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The Impact of Intangible Capital and Diversity Reputation on Firm Performance

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Abstract

This dissertation examines the effects that intangible capital and diversity reputation have on firm performance. In Chapter 1, entitled "CEO Overconