Are Overconfident CEOs Good Leaders? Evidence from Stakeholder Commitments*

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Abstract

We find systematic evidence that the leadership of overconfident CEOs induces stakeholders (i.e. suppliers and employees) to take actions that contribute to their firms' success. By being intentionally over-exposed to the idiosyncratic risk of their firms, overconfident CEOs signal private information along the supply chain. Overconfident CEOs are more likely to attract suppliers and induce greater relationship-specific investment. They also gain stronger commitments from their own employees. Our evidence suggests that overconfident CEOs achieve these commitments through their leadership actions rather than their words.

"I told people you weren't betting on a device. You were betting on Steve Jobs."

~ Randall Stephenson (AT&T CEO)

A growing literature examines the effects of managerial overconfidence on firm decision and outcomes. Studies find that overconfident CEOs destroy firm value by over–investing, making costly merger and acquisition decisions, and employing loose accounting practices (Malmendier and Tate, 2005, 2008; Schrand and Zechman 2012; Ahmed and Duellman, 2013). This raises questions of why corporate boards employ such leaders (Goel and Thakor, 2008) and what can mitigate their actions (Banerjee, Humphrey–Jenner, and Nanda, 2015). However, recent evidence suggests a potential bright side as overconfident CEOs tend to be better innovators (Hirshleifer, Low, and Teoh, 2012). We add to this growing debate by asking: Are overconfident CEOs good leaders?

Our definition of leadership follows Hermalin (1998), where a leader's actions motivate employees and key affiliated parties, such as stakeholders, to work harder. The leader's action may act as a coordinating signal to stakeholders, who follow and commit to the leader's vision. We test the hypothesis that overconfident CEOs are good leaders by studying the behavior of the firm's major stakeholders – suppliers and employees. Stakeholder actions are an ideal test setting because firm success is closely tied to the relationship-specific investment (RSI) committed by stakeholders.

For example, consider the importance of stakeholder commitment in the success of the original iPhone. AT&T (then Cingular) helped Apple Inc. to secretly develop the iPhone and made heavy concessions to become the exclusive iPhone carrier in the U.S. market, effectively tying their fate to the iPhone's future prospects.[1] This example shows the close inter-dependency between a firm's success and the commitments made by a

[1] "*Life After the iPhone: How AT&T's Bet on Apple Mobilized the Company*" Forbes Jan 21, 2013.

firm's stakeholders towards product design and quality. More notably, the motivation behind the decision by Randall Stephenson, the CEO of AT&T, to make the RSI for Apple Inc. was not the prospect of the device per se, but the belief in the leadership of Steve Jobs who was the CEO of Apple Inc.

By intentionally holding vested in-the-money stock options, overconfident CEOs may provide a signal to key stakeholders on the future prospects of their firm. This may attract stakeholder investment, particularly when it is valuable to the firm's success. This signaling mechanism is unlikely to reflect "cheap talk" because if the signal is revealed to be untrue, the CEO not only loses her reputation and (potentially) her job but also her personal investment in the firm. Thus, unless the CEO has precise and positive information on the firm's investment projects, the costs are too prohibitively large to concentrate her personal wealth in the firm. In this paper, we use Malmendier and Tate (2005)'s vested in-the-money stock option measure as a credible personal investment signal by CEOs to induce relationship-specific investment from stakeholders[2].

We develop a simple model to highlight the importance of signaling to attract commitment and RSI from stakeholders. This model helps to guide our empirical tests. Canonical finance theories propose that dividends and debt are classic signaling mechanism to *shareholders* (see Modigliani and Miller, 1958; Leland and Pyle, 1977). However, such actions raise bankruptcy risk and therefore increase the probability that *stakeholders* will fail to recoup their investment, adversely affecting their commitment and choices. Since RSI has high switching costs due to unique customization and low re-

[2] The S.E.C. requires insider trades (inclusive of share purchases and sales related to stock option exercises) to be filed electronically through the EDGAR system within two days of the transaction. Top executive compensation must also be disclosed periodically through the company filings with the S.E.C. Thus, stakeholders are able to observe the holdings or change in holdings of a firm's CEO and these holdings disclosure will serve as credible and timely signals.

deployability, stakeholders engage in RSI only when they are confident of the continuity and growth of a bilateral economic relationship. Because signaling with the CEO's personal wealth does not raise the firm's bankruptcy risk, it may serve as an ideal signal to convince stakeholders to take actions that will improve the probability of firm success. In addition, signaling with one's own wealth potentially constitutes a more credible signal than signaling using corporate resources because the personal costs are high.

Our study focuses on 2391 unique firms in the Execucomp database with available CEO stock options data over the sample period from 1993 to 2011. For each firm, we identify its dependent suppliers using the customer-supplier dataset[3] from the business segment files of Compustat where we follow SFAS 14 in classifying dependent suppliers as firms that generate at least 10 percent of revenues from a customer firm.[4] Results from a conditional logit model show that increases in the CEO's vested option holdings raise the likelihood of the firm initiating a dependent supplier network and expanding its existing dependent supplier network. Controlling for firm fixed effects, we find that a positive signal from the CEO's personal investment has a marginal effect of +8.03% on the likelihood of increasing the number of dependent suppliers on board the firm. This is economically large given that only 6.20% of firm-year observations in our sample experienced an increase in dependent suppliers.

We also find similar effects when CEOs divest their personal investment in the firm through exercise of their vested options – dependent suppliers are more likely to terminate their relation with these customers. Our results continue to hold using an OLS model, a propensity score-matched sample, and with the deployment of firm strata (i.e. fixed

[3] Section 3.2 provides details on our customer-supplier dataset.

[4] Sample firms that are not reported as customers in this dataset are assumed to have no dependent suppliers.

effects). Collectively, this suggests that unobserved firm heterogeneity is not driving our results.

Moreover, our previous results are most pronounced for firms in durable goods manufacturing industries (SIC: 3400 – 3999). Firms in this durable sector produce more unique products that require greater relationship-specific inputs from stakeholders (Titman and Wessels, 1988; Banerjee, Dasgupta, and Kim, 2008). It is more important for CEOs of firms in this sector to attract stakeholder commitment because firm success is more reliant on relationship-specific investment. Our empirical results support this intuition. Our results are also stronger for firms in industries characterized by high contract intensities which represent the depth of relationship-specific investment (Nunn, 2007).[5]

Our simple model also predicts that CEO's vested options holdings relate to increases in suppliers' RSI. Following extant literature, we use R&D as a proxy for RSI and find that increases in the CEO's vested options holdings raise the R&D intensities of their suppliers. This result remains robust to the inclusion of industry-year fixed effects and firm fixed effects. Together, our evidence suggests that suppliers take cues from their customer firm CEO's personal investment, and choose their commitment and investment accordingly.

Next, we focus on another important stakeholder: employees. We find evidence that CEO's option exercise behavior predicts employee commitment as measured by the moneyness of non-executive employees' options. Controlling for firm and industry-year fixed effects, a positive (negative) signal from the CEO's option exercise behavior is

[5] We thank Professor Nunn for providing the data on his website. For a given I-O industry, contract intensity is measured as the proportion of inputs that are neither bought nor sold on an exchange nor reference-priced (Nunn, 2007).

associated with about +0.36 (-0.35) unit change in non-executive employees' option moneyness. This suggests that employees also take cues from CEO's option behavior.

A natural question is whether stakeholder commitments are induced by the CEO's actions or words. For example, overconfident CEOs may be particularly charismatic, "charming" stakeholders into long-term investments with their firms. Using a media-based measure of CEO overconfidence (Banerjee, Humphrey-Jenner, and Nanda, 2015), we find that suppliers only respond to the vested CEO options and not to the media-based level of CEO overconfidence. This is consistent with the view that stakeholders follow the CEO's actions rather than "cheap-talk." This finding also helps to eliminate a related endogeneity concern that our option holdings variable may proxy for some unobserved managerial characteristics that also drive stakeholder commitments to the extent that the media-based measure captures these unobserved managerial characteristics.

One concern with our analysis is that the nature of the customer-supplier dataset is mechanically biased towards customers that are much larger than their suppliers due to the reporting requirements of SFAS 14. One critique is that a large firm may not need to signal to small stakeholders because of an asymmetric bargaining power effect the suppliers in our sample are more dependent on the customer. Large firms are typically industry leaders that may threaten termination to pressure their existing suppliers or to leverage their market leader status to attract new suppliers. Therefore, it would be less important for CEOs of large firms to signal to small stakeholders. However, this would likely bias against finding our results. Moreover, the asymmetric bargaining power can work in the opposite direction particularly when RSI is involved. For example, firms with greater bargaining power can subject their suppliers to greater holdup risks. This will reduce the incentives of suppliers to commit to greater RSI, since unique products are costly to re-deploy for other uses. As such, there exists a greater need for CEOs to signal

in order to ameliorate the fear of holdup in suppliers, especially if supplier RSI is critical to the firm's success.[6]

Nevertheless, we address the relative size/bargaining power bias of the dataset by interacting a *Large Firm* indicator with our CEO confidence measures. We find that large sample firms do not experience differential supplier outcomes from small sample firms when their CEOs signal through option holdings. We conclude that the relative size/bargaining power bias of the dataset is not driving our results.

Lastly, we address the selective disclosure issue of the customer-supplier dataset. In June 1997, SFAS 131 was issued which requires firms to disclose sales to each material customer, but not the identity of the customer. Even prior to its issuance, Ellis, Fee, and Thomas (2012) find selective disclosure of customer identities by firms. To the extent that suppliers that make greater RSIs for their customers are more likely to disclose the identities of their customers, this would bias towards finding our results. However, Ellis, Fee, and Thomas (2012) find the opposite selective disclosure inclination – suppliers with greater proprietary costs are less inclined to disclose their customers' identities due to competition. This finding works against finding our results.

Our study contributes to the literature on leadership in two ways. First, we show that CEO leadership may reach beyond the boundaries of the firm to include key stakeholders such as major suppliers. This extends existing studies on how managerial leadership motivates firm employees. Almazan, Chen, and Titman (2013) show that "top-down" capital allocation may optimally create higher levels of investment expenditure to

[6] Also using the same dataset, extant literature finds that customers actively induce RSI from suppliers by lowering firm leverage (Banerjee, Dasgupta, and Kim, 2008; Kale and Shahrur, 2007) and decreasing earnings management (Raman and Shahrur, 2008). Anecdotal evidence also suggests that large firms pursue small firms for their intellectual property. For example, Google has acquired at least 221 startups from 2006 to 2014. "How Google perfected the Silicon Valley acquisitions" (http://time.com/3815612/silicon-valley-acquisition/)Thus, an asymmetric mutual dependency between our sample firms and their suppliers does not eliminate a need for signaling private information, especially if suppliers have useful proprietary technologies.

motivate effort from employees. Hermalin (1998) and Komai, Stegeman, and Hermalin (2007) show that greater effort by managers may signal private information, motivating subordinates to work harder. Second, we introduce a new signaling mechanism – CEO's own personal wealth in the firm – which suggests that CEO overconfidence may be an important aspect of providing leadership.

