit regression results for the pooled data. The dependent variable is the percentage of debt hedged and is defined as the ratio of notional amount of interest rate derivatives to total debt. The *p*-values are in parentheses. Variables significant at the 10 percent level or less are denoted in bold.

Tobit Pooled Model

Independent variables*	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	**-1.2174** (0.0016)	**-0.6054** (0.0922)	**-1.3003** (0.0012)	**-0.6748** (0.0744)	**-0.7825** (0.0552)	**-1.1474** (0.0033)
DEBT	**0.5889** (0.0003)		**0.5981** (0.0002)		**0.6059** (0.0001)	**0.5467** (0.0004)
COV		**-0.0311** (0.0307)		**-0.0335** (0.0218)		
MB	**0.1590** (0.0616)	0.1028 (0.2178)	**0.1634** (0.0537)	0.1041 (0.2106)	0.1386 (0.1061)	**0.1631** (0.0688)
SIZE	**0.0335** (0.0311)	0.0244 (0.1209)	**0.0444** (0.0090)	**0.0347** (0.0432)	0.0127 (0.2034)	**0.0300** (0.0769)
OWNER	0.0078 (0.5232)	0.0068 (0.5850)				
EXEROPT	0.0001 (0.6037)	0.0001 (0.3271)				
CEOCOMP	**-0.1969** (0.0130)	**-0.1323** (0.0846)	**-0.2467** (0.0022)	**-0.1887** (0.0164)	**-0.2088** (0.0088)	**-0.2564** (0.0016)
SENVOLAT			-0.0003 (0.3250)	-0.0002 (0.2923)	-0.0003 (0.1301)	-0.0002 (0.3947)
SENPRICE			0.0001 (0.7959)	0.0001 (0.5978)	0.0001 (0.6097)	0.0001 (0.9730)
INST					**0.0033** (0.0001)	
CASH	-1.5370 (0.1397)	-1.3399 (0.2093)	**-1.7399** (0.1002)	-1.5730 (0.1491)	**-1.6581** (0.1041)	-1.0037 (0.3415)
CONVPREF	0.3134 (0.3644)	0.5076 (0.1427)	0.3411 (0.3146)	**0.5741** (0.0900)	0.5435 (0.1047)	0.2662 (0.4339)
OPDUMMY						0.0411 (0.3883)
SMDUMMY						**0.1632** (0.0165)
Number of Observations	309	309	312	312	312	312
Log Likelihood	-102.06	-104.72	-103.78	-106.47	-96.16	-99.63

* See Table 1 for definitions

Table 7
Cragg's Model - Analysis of Decision to Hedge for the Pooled Data: 1999-2001

This table presents probit regression results for the pooled data. The dependent variable is 1 if the REIT is a hedger in a particular year and 0 if it is a non-hedger for the same year. The *p*-values are in parentheses. Variables significant at the 10 percent level or less are denoted in bold.

Probit Pooled Model

Independent variables*	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	**-9.4391** (<.0001)	**-6.9464** (<.0001)	**-8.6183** (<.0001)	**-6.3099** (0.0006)	**-6.6535** (0.0017)	**-7.9652** (<.0001)
DEBT	**2.2515** (0.0020)		**2.1245** (0.0028)		**2.3879** (0.0011)	**1.8928** (0.0075)
COV		**-0.1274** (0.0653)		**-0.1250** (0.0660)		
MB	0.1187 (0.7594)	-0.0551 (0.8844)	0.1934 (0.6154)	-0.0147 (0.9688)	0.2171 (0.5850)	0.2713 (0.4961)
SIZE	**0.3344** (<.0001)	**0.2899** (<.0001)	**0.3651** (<.0001)	**0.3258** (0.0002)	**0.2392** (0.0177)	**0.3159** (0.0007)
OWNER	**0.0992** (0.0829)	0.0969 (0.1283)				
EXEROPT	0.0001 (0.8814)	0.0001 (0.9133)				
CEOCOMP	**-0.7498** (0.0334)	-0.4937 (0.1396)	**-0.7462** (0.0343)	-0.5245 (0.1200)	**-0.7289** (0.0408)	**-0.8757** (0.0149)
SENVOLAT			-0.0007 (0.6530)	-0.0009 (0.6093)	-0.0016 (0.3386)	-0.0012 (0.4799)
SENPRICE			0.0004 (0.4007)	0.0005 (0.3414)	0.0004 (0.4275)	0.0003 (0.5067)
INST					**0.0105** (0.0035)	
CASH	**-7.8947** (0.0824)	**-7.4333** (0.1001)	**-8.4111** (0.0674)	**-7.9350** (0.0843)	**-8.1761** (0.0643)	-6.6034 (0.1312)
CONVPREF	1.1110 (0.4071)	2.0404 (0.1164)	1.4898 (0.2556)	**2.4100** (0.0570)	2.1399 (0.1099)	1.8401 (0.1680)
OPDUMMY						**0.3506** (0.0807)
SMDUMMY						0.2201 (0.3311)
Number of Observations	312	309	312	312	312	312
Log Likelihood	-189.61	-187.89	-192.55	-193.62	-188.21	-190.19

