The impact of risk, complexity and monitoring on CEO compensation

Ana Albuquerque
Boston University School of Management
albuquea@bu.edu

George Papadakis
Boston University School of Management
papadak@bu.edu

Peter Wysocki
MIT Sloan School of Management
wysockip@mit.edu

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Abstract:

This paper examines the association between a firm's operating structure and contracting outcomes with management. Our novel approach provides insights on the association between a firm's operational risk and complexity and how managers are compensated and monitored. We use a novel empirical setting based on a sample of supplier firms that rely on a few large customers for the bulk of their revenues. We argue that supplier firms with higher customer concentration face higher idiosyncratic risk, lower operational complexity, and lower costs of monitoring the firms' managers. Given these operating characteristics, we predict that these firms will rely less on incentive compensation contracts because of the higher risk, lower task complexity and easier monitoring of management. Our empirical results support this prediction.

JEL classification: G30; D81; M40
Key words: Compensation, Customers, Incentives, Monitoring, Risk, Suppliers

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1. Introduction

This paper examines how a firm's short-run operating structure affects contracting outcomes with management. Our novel approach provides new insights on the association between a firm's operational risk and complexity and how managers are compensated and monitored. To capture the link between operating structure and contracting outcomes, we identify a broad sample of U.S. supplier firms that have large customers. In many cases, the supplier firms in our sample derive the bulk of their revenues from a few large customers. Given this concentrated portfolio of customers, we argue that supplier firms with higher concentration of large customers face: (i) higher idiosyncratic risk because demand changes from even a single customer can lead to large swings in a supplier firm's revenues and profits, (ii) lower operational complexity facing the firms' managers, and (iii) lower costs of monitoring the firms' managers. Using standard principal-agent insights (see, for example, Holmstrom and Milgrom, 1991, and Prendergast, 2002), we argue that, in the short run, the operational structure of a supplier firm is exogenous and that the concentration of large customers affects the risk, task complexity and necessary oversight imposed on the firms' managers. Therefore, a supplier firm with a higher concentration of large customers will generally use lower incentive pay for its managers based on the higher (idiosyncratic) risk and lower operating complexity facing the firm's managers and the lower cost of monitoring of managers by various stakeholders. Our empirical results are consistent with this hypothesis.

Our unique empirical setting attempts to avoid some of the common problems and often mixed empirical results in prior studies that examine the association between performance pay and the risk imposed on managers. As summarized by Prendergast (2002), empirical research to date has shown mixed findings on the relationship between pay for performance for executives

and observed measures of uncertainty. In general, the cumulative prior evidence can be viewed as inconclusive. For example, Prendergast (2002) examines eleven empirical studies with three studies finding a statistically significant negative association, three finding a significant positive relationship, and five others finding no relationship between risk and incentives. A common feature of these studies is that they generally use observed *historical* total volatility, variance, or idiosyncratic variation in *stock returns* as the measures of uncertainty faced by the firm's managers.

From a theoretical perspective, principal-agent models do not distinguish between the variability of a performance measure (i.e., variance in stock returns) and the underlying economics sources of this variability (i.e., a few large customers). Therefore, the simple structure of theoretical models that link risk and incentives has often lead empirical researchers to focus primarily on the observed *historical* variability of a performance measure rather than on the structural sources of this variability. However, it is unclear that the observed *historical* variability of a performance measure is the best way to characterize a firm's ***future*** risk exposure and it certainly does not capture task or monitoring complexity.[1]

In contrast with many previous empirical studies, we examine specific structural determinants of a firm's idiosyncratic risk, and task and monitoring complexity facing managers. This approach has a number of advantages. First, we argue that both managers and a firm's board of directors (who approve the managers' compensation contracts) can easily observe whether the firm is exposed to a few large customers at the beginning of the fiscal year which could cause dramatic *ex post* swings in revenues, profits, and stock returns. While in the long-run, managers

[1] In addition, measures such as the historical variance of a firm's stock returns (especially measured as the historical idiosyncratic volatility in stock returns) may be downplayed by managers and boards of directors in setting future compensation policies because the contracting parties cannot agree on whether these historical measures capture the future risks facing the firm over the coming year.

can influence the firm's customer portfolio, the supplier firm and its managers essentially face an exogenous exposure to these large customers in the short run. We argue that the existence of these large customers is easily *understood* by all contracting parties as an uncontrollable and undiversifiable risk facing the firm and its management over the coming year. Second, we argue that the firm's structural exposure to a few large customers lowers the complexity of managing the firm and simplifies delegation of tasks. Specifically, the manager of a supplier firm servicing just a few large customers arguably faces lower task complexity than a manager who has to service a large and diverse set of customers. When there are just a few customers, there is lower information asymmetry between shareholders and managers about how managers should allocate their efforts.[2] Furthermore, the potential penalty for losing a major customer is so strong that equity incentives are not as necessary to ensure a manager exerts effort and allocates her/his efforts efficiently. Third, it is easier for shareholders to monitor managers if there are only a few large customers. In addition, large customers can also have complementary incentives to monitor the supplier firm because (in many cases) the supplier firm can "hold-up" the customer if the supplier is a key supplier.[3] Also, some of the customers may have strategic alliances with or significant ownership stakes in the supplier firms. In these cases, the customer can directly observe and monitor the supplier firm CEO's performance. Therefore, shareholders can benefit from the monitoring activities of large customers which can lower overall monitoring costs and reduce the need for incentive compensation.

[2] Complexity is lower because one of the main activities of the agent is to satisfy the major customer(s), assuming it is in the interest of shareholders. Thus, the agent's task and delegation of responsibilities by the principal is unambiguous.

[3] To address the potential holdup problem, large customers may also have significant ownership stakes in a supplier firm. In this case, the customer/large shareholder can directly observe and monitor the management of the supplier firm. This again makes incentive pay relatively less attractive,

The main findings of our study can be summarized as follows. We rely on data that captures mandated disclosures by the SEC on a firm's major customers (in excess of 10% of total firm sales) and on the ExecuComp database to characterize the structure of a CEO's compensation contract. We measure a CEO's equity incentives as the dollar change in the CEO's wealth from a 1% stock price increase (see, Baker and Hall, 2004, and Core and Guay, 1999). Using a sample of 9,870 firm-year observations, we find that a CEO's equity incentives are negatively related to the *total*, *average*, and *single-customer* percentage of sales attributable to a firm's major customers. We also find that these effects are increasing in the variability of a firm's stock returns. Our findings are confirmed for *changes* in CEO equity incentives as these are negatively associated with *changes* in sales to major customers.

The remainder of the paper is organized as follows. In section 2, we outline the theory underlying our hypotheses on the relation between incentive pay and the *structural* determinants of a firm's risk, operational complexity and monitoring needs. Section 3 outlines the unique experimental setting and data used in our empirical analysis. Section 4 summarizes our empirical tests and findings. Section 5 provides a series of robustness tests. Section 6 concludes and suggests directions for future research.

2. Hypothesis Development.

The principal-agent problem between shareholder and managers can be addressed in a number of ways. For example, shareholders can expend time and effort directly monitoring the activities of managers. However, the benefits of monitoring in addressing the principal-agent problem are not without costs if it is difficult for the principal to define, delegate and monitor managerial tasks (see, for example, Prendergast, 2002). In other words, the complexity and

observability of managerial tasks can make monitoring costly and infeasible. On the other hand, incentive-based pay can help align the interests of owners (shareholders) with those of agents (managers). However, risk-averse agents will require more pay, at the expense of shareholders, to compensate them for the increased risk that they are exposed to. Thus a basic prediction of the principal-agent model is that of a negative relation between firm specific risk and incentives (Holmstrom and Milgrom, 1987).

Empirical evidence on the relationship between risk and incentives is mixed. For example, Aggarwal and Samwick (1999) find a negative relationship between volatility of stock returns, their proxy for risk, and equity incentives, consistent with the predictions of agency theory. Jin's (2002) results are also consistent with theory as he finds a negative relation between equity incentives and idiosyncratic risk but no relation between incentives and systematic risk.