We also contribute to the growing literature on the dark and bright side of CEO overconfidence. Our findings suggest that CEO overconfidence produces good outcomes by inducing RSI from suppliers and commitment by employees. This is consistent with the finding that overconfident CEOs are better innovators (Hirshleifer, Low, and Teoh, 2012).

Our paper is structured as follows. In Section 1, we formulate our hypotheses using a simple model. Section 2 discusses our data, variable construction, and empirical design. We present our empirical results and additional tests in Section 3 and 4, respectively. Section 5 concludes.

1. Model

We use a simple model to illustrate that a CEO whose firm has good prospects can signal to stakeholders by holding a larger fraction of their personal wealth in the firm through equity-based ownership. The main friction in the model is that the CEO has private information on firm type (high/low), which stakeholders cannot observe. If the CEO can credibly signal, then stakeholders will increase their investment toward the CEO's firm, improving the total firm's output.

Consider a firm with random output $\tilde{X}_t(I)$ which is increasing in stakeholder's investment, I. The productivity of the random output $\tilde{X}_t(I)$ is either low or high, i.e. $t = L, H$. The probability p that $t = H$ and $1 - p$ that $t = L$ are common knowledge to both

CEO and stakeholders. The mean of $\tilde{X}_t(I)$ is X_t^I with investment and X_t^0 without investment. Before the CEO observes the firm type and chooses α, the value of the firm is $V_0 = pX_H + (1-p)X_L$. For simplicity, we assume that stakeholder prefers to invest in the firm only if the firm is the high-type, and prefers to invest nothing if the firm is low-type. If the firm is high-type, the firm may receive stakeholder investment and produce output X_H^I or no-investment output X_H^0 where $X_H^I > X_H^0$. If the firm is low-type, X_L, the firm may receive stakeholder investment and produce output X_L^I or no-investment output X_L^0 where $X_L^I > X_L^0$.

The CEO's wealth is described in the following equation:

$$W_t = s - \alpha s + \frac{\alpha s}{V_0}\widetilde{X_t}(I)$$

where s is her total salary, α is the fraction of salary invested in firm equity, V_0 is firm value at time 0, and $\frac{\alpha s}{V_0}\widetilde{X_t}(I)$ represents the dollar value of equity holding in the company.

We assume the CEO is risk-averse with expected utility function:

$$U(W_t) = EW_t - \frac{b}{2}Var(W_t) \qquad \text{where } t = L, H$$

where b is the CEO's risk aversion. Therefore, the expected utility of a type t entrepreneur can be written as:

$$EU_t(\alpha, V) = s - \alpha s + \frac{\alpha s}{V_0}\widetilde{X_t}(I) - \frac{b}{2}\frac{\alpha^2 s^2}{V_0^2}\sigma^2$$

The timeline of events is as follows:

t=1	t=2	t=3
CEO observes firm type $\tilde{X}_t$ and chooses α	Stakeholder observes α, choose I	X output is realized

Let us examine the α values that allow the high-type to signal. Consider a low-type firm first. In the separating equilibrium, the low-type CEO does not hold firm equity and

$EU_L(0, X_L^0) = s$. If the low-type CEO successfully mimics, then $EU_L(\alpha, X_L^I) = s - \alpha s + \frac{\alpha s}{V_0} X_L^I - \frac{b}{2}\frac{\alpha^2 s^2}{V_0^2}\sigma^2$ where σ^2 is the firm variance. The separating equilibrium occurs when the low-type is better off not mimicking, $EU_L(0, X_L^0) \geq EU_L(\alpha, X_L^I)$ which yields $\alpha \geq \hat{\alpha}_L^*$. Therefore, the high-type CEO will need to invest at least $\hat{\alpha}_L^*$ to deter the low-type CEO from mimicking, where:

$$\hat{\alpha}_L^* = \frac{2V_0(X_L^I - V_0)}{sb\sigma^2}$$

For the high-type CEO, $EU_H(\alpha, X_H^I) = \alpha X_H^I + s - \alpha V_0 - \frac{b}{2}\alpha^2\sigma^2$ if she is able to successfully signal by holding α. $EU_H(0, X_H^0) = s$ if she does not signal. The separating equilibrium occurs when $EU_H(\alpha, X_H^I) \geq EU_H(0, X_H^0)$. Therefore the high-type CEO will invest at most $\alpha \leq \hat{\alpha}_H^*$, where:

$$\hat{\alpha}_H^* = \frac{2V_0(X_H^I - V_0)}{sb\sigma^2}$$

Since $X_H^I > X_L^I$, then $\hat{\alpha}_H^* > \hat{\alpha}_L^*$ implying a range of α such that the high-type firm can separate from the low-type firm. This model highlights conditions of existence of a separating equilibrium, which are useful in developing our empirical tests.

One empirical consideration with taking the model to the data is that modern compensation contracts are complex. CEO compensation commonly includes an equity–based component consisting of stock and options with vesting guidelines. Thus α can be decomposed into two components, $\alpha' + \alpha''$, which represents stock ownership and option ownership. We empirically focus on α'' because α' reflects a mixture of other factors such founder ownership and contracting incentives. For example, Core and Guay (1999) find that CEOs are required to hold equity as part of an optimal incentive structure. The CEO's stock ownership is a constrained choice and represents a noisy signal.

For this reason, we use option ownership to measure the unconstrained portion of the CEO's personal investment in the firm. The high-type firm can attract stakeholder investment if it can credibly signal and separate from the low-type. Our first set of predictions relate to stakeholder investment.

Prediction 1: *High levels of vested in-the-money options increase the size and likelihood a dependent supplier network.*

Because our model simplifies the stakeholder investment decision, our baseline prediction is based on simple counts of supplier networks. However, the model also shows that signaling is more valuable to the high-type when X_H^I is particularly high. Empirically we expect reflect industry structures where RSI is particularly valuable.

Prediction 2: *High levels of vested in-the-money options increase the size and likelihood a dependent supplier network, particularly when RSI is more valuable.*

These basic predictions from the model structure our empirical tests. We provide additional tests that consistent with model predictions in Section 3.

2. Data

This section describes the data and variable construction. We start with firms in the Execucomp database with available stock option data on CEOs. The Execucomp database covers more than 3000 firms and provides compensation data for top executives of firms from the year 1992 onwards. Following standard literature, we remove utilities (SIC: 4000 – 4999) and financial firms (SIC: 6000 – 6999). Next, we identify customer and supplier pairs from the business segment files of Compustat. Financial variables and stock return data are obtained from Compustat and CRSP, respectively. Our sample period starts from

1993 and ends in 2011, which is the last year that we have information on customer-supplier pairs.

2.1 Overconfidence Measures

When the CEO holds vested in-the-money options for an extended period, she concentrates her personal investment in the firm and her decision to not diversify serves as a powerful signal of her expectations of the future business prospects of the firm. This idea motivates our focus on option-based measures as our primary proxies of the CEO's personal investment in her own firm.

From Execucomp, we obtain data on the number and value of the CEO's vested stock options. First, we construct the *CEO Confidence* measure as the ratio of average value per option to average strike price (see Malmendier, Tate and Yan, 2011; Banerjee, Humphrey-Jenner, and Nanda, 2015), where the average value per option is the total value of the CEO's option holdings (Execucomp: opt unex exer val) scaled by the number of such options (Execucomp: opt unex exer num). The average strike price is the firm's stock price at the end of the fiscal year (CRSP: prcc_f) less the average value per option. Next, we construct 2 measures based on the *CEO Confidence* measure. *CEO Confidence Up* is an indicator which equates to unity if *CEO Confidence* in year t is in the top quartile of the year and *CEO Confidence* in year t-1 is not in the top quartile of the year, and equates to 0 otherwise. *CEO Confidence Down* is defined symmetrically. In addition to option-based measures, we also use a stock ownership measure. *CEO Share Ownership* equates to unity if the fraction of stock awards in the CEO's total compensation is in the top quartile of the year, and equates to 0 otherwise. As discussed in Section 1, we focus on option-based measures because most CEOs of public firms do not have high stock ownership in their own firms and there may be contractual clauses requiring CEOs to hold company shares.

2.2 Identifying Supplier-Customer Links

We identify major customer-supplier relationships from the business segment files of Compustat. In accordance with SFAS 14, public firms are required to disclose sales to their principal customers, which are defined as customers that contribute to at least 10 percent of the total revenue of the firm, or if sales to a customer is material to the business of the firm. The names of the principal customers are manually matched to its GVKEY in Compustat by closely following the approach[7] in Fee, Hadlock and Thomas (2006). By inverting this dataset, we have a list of firms reporting the identities of their dependent suppliers.

Next, we identify whether our sample of Execucomp firms are reported as customers by firms in the customer-supplier dataset. *Start of Supplier Network* equates to unity if a firm has at least one dependent supplier in year t and no dependent suppliers in year t-1, and equates to 0 otherwise. *End of Supplier Network* is defined symmetrically. Where *Start of Supplier Network* and *End of Supplier Network* both equate to 0, there is a status quo in the existence of a supplier network. We also compute *Number of Suppliers* which is the number of dependent suppliers in the firm's network. Relatedly, *Increase* (*Decrease*) *in Number of Suppliers* equates to unity if the year-on-year change in *Number of Suppliers* is positive (negative), and equates to 0 otherwise.

2.3 Relationship-Specific Investment: Industry

Firms in durable goods manufacturing industries ("durable sector") produce unique products that require greater RSI and are less easily re-deployable (Titman and Wessels,

[7] For customer names that are abbreviated, visual inspection and industry affiliation are used to determine whether the customer is listed in Compustat. For the remaining unmatched customers, their corporate websites in the Directory of Corporate Affiliation (DCA) database is checked to determine if the customer is a subsidiary of a listed firm. If so, the customer is assigned to its parent's GVKEY. To ensure accuracy, any customer name that cannot be unambiguously matched to a GVKEY is discarded.

1988; Banerjee, Dasgupta and Kim, 2008). This suggests that firms in the durable sector are more likely to require customized inputs from their suppliers and will benefit to a larger extent from RSI of suppliers relative to firms in other sectors. For example, Banerjee, Dasgupta and Kim (2008) find that firms in the durable sector have lower leverage in order to induce RSI from suppliers. Therefore, we hypothesize that CEOs of firms in the durable sector are more likely to signal their firm prospects via personal option holdings in order to induce RSI from suppliers relative to CEOs of firms in other sectors.

To test the hypothesis that the CEOs' personal investment signals have stronger effects on supplier outcomes when the firms are in the durable sector, we allocate firms whose primary SIC codes are from 3400 (inclusive) to 4000 (exclusive) to the *Durable sector* subsample. On the other hand, firms with primary SIC codes in the range of 2000 (inclusive) to 3400 (exclusive) are allocated to the *Non-Durable Manufacturing goods industries* ("non-durable" sector) subsample. For this analysis, we restrict our sample firms to only manufacturing firms in these two sectors.

The durable sector classification may not be sufficient to capture the cross-sectional variation in RSI across more narrowly-defined sectors. Therefore, we use a continuous industry-level measure of RSI by Nunn (2007). Nunn (2007) identify RSI as those inputs that are neither bought and sold on an exchange nor reference-priced and construct an industry *contract intensity* variable that measures, for each good, the proportion of its intermediate inputs that require RSI. We use the *contract intensity* variable for the benchmark year 1997 to classify our firms into two subsamples where the high and low industry-RSI subsamples consist of firms whose industry contract intensities are above and below the sample median, respectively. Similar to our hypothesis on the nature of products manufactured by firms in the durable sector, firms in the high industry-RSI

subsample are presumed to produce more unique products and require greater RSI from their suppliers than firms in the low industry-RSI subsample. Therefore, the CEOs' personal investment signals should have stronger effects on supplier outcomes when the firms are in high-industry RSI subsample.

2.4 Measuring Supplier and Employee RSI

An observable outcome from suppliers is a change in the supplier RSI following a personal investment signal from CEOs. We use supplier R&D expenses scaled by supplier total assets as a measure of supplier RSI where missing supplier R&D expenses are set to zero. Since each firm can have multiple dependent suppliers, we construct a weighted average supplier R&D where the weight is computed as the supplier sales attributed to the firm divided by the sum of sales across all dependent suppliers producing for the firm. We then construct a *Change in Supplier R&D* variable which is the year-on-year change in Supplier R&D of sample firms.

Employees are key stakeholders in the firm and, as does the CEO, have human capital closely tied to firm performance. If the CEO's option holdings are a valuable signal of future prospects, we would also expect employees to increase their commitment and investment in the firm. However, measuring employee commitment is an empirically daunting task. One possibility is to use survey data (i.e. 100 best places to work for), but that approach significantly reduces the available sample and has limited time-series. Instead, we use non-executive employee option moneyness (*NEE Moneyness*) as a measure of commitment. We argue that employees who keep larger amounts of their options in the firm are more committed to the firm. Employee options are good measure for our purposes because it signals both that the employee has a long-term commitment and is willing to invest their own personal wealth.

NEE Moneyness is computed as the average value of non-executive employees' options scaled by the average strike price. The value of non-executive employees' options is computed by subtracting the value of the top-5 executives' options (source: EXECUCOMP) from the value of options granted to all employees (source: IRRC). The value of non-executive employees' options is then scaled by the number of non-executive employees to obtain the numerator of this variable. The denominator is the difference between the firm's stock price at the end of the fiscal year and the numerator. Following this, we create *Change in NEE Moneyness* which is the year-on-year change in *NEE Moneyness.*

2.5 Additional Variables

We control for firm size using the logarithm of one plus total assets, *log(1 + Total Assets),* since larger firms are less likely to suffer from information asymmetry and more likely to have a supply chain network. Prior studies (Titman, 1984; Maksimovic and Titman, 1991; Kale and Shahrur, 2007; Banerjee, Dasgupta and Kim, 2008) have documented that a firm's capital structure affects stakeholder commitment towards long-term contracting since a more levered firm can pass on higher financial distress risks to stakeholders. Thus, we control for the firm's *Leverage* computed as the sum of short-term and long-term debt scaled by total assets.

To control for profitability and sales expansion, we use the *returns on assets* (ROA) which is computed as operating income scaled by lagged total assets, and the *sales growth* which is the year-to-year change in sales scaled by lagged sales, respectively. Firm valuation is controlled by the *Market-to-Book Ratio* of the firm which is computed as the market value of equity divided by the book value of equity.

Additionally, we include the firm's capital expenditures scaled by total assets (*Capital Expenditure*) and its R&D expenses scaled by total assets (*Research & Development*) since

firms that are aggressively taking on investment projects and/or innovating may require more suppliers and/or greater RSI from existing suppliers. We set missing R&D values to be zero. However, this may not be valid. Therefore, we create a *missing R&D indicator* that equates to unity if R&D expenses are missing, and zero otherwise, and include this indicator in our regressions.

We also control for the firm's cash level and the stability of operating income, since firms with larger cash buffer and more stable operating income may find it less costly to induce stakeholder commitments. *Cash* is computed as cash and cash equivalents scaled by total assets while stability of operating income is measured by *ROA Volatility*. Importantly, we include the logarithm of buy-and-hold returns of firm stock over the past 24 months (*24-month BHR*) as a control variable because equity performance may be mechanically correlated with our personal investment measure. Lastly, CEOs with longer tenures at the firms would have more established track records for new suppliers to rely upon and/or have built greater trust with existing suppliers. Therefore, CEO tenure can directly affect stakeholder commitment. We include the logarithm of one plus the CEO tenure (*Log (1 + CEO Tenure)*).

In robustness tests, we also control for corporate governance of the firms by using the *G-Index* (Gompers, Ishii and Metrick, 2003). A firm with better corporate governance may be less likely to hold up her stakeholders, and can therefore induce stakeholder commitments more easily. We exclude *G-Index* in our main analyses because its inclusion in the regression specifications reduces sample size substantially. However, our results are largely robust to the *G-Index* inclusion despite the smaller sample size.

All financial variables are winsorized at the 1st and 99th percentiles of their distributions to minimize the influence of outliers. We control for fixed effects across

various dimensions such as industry, year and firm in both our OLS and conditional logit regressions.

2.6 Summary Statistics

We have 2391 unique firms from 1993 to 2011, giving a panel of 21294 firm-year observations. Among these firms, departures of dependent suppliers (mean = 15.7%) are more common than arrivals of dependent suppliers (mean=6.2%). Unsurprisingly, terminations and initiations of supplier networks are rarer events, occurring in 3.3% and 3.9% of the sample observations respectively.

[Insert Table 1]

In Panel A of Table 1, we compare our sample firms with firms in the Compustat database (median Compustat values in parentheses). On average, the median sample firm has total assets of 948.5 million (83.4 million). The median sample firm has total debt of 20.2% (18.7%), cash level of 7.2% (8.1%), sales growth and ROA of 9.2% (8.4%) and 6.1% (1.2%) respectively, a market-to-book ratio of 2.4 (1.8), and capital expenditure of 4.6% (3.9%). The median sample firm also has R&D expense that is 0.7% (0.0%) of total assets and its 24-month buy-and-hold returns is 15.4% (7.0%). These summary statistics suggest that the average sample firm is financially sound.

Panel B of Table 1 partitions the sample firms into two groups - firms with and without dependent suppliers. Relative to the average firm without suppliers, the average firm with suppliers is significantly larger (about 4 times larger), has higher valuation by the *market-to-book* ratio (3.92 vs 3.23), higher profitability by *ROA* (6.4% vs 5%) and 24-month buy-and-hold returns (15.5% vs 10.2%), lower volatility in ROA (4.9% vs 6.2%), makes more capital expenditure (7.5% vs 6.9%) and engage in greater R&D activities (4.8% vs 4.2%). As expected, firms with supplier networks also belong to industries with

higher RSI than firms without supplier networks (64.7% vs 63.3%). Notably, leverage is higher (25.1% vs 23.2%) and cash level (10.3% vs 13.6%) is lower for the average firm with suppliers relative to the average firm without suppliers. In terms of personal investment, the CEO of the average firm with suppliers has higher CEO Confidence measure (i.e. greater vested in-the-money option holdings).

3. Results

This section presents our main results. We start by testing our first prediction that CEO's holdings of vested in-the-money options relate to supplier commitment.

3.1 Attracting Supplier Networks

We estimate a conditional logistic regression using the following specification:

$$SuppliersIncrease_{it} = a + b_1 CEO\ Confidence\ Up_{it} + b_2 CEO\ Confidence\ Down_{it} + b_3 \theta_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where the dependent variable, *Suppliers Increase*, equates to one if the firm experiences an increase in the number of suppliers from year t-1 to t, and zero otherwise. θ is our set of control variables as described in Section 3.7 and Appendix 1. Our main variables of interests, are *CEO Confidence Up*, which equates to one if the continuous *CEO Confidence* measure is in the top quartile of the sample in year t but not in the top quartile in year t-1, and zero otherwise; and *CEO Confidence Down*, which equates to one if the *CEO Confidence* measure was in the top quartile of the sample in year t-1 but not in the top quartile in year t, and zero otherwise. By including both *CEO Confidence Up* and *CEO Confidence Down* in the same regression, we select the base case to be the status quo in *CEO Confidence* from year t-1 to t. Therefore, b_1 and b_2 will be estimated based on a change in CEO confidence from the base case. We expect $b_1 > 0$ and $b_2 < 0$ if increase

in CEO's personal investment serves as a positive signal to attract suppliers onboard the firm.

We use a conditional logit model (also known as the fixed-effect logit model) because it stratifies observations along the dimension of the intended fixed effect. For example, when the stratification is industry fixed effects, the conditional logit model runs specification (1) for each industry. Therefore, there must be variation within each stratum.[8] This condition allows the conditional logit model to sidestep the incidental parameters problem by avoiding the estimation of the fixed effect parameters. Inevitably, this causes fluctuations in sample sizes across different model specifications. We perform various stratifications and clustering to ensure that our results are robust.

[Insert Table 2]

The results in Panel A of Table 2 show that suppliers respond strongly to the CEO's personal investment signals. In Column (1) where we use *Suppliers Increase* indicator as the dependent variable and include industry-year fixed effects, the loading on *CEO Confidence Up* is positive and strongly significant at the 1 percent statistical level. This indicates that a firm is more likely to attract additional suppliers in the same year that CEO confidence moves into the top quartile. This effect is also economically significant. The *CEO Confidence Up* has a marginal effect of +8.03% on the likelihood of the firm experiencing an expansion of its supplier network, where the unconditional mean of a supplier network expansion is only 6.20%. The results are similar using firm strata in Column (2).

The personal investment signal of CEOs may have asymmetric effects in attracting new suppliers versus retaining existing suppliers. Presumably, existing suppliers would

[8] If a certain stratum experiences no variation in the dependent variable, all observations in that stratum are eliminated. This condition will result in significant variation in the sample size across different specifications.

have committed to a certain level of RSI for the firm. Since the value of relationship-specific inputs is higher within the bilateral relationship, existing suppliers would be less inclined to exit the relationship unless the personal investment signal from the firm's CEO is sufficiently negative. We test this by substituting the dependent variable in (1) with the *Suppliers Decrease* indicator that equates to one if the firm experiences a decrease in the number of suppliers from year t-1 to t, and zero otherwise. We expect $b_1 < 0$ and $b_2 > 0$ and b_2 to have stronger effects than b_1, since *CEO Confidence Down* is a strong negative personal investment signal from the CEO.

In Column (3) and (4) where we use *Suppliers Decrease* indicator as the dependent variable, we find strong evidence that a firm tends to lose dependent suppliers when the CEO emits negative signals from her personal investment in the firm. In Column (3), the *CEO Confidence Down* has a marginal effect of +0.9% on the likelihood of the firm experiencing a contraction of its supplier network. Notably, increases (decreases) in the supplier network size are only significantly driven by positive (negative) personal investment signals.

While the number of observations varies due to the conditional logit estimation procedure, our conclusions remain unchanged. Our results are also not affected by *CEO Share Ownership*, consistent with the idea that ownership is a weak signal. We also find that larger, expanding, innovating, and profitable firms (i.e. higher sales growth, higher R&D, higher capital expenditure, higher 24-month BHR) are more likely to induce supplier networks.

[Insert Table 3]

A sharper test of our hypothesis is to consider the boundary scenario where firms attract their first dependent supplier or when they lose their last dependent supplier. We do this in Table 3 where we examine whether the CEO's confidence affects the initiation

and termination of supplier network. In Column (1) and (2), the dependent variable is the *Start of Supplier Network* indicator that equates to one when the firm goes from having no dependent supplier in year t-1 to at least one dependent supplier in year t, zero otherwise. From Column (1), the positive and significant loading on *CEO Confidence Up* shows that a firm increases the likelihood of inducing a supplier network from none previously by +1.5% (marginal effect) when *CEO confidence* moves into the top quartile in the same year. The loading on *CEO Confidence Down* is also correctly signed, albeit insignificant. The results remain robust in Column (2) which employs firm strata.

In Column (3) and (4), the dependent variable is the *End of Supplier Network* indicator which equates to one when the firm goes from having at least one dependent supplier in year t-1 to none in year t, zero otherwise. Again, we observe that a *CEO Confidence Down* signal strongly increases the termination likelihood of the firm's supplier network. In Column (3), *CEO Confidence Down* has a marginal effect of +1.1% on the likelihood of the firm experiencing a termination of its supplier network relative to the unconditional mean of 3.90% for termination of supplier network in the overall sample.

Overall, our findings indicate that positive (negative) signals from the CEO's option holdings have strong effects on the initiation (termination) and expansion (contraction) of the firm's supplier network.

3.2 Importance of Signaling in RSI-Intensive Industries

Next, we consider whether CEO Confidence has differential effects on supplier outcomes across industries. Firms in durable goods manufacturing industries (i.e. durable sector) produce more unique products that can only be sold to few customers (Titman and Wessels, 1988). To the extent that firms in durable sector require greater customization in inputs from suppliers, it becomes more critical for CEOs of firms in this sector to signal

their private information in order to attract valuable suppliers onboard the firm and to induce greater supplier RSI.

[Insert Table 4]

To test the hypothesis that signals of CEOs' option holdings have stronger effects on supplier outcomes for firms in the durable sector, we restrict our sample to only manufacturing firms and split these firms into two industry types - durable sector and non-durable sector. Panel A of Table 4 presents results from the subsample analyses. From Column (1) and (2), we find that *CEO Confidence Up* increases the likelihood of a firm experiencing a supplier network expansion for firms in the *durable* sector, but not for firms in the *non-durable* sector. In unreported results[9], we also find that the effect of *CEO Confidence Down* on *Suppliers Decrease* is limited to firms in the *Durable* sector. We further investigate our previous results on the start of supplier network using both subsamples. Consistent with our conjecture, the CEOs' Confidence signals strongly increase the likelihood of a firm starting a supplier network when the firm is in the durable sector but not when the firm is in the non-durable sector. In unreported results, we also find consistent results for termination of a supplier network.

In Panel B, we partition manufacturing firms into high and low industry-RSI by the Nunn (2007)'s contract intensity measure. From Column (1) and (3), *CEO Confidence Up* positively and significantly increases the likelihood of a firm inducing a supplier network or expanding its supplier network but only when the firm is in a high RSI industry. In unreported results, we also find that *CEO Confidence Down* increases the likelihood of a firm losing/contracting its supplier network when the firm is in the high industry-RSI subsample but not when the firm is in the low-industry RSI subsample. Collectively, our results indicate that CEO confidence signals are particularly important

[9] Available upon request from the authors.

in inducing supplier commitments for firms that rely on relationship-specific inputs and where the cost of supplier commitment tends to be higher and the contracting imperfections are likely to be more salient.

3.3 Relationship-Specific Investment by Suppliers

Relationship-specific inputs are costly to re-deploy to other uses and to other customers. Therefore, suppliers would require greater inducement from their customers in order to commit to RSI. Thus, we expect that the CEOs' confidence increases supplier RSI. We test this by focusing on only firms with dependent suppliers using supplier R&D as a measure of supplier RSI and compute the year-on-year *Change in Supplier R&D*. We estimate the OLS specification in (2).

$$\Delta\, Supplier\ R\&D_{it} = \alpha + b_1 CEO\ Confidence\ Up_{it} + b_2 CEO\ Confidence\ Down_{it} + b_3\theta_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Since each firm can have multiple suppliers, we compute the weighted average supplier R&D for each firm. The weight is computed as the sales of each supplier that is attributable to the firm divided by the sum of dependent suppliers' sales attributable to the firm.

[Insert Table 5]

Table 5 reports the results. Across all columns, *CEO Confidence Up* positively and significantly leads to a positive change in *supplier R&D* after controlling for fixed effects in different dimensions. For example, in Column (3) where we include industry-year strata, CEO Confidence Up leads to a 2.3% change in Supplier R&D. Interestingly, *CEO Confidence Down* does not lead to significant change in Supplier R&D. One reason could be the difficulty in reversing R&D commitments in the short run since RSI is typically made with a longer-term focus.

3.4 Attracting Employee Commitment

We explore how employees respond to changes in CEO confidence. While we use supplier RSI in the previous section, the prediction of our model also extends to employee commitment. To test employee commitment, we estimate OLS regressions using the specifications in (3) and (4):

$$NEE\ Moneyness_{it} = a + b_1 CEO\ Confidence_{it} + b_2 \theta_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$\Delta\ NEE\ Moneyness_{it} = b_1 CEO\ Confidence\ Up_{it} + b_2 CEO\ Confidence\ Down_{it} + b_3 \theta_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

Table 6 presents the results of our employee commitment tests. Column (1) and (2) show that *CEO Confidence* positively and significantly increases non-executive employee option moneyness. Further, from Column (3) and (4), *CEO Confidence Up* leads to a strong positive change in non-executive employee option moneyness while *CEO Confidence Down* leads to a negative change. These findings suggest that employees also take cues from the option holding behavior of their CEOs. Controlling for firm and industry-year fixed effects, we find that an event of *CEO Confidence Up* (*CEO Confidence Down*) is associated with a +0.36 (-0.35) unit increment in *Change in NEE Money* respectively. The robustness of our findings to firm fixed effects suggests that unobserved firm heterogeneity is not behind our results.

[Insert Table 6]

A possible issue with this analysis is that both the CEO and employees share similar views on the future prospects of the firm. This opens the possibility of an omitted variable driving both parties to hold onto their vested options. However, we argue that this is unlikely for two reasons. First, non-executive employees are unlikely to have the same information set as the CEO. Second, if the result is indeed driven by both parties sharing

the same views, we should not observe the marginal effects of *CEO Confidence Up* to be similar in magnitude to that on *CEO Confidence Down* (as shown above). Non-executive employees ought to react asymmetrically to the CEO's option exercise behavior because negative signals from her personal investment decisions may be noisier than positive ones. The decision to exercise vested options could be motivated by personal circumstances instead of a signaling intent. For example, Liu and Yermack (2012) document that S&P500 CEOs purchase personal real estate using options and equity. Instead, we observe evidence that is consistent with the CEO's confidence signaling channel.

4 Additional Tests

This section presents our additional tests. First, we examine whether stakeholders are influenced by CEO actions or their words. Next, we address the relative size/bargaining power bias (i.e. large customer-small supplier pair) of the customer-supplier dataset by investigating whether our results differ according to the size of sample firms. Lastly, we use a propensity score matched subsample to check that our results are robust.

4.1 Media Measure of Overconfidence

An alternative behavioral story for our results could be that our option-based measures are capturing overconfidence of CEOs. As an artefact of overconfidence, these CEOs may also be highly charismatic and hence more likely to charm suppliers into long-term contractual commitments. To support the claim that our results are driven by a rational personal investment signaling mechanism, we employ *CEO Media Positivity* as a news-based measure of CEO overconfidence. This measure is constructed based on the relative frequency of positive statements to negative states made by the CEO (Banerjee, Humphrey-Jenner, and Nanda, 2015). Since this measure is independent of the CEOs'

option exercise behavior, it does not constitute a personal investment signal. Instead, *CEO Media Positivity* is likely to measure the behavioral bias of CEOs.

[Insert Table 7]

We add *CEO Media Positivity* and pit it against the CEO personal investment measures in Table 7. We then repeat the tests using *Number of Suppliers* and *Non-Executive Employees Moneyness* as dependent variables. We largely find that *CEO Media Positivity* has weak predictive power while the CEO personal investment measures retain their explanatory powers. In fact, in Column (1), *CEO Media Positivity* has the opposite sign to CEO Confidence, suggesting that *CEO Media Positivity* decreases the size of the firm's supplier network, albeit weakly at the 10% level of significance. Overall, the finding seems to suggest that stakeholders take cues from the CEO's personal investment actions in the firms, and not from their overconfidence that is exuded through words. While this does not rule out the possibility that our CEO personal investment measures are encapsulating some form of overconfidence or managerial hubris, our evidence suggests that there may also be room for a rational signaling explanation.

4.2 Relative Size/Bargaining Power Bias

To address the relative size/bargaining power bias of the dataset, we create a *Large Firm* indicator that equates to unity if the firm's *Total Assets* is above the industry-year median value, and equates to zero otherwise. We then interact the *Large Firm* Indicator with our *CEO Confidence Up* and *CEO Confidence Down* indicators and repeat the previous analyses using *Change in Number of Suppliers* and *Change in Supplier R&D* as dependent variables, respectively. Thus, the loading on the interaction term *CEO Confidence UP*Large Firm* picks up the incremental effect of the CEOs' personal investment signal for large (customer) firms on supplier commitment. A positive and

significant loading on the interaction term would suggest that large firms can incrementally attract supplier commitment relative to small firms, in support of the relative size/bargaining power bias of the dataset. On the other hand, an insignificant loading on the interaction term would indicate no differential effects of CEOs' personal investment on supplier commitment between large and small firms.

[Insert Table 8]

Table 8 presents our results using OLS regressions. Across Column (1)-(4), the loadings on *CEO Confidence Up*Large Firm* are insignificant. Similarly, the loadings on *CEO Confidence Down*Large Firm* are largely insignificant (except for marginal significance in Column (2)). Taken together, we conclude that the asymmetric size/bargaining power between our sample firms and their suppliers do not drive our results.

4.3 Propensity Score Matching

In this section, we repeat our previous analyses using a propensity score-matched subsample. In specifications where the dependent variable is *Suppliers Increase,* we define the treatment variable to be *CEO Confidence Up* while in specifications where the dependent variable is *Suppliers Decrease,* we define the treatment variable to be *CEO Confidence Down.* Using propensity score matching, we match each treated observation to control observation(s) that have both *CEO Confidence Up* and *CEO Confidence Down* equal to zero. We also require that the control observation(s) be in the same exact-match dimension (i.e. by industry-year) with the treated observation before propensity score matching is performed. We perform 1-to-1 matches with the caliper width set at 0.01. This restriction, while substantially reduces sample size, will ensure the most stringently-matched sample. We then relax the restriction by matching each treated observation with

up to 5 control observations with the caliper width set at 0.05. Table 9 presents the results.

[Insert Table 9]

In Column (1) and (2) where 1-to-1 matches are performed, *CEO Confidence Up* and *CEO Confidence Down* increase the likelihood of firms experiencing expansion and contraction, respectively, of their supplier network. In Appendix 2 where we present the propensity score matching diagnostics, we observe that the firms in both the treated and control samples are well-matched on all observable characteristics. In sum, our previous findings remain robust despite the small sample size that remains.

5 Conclusion

This paper tests the hypothesis that overconfident CEOs are good leaders. Our study suggests that CEO overconfidence adds value to the firm by attracting suppliers onboard the firm and inducing greater supplier RSI, particularly for firms in durable goods manufacturing industries and high relationship-specificity industries. CEO overconfidence further induces employees to commit their personal wealth in the firm which serves as a strong indication of the belief of employees in the firm's future prospects. Our results reveal an under-explored bright side of CEO overconfidence. While overconfidence is often perceived as a negative trait, future research may explore the potential bright side of CEO overconfidence.

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Appendix 1: Variable Definitions

Variable	Definition	Data Source
CEO Confidence	Average value of the CEO's options scaled by the average strike price (Malmendier et al., 2011). The numerator is the value of the CEO's vested and unexercised options (EXECUCOMP: opt unex exer val) scaled by the number of such options (EXECUCOMP: opt unex exer num). The denominator is the difference between the firm's stock price at the end of the fiscal year (CRSP: prcc f) and the numerator.	Execucomp, CRSP
CEO Confidence Up	Variable equates to unity if CEO Confidence in the current year is in the top quartile of the sample and if CEO Confidence in the previous year is not in the top quartile of the sample, and equates to 0 otherwise.	Execucomp, CRSP
CEO Confidence Down	Variable equates to unity if CEO Confidence in the current year is not in the top quartile of the sample and if CEO Confidence in the previous year is in the top quartile of the sample, and equates to 0 otherwise.	Execucomp, CRSP
CEO Media Positivity	Variable equals the relative frequency of positive media statements to negative media statements made by the CEO (Hirshleifer, Low & Teoh, 2012).	Banerjee, Humphrey-Jenner, and Nanda (2015)
Industry Relationship-Specificity	Proportion of inputs used in I-O industry which are neither sold on organized exchanges nor reference priced. Readers may refer to Nunn (2007) for more details.	Nunn (2007)
CEO Share Ownership	Variable equals unity if fraction of shares awarded to CEO in total compensation is in the top quartile of the year, and equals 0 otherwise.	Execucomp
Total Assets	Total Assets of firm	Compustat
Log (1 + Total Assets)	Logarithm of Total Assets of firm	Compustat
Leverage	Sum of long-term debt and short-term debt, scaled by total assets.	Compustat
Market-to-Book Ratio	Ratio of market value of equity to book value of equity.	Compustat
Return on Assets	Ratio of net income to assets.	Compustat
Sales Growth	Difference between sales in year (t) and year (t-1), scaled by sales in year (t-1).	Compustat
Capital Expenditure	Capital expenditure of firm, scaled by total assets.	Compustat
Research & Development	R&D expenses of customer firm, scaled by total assets. Where R&D expenses are missing, they are set to 0.	Compustat

Appendix 1 (Continued): Variable Definitions

Variable	Definition	Data Source
Missing R&D Indicator	Dummy variable which equates to unity if R&D expenses are missing in the Compustat database, and equates to 0 otherwise.	Compustat
Cash	Cash holdings of firm, scaled by total assets.	Compustat
ROA Volatility	Standard deviation of ROA over past 36 months.	Compustat
24-month BHR	Buy-and-hold returns of firm stock over past 24 months	CRSP
Suppliers Increase	Variable equates to unity if the number of dependent suppliers in year (t) is higher than the number of dependent suppliers in year (t-1), and equates to 0 otherwise.	Compustat
Suppliers Decrease	Variable equates to unity if the number of dependent suppliers in year (t) is lower than the number of dependent suppliers in year (t-1), and equates to 0 otherwise.	Compustat
Start of Supplier Network	Variable equates to unity if firm has at least one dependent supplier in year (t) and has no dependent supplier in year (t-1), and equates to 0 otherwise.	Compustat
End of Supplier Network	Variable equates to unity if firm has no dependent supplier in year (t) and has at least one dependent supplier in year (t-1), and equates to 0 otherwise.	Compustat
Supplier R&D	For each supplier of a given customer, the R&D intensity of the supplier equates to its R&D expense (missing values are set to 0), scaled by total assets. Supplier R&D is the customer firm's weighted average supplier R&D intensities. The weight allocated to a supplier is computed by supplier-to-customer sales scaled by the sum of dependent-supplier sales to the customer.	Compustat
Change in Supplier R&D	Year-on-year change in Supplier R&D (see above) of sample firms.	Compustat
NEE Moneyness	Average value of non-executive employees' options scaled by average strike price. The value of non-executive employees' options is computed by subtracting the value of the top-5 executives' options (EXECUCOMP) from the value of options granted to all employees (IRRC). The value of non-executive employees' options is then scaled by the number of non-executive employees to obtain the numerator of this variable. The denominator is the difference between the firm's stock price at the end of the fiscal year and the numerator.	Execucomp, IRRC
Change in NEE Moneyness	Year-on-year change in NEE Moneyness	Execucomp, IRRC

Appendix 1 (Continued): Variable Definitions

Variable	Definition	Data Source
Durable Firm	Industries whose SIC codes are between 3400 to 3999	Titman and Wessels (1988)
Non-Durable Firm	Industries whose SIC codes are between 2000 to 3399	Titman and Wessels (1988)
High RSI	Industries whose Industry Relationship-Specificity (see above) values are higher than the sample median.	Nunn (2007)
Low RSI	Industries whose Industry Relationship-Specificity (see above) values are lower than the sample median.	Nunn (2007)
Large Firm	Dummy variable which equates to unity if Total Assets (see above) is greater than the industry-year median, and equates to 0 otherwise. The industry-year median is computed from the sample where there is non-missing Change in Supplier R&D (see above).	Compustat

Appendix 2: Propensity Score Matching Balance Diagnostics

Table 9 Column (1)	**Treatment Mean**	**Control Mean**	**t-stat of Difference in Means**	**p-value**
CEO Share Ownership	0.242	0.238	0.19	0.85
Log (1 + Total Assets)	6.919	7.139	-2.67	0.01
Leverage	0.198	0.202	-0.34	0.74
Market-to-Book Ratio	3.222	3.246	-0.16	0.87
Return on Assets	0.064	0.067	-0.60	0.55
Sales Growth	0.133	0.153	-1.32	0.19
Capital Expenditure	0.069	0.066	0.62	0.54
Research & Development	0.051	0.050	0.02	0.99
Missing R&D Indicator	0.381	0.392	-0.39	0.69
Log (1 + CEO Tenure)	0.983	0.975	0.45	0.66
Cash	0.144	0.150	-0.60	0.55
ROA Volatility	0.055	0.054	0.47	0.64
24-month BHR	0.367	0.364	0.09	0.93
Num. Suppliers in Previous Year	0.837	0.795	0.18	0.85

Table 9 Column (2)	**Treatment Mean**	**Control Mean**	**t-stat of Difference in Means**	**p-value**
CEO Share Ownership	0.258	0.252	0.32	0.75
Log (1 + Total Assets)	6.904	7.042	-1.98	0.05
Leverage	0.221	0.210	1.21	0.23
Market-to-Book Ratio	3.790	3.664	0.92	0.36
Return on Assets	0.066	0.074	-1.55	0.12
Sales Growth	0.183	0.177	0.48	0.63
Capital Expenditure	0.075	0.071	0.93	0.35
Research & Development	0.054	0.054	0.04	0.97
Missing R&D Indicator	0.388	0.405	-0.71	0.48
Log (1 + CEO Tenure)	0.972	0.977	-0.30	0.76
Cash	0.147	0.143	0.51	0.61
ROA Volatility	0.060	0.056	1.04	0.30
24-month BHR	0.043	0.044	-0.03	0.98
Num. Suppliers in Previous Year	0.864	0.825	0.19	0.85

Appendix 2 (Continued): Propensity Score Matching Balance Diagnostics

Table 9 Column (3)	**Treatment Mean**	**Control Mean**	**t-stat of Difference in Means**	**p-value**
CEO Share Ownership	0.251	0.274	-0.87	0.39
Log (1 + Total Assets)	6.928	7.021	-0.99	0.32
Leverage	0.208	0.211	-0.24	0.81
Market-to-Book Ratio	3.116	3.170	-0.33	0.74
Return on Assets	0.060	0.063	-0.35	0.72
Sales Growth	0.140	0.169	-1.81	0.07
Capital Expenditure	0.065	0.066	-0.17	0.87
Research & Development	0.049	0.049	-0.05	0.96
Missing R&D Indicator	0.410	0.461	-1.63	0.10
Log (1 + CEO Tenure)	0.984	0.962	0.98	0.33
Cash	0.137	0.145	-0.82	0.41
ROA Volatility	0.053	0.053	0.00	1.00
24-month BHR	0.456	0.562	-3.55	0.00
Num. Suppliers in Previous Year	0.762	0.761	0.00	1.00

Table 9 Column (4)	**Treatment Mean**	**Control Mean**	**t-stat of Difference in Means**	**p-value**
CEO Share Ownership	0.277	0.297	-0.80	0.43
Log (1 + Total Assets)	6.917	6.932	-0.19	0.85
Leverage	0.220	0.202	1.48	0.14
Market-to-Book Ratio	4.050	4.252	-1.13	0.26
Return on Assets	0.079	0.093	-2.22	0.03
Sales Growth	0.212	0.243	-1.82	0.07
Capital Expenditure	0.080	0.085	-1.19	0.23
Research & Development	0.055	0.063	-1.82	0.07
Missing R&D Indicator	0.409	0.421	-0.46	0.65
Log (1 + CEO Tenure)	0.972	0.979	-0.35	0.73
Cash	0.159	0.167	-0.77	0.44
ROA Volatility	0.061	0.060	0.35	0.73
24-month BHR	-0.012	-0.063	1.46	0.14
Num. Suppliers in Previous Year	0.839	1.294	-1.46	0.14

Table 1: Summary Statistics

Panel A reports the summary statistics for the full sample and Compustat firms. In Panel B, we partition sample firms into two subsamples – firms with and without dependent supplier networks, and report the variable means in each subsample. All variables are defined in Appendix 1. Financial variables are winsorized at the l and 99 percentiles to reduce the influence of outliers.

Panel A. Summary Statistics for Sample Firms and Compustat Firms

	Sample Firms								Compustat Firms	
	N	**Mean**	**S.D.**	**P10**	**P25**	**P50**	**P75**	**P90**	**Mean**	**P50**
CEO Confidence	21294	0.315	0.266	0	0.061	0.278	0.512	0.704	-	-
CEO Confidence Up	18639	0.067	0.250	0	0	0	0	0	-	-
CEO Confidence Down	18639	0.081	0.273	0	0	0	0	0	-	-
Industry Relationship-Specificity	12788	0.636	0.226	0.311	0.503	0.694	0.819	0.931	-	-
CEO Media Positivity	2757	3.057	2.326	0	1.100	2.800	4.800	6.300	-	-
CEO Share Ownership	22213	0.250	0.433	0	0	0	0	1	-	-
Total Assets	24289	3808.557	8510.969	159.486	353.448	948.521	2952.000	9187.963	1376.907	83.354
Log (1 + Total Assets)	24289	6.989	1.546	5.072	5.868	6.855	7.990	9.126	4.542	4.435
Leverage	24190	0.236	0.224	0	0.041	0.202	0.349	0.504	0.391	0.187
Market-to-Book Ratio	23518	3.357	3.195	1.064	1.573	2.396	3.836	6.443	2.587	1.778
Return on Assets	24278	0.053	0.121	-0.064	0.016	0.061	0.108	0.171	-0.371	0.012
Sales Growth	24227	0.146	0.310	-0.116	0.004	0.092	0.216	0.435	0.316	0.084
Capital Expenditure	24099	0.070	0.075	0.013	0.025	0.046	0.085	0.150	0.091	0.039
Research & Development	24289	0.043	0.072	0	0	0.007	0.057	0.138	0.076	0
Missing R&D Indicator	24385	0.448	0.497	0	0	0	1	1	0.557	1
Cash	24032	0.130	0.161	0.009	0.025	0.072	0.172	0.318	0.256	0.081
ROA Volatility	23923	0.060	0.080	0.007	0.015	0.032	0.070	0.140	0.410	0.062
24-month BHR	20680	0.111	0.608	-0.644	-0.203	0.154	0.471	0.807	0.321	0.070
CEO Tenure	24374	1.690	0.891	0.693	1.099	1.792	2.303	2.833	-	-
Log (1 + CEO Tenure)	24374	0.923	0.387	0.527	0.741	1.027	1.195	1.344	-	-
Suppliers Increase	24385	0.062	0.241	0	0	0	0	0	-	-
Suppliers Decrease	24385	0.157	0.364	0	0	0	0	1	-	-
Change in Number of Suppliers	22220	-0.022	0.916	0	0	0	0	0	-	-
Start of Supplier Network	22220	0.033	0.178	0	0	0	0	0	-	-
End of Supplier Network	22220	0.039	0.193	0	0	0	0	0	-	-
Change in Supplier R&D	3489	-0.004	0.114	-0.063	-0.007	0	0.006	0.050	-	-
NEE Moneyness	10189	1.539	1.041	0.668	0.950	1.278	1.748	2.618	-	-
Change in NEE Moneyness	8618	-0.185	0.901	-1.014	-0.381	-0.027	0.213	0.536	-	-

Table 1: Summary Statistics

Panel B. Summary Statistics for Customer and Non-Customer Firms

	Number of Suppliers = 0		Number of Suppliers > 0			
	N(1)	**Mean(1)**	**N(2)**	**Mean(2)**	**Difference***	**p-Value**
CEO Confidence	17379	0.312	3915	0.326	0.014	0.003
CEO Confidence Up	15098	0.068	3541	0.062	-0.005	0.240
CEO Confidence Down	15098	0.082	3541	0.077	-0.004	0.393
Industry Relationship-Specificity	10609	0.633	2179	0.647	0.014	0.013
CEO Media Positivity	2282	3.087	475	2.912	-0.175	0.129
CEO Share Ownership	18126	0.255	4087	0.226	-0.028	0.000
Total Assets	19941	2200.689	4348	11182.640	8981.951	0.000
Log (1 + Total Assets)	19941	6.685	4348	8.383	1.698	0.000
Leverage	19862	0.232	4328	0.251	0.019	0.000
Market-to-Book Ratio	19262	3.231	4256	3.924	0.693	0.000
Return on Assets	19930	0.050	4348	0.064	0.014	0.000
Sales Growth	19882	0.147	4345	0.144	-0.002	0.626
Capital Expenditure	19789	0.069	4310	0.075	0.007	0.000
Research & Development	19941	0.042	4348	0.048	0.006	0.000
Missing R&D Indicator	20023	0.459	4362	0.398	-0.061	0.000
CEO Tenure	20015	1.701	4359	1.638	-0.062	0.000
Log (1 + CEO Tenure)	20015	0.927	4359	0.903	-0.024	0.000
Cash	19775	0.136	4257	0.103	-0.033	0.000
ROA Volatility	19618	0.062	4305	0.049	-0.013	0.000
24-month BHR	16997	0.102	3683	0.155	0.053	0.000

* Difference = Mean(2) – Mean(1)

Table 2: The Effect of CEO Confidence on the Number of Suppliers

This table presents results from a conditional logit model on the effect of CEO confidence on the change in the number of suppliers. The dependent variables in Table 2 are the *Suppliers Increase* (*Decrease*) indicators in year t. *Suppliers Increase* (*Decrease*) is a dummy variable which equates to unity if a firm has more (less) dependent suppliers in year t than it has in t-1, and equates to zero otherwise. We define dependent suppliers according to SFAS 14. The key independent variable is the *CEO Confidence Up* (*Down*) indicator. *CEO Confidence Up* (*Down*) is a dummy variable which equates to unity if *CEO Confidence* in year t is (is not) in the top quartile of the sample and *CEO Confidence* in t-1 is not (is) in the top quartile of the sample, and equates to zero otherwise. *CEO Confidence* is per-option value of CEO's vested and unexercised options scaled by average strike price. All other variables are described in Appendix 1. Robust standard errors are reported in parentheses. All standard errors are clustered at the 2-digit SIC industry level. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) Suppliers Increase	(2) Suppliers Increase	(3) Suppliers Decrease	(4) Suppliers Decrease
CEO Confidence Up	0.418***	0.323***	0.215	0.164
	(0.104)	(0.102)	(0.136)	(0.132)
CEO Confidence Down	-0.030	0.144	0.362***	0.279**
	(0.160)	(0.140)	(0.126)	(0.118)
CEO Share Ownership	0.100	0.137	-0.116	0.160
	(0.117)	(0.186)	(0.101)	(0.141)
Log (1 + Total Assets)	0.801***	-0.064	0.704***	0.257***
	(0.041)	(0.067)	(0.102)	(0.096)
Leverage	-0.329	0.137	-0.258	0.364
	(0.215)	(0.226)	(0.225)	(0.405)
Market-to-Book Ratio	0.038**	0.008	0.026***	0.004
	(0.019)	(0.010)	(0.010)	(0.017)
Return on Assets	0.226	0.646	-0.745*	-0.859*
	(0.430)	(0.618)	(0.437)	(0.462)
Sales Growth	0.277*	0.335*	-0.712***	-0.323
	(0.143)	(0.183)	(0.129)	(0.210)
Capital Expenditure	1.187	1.770**	1.517	0.278
	(0.978)	(0.719)	(0.956)	(1.277)
Research & Development	5.105***	3.781***	5.018***	0.542
	(0.626)	(0.849)	(0.656)	(1.474)
Missing R&D Indicator	0.131	0.218	0.082	-0.014
	(0.148)	(0.507)	(0.162)	(0.377)
Log (1 + CEO Tenure)	-0.004	-0.010	0.101	0.050
	(0.112)	(0.103)	(0.124)	(0.151)
Cash	0.109	-0.714*	-0.332	-0.339
	(0.325)	(0.375)	(0.366)	(0.697)
ROA Volatility	1.130**	0.532	-0.392	-1.896***
	(0.456)	(0.617)	(0.873)	(0.481)
24-month BHR	0.292***	0.208***	-0.225***	-0.173**
	(0.088)	(0.076)	(0.073)	(0.072)
Num. Suppliers in Previous Year	-0.015**	-0.128***	0.057	0.549***
	(0.007)	(0.031)	(0.064)	(0.175)
Observations	11,603	5,621	12,380	5,926
INDUSTRY-YEAR strata	Yes	No	Yes	No
FIRM strata	No	Yes	No	Yes