* See Table 1 for definitions.

Table 8
Cragg's Model– Analysis of Extent of Hedging for the Pooled Data

This table presents truncated regression results for the pooled data. The dependent variable is the percentage of debt hedged and is defined as the ratio of notional amount of interest rate derivatives to total debt. The *p*-values are in parentheses. Variables significant at the 10 percent level or less are in bold.

Truncated Pooled Model

Independent variables*	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	**3.8328** (0.0001)	**3.6515** (0.0001)	**3.5162** (0.0001)	**3.5613** (0.0002)	**4.1491** (0.0001)	**3.0520** (0.0004)
DEBT	-0.3816 (0.2022)		-0.1031 (0.7367)		0.0114 (0.9705)	-0.0587 (0.8346)
COV		0.0006 (0.9811)		-0.0138 (0.6045)		
MB	0.2260 (0.1122)	**0.2660** (0.0476)	**0.2429** (0.0934)	**0.25311** (0.0720)	0.2054 (0.1492)	0.1189 (0.3630)
SIZE	**-0.1378** (0.0002)	**-0.1424** (0.0003)	**-0.1674** (0.0002)	**-0.1695** (0.0003)	**-0.2053** (0.0001)	**-0.1355** (0.0015)
OWNER	**-0.0546** (0.0110)	**-0.0487** (0.0254)				
EXEROPT	**0.0001** (0.0529)	**0.0001** (0.1035)				
CEOCOMP	-0.1809 (0.1822)	**-0.2741** (0.0444)	**-0.3103** (0.0466)	**-0.3495** (0.0191)	**-0.3085** (0.0417)	**-0.2696** (0.0534)
SENVOLAT			-0.0002 (0.7197)	-0.0002 (0.7070)	-0.0004 (0.5349)	-0.0002 (0.6831)
SENPRICE			-0.0001 (0.7712)	-0.0001 (0.8529)	-0.0001 (0.8361)	-0.0001 (0.8023)
INST					**0.0032** (0.0402)	
CASH	1.5627 (0.4067)	0.9883 (0.61908)	1.2133 (0.5525)	0.7388 (0.7253)	0.7905 (0.6954)	0.4053 (0.8329)
CONVPREF	0.0964 (0.8427)	-0.0801 (0.8682)	0.2322 (0.6507)	0.1416 (0.7738)	0.2638 (0.5968)	-0.00731 (0.8661)
OPDUMMY						**-0.1900** (0.0071)
SMDUMMY						0.0969 (0.3105)
Number of Observations	309	309	312	312	312	312
Log Likelihood	104.92	104.10	101.31	101.39	103.64	105.25