Core and Guay (1999) on the other hand find a positive relation between equity incentives and risk using either volatility of returns or idiosyncratic risk as their proxies of risk. Moreover, Core and Guay (2002) question the findings of Aggarwal and Samwick (1999) and critique the risk proxy used in Aggarwal and Samwick (1999). Finally, a number of studies find no significant relation between risk and incentives (for example, Bushman et al., 1996).[4]

We employ a unique setting to test the theoretical prediction between risk and incentives by analyzing the association between equity incentives and a *structural* determinant of firm's risk. In our setting, we examine how a firm's operating structure impacts the risk exposure, task and monitoring complexity of a firm and its management.

With regard to risk, principal-agent models do not provide guidance on how to measure the firm's performance measure variability. Both empirical and theoretical researchers have often relied on the historical variability of a performance measure (e.g. past stock return

[4] See Prendergast (2002) for an overview of studies and findings on the relation between equity incentives and risk.

variance) as a simple way to capture a firm's risk exposure. However, when setting compensation contracts the current and future firm's risk exposure should be more relevant to the board of directors' decision regarding the amount of incentive pay. If business economic conditions change, then the historical variability of the performance measure will be a noisy proxy for future performance variability. Arguably, an alternative way to gauge firm's risk exposure is by assessing the underlying structural risks the firm is exposed to.

In our setting, we examine a unique sample of supplier firms that rely on a few large customers for a significant part of their revenues. On one hand, the existence of these large customers can impose higher (idiosyncratic) risk on the supplier firm and its managers because losing a major customer can have a large impact in a firm's profitability, stock price, sales growth and ability to meet financial obligations. On the other hand, the existence of a few large customers reduces the complexity of managers' tasks and the costs of monitoring the firms' managers. It is interesting to note the higher concentration of customers leads to higher (idiosyncratic) risk, lower task complexity and lower monitoring costs. As we argue below, each of these forces would lead to *lower* incentive pay for managers.

As illustrated below, firms recognize the structural source of risk arising from the existence of a few large customers. For example, Schiff Nutrition International states in their 2007 10K filing that a major source of risk for the firm is their dependence on two large customers:

"Our largest customers are Costco and Wal-Mart. Combined, these two customers accounted for approximately 69%, 70% and 72%, respectively, of our total net sales for fiscal 2007, 2006 and 2005. …. We do not have supply contracts with either Costco or Wal-Mart and therefore cannot assure you that either Costco or Wal-Mart will continue to be significant customers in the future. The loss of either Costco or Wal-Mart as a customer, or a significant reduction in purchase volume by Costco or Wal-Mart, would have a material adverse effect on our results of operations and financial condition."

Basin Water (2008, 10K) also discusses that one of the significant risk factors associated with their operations is the reliance on one major customer:

"Due to our current client concentration, a loss of one of our significant customers could harm our business, operating results, financial condition and prospects. *We had one customer who accounted for 17% of our revenues during 2008. Our customers may, upon the occurrence of certain circumstances, elect to terminate their contracts with us prior to their contractual expiration date and seek services from our competitors. In addition, upon the expiration of these contracts, our customers may decide not to renew such contracts with us. If we were to lose one or more of these significant customers for any reason, our revenues would decline significantly and our business, operating results and prospects would suffer."*

Past studies show that the characteristics of major customers, suppliers and customer-supplier relationships imply that major customers may have strong bargaining power over suppliers. For example, major customers tend to be much larger than suppliers and suppliers stock returns react to changes in major customers firm valuations (Cohen and Frazzini, 2008), major customers are able to enjoy higher profit margins through their higher bargaining power (Gosman et al, 2004) and do not actively participate in the governance of the supplier firm with fewer than one percent of all customer-supplier relationships leading to a merger (Fee et al., 2006). Finally, based on the anecdotal evidence from the 10K disclosures, long-term binding contracts are not the norm in supplier-customer relationships. Overall, this evidence suggests that there is an inherent risk for a supplier of losing a major customer at any point in time.

Additional evidence on the importance of revenue concentration risk comes from the point of view of regulators. Standards SFAS No. 14 (FASB, 1976) and SFAS No. 131 (FASB, 1997) mandate disclosure of customers when sales to any single customer exceed 10% of overall sales. These disclosures are an example of standard setters concerns about the supplier's exposure to potential risks when a large proportion of the sales are derived from a single major customer.

Many firms (suppliers) depend on a single (or few) firms as the major contributors to their revenues. In our sample, 857 of the 1,993 unique firms have a major customer at some point during the 1992 to 2006 sample period. Relative to a firm that does not depend on a few customers as its major revenue drivers, a firm that depends on a small number of major customers is less diversified and this lack of customer diversification can create an additional risk exposure to the supplier firm.

We thus argue that customer concentration is a significant risk factor for firms and test the following hypothesis:

Hypothesis 1: ***Stock return volatility is positively related to the magnitude of sales to major customers.***

While a number of past studies have argued and shown that stock return volatility is negatively-related to incentive compensation, we argue that the operational structure of the firm can be a more direct way of identifying the risks and task complexity facing managers. First, when setting CEO compensation, the board of director will consider the 'expected' level of future risks the firm is exposed to and the associated variability of the performance measures. We argue that the existence of a few major customers is an easily understood source of future risk, by both managers and boards of directors that will be incorporated when setting the level of CEO's incentive compensation. While in the long-run, CEOs manage the firm's customer portfolio, the existence of a major customer represents an exogenous source of undiversifiable risk in the short run.[5] Second, we argue that the firm's structural exposure to a few large customers lowers the complexity of managing the firm and simplifies task definition and

[5] Other sources of undiversifiable risk may also have a bearing on the level of equity incentives, such as inability to successfully market and develop a new product (especially relevant for firm with high growth options), business or geographic concentration of firm's operations, as examples. We recognize that these other sources of risk can impact the level of CEO's equity incentives and control for operating segments diversification, growth options, and historical firm volatility in our analysis, among other determinants of equity incentives.

delegation. Specifically, a supplier firm that concentrates on servicing a few large customers arguably has less complex operations and both shareholders and managers understand where managers must allocate their effort which reduces the need to rely on incentive compensation contracts. Third, it is easier for shareholders to monitor managers if there are only a few large customers. Therefore, the lower monitoring cost in firms with higher customer concentrations makes incentive compensation relatively less attractive.

Thus, our second hypothesis is:

Hypothesis 2a: ***Equity incentives are negatively related to the magnitude of sales to major customers, incremental to the effect of idiosyncratic volatility on equity incentives.***

Hypothesis 2b: ***Equity incentives are negatively related to the magnitude of sales to major customers for firms operating in more volatile environments.***

Theory predicts that equity incentives are related to firm size, growth opportunities and firm specific risk as captured by idiosyncratic volatility. Moreover, Core and Guay (1999) discuss how the level of optimal equity incentives is not constant over time. For the purpose of this paper, we are interested in examining whether significant changes in firm characteristics such as a shift in the concentration of revenue have an effect in the optimal level of equity incentives. We argue that a significant change in revenue concentration (adding or dropping a large customer) constitutes information concerning a change in risk, complexity and monitoring, and therefore compensation will adjust accordingly to the new optimal level. Moreover, a changes specification complements the levels analysis in hypothesis 2 because it controls for potential omitted variables that may be present in the levels specification. Formally stated our third hypothesis is:

Hypothesis 3: ***Increases in the level of sales to major customers lead to a lower level of equity incentives whereas significant decreases of sales to major customers lead to higher levels of equity incentives.***

3. Data and sample selection

Our analysis uses data from ExecuComp, Compustat Segments and CRSP. We start with 31,429 firm-year observations from ExecuComp covering the 1992 to 2006 period. We delete observations with less than 12 months of return data available and observations that have negative values for total assets and sales. We lose around 8,000 firm-year observations by applying the filters mentioned above. Since we control for firm diversification using a Herfindahl index based on business segment sales, we also require data on the number of business segments for firms as well as the corresponding number of sales for each business segment. This data requirement results in a further loss of 1,500 observations. Finally, we require availability of compensation data to compute equity incentives and that CEOs be with the firm for at least one full fiscal year. Our final sample consists of 9,870 firm-year observations covering the 1992-2006 period.