Table 3: The Effect of CEO Confidence on the Start/End of Supplier Network

This table presents results from a conditional logit model on the effect of CEO Confidence on the start/end of supplier network. The dependent variables are the *Start* (*End*) *of Supplier Network* indicators in year t. *Start* (*End*) *of Supplier Network* is a dummy variable which equates to unity when the firm has at least one (no) dependent supplier in year t and none (at least one dependent supplier) in t-1, and equates to zero otherwise. We define dependent suppliers according to SFAS 14. The key independent variables are the *CEO Confidence Up* (*Down*) indicators. *CEO Confidence Up* (*Down*) is a dummy variable which equates to unity if *CEO Confidence* in year t is (is not) in the top quartile of the sample and *CEO Confidence* in t-1 is not (is) in the top quartile of the sample, and equates to zero otherwise. *CEO Confidence* is per-option value of CEO's vested and unexercised options scaled by average strike price. All other variables are described in Appendix 1. Robust standard errors are reported in parentheses. All standard errors are clustered at the 2-digit SIC industry level. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) Start of Supplier Network	(2) Start of Supplier Network	(3) End of Supplier Network	(4) End of Supplier Network
CEO Confidence Up	0.291**	0.262*	0.147	0.170
	(0.126)	(0.136)	(0.171)	(0.163)
CEO Confidence Down	-0.187	-0.075	0.375**	0.322**
	(0.177)	(0.174)	(0.148)	(0.129)
CEO Share Ownership	-0.012	0.117	-0.025	0.099
	(0.107)	(0.243)	(0.095)	(0.154)
Log (1 + Total Assets)	0.326***	-0.176**	0.452***	0.327***
	(0.043)	(0.078)	(0.034)	(0.109)
Leverage	0.200	0.231	0.059	0.766**
	(0.292)	(0.295)	(0.301)	(0.342)
Market-to-Book Ratio	0.014	0.030**	0.017	-0.003
	(0.022)	(0.014)	(0.015)	(0.024)
Return on Assets	0.044	0.302	-1.468**	-1.525**
	(0.491)	(0.688)	(0.583)	(0.641)
Sales Growth	0.385**	0.532**	-0.407**	-0.143
	(0.196)	(0.251)	(0.161)	(0.166)
Capital Expenditure	0.020	-0.612	1.058	0.649
	(1.705)	(1.394)	(1.096)	(1.519)
Research & Development	2.965***	1.703	2.730**	0.457
	(0.519)	(1.037)	(1.298)	(1.944)
Missing R&D Indicator	-0.153	0.520	-0.084	0.171
	(0.188)	(0.463)	(0.164)	(0.413)
Log (1 + CEO Tenure)	0.097	0.138	0.136	0.052
	(0.152)	(0.150)	(0.167)	(0.238)
Cash	-0.299	-0.538	0.208	0.308
	(0.228)	(0.487)	(0.432)	(0.695)
ROA Volatility	1.079**	-0.343	-0.710	-1.569*
	(0.499)	(0.781)	(0.723)	(0.866)
24-month BHR	0.329***	0.152	-0.152**	-0.097
	(0.115)	(0.096)	(0.068)	(0.073)
Num. Suppliers in Previous Year	-	-	-0.020*	0.437***
			(0.010)	(0.102)
Observations	9,681	4,347	10,612	5,228
INDUSTRY-YEAR strata	Yes	No	Yes	No
FIRM strata	No	Yes	No	Yes

Table 4: The Effect of CEO Confidence on Suppliers in High RSI Industries: Manufacturing Industries

This table includes only manufacturing firms (SIC: 2000-3999) in our sample and presents results from a conditional logit model. The dependent variables in each panel are *Suppliers Increase* and *Start of Supplier Network*. The key independent variables are *CEO Confidence Up* and *CEO Confidence Down* indicators. The dependent variables and key independent variables are defined in Table 2 and 3, and in Appendix 1. In Panel A, we split the manufacturing firms into (i) durable (SIC: 3400-3999), and (ii) non-durable (SIC: 2000-3399) manufacturing industry types following Titman and Wessels (1988). In Panel B, we split the manufacturing firms by industry-level relationship-specificity according to the year 1997 contract intensity variable from Nunn (2007). An industry is classified as *High* (*Low*) *RSI* if its industry contract intensity is above (below) the sample median. All other variables are described in Appendix 1. Robust standard errors are reported in parentheses and clustered at the 2-digit SIC industry level. All regressions include firm stratification. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

Panel A. Durable/Non-Durable Manufacturing Industries Subsample Analysis

	(1) Suppliers Increase	(2) Suppliers Increase	(3) Start of Supplier Network	(4) Start of Supplier Network
Industry Type	Durable	Non-Durable	Durable	Non-Durable
CEO Confidence Up	0.425**	0.253	0.485***	-0.161
	(0.211)	(0.200)	(0.166)	(0.239)
CEO Confidence Down	0.094	0.427	-0.146	0.143
	(0.139)	(0.374)	(0.343)	(0.328)
CEO Share Ownership	0.248	-0.328	0.445	-0.489
	(0.324)	(0.611)	(0.363)	(0.569)
Log (1 + Total Assets)	-0.095	-0.133	-0.183***	-0.198
	(0.132)	(0.121)	(0.058)	(0.139)
Leverage	0.445	0.246	0.410	0.707
	(0.288)	(0.397)	(0.474)	(0.624)
Market-to-Book Ratio	-0.014	0.009	0.029***	0.037
	(0.012)	(0.015)	(0.010)	(0.026)
Return on Assets	-0.730	2.404***	-0.021	0.336
	(0.571)	(0.900)	(0.433)	(1.200)
Sales Growth	0.657*	0.228	0.314	0.516
	(0.358)	(0.188)	(0.578)	(0.342)
Capital Expenditure	1.472	2.003	-2.177	0.366
	(1.119)	(1.909)	(2.130)	(1.346)
Research & Development	3.064***	6.123***	3.398**	0.844
	(1.155)	(1.670)	(1.539)	(3.143)
Missing R&D Indicator	-0.160	0.048	-0.378	0.604
	(2.394)	(0.414)	(2.518)	(0.571)
Log (1 + CEO Tenure)	-0.007	-0.266**	0.362	0.033
	(0.160)	(0.110)	(0.243)	(0.246)
Cash	-0.324	-1.411**	-0.845	-0.418
	(0.783)	(0.717)	(0.807)	(0.566)
ROA Volatility	0.575	0.148	-0.687	0.019
	(0.990)	(1.268)	(1.572)	(1.378)
24-month BHR	0.429**	0.286*	0.314	0.254
	(0.192)	(0.167)	(0.212)	(0.215)
Num. Suppliers in Previous Year	-0.124**	-0.295***	-	-
	(0.051)	(0.052)		
Observations	1,891	1,537	1,476	1,145

Table 4 (Continued)

Panel B. High/Low RSI Manufacturing Industries Subsample Analysis

	(1) Suppliers Increase	(2) Suppliers Increase	(3) Start of Supplier Network	(4) Start Of Supplier Network
Relationship-Specificity	High	Low	High	Low
CEO Confidence Up	0.309***	0.293	0.427***	-0.110
	(0.110)	(0.303)	(0.111)	(0.337)
CEO Confidence Down	0.194	0.525	-0.064	0.209
	(0.178)	(0.436)	(0.395)	(0.334)
CEO Share Ownership	0.244	-0.268	0.497	-0.472
	(0.372)	(0.603)	(0.418)	(0.499)
Log (1 + Total Assets)	-0.112	-0.026	-0.225***	-0.185*
	(0.105)	(0.114)	(0.058)	(0.098)
Leverage	0.192	0.351	0.331	0.526
	(0.256)	(0.425)	(0.468)	(0.701)
Market-to-Book Ratio	-0.015	0.008	0.020	0.021
	(0.011)	(0.008)	(0.014)	(0.022)
Return on Assets	-0.478	2.522***	0.569	0.440
	(0.887)	(0.774)	(0.798)	(1.098)
Sales Growth	0.755**	0.050	0.440	0.265
	(0.358)	(0.168)	(0.569)	(0.339)
Capital Expenditure	1.134	3.991	-3.358**	2.068
	(1.138)	(2.535)	(1.421)	(1.511)
Research & Development	2.895***	6.664***	3.248***	2.042
	(0.523)	(1.428)	(0.939)	(2.401)
Missing R&D Indicator	-0.032	-0.735	-0.148	-0.147
	(1.348)	(0.749)	(1.398)	(1.310)
Log (1 + CEO Tenure)	-0.192	-0.229*	0.050	0.065
	(0.190)	(0.134)	(0.300)	(0.320)
Cash	-0.608	-1.420***	-1.051	-0.413
	(0.800)	(0.518)	(0.746)	(0.613)
ROA Volatility	-0.125	-0.022	-0.880	-0.008
	(1.156)	(0.984)	(1.421)	(1.067)
24-month BHR	0.202	0.515***	0.147	0.427***
	(0.152)	(0.122)	(0.168)	(0.151)
Num. Suppliers in Previous Year	-0.159*	-0.349***	-	-
	(0.093)	(0.065)		
Observations	1,657	1,275	1,300	992

Table 5: The Effect of CEO Confidence on Supplier R&D

This table presents results from an OLS model on the effect of CEO Confidence on supplier R&D. The dependent variable is *Change in Supplier R&D*. In each fiscal year, we compute a supplier's R&D intensity as the ratio of its R&D expense (missing values are set to 0) to its total assets. Since each sample firm may have multiple suppliers, we define the firm's *Supplier R&D* as the weighted-average supplier R&D intensities. The weight allocated to a supplier is computed by supplier-to-customer sales scaled by the sum of dependent-supplier sales to the customer. *Change in Supplier R&D* is the year-on-year change in *Supplier R&D* of sample firms. The key independent variables are *CEO Confidence Up* and *CEO Confidence Down* indicators which are defined in Table 2 and in Appendix 1. All other variables are also described in Appendix 1. Robust standard errors are reported in parentheses and clustered at the 2-digit SIC industry level. Where multiple fixed effects are deployed, singleton observations are eliminated from the sample. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) Change in Supplier R&D	(2) Change in Supplier R&D	(3) Change in Supplier R&D	(4) Change in Supplier R&D
CEO Confidence Up	0.023***	0.012***	0.016***	0.016***
	(0.008)	(0.004)	(0.005)	(0.005)
CEO Confidence Down	0.007	0.009	0.006	0.008
	(0.010)	(0.009)	(0.010)	(0.010)
CEO Share Ownership	-0.010**	-0.008	-0.009**	-0.008
	(0.005)	(0.005)	(0.004)	(0.005)
Log (1 + Total Assets)	0.004	0.010**	0.004	0.017**
	(0.003)	(0.004)	(0.002)	(0.008)
Leverage	-0.018	-0.046***	-0.023	-0.051***
	(0.017)	(0.014)	(0.015)	(0.016)
Market-to-Book Ratio	-0.001	-0.002	-0.000	-0.002
	(0.001)	(0.002)	(0.001)	(0.002)
Return on Assets	0.028	0.006	0.013	0.018
	(0.047)	(0.043)	(0.048)	(0.043)
Sales Growth	-0.013	0.009	-0.010	0.015
	(0.013)	(0.019)	(0.009)	(0.019)
Capital Expenditure	0.013	0.021	0.004	0.008
	(0.031)	(0.054)	(0.026)	(0.048)
Research & Development	-0.117**	-0.283*	-0.108***	-0.268
	(0.045)	(0.161)	(0.026)	(0.160)
Missing R&D Indicator	0.005	0.054	0.006	0.056
	(0.005)	(0.042)	(0.006)	(0.043)
Log (1 + CEO Tenure)	0.000	-0.003	-0.003	-0.003
	(0.004)	(0.006)	(0.006)	(0.005)
Cash	0.065***	-0.017	0.045**	-0.014
	(0.019)	(0.023)	(0.018)	(0.022)
ROA Volatility	-0.056	-0.091***	-0.059**	-0.091**
	(0.036)	(0.030)	(0.026)	(0.034)
24-month BHR	-0.004	0.003	-0.001	0.000
	(0.006)	(0.005)	(0.006)	(0.006)
Num. Suppliers in Previous Year	-0.000	-0.001	-0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.001)
Observations	2,259	2,312	2,408	2,312
INDUSTRY fixed effects	No	No	Yes	No
YEAR fixed effects	No	No	Yes	Yes
INDUSTRY-YEAR fixed effects	Yes	No	No	No
FIRM fixed effects	No	Yes	No	Yes