*See Table 1 for definitions

APPENDIX 1
One-year Approximation (OA) Method

Core and Guay (2002) propose one-year approximation (OA) method to estimate the sensitivity of CEO's option and stock portfolios to volatility and stock price. The procedure requires the collection of the following data individually from proxy statements: For newly granted options, (i) number of options, (ii) exercise price, (iii) maturity date of the options; for previously granted options, (i) number of exercisable and unexercisable options, (ii) realizable value of exercisable and unexercisable options. However, proxies do not provide all the required inputs to calculate the Black-Scholes value of stock options. The following information and assumptions are used to determine exercise price and time-to-maturity of stock options for previously granted exercisable and unexercisable stock options:

1. For determining exercise price:
    a. For exercisable options, the exercise price X is:
        i. X = S - [(Realizable value of the exercisable options - realizable value of newly granted that are exercisable as of the fiscal year end) / (Number of exercisable options-number of newly granted options, which are exercisable as of the fiscal year end)]

    b. For unexercisable options, the exercise price X is:
        i. X = S - [(Realizable value of the unexercisable options- realizable value of newly granted which are unexercisable as of the fiscal year end) / (Number of unexercisable options-number of newly granted options that are unexercisable as of the fiscal year end)]

    c. If the previously granted options are out of money, the realizable values reported in the proxy statement are zero, in which case we set the exercise price of the previously granted options equal to stock price.

2. For determining time-to-maturity of stock options:
    a. For previously granted exercisable options we set time-to-maturity, T, equal to three years less than time-to-maturity of the unexercisable options (or six years if no new grant is made).[22]
    b. For previously granted unexercisable options, we set time-to-maturity, T, equal to one year less than time-to-maturity of the newly granted option (or nine years if no new grant is made).
    c. For newly granted options, this information is available.

Given the information from proxies and assumptions made above, we estimate the sensitivities of stock options portfolios to stock-return volatility and stock price using the Black-Scholes formula for valuing European call options, as model modified by Merton (1973) to account for dividend payouts.

$$\textbf{Option Value} = S e^{-dT} N(Z) - X e^{-rT} N(Z - \sigma T^{(1/2)})$$

$Z = (\ln(S/X) + T(r-d+\sigma^2/2)) / \sigma T^{(1/2)}$

N = Cumulative probability function for normal distribution

S = Price of the underlying stock as of fiscal year end. (Collected from CRSP)

X = Exercise price of the option (Obtained from proxies)

σ = Annualized volatility, estimated as the standard deviation of stock returns over the last 120 trading days prior to fiscal year end. (Data collected from CRSP)

r = ln(1+risk-free interest rate), where the risk-free interest rate is the yield as of year end, on a treasury bond corresponding to the time to maturity as the remaining life of the stock option (Treasury data from Bloomberg)

T = Time-to-maturity of the option in years as of the year end. (Obtained from proxies)

d = ln(1+expected dividend rate), where the expected dividend rate is per-share dividend paid during the year dividend by the year-end stock price (Obtained from SNL-Data Source)

The sensitivities that are used in the estimation of our models are calculated as follows:

The sensitivity of an option value with respect to a 1% change in stock price is calculated as:

$$\partial \text{ (option value)} / \partial \text{ (price)} * \text{(price/100)} = e^{-dT} N(Z) * \text{(price/100)} \quad (1)$$

The sensitivity of an option value to 0.01 change in stock return volatility is calculated as:

$$[\partial \text{ (option value)} / \partial \text{ (option volatility)}] * 0.01 = e^{-dT} N'(Z) S T^{(1/2)} * (0.01) \quad (2)$$

where N'(Z) denotes normal density function

The sensitivities for one option are calculated using (1) and (2) above, then, are multiplied with the number of options held by CEOs to find the sensitivities for option portfolios as follows:

Sensitivity of the newly granted option to stock price (volatility) = (Sensitivity to stock price (volatility) calculated using B-S) * (Number of newly granted options) (3)

Sensitivity of the unexercisable option to stock price (volatility) = (Sensitivity to stock price (volatility) calculated using B-S) * (Number of unexercisable options) (4)

Sensitivity of the exercisable option to stock price (volatility) = (Sensitivity to stock price (volatility) calculated using B-S) * (Number of exercisable options) (5)

The total sensitivity of the option portfolio to stock price (volatility) is the sum of the sensitivities calculated, (3) + (4) +(5).