One main variable of interest in our study is our proxy for structural risk using the concentration of revenues to few customers. We collect data on sales to major customers from the Compustat Segments dataset. A firm is required by FAS131 to disclose whether one or more customers constitute more than 10% of total sales for the firm. Many times, firms also disclose information about customers that constitute less than 10% of the sales; we treat these observations as sales to major customers as well. If a firm does not report any sales to major customers, we infer that no major customers exist for that firm.

4. Empirical tests and results

This section lays out the research design and presents the results. Section 4.1 explores whether firms with major customers exhibit higher stock volatility. Section 4.2 examines the link between the level of CEO equity incentives and a firm's operating structure due to an concentrated customer base. The last sub-section investigates whether changes in customer concentration lead to changes in the level of CEO incentives.

4.1. Firm volatility and suppliers with major customers

4.1.1. Tests

To test H1, we estimate the following regression:

$$\begin{aligned} \textit{Firm Volatility}_{i,t} = \; & \alpha + \beta_0 \, \textit{Major Customer}_{i,t-1} + \beta_1 \, \textit{Firm Volatility}_{i,t-1} \; + \\ & \Sigma \, \beta_m \, \textit{Controls}_{m,i,t-1} \; + \varepsilon_{i,t}. \end{aligned} \tag{1}$$

Our proxy for *Firm Volatility* is either the natural logarithm of the standard deviation of total stock returns or the cumulative distribution function of the firm's idiosyncratic variance. The variable *Major Customer* captures the extent to which suppliers have major customers and are exposed to customer concentration risk. *Major Customer* is measured in a variety of ways. Our first measure is defined as the sum of sales to major customers scaled by total sales. Our second measure is equal to sales to the single largest customer scaled by total firm sales. *Controls* are a set of variables that are likely to be determinants of the firm's volatility. These control variables are all measured at the beginning of the year and include firm diversification (equal to the Herfindahl index of the firm's percentage of sales to the different business segments that a company participates in), performance (measured as annual stock returns), size (proxied by the log of the firms' market capitalization), growth options (measured by the book to market of equity, and research and development scaled by lagged assets), and market leverage (equal to

debt over book debt plus the market value of equity). The set of control variables also include year and industry dummies (following the Fama and French (1997) 12 industry classification). The Appendix provides detailed definitions for the variables included in all our tests. We expect that firms with greater magnitude of sales to major customers will exhibit higher firm volatility.

4.1.2. Results

Before proceeding to discuss the results, we provide descriptive statistics about the sample of suppliers in Table 2. Panel A provides descriptive statistics for the full sample of suppliers' firm characteristics used in the tests and Panel B compares firm characteristics across different levels of major customer concentration. Panel A shows that sample suppliers give on average (median) $785.5 ($122.6) thousand of equity incentives which translates into mean and median logarithm equity incentives of 4.84 and 4.82, respectively. The mean (median) percentage of revenues generated from major customers is 12% (0%) showing that the firms in our sample have on average a diversified customer base. The average number of major customers is 1.62 and 25% of the full sample has at least one major customer. The largest number of major customers for a firm-year observation is 20 (not tabulated). The mean (median) duration of the relationship between a major customer and a supplier is 2.4 (0) years. The sample of suppliers operates on average in two differentiated business segments, which corresponds to a concentration of business segments (according to the Herfindahl index) of 0.75. Panel A also shows that firms in the sample tend to be large with mean market capitalization of approximately $6.2 billion.

Panel B shows firm characteristics for suppliers with varying degrees of revenue concentration. Suppliers without major customers tend to be larger firms (mean market capitalization of suppliers with no major customers is $7.3 billion compared to $4.4 billion for

suppliers with major customers representing more 10% of total sales), have fewer growth opportunities (both in terms of book-to-market of equity and R&D levels), and have higher levels of leverage than firms with major customers. Firms without major customers are more diversified and complex as these firms operate in more business segments, exhibit lower firm volatility (using both the standard deviation of total stock returns and the CDF of the idiosyncratic variance measures), and provide higher level of equity incentives than firms with major customers. Also, firms without major customers' exhibit higher stock returns (median only) and profit margins than firms with major customers supporting the evidence in Gosman et al (2004) that having a large customer is associated with smaller profit margins due to the bargaining power of the major customer. All the differences of means (t-test) between suppliers without major customers and suppliers with major customers are statistically significant at the five percent level, except for CEO Tenure. The results for the nonparametric tests on the equality of medians (chi-square test) across these groups are qualitatively the same.

Table 3 reports correlations among the variables used in the multivariate tests. Pearson (Spearman) correlations are reported in the lower (upper) diagonal. We discuss only the Pearson correlations as the results are similar for the Spearman correlations. The correlation between (natural logarithm) equity incentives and the magnitude of sales to major customers is negative (-0.12) and statistically significant at the five percent level providing preliminary evidence that CEOs of firms with major customers receive less incentive pay. The univariate correlation between incentive pay and firm volatility, as measured by the CDF of idiosyncratic variance, is also negative and statistically significant (-0.215) providing evidence that firms with higher exposure to risk rely less on incentive compensation. [6]

Table 4 presents the Fama and French 12-industry breakdown for the total sample of

[6] Similar qualitative results are obtained if the log of the standard deviation of stock returns is used instead.

suppliers and for suppliers with major customers (with sales to major customers larger than 10% (25%) in the second (third) columns). Table 4, Column 2, shows that the two most-represented industries in the sample with major customers are 'Business Equipment' and 'Healthcare, Medical Equipment and Drugs' with 30% and 14% of the total observations, respectively. Overall, the major customer-supplier sample is spread across several different industries which speak to the predominance of these relations across industries and business segments.

Table 5 presents the results for our first hypothesis. Columns one through four present the results of estimating Equation 1 using OLS and columns five through eight present the results using Robust regressions. Robust and Median regressions have been proposed in the compensation literature as a way to attenuate the effect of outliers (see as examples Aggarwal and Samwick, 1999, and Jin, 2002). In untabulated results we run all tests using Median regressions and obtain results qualitatively similar to the one's reported using the Robust regressions.

We first discuss the results for the OLS regressions. Columns 1 and 2 present the results of estimating the firm volatility measured as the CDF of the idiosyncratic variance and columns 3 and 4 present the results when firm volatility is measured by the natural logarithm of the standard deviation of past stock returns. The first column shows that, as expected, better performing firms (proxied by lagged stock returns), that are larger and have fewer growth options (proxied by Book/Market and R&D) have lower stock return volatility, even after controlling for lagged stock return volatility. The coefficient on the lagged business segment Herfindahl index is positive and statistically significant meaning that firms with more concentrated business segments, and thus less diversified, also exhibit higher volatility.

Our first hypothesis states that revenue concentration is positively related with volatility.

The coefficient on the total percentage of sales to major customer is positive (0.034) and statistically significant at the one percent level providing evidence that firms with higher customer concentration exhibit higher stock return volatility. The results when customer concentration is proxied by the percentage of sales to the firm's single major customer (in columns 2, and 4), or when firm volatility is measured by the standard deviation of stock returns (in columns 3, and 4) are similar to those presented in column 1. The results using Robust regressions are also qualitatively similar to those obtained using OLS, except for the coefficient on *BusSegmHerfindahl* which becomes insignificant when firm volatility is measured by the firm's idiosyncratic variance. The adjusted R^2 (e.g. 0.86 in Column 1) is high mainly due to the fact that the lagged volatility is included in the regression to control for any omitted variables. Exclusion of the lagged reduces the adjusted R^2 to 0.37 and the results remain qualitatively the same.

4.2. CEO Equity Incentives and suppliers with major customer

4.2.1. Tests

To test H2a and H2b, that firm's with major customers provide fewer incentives to their CEOs, we estimate the following regression models:

$$\begin{aligned} CEO\ Equity\ Incentives_{i,t} = {} & \alpha + \beta_0\ Major\ Customer_{i,t-1} + \beta_1\ Firm\ Volatility_{i,t-1} + \\ & \beta_2\ BusSegmHerfindahl_{i,t-1} + \Sigma\ \beta_m\ Controls_{m,i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

$$\begin{aligned} CEO\ Equity\ Incentives_{i,t} = {} & \alpha + \beta_0\ Major\ Customer_{i,t-1} + \beta_1\ Firm\ Volatility_{i,t-1} + \\ & + \beta_2\ Major\ Customer_{i,t-1} * Firm\ Volatility_{i,t-1} + \\ & \beta_3 BusSegmHerfindahl_{i,t-1} + \Sigma\ \beta_m\ Controls_{m,i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

We expect that firms with major customers will grant less equity incentives to their CEOs as these firms are more exposed to customer concentration risk, have lower operating complexity and lower monitoring costs.. We expect the effect of having major customers on the level of incentives to be particularly strong for CEOs of firms that are highly volatile as these firms might

be more concerned with CEO's risk exposure and face higher monitoring costs. We thus predict that $\beta_0 < 0$ in Equation 2, and that $\beta_2 < 0$ and $\beta_0 + \beta_2 < 0$ in Equation 3, respectively. *CEO Equity Incentives* is the natural logarithm of total equity incentives provided by options and restricted stock owned by the CEO. Equity incentives are measured as the dollar change in the CEO's wealth from a 1% change in stock price following the method developed in Core and Guay (1999; 2002a). We use three different measures to capture exposure to major customers. In addition to the *TotalMCSalePerct* and *SingleMCSalePerct* variables described in section 4.1.1, we also use *AvgMCSalePerct* as an additional proxy for revenue concentration due to major customers. The *AvgMCSalePerct* equals the total percentage of sales to major customers divided by the total number of major customers. We use these three variables to capture different dimensions of customer concentration related risk. *Firm Volatility* is measured as the CDF of the firm's idiosyncratic variance and it proxies for firm specific risk. *BusSegmHerfindahl* is defined above and controls for the effect of business segment diversification on the level of equity incentives.

We use a set of control variables that have been shown to explain the level of incentives (e.g. Baker and Hall, 2004; Core and Guay 1999; Core and Guay 2002b; Coles, Daniel and Naveen, 2006; Gibbons and Murphy, 1992; Jin, 2002; Ragjopal and Shevlin, 2002; Smith and Watts, 1992). The set of control variables include firm size (natural log of market value of equity), growth opportunities (market-to-book value of equity and research and development), firm leverage (market leverage), CEO tenure (natural logarithm of number of years with the firm). We measure all variables at the beginning of the year to account for any endogeneity between firm characteristics and incentives being provided.[7] We further include lagged stock return as a control to account for the fact that better performing firms offer higher equity

[7] The results are qualitatively the same when firm characteristics are contemporaneously measured.

incentives to their CEOs. Finally, we include 12 industry indicators (using the Fama and French (1997) 12 industry classification) and year dummies to control for industry and year effects.

4.2.2. Results

The results of estimating Equation 2 are provided in Table 6. Columns 1 through 3 present the results using OLS regressions and columns 4 through 6 present results using robust regressions. Consistent with H2a we find that CEOs in firms with a larger percentage of sales to major customers receive less equity incentives than CEOs in firms with smaller percentage of sales to major customers or with no major customers (coefficient on *TotalMCSalePerct* is -0.406 and statistically significant at the 1% level), even after controlling for firm's idiosyncratic volatility and diversification. The results are similar when the supplier's exposure to major customers is measured as the average percentage of total sales to major customers (coefficient of -0.666 in Column 2, also statistically significant at 1% level) or percentage of total sales to the single largest customer (coefficient of -0.676 in Column 3, also statistically significant at 1% level). The coefficient on firm volatility is not statistically significant in the OLS regressions, but it is positive (coefficient of 0.127 in Column 4) and statistically significant in the robust regressions. The positive coefficient on risk as it is captured by the volatility of returns is consistent with prior studies (e.g. Core and Guay 1999, 2002b). The coefficients on the control variables show that firm size, performance and CEO tenure are positively related to the level of equity incentives as expected. Also, CEOs in firms with more growth options, as proxied for book-to-market value of equity, offer higher equity incentives as predicted, but firms with higher R&D offer fewer equity incentives consistent with prior literature (Bizjak, Brickley and Coles, 1993). The results are qualitatively similar when using Robust regressions.

Table 7 presents the results from estimating Equation 3. The empirical model estimated

in Table 7 augments the one presented in Table 6 to allow for the sensitivity of equity incentives to revenue concentration risk to vary across firms with different levels of idiosyncratic firm risk.

The results show that firms exposed to revenue concentration risk coupled with high return volatility provide lower equity incentives than firms with similar levels of revenue concentration risk but with lower return volatility. The coefficient (β_2) on the interaction between *TotalMCSalePerct* and *CDF_IdVariance* is -1.336 and statistically significant at 1% level as predicted by H2b. At the bottom of Table 7 we further test whether a CEO's level of equity incentives is decreasing for firms with major customers, by testing whether $\beta_0+\beta_2=0$ against the alternative hypothesis that $\beta_0+\beta_2<0$. The null hypothesis of no association between equity incentives and firms having major customers is rejected across all estimation methods and major customers' proxies at 0% significance level confirming the alternative hypothesis that equity incentives decrease for firms with more revenue concentration risk.

An alternative interpretation of the coefficient β_2 is that firms with major customers may actually put more weight on past firm volatility when deciding on the amount of incentive pay. We do not observe the actual compensation negotiation process and thus are unable to know what the inputs that are agreed upon to estimate firm risk are. Historical volatility of stock returns may be a sufficient measure of risk going forward, but the parties involved in the negotiation of the contract do not necessarily agree upon this measure of risk. The fact that some firms are exposed to an undiversified customer base may work as a catalyst in inducing all the negotiating parties to agree that risk will not be reduced in the foreseeable future. If this is the case, the presence of a major customer may lead the parties to agree that historical volatility of stock returns is an appropriate measure of current and future risk and subsequently used it in determining the optimal level of equity incentives.

In summary, tables 6 and 7 provide evidence consistent with the idea that firms with a more concentrated customer base use less incentive pay, and this effect is particularly strong for firms that operate in less predictable environments. This result confirms the idea that the board of directors recognizes the risks associated with revenue concentration and the corresponding exposure of the CEO to these risks and adjusts incentive compensation accordingly. The results are also consistent with the compensation committee using less incentive pay for firms with major customers as the board can rely on other sources of monitoring mechanisms (e.g. customer satisfaction) and the fact that the CEO has arguably a less complex task.

4.3. Relation between significant changes to customer concentration and changes in equity incentives

4.3.1. Tests

Hypothesis 3 predicts that the board of directors adjusts incentive levels following significant changes to revenue concentration. We test this prediction using the following regression specification:

$$\begin{aligned}\Delta CEO\ Equity\ Incentives_{i,t} = \ & \alpha + \beta_0 ChgMCsalesplusX_{i,t-1} + \beta_1 ChgMCsalesminusX_{i,t-1} + \\ & \beta_2 Firm\ Volatility_{i,t-1} + \beta_3 BusSegmHerfindahl_{i,t-1} + \\ & \Sigma\beta_m\ Controls_{m,i,t-1} + \varepsilon_{i,t}\end{aligned} \quad (4)$$

The variable $ChgMCsalesplusX_{i,t-1}$ is defined as a dummy taking the value of one if the percentage of total sales to major customers from t-2 to t-1 of firm i increases by an amount greater than X, where X is 25%, 40% or 50%, and zero otherwise. Similarly, the variable $ChgMCsalesminusX_{i,t-1}$ equals one if the percentage of total sales to major customers from t-2 to t-1 of firm i drops by an amount greater than X, where X is 25%, 40% or 50%, and zero otherwise.

We measure the lagged changes in percentage of sales to major customers, instead of concurrent changes, as equity incentives are granted at different times throughout the fiscal year and often do not coincide with the end of the fiscal year (Aboody and Kasznik, 2002; Yermack, 1997). For example, if a firm's board of directors decides on the amount of equity incentives for year t during the first quarter of the year, then the information regarding change in sales available at the beginning of the year will be incorporated in that decision, whereas sales that occur later in the year are not available yet. The test of H2b rests on coefficients β_0 and β_1, the coefficients on large increases and decreases in sales to major customers, respectively. A negative β_0 (positive β_1) is consistent with the hypothesis that after adopting (dropping) a major customer, firms decrease (increase) their CEO's incentive level as a way to adjust the level of risk the CEO is exposed to. The control variables are as defined above. In addition to the control variables used in models 2 and 3, Model 4 also includes the contemporaneous firm's performance (stock returns, return on assets, and sales growth) and change in firm's volatility as control variables. These additional control variables are included to capture any change in equity incentives that is related to an increase in firm volatility (and thus an increase in option value) or additional equity compensation for increase in firm performance.

4.3.2. Results

The results are reported in Table 8. Columns 1, 2 and 3 present results for cases where the change in sales to major customer amounts to 25%, 40% and 50% of total sales, respectively, using OLS regressions. Adding a customer representing an increase of 40% or 50% of total sales is associated with a decrease in equity incentives (coefficients of -0.142 and -0.191, statistically significant at 5% level). Dropping a customer representing a decrease of 50% in total sales leads to an increase of equity incentives (coefficient of 1.51, statistically significant at 5% level). The

results in columns 4, 5 and 6 for the Robust regressions show stronger evidence supporting H2b. Even for cases where a firm adds (drops) a customer representing 25% of total sales, the change in equity incentives is negative (positive) and statistically significant at common significance levels. The adjusted R^2 for the Robust regressions is approximately 57%, which is higher than the 37% adjusted R^2 for the OLS regressions, indicating that the Robust regression model explains a higher proportion of the cross sectional variation of changes in equity incentives.

The fact that firms adopting an important major customer provide lower equity incentives does not mean that these CEOs are penalized in the form of lower total compensation. In untabulated results we find that CEOs that adopt large major customers get paid higher total compensation than those that drop a major customer, even after controlling for known drivers of total compensation flow.

5. Robustness tests

We perform a couple of robustness tests to complement the main tests in the paper. First, the independent variables in our analysis of H1, and H2 are lagged by one period in order to avoid confounding issues where equity incentives (dependent variable) and determinants are measured at the same point in time. If we concurrently measure the dependent and independent variables the results are qualitatively similar to our main tests.

We rerun all our tests using median regressions as in Aggarwal and Samwick (1999) and Jin (2002) and obtain results similar to the Robust regression results presented in the paper. Some prior studies (e.g. Core and Guay, 1999) use a logarithmic transformation of the risk measure in their tests. The results in our main analysis for the idiosyncratic variance are robust to this alternative measure of risk. Finally, we rerun the tests by excluding financial firms from our sample as compensation contracts for these firms may be set in a different manner and the results

remain unchanged.

6. Conclusion

We undertake a novel empirical investigation of the association between a firm's operational risk and complexity and how managers are compensated and monitored. To capture the link between operating structure and contracting outcomes, we use a sample of U.S. supplier firms that have large customers. In many cases, the supplier firms derive the bulk of their revenues from a few large customers. Given this concentrated portfolio of customers, we argue that supplier firms with higher concentration of large customers face higher (idiosyncratic) risk, lower operational complexity for the firms' managers, and lower costs of monitoring the firms' managers. We argue that, in the short run, the operational structure of a supplier firm is exogenous and, therefore, a supplier firm with a higher concentration of large customers will generally use lower incentive pay for its managers based on the higher (idiosyncratic) risk and lower operating complexity facing the firm's managers and the lower cost of monitoring of managers by various stakeholders.

To test these predictions, we collect information on executive compensation for U.S. firms and estimate a CEO's equity incentives as the dollar change in the CEO's wealth from a 1% stock price increase (see, Baker and Hall, 2004, and Core and Guay, 1999). Then, we estimate the degree of revenue concentration for these firms by identifying firms that rely on large customers (greater than 10% of total sales) as major sources of their revenues.

Consistent with our main predictions, we find that a CEO's equity incentives are negatively related to the total, average, and single-customer percentage of sales attributable to a firm's major customers. We also find that these effects are increasing in the variability of a firm's stock returns. Our findings are confirmed for changes in CEO equity incentives as they

relate to changes in sales to major customers. The unique setting of our study avoids some of the common problems and often mixed empirical results found in prior studies examining the association between performance pay and the risk imposed on managers (see summary of prior empirical research by Prendergast, 2002). In contrast with many previous empirical studies, we directly examine specific structural determinants of a firm's idiosyncratic risk, the task complexity facing managers and the monitoring costs facing shareholders.

In future work, we plan to empirically investigate additional elements of the structural determinants of incentive compensation in our unique setting. In particular, the risk, complexity and monitoring hypotheses all point toward lower use of incentive compensation in supplier firms with high customer concentration. Therefore, we hope to both disentangle these effects and also determine if they are complementary and reinforcing. In addition, we plan to determine which of these factors has the most pronounced effect on incentive compensation.

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APPENDIX
Variable Definitions

Major Customer Measures

% Sales to Major Customers (TotalMCSalePerct)	= Sum of sales to major customers scaled by total firm sales.
% Sales to Largest Customer (SingleMCSalePerct)	= Sales to single largest customer scaled by total firm sales.
% Average Sales per Major Customer (AvgMCSalePerct)	= Average sales per major customer, defined as *% Sales to Major Customers* / Total number of major customers.
Δ*(% Sales to MCs) > 25, 40, 50% (Chgmcsalesplus__)*	= Indicator variable equal to 1 if there is an increase in % Sales to Major Customers greater than 25, 40, or 50%.
Δ*(% Sales to MCs) > 25, 40, 50% (Chgmcsalesminus__)*	= Indicator variable equal to 1 if there is a decrease in % Sales to Major Customers greater than 25, 40, or 50%.

Compensation

Log(EquityIncentives) (CEO Equity Incent)	= The level of equity incentives is defined as the logarithm of the change in the dollar value of the CEO's stock and stock options holdings for a 1% increase in the firm's stock price. We use the method developed by Core and Guay (1999, 2002a) to calculate this variable. Most of the data needed to calculate the change in CEO wealth resulting from changes in the value of stock holdings or in the value of newly granted stock options are readily available (e.g the amount of stock holdings, stock options granted, strike price, maturity of options, volatility of stock, dividend yield, and current stock price can be obtained from ExecuComp and the risk free rate from CRSP). However, to calculate the change in the value of previously granted stock options assumptions regarding options holdings, exercise price, maturity are needed. Core and Guay (2002a) show that their method to estimate option portfolio sensitivity to stock price changes is 99% correlated with the measure that would be obtained with full information about the option portfolio.
Δ*CEO Equity Incentives*	= Change in the natural logarithm of *CEO Equity Incentives*.

Controls

Log(Market Capitalization) LogMktCap	= Logarithm of the Market Capitalization.
Sales growth (ChgSales/Assets)	= Annual change in sales deflated by lagged total assets.
R&D Expenditures (R&D)	= R&D expenditures scaled by total assets.
Book-to-Market (Book/Market)	= Book to market value of equity. To remove the effect of extreme outliers, we winsorized this variable to be between zero and its' 99 percentile. The range of values for book-to-market value of equity is from -31.94 to 9.84, whereas 99% percentile lies at 1.85.