Table 6: The Effect of CEO Confidence on Non-Executive Employees' Options

This table presents results from an OLS model. The dependent variable in Columns (1) and (2) is *NEE Moneyness*. The value of non-executive employees' (NEE) options is obtained by subtracting the value of options held by top-5 executives in Execucomp from the value of options held by all employees in IRRC. *NEE Moneyness* is computed by scaling the average option value held by non-executive employees by the firm year stock price. The dependent variable in Columns (3) and (4) is *Change in NEE Moneyness*. *Change in NEE Moneyness* is the year-on-year change in *NEE Moneyness*. The key independent variable in Column (1) and (2) is *CEO Confidence*. The key independent variables in Column (3) and (4) are *CEO Confidence Up* and *CEO Confidence Down* indicators. All key variables are defined in Table 2 and in Appendix 1. All other variables are described in Appendix 1. Robust standard errors are reported in parentheses and clustered at the 2-digit SIC industry level, and at the year level. Where multiple fixed effects are deployed, singleton observations are eliminated from the sample. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) NEE Moneyness	(2) NEE Moneyness	(3) Change in NEE Moneyness	(4) Change in NEE Moneyness
CEO Confidence	1.433***	1.301***		
	(0.062)	(0.059)		
CEO Confidence Up			0.468**	0.360**
			(0.155)	(0.111)
CEO Confidence Down			-0.442***	-0.347***
			(0.120)	(0.098)
CEO Share Ownership	0.080*	0.065	-0.064**	-0.118*
	(0.036)	(0.061)	(0.026)	(0.055)
Log (1 + Total Assets)	0.004	-0.508***	-0.003	-0.042
	(0.018)	(0.098)	(0.024)	(0.135)
Leverage	-0.093	0.394*	0.135*	0.255
	(0.059)	(0.181)	(0.068)	(0.221)
Market-to-Book Ratio	-0.004	-0.051***	-0.086***	-0.142***
	(0.008)	(0.013)	(0.018)	(0.032)
Return on Assets	0.357*	0.112	-0.610*	-0.574*
	(0.185)	(0.149)	(0.327)	(0.285)
Sales Growth	-0.036	0.043	-0.448***	-0.254*
	(0.057)	(0.057)	(0.095)	(0.115)
Capital Expenditure	0.322*	-0.251	-0.527	-0.529
	(0.161)	(0.327)	(0.319)	(0.490)
Research & Development	0.484	0.112	0.768	0.691
	(0.365)	(0.420)	(0.444)	(0.986)
Missing R&D Indicator	0.004	-0.175*	0.007	0.030
	(0.039)	(0.085)	(0.030)	(0.109)
Log (1 + CEO Tenure)	-0.010	-0.039*	0.013	-0.022
	(0.013)	(0.018)	(0.037)	(0.074)
Cash	-0.157*	-0.180**	-0.745***	-1.127***
	(0.086)	(0.068)	(0.225)	(0.219)
ROA Volatility	-0.022	-0.456**	0.119	0.143
	(0.226)	(0.177)	(0.302)	(0.316)
24-month BHR	0.573***	0.488***	0.117	0.154**
	(0.068)	(0.049)	(0.070)	(0.064)
Observations	7,575	7,426	7,454	7,306
INDUSTRY fixed effects	Yes	No	Yes	No
YEAR fixed effects	Yes	No	Yes	No
INDUSTRY-YEAR fixed effects	No	Yes	No	Yes
FIRM fixed effects	No	Yes	No	Yes

Table 7: Distinguishing Cheap Talk from Signals – CEO Media Positivity

This table presents results from a panel Tobit (Honoré, 1992) model in Column (1) and (2) where the dependent variable is *Number of Suppliers*. In Column (3) and (4), we present results from an OLS model where the dependent variable is *NEE Moneyness* which is defined in Table 6 and in Appendix 1. The key independent variables are *CEO Media Positivity* and *CEO Confidence*. *CEO Media Positivity* is the relative frequency of positive media statements to negative media statements made by the CEO (Banerjee, Humphrey-Jenner, and Nanda, 2015). All other variables are described in Appendix 1. Observations with missing *CEO Media Positivity* are dropped from the sample. Robust standard errors are reported in parentheses. Standard errors in Columns (3) and (4) are clustered at the 2-digit SIC industry level, and at the year level. Where multiple fixed effects are deployed, singleton observations are eliminated from the sample. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) Number of Suppliers	(2) Number of Suppliers	(3) NEE Moneyness	(4) NEE Moneyness
CEO Confidence	12.076***	4.427**	1.336***	1.240***
	(2.717)	(1.951)	(0.134)	(0.290)
CEO Media Positivity	-2.685*	0.101	-0.010	-0.016
	(1.411)	(0.101)	(0.014)	(0.019)
CEO Share Ownership	7.779*	-1.773	0.116***	0.056
	(4.294)	(1.799)	(0.032)	(0.120)
Log (1 + Total Assets)	22.689***	0.038	-0.020	-0.501**
	(6.973)	(0.585)	(0.026)	(0.203)
Leverage	-4.023	-1.740	-0.077	0.903*
	(11.035)	(3.240)	(0.180)	(0.460)
Market-to-Book Ratio	2.623**	-0.221	-0.019	-0.024
	(1.265)	(0.173)	(0.014)	(0.016)
Return on Assets	4.059	0.670	0.951**	1.041**
	(22.067)	(6.182)	(0.385)	(0.463)
Sales Growth	12.700*	0.425	-0.176	-0.133
	(7.447)	(1.463)	(0.101)	(0.120)
Capital Expenditure	74.144	-0.205	0.331	-1.440
	(49.485)	(9.707)	(0.194)	(0.808)
Research & Development	119.593*	33.376	0.807***	-0.278
	(61.631)	(25.543)	(0.245)	(1.376)
Missing R&D Indicator	-3.545	-3.375	-0.001	-0.331**
	(3.619)	(0.000)	(0.076)	(0.126)
Log (1 + CEO Tenure)	-3.887	0.392	-0.007	-0.051
	(2.541)	(0.912)	(0.099)	(0.093)
Cash	-68.523**	-6.771*	-0.397	-0.888**
	(33.786)	(3.961)	(0.235)	(0.355)
ROA Volatility	43.278	3.352	-0.021	-0.386
	(35.417)	(4.649)	(0.292)	(0.441)
24-month BHR	-3.724	0.266	0.629***	0.439***
	(3.943)	(0.710)	(0.112)	(0.114)
Censoring	1-side	1-side	-	-
Observations	2,080	2,080	884	496
INDUSTRY fixed effects	Yes	No	Yes	No
YEAR fixed effects	No	No	Yes	Yes
FIRM fixed effects	No	Yes	No	Yes

Table 8: Bargaining Power – Signaling Effect and Customer Firm Size

This table includes only manufacturing firms (SIC: 2000- 3999) and employs OLS regressions. In Column (1) and (2), the dependent variable is *Change in Number of Suppliers* while in Column (3) and (4), the dependent variable is the *Change in Supplier R&D*. We split manufacturing firms into durable (SIC: 3400-3999) and non-durable (2000-3399) industry types. The key independent variables are *CEO Confidence Up*, *CEO Confidence Down*, and their interactions with the *Large Firm* indicator where *Large Firm* is an indicator which equates to unity if the firm's *Total Assets* is above the industry-year median value, and equates to zero otherwise. All other variables are defined in Table 2 or in Appendix 1. Control variables are included in all model specifications but not reported. Robust standard errors are reported in parentheses. Where multiple fixed effects are deployed, singleton observations are eliminated from the sample. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) Change in Num. of Suppliers	(2) Change in Num. of Suppliers	(3) Change in Supplier R&D	(4) Change in Supplier R&D
Industry Type	Durable	Non-Durable	Durable	Non-Durable
CEO Confidence Up	0.009	0.004	0.049**	0.084**
	(0.026)	(0.029)	(0.022)	(0.040)
CEO Confidence Up X Large Firm	-0.055	0.058	-0.019	-0.162
	(0.089)	(0.086)	(0.031)	(0.125)
CEO Confidence Down	-0.062**	-0.008	-0.013	0.018
	(0.028)	(0.019)	(0.021)	(0.044)
CEO Confidence Down X Large Firm	0.050	0.143*	0.015	0.048
	(0.100)	(0.084)	(0.029)	(0.042)
Large Firm	0.098**	0.033	-0.012	0.026
	(0.039)	(0.028)	(0.018)	(0.031)
Control Variables	Yes	Yes	Yes	Yes
Observations	5,170	4,238	768	586
INDUSTRY-YEAR fixed effects	No	No	Yes	Yes
FIRM fixed effects	Yes	Yes	Yes	Yes
YEAR fixed effects	Yes	Yes	No	No
YEAR cluster	No	No	Yes	Yes
INDUSTRY-YEAR cluster	Yes	Yes	No	No

Table 9: Propensity-Score Matched Case-Control Study – Number of Suppliers

This table presents results from a conditional logit model. The dependent variables in this table are *Suppliers Increase* and *Suppliers Decrease*. The key independent variables are *CEO Confidence Up* and *CEO Confidence Down*. In specifications where the dependent variable is *Suppliers Increase,* we define the treatment variable to be *CEO Confidence Up*. In specifications where the dependent variable is *Suppliers Decrease,* we define the treatment variable to be *CEO Confidence Down*. Using propensity score matching, we match each treated observation to control observation(s) with both *CEO Confidence Up* and *CEO Confidence Down* equating to zero. In Columns (1) and (2), we perform 1-to-1 matches with the caliper width set at 0.01. In Columns (3) to (4), we match each treated observation with up to 5 control observations with the caliper width set at 0.05. We also require that the control observation(s) be in the same exact-match dimension (i.e. industry-year) with the treated observation before propensity score matching is performed. Matched-case stratification is deployed in all specifications to pit treated observations against their control observations. All variables are described in Appendix 1. Robust standard errors are reported in parentheses. All standard errors are clustered at the exact-match dimension of each specification. ***, **, * represent statistical significance at the 1%, 5% and 10% levels respectively.

	(1) Suppliers Increase	(2) Suppliers Decrease	(3) Suppliers Increase	(4) Suppliers Decrease
Caliper Width	0.01	0.01	0.05	0.05
Max Number of Neighbors	1	1	5	5
Exact-Match Dimension	Industry-Year	Industry-Year	Industry-Year	Industry-Year
Treatment Variable [A]: CEO Confidence Up	0.513* (0.309)		0.375* (0.223)	
Treatment Variable [B]: CEO Confidence Down		0.801** (0.340)		0.305 (0.251)
Control Variables	Yes	Yes	Yes	Yes
Observations	196	292	280	383
MATCHED-CASE strata	Yes	Yes	Yes	Yes
INDUSTRY cluster	No	No	No	No
INDUSTRY-YEAR cluster	Yes	Yes	Yes	Yes