Business Segments HH Index (BusSegmHerfindahl)	= Herfindahl index based on the sales per business segment that the firm operates in. Calculated as $H = \sum_{i=1}^{N} s_i^2$, where N = Number of business segments for the firm-year and s_i = sales for segment i.
Stock Return (Stock Return)	= Cumulative 12-month stock return.
Return on Assets (ROA)	= Net Income Before Extraordinary Items scaled by total assets.
Profit Margin (pm)	= Income Before Extraordinary Items scaled by sales.
Firm Volatility (LogStdDevRet)	= The natural logarithm of the standard deviation of monthly stock returns calculated over months t-12 to t.
Idiosyncratic Variance (CDF Idiosy. Variance)	= The Cumulative Distribution Function of the idiosyncratic variance. Calculated using the variance of the residuals from regressions of the firm stock return on the market return. A minimum of 12 months of data is required for the calculation and a maximum of 36 months.
Change in Firm Volatility (Change in StdRet)	= The change in *LogStdDevRet*.
Market Leverage (MarketLeverage)	= Market leverage defined as debt over book debt plus the market value of equity.
Industry (FF12 Industry)	= 12 Industry Dummies based on the Fama-French 12 Industry Classification.
CEO Tenure (LogCEOTenure)	= Natural logarithm of CEO tenure with the firm.

Table 1

Summary of sample selection

The sample covers the period of 1992 to 2006.

	Firm-Year Observations
Firms on Execucomp with data available on major customers	31,429
Firms with stock return data	28,697
Firms with positive values for assets, sales, and available data for stock return volatility	23,300
Firms with data on business segments available	21,992
Firms with incentive compensation data	10,192
Firms where CEOs have been with the firm for more than one year	9,870

Table 2

Panel A. Descriptive statistics of supplier firm characteristics

	N	Mean	Std Dev	p25	Median	p75
Equity Incentives	9,870	785.5	4,885.7	39.0	122.6	381.3
Log Equity Incentives	9,870	4.84	1.73	3.69	4.82	5.95
Chg Log Equity Incentives	7,800	0.14	0.66	-0.18	0.16	0.49
Nr. Bus. Segments	9,870	2.48	1.65	1	2	4
BusSegmHerfindhal	9,870	0.75	0.27	0.50	0.83	1.00
Stock Returns	9,870	0.22	0.68	-0.11	0.13	0.40
Profit Margin	9,869	-0.06	2.53	0.02	0.05	0.09
Operating Profit Margin	9,730	0.02	2.10	0.05	0.10	0.16
Std. Dev. Stock Returns	9,870	0.11	0.07	0.07	0.10	0.14
CDF Idiosy. Variance	9,870	0.49	0.28	0.24	0.48	0.73
Major Cust. Duration (years)	9,870	2.41	4.06	0	0	4
TotalMCSales Percentage	9,870	0.12	0.21	0	0	0.15
SingleMCSales Percentage	9,870	0.06	0.124	0	0	0.09
Nr. Major Customers	9,870	1.62	5.064	0	0	1
Market Capitalization	9,870	6,154.4	18,829.4	521.8	1,413.3	4,364.6
Log Mkt. Capitalization	9,870	7.37	1.56	6.26	7.25	8.38
Book/Market of Equity	9,870	0.47	0.32	0.25	0.41	0.61
Market Leverage	9,870	0.16	0.15	0.04	0.12	0.24
Research & Development	9,870	0.04	0.08	0	0	0.04
CEO Tenure	9,870	7.84	6.88	3	6	10
Log CEO Tenure	9,870	1.93	0.69	1.37	1.90	2.43

Panel B. Comparison of firm characteristics across suppliers with different levels of major customers

	(1) Suppliers with no MC (N=6,153)		(2) Suppliers with ≥10% sales to MC (N=2,963)		(3) Suppliers with ≥25% sales to MC (N=1,857)		Test of difference (1)=(2) (t-stat/p-value)		Test of difference (1)=(3) (t-stat/p-value)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Equity Incentives	999.4	141.4	401.8	93.2	380.4	84.5	6.0	0.00	4.8	0.00
Log Equity Incentives	4.985	4.959	4.559	4.546	4.481	4.448	11.0	0.00	10.9	0.00
Chg Log Equity Incentives	0.164	0.176	0.091	0.121	0.082	0.105	4.4	0.00	4.2	0.00
Nr. Bus. Segments	2.632	2.000	2.163	1	1.987	1	12.9	0.00	15.0	0.00
BusSegmHerfindhal	0.721	0.740	0.793	1	0.824	1	-12.1	0.00	-14.5	0.00
Stock Returns	0.204	0.132	0.244	0.119	0.261	0.108	-2.7	0.00	-3.2	0.00
Profit Margin	-0.034	0.055	-0.140	0.046	-0.174	0.044	1.8	0.00	2.1	0.00
Std. Dev. Stock Returns	0.106	0.090	0.136	0.115	0.143	0.123	-20.1	0.00	-21.1	0.00
CDF Idiosy. Variance	0.438	0.408	0.599	0.640	0.637	0.681	-26.1	0.00	-27.5	0.00
Major Cust. Duration (years)	0	0	6.56	6	7.15	7	-192.0	0.00	-238.2	0.00
TotalMCSalesPerc	0	0	0.373	0.320	0.499	0.460	-229.3	0.00	-424.4	0.00
SingleMCSales Percentage	0	0	0.193	0.152	0.239	0.200	-169.0	0.00	-220.1	0.00
Nr. Major Customers	0	0	5.041	3	6.265	3	-79.9	0.00	-99.6	0.00
Market Cap	7,315.0	1,793.5	4,354.7	943.2	4,184.2	845.1	6.9	0.00	5.9	0.00
Log MktCap	7.569	7.492	6.995	6.849	6.895	6.739	16.5	0.00	16.3	0.00
Book Equity/Market Equity	0.482	0.424	0.465	0.397	0.465	0.399	2.3	0.00	2.0	0.02
Market Leverage	0.170	0.135	0.130	0.098	0.125	0.091	12.3	0.00	11.4	0.00
Research & Development	0.026	0.000	0.057	0.023	0.065	0.029	-18.4	0.00	-19.7	0.00
CEO Tenure	7.825	5.667	7.962	5.917	8.118	5.917	-0.9	0.13	-1.6	0.03

Table 3

Correlation Table

Correlation matrix for regression variables, where the lower triangle presents Pearson and the upper triangle presents Spearman correlations. * indicates statistical significance at 5%.

		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
I.	LogEquityIncentives	1	-0.1110*	0.1885*	-0.0624*	0.5843*	-0.3523*	-0.1373*	-0.0234*	-0.2122*	0.3739*
II.	TotalMCSalesPerc	-0.1211*	1	-0.0192	0.1376*	-0.1801*	-0.0542*	-0.1275*	0.2450*	0.2508*	0.0165
III.	Stock Returns	0.1340*	0.0187	1	0.0140	0.1256*	-0.2429*	-0.1180*	-0.0126	-0.0163	0.0215*
IV.	BusSegmHerfindhal	-0.0720*	0.1613*	0.0378*	1	-0.2149*	-0.1070*	-0.1935*	0.0027	0.3228*	0.0579*
V.	LogMktCap	0.5946*	-0.1682*	0.0595*	-0.2130*	1	-0.3562*	-0.0341*	-0.0061	-0.4580*	-0.0140
VI.	Book/Market Equity	-0.3504*	-0.0352*	-0.2082*	-0.0578*	-0.3996*	1	0.3883*	-0.2798*	-0.0363*	-0.0489*
VII.	Market Leverage	-0.1268*	-0.1245*	-0.1102*	-0.1314*	-0.0767*	0.3682*	1	-0.3634*	-0.2298*	-0.0557*
VIII.	Research & Dev.	-0.0892*	0.2310*	0.0495*	0.1255*	-0.0919*	-0.1942*	-0.2722*	1	0.2943*	-0.0234*
IX.	CDF Idiosy. Variance	-0.2154*	0.2784*	0.1104*	0.3131*	-0.4531*	0.0312*	-0.1634*	0.3445*	1	0.0472*
X.	Log CEO Tenure	0.3866*	0.0235*	0.0186	0.0549*	-0.014	-0.0509*	-0.0474*	0.0031	0.0468*	1

Table 4 - Industry Distribution

Fama and French (1997) 12 Industry Classifications

	Industry Description	Total Sample of suppliers (1)			Suppliers with customers' sales ≥10% total sales (2)			Suppliers with customers' sales ≥25% total sales (3)		
		Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.
1	Consumer NonDurables -- Food, Tobacco, Textiles, Apparel, Leather, Toys	672	6.81	6.81	232	7.83	7.83	137	7.38	7.38
2	Consumer Durables -- Cars, TV's, Furniture, Household Appliances	325	3.29	10.1	143	4.83	12.66	99	5.33	12.71
3	Manufacturing -- Machinery, Trucks, Planes, Off Furn, Paper, Com Printing	1,439	14.58	24.68	463	15.63	28.28	240	12.92	25.63
4	Oil, Gas, and Coal Extraction and Products	409	4.14	28.82	202	6.82	35.1	117	6.3	31.93
5	Chemicals and Allied Products	365	3.7	32.52	81	2.73	37.83	39	2.1	34.03
6	Business Equipment -- Computers, Software, and Electronic Equipment	1,918	19.43	51.96	893	30.14	67.97	586	31.56	65.59
7	Telephone and Television Transmission	222	2.25	54.2	34	1.15	69.12	13	0.7	66.29
8	Utilities	497	5.04	59.24	28	0.94	70.06	9	0.48	66.77
9	Wholesale, Retail, and Some Services (Laundries, Repair Shops)	1,262	12.79	72.03	153	5.16	75.23	92	4.95	71.73
10	Healthcare, Medical Equipment, and Drugs	866	8.77	80.8	400	13.5	88.73	314	16.91	88.64
11	Finance	751	7.61	88.41	60	2.02	90.75	39	2.1	90.74
12	Other -- Mines, Construction, Building Materials, Transport, Hotels, Business Services, Entertainment	1,144	11.59	100	274	9.25	100	172	9.26	100
	Total	9,870	100		2,963	100		1,857	100	

Table 5
Regressions of firm stock return volatility on lagged sales to major customers

Regressions of stock return volatility (measured as total stock return volatility (columns 1 through 4) and idiosyncratic variance of stock returns (columns 5 through 8)) on the lagged sales to major customers. Heteroskedasticity-robust t statistics with standard errors clustered by firm are reported for the OLS regressions. The absolute value of t statistics are reported in parentheses. * indicates significant at 10%; ** significant at 5%; and *** significant at 1%.

	OLS Regressions				Robust Regressions			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$BusSegmHerfindahl_{t-1}$	0.011**	0.011***	0.005***	0.005***	0.004	0.005	0.004***	0.004***
	(2.54)	(2.62)	(3.69)	(3.68)	(1.18)	(1.25)	(3.44)	(3.37)
$StockReturn_{t-1}$	0.006***	0.006***	0.008***	0.008***	0.005***	0.005***	0.008***	0.009***
	(4.77)	(4.77)	(6.25)	(6.25)	(3.59)	(3.56)	(17.38)	(17.55)
$LogMktCap_{t-1}$	-0.009***	-0.009***	-0.004***	-0.004***	-0.006***	-0.006***	-0.003***	-0.003***
	(9.42)	(9.46)	(11.59)	(11.53)	(7.64)	(7.66)	(13.85)	(13.78)
$Book/Market_{t-1}$	0.013***	0.013***	-0.007***	-0.007***	0.018***	0.018***	-0.005***	-0.005***
	(2.77)	(2.78)	(3.64)	(3.62)	(5.10)	(5.09)	(4.10)	(4.05)
$MarketLeverage_{t-1}$	0.010	0.009	0.001	0.001	0.002	0.001	0.002	0.002
	(1.17)	(1.05)	(0.31)	(0.27)	(0.31)	(0.17)	(0.80)	(0.75)
$R\&D_{t-1}$	0.145***	0.146***	0.071***	0.071***	0.114***	0.116***	0.085***	0.084***
	(6.79)	(6.64)	(5.80)	(5.71)	(8.11)	(8.24)	(17.31)	(17.10)
CDF Idiosy. $Variance_{t-1}$	0.875***	0.876***			0.915***	0.917***		
	(164.99)	(165.76)			(219.50)	(220.50)		
$LogStdDevRet_{t-1}$			0.604***	0.605***			0.550***	0.551***
			(48.40)	(48.44)			(87.91)	(88.32)
$TotalMCSalePerct_{t-1}$	0.034***		0.006***		0.023***		0.007***	
	(6.04)		(2.71)		(4.73)		(4.02)	
$SingleMCSalePerct_{t-1}$		0.043***		0.011**		0.025***		0.012***
		(4.48)		(2.55)		(3.13)		(4.42)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FF12 Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,870	9,870	9,870	9,870	9,870	9,870	9,870	9,870
Adjusted R-squared	0.8615	0.8613	0.5004	0.5004	0.8924	0.8924	0.5868	0.5872

Table 6
Regressions of CEO equity incentives on lagged percentage of sales to major customers

Regressions of the natural logarithm of total equity incentives. Equity incentives are measured as the dollar change in the CEO's wealth from a 1% stock price increase (Baker and Hall, 2004; Core and Guay, 1999). We compute this measure as: 1% × (share price) × (the number of shares held) + 1% × (share price) × (option Chg) × (the number of options held). Heteroskedasticity-robust t statistics with standard errors clustered by firm are reported for the OLS regressions. The absolute value of t statistics are reported in parentheses. * indicates significant at 10%; ** significant at 5%; and *** significant at 1%.

	OLS Regressions			Robust Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
$BusSegmHerfindahl_{t-1}$	0.118	0.105	0.116	0.073	0.063	0.072
	(1.41)	(1.26)	(1.38)	(1.59)	(1.36)	(1.56)
$StockReturn_{t-1}$	0.203***	0.204***	0.203***	0.244***	0.243***	0.239***
	(6.31)	(6.34)	(6.31)	(13.98)	(13.90)	(13.70)
$LogMktCap_{t-1}$	0.610***	0.610***	0.609***	0.596***	0.596***	0.595***
	(32.17)	(32.21)	(32.13)	(63.62)	(63.56)	(63.50)
$Book/Market_{t-1}$	-0.578***	-0.579***	-0.580***	-0.610***	-0.613***	-0.613***
	(7.48)	(7.50)	(7.50)	(14.42)	(14.48)	(14.49)
$MarketLeverage_{t-1}$	-0.093	-0.085	-0.089	-0.018	-0.009	-0.015
	(0.48)	(0.45)	(0.47)	(0.20)	(0.10)	(0.17)
$R\&D_{t-1}$	-1.728***	-1.722***	-1.706***	-1.840***	-1.833***	-1.817***
	(5.31)	(5.37)	(5.30)	(10.04)	(9.98)	(9.91)
CDF Idiosy. $Variance_{t-1}$	0.123	0.100	0.116	0.127**	0.104*	0.119**
	(1.36)	(1.12)	(1.29)	(2.38)	(1.95)	(2.24)
$LogCEOTenure_{t}$	0.949***	0.949***	0.949***	0.961***	0.960***	0.960***
	(27.48)	(27.51)	(27.51)	(59.69)	(59.63)	(59.64)
$TotalMCSalePerct_{t-1}$	-0.406***			-0.353***		
	(3.78)			(6.11)		
$AvgMCSalePerct_{t-1}$		-0.666***			-0.567***	
		(3.15)			(4.70)	
$SingleMCSalePerct_{t-1}$			-0.676***			-0.592***
			(3.97)			(6.13)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
FF12 Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,870	9,870	9,870	9,870	9,870	9,870
Adjusted R-squared	0.5739	0.5731	0.5739	0.5885	0.5879	0.5884

Table 7
Regressions of CEO equity incentives on lagged percentage of sales to major customers interacted with CDF of firm idiosyncratic variance

Regressions of the natural logarithm of total equity incentives. Equity incentives are measured as the dollar change in the CEO's wealth from a 1% stock price increase (Baker and Hall, 2004; Core and Guay, 1999). We compute this measure as: 1% × (share price) × (the number of shares held) + 1% × (share price) × (option Chg) × (the number of options held). Heteroskedasticity-robust t statistics with standard errors clustered by firm are reported for the OLS regressions. The absolute value of t statistics are reported in parentheses. * indicates significant at 10%; ** significant at 5%; and *** significant at 1%.

	OLS Regressions			Robust Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
$BusSegmHerfindahl_{t-1}$	0.119	0.103	0.112	0.075	0.061	0.068
	(1.43)	(1.23)	(1.34)	(1.63)	(1.32)	(1.47)
$StockReturn_{t-1}$	0.202***	0.204***	0.202***	0.235***	0.238***	0.232***
	(6.29)	(6.33)	(6.28)	(13.48)	(13.64)	(13.32)
$LogMktCap_{t-1}$	0.612***	0.611***	0.611***	0.599***	0.598***	0.597***
	(32.30)	(32.25)	(32.22)	(64.16)	(63.76)	(63.80)
$Book/Market_{t-1}$	-0.580***	-0.579***	-0.581***	-0.615***	-0.613***	-0.615***
	(7.51)	(7.50)	(7.52)	(14.60)	(14.49)	(14.57)
$MarketLeverage_{t-1}$	-0.087	-0.085	-0.085	-0.005	-0.005	-0.006
	(0.46)	(0.44)	(0.45)	(0.06)	(0.06)	(0.07)
$R\&D_{t-1}$	-1.605***	-1.631***	-1.594***	-1.721***	-1.726***	-1.692***
	(5.02)	(5.20)	(5.03)	(9.38)	(9.31)	(9.17)
$CDF\_IdVariance_{t-1}$	0.260***	0.161*	0.203**	0.289***	0.185***	0.230***
	(2.61)	(1.69)	(2.11)	(5.05)	(3.31)	(4.10)
$LogCEOTenure_t$	0.946***	0.948***	0.946***	0.957***	0.958***	0.957***
	(27.53)	(27.52)	(27.52)	(59.66)	(59.58)	(59.56)
$TotalMCSalePerct_{t-1}$	0.470**			0.588***		
	(2.03)			(4.02)		
$TotalMCSalePerct_{t-1}$*	-1.336***			-1.489***		
$CDF\_IdVariance_{t-1}$	(4.04)			(7.28)		
$AvgMCSalePerct_{t-1}$		0.269			0.543*	
		(0.60)			(1.85)	
$AvgMCSalePerct_{t-1}$*		-1.421**			-1.806***	
$CDF\_IdVariance_{t-1}$		(2.13)			(4.44)	
$SingleMCSalePerct_{t-1}$			0.448			0.691***
			(1.17)			(2.73)
$SingleMCSalePerct_{t-1}$*			-1.645***			-1.980***
$CDF\_IdVariance_{t-1}$			(2.97)			(5.79)
Estimated $\beta_0+\beta_2$	-0.866	-1.152	-1.197	-0.901	-1.263	-1.289
Ho: $\beta_0+\beta_2=0$; *Ha:* $\beta_0+\beta_2<0$	0.00	0.00	0.00	0.00	0.00	0.00
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
FF12 Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,870	9,870	9,870	9,870	9,870	9,870
Adjusted R-squared	0.5756	0.5736	0.5748	0.5913	0.5889	0.5901

Table 8

Regressions of change in CEO equity incentives on having lost (gained) a major customer

Regressions of the percentage change in total equity incentives. Equity incentives are measured as the dollar change in the CEO's wealth from a 1% stock price increase (Baker and Hall, 2004; Core and Guay, 1999). Heteroskedasticity-robust t statistics with standard errors clustered by firm are reported for the OLS regressions. The absolute value of t statistics are reported in parentheses. * indicates significant at 10%; ** significant at 5%; and *** significant at 1%.

	OLS Regressions			Robust Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
$BusSegmHerfindahl_{t-1}$	-0.014	-0.013	-0.013	-0.016	-0.016	-0.017
	(0.71)	(0.67)	(0.67)	(0.87)	(0.89)	(0.92)
$StockReturn_{t-1}$	0.165***	0.166***	0.167***	0.200***	0.199***	0.200***
	(8.24)	(8.26)	(8.41)	(22.47)	(22.42)	(22.58)
$StockReturn_{t}$	0.598***	0.597***	0.597***	0.700***	0.698***	0.699***
	(15.19)	(15.18)	(15.19)	(77.73)	(77.58)	(77.72)
ROA_{t}	0.345***	0.344***	0.343***	0.607***	0.618***	0.618***
	(3.48)	(3.49)	(3.48)	(15.90)	(16.21)	(16.23)
$LogMktCap_{t-1}$	-0.013***	-0.013***	-0.013***	-0.002	-0.002	-0.002
	(2.90)	(2.91)	(2.89)	(0.46)	(0.47)	(0.50)
$Book/Market_{t-1}$	0.175***	0.176***	0.176***	0.184***	0.186***	0.186***
	(6.82)	(6.88)	(6.88)	(10.32)	(10.41)	(10.43)
$MarketLeverage_{t-1}$	0.031	0.028	0.030	0.059*	0.059*	0.058
	(0.76)	(0.68)	(0.72)	(1.66)	(1.65)	(1.64)
$R\&D_{t-1}$	0.026	0.037	0.034	0.160**	0.168**	0.168**
	(0.25)	(0.36)	(0.33)	(2.20)	(2.32)	(2.30)
$CDF\_IdVariance_{t-1}$	-0.311***	-0.308***	-0.308***	-0.221***	-0.220***	-0.220***
	(11.37)	(11.29)	(11.31)	(10.07)	(10.05)	(10.04)
Change in $StdRet_{t}$	2.142***	2.145***	2.144***	1.861***	1.861***	1.868***
	(9.51)	(9.50)	(9.51)	(17.22)	(17.24)	(17.32)
$LogCEOTenure_{t}$	-0.093***	-0.093***	-0.094***	-0.087***	-0.086***	-0.087***
	(11.81)	(11.81)	(11.84)	(12.48)	(12.45)	(12.49)
$ChgSales/Assets_{t-1}$	-0.030	-0.030	-0.031	-0.027**	-0.028**	-0.029**
	(1.53)	(1.57)	(1.57)	(2.21)	(2.25)	(2.35)
$Chgmcsaleplus25_{t-1}$	-0.013			-0.068**		
	(0.30)			(2.24)		
$Chgmcsaleminus25_{t-1}$	0.067			0.092***		
	(1.42)			(2.94)		
$Chgmcsalesplus40_{t-1}$		-0.142**			-0.167***	
		(2.18)			(3.97)	
$Chgmcsaleminus40_{t-1}$		0.093			0.150***	
		(1.45)			(3.48)	
$Chgmcsaleplus50_{t-1}$			-0.191**			-0.225***
			(2.26)			(4.20)
$Chgmcsaleminus50_{t-1}$			0.151**			0.204***
			(2.02)			(3.90)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
FF12 Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,800	7,800	7,800	7,800	7,800	7,800
Adjusted R-squared	0.3683	0.3689	0.3691	0.5678	0.5685	0.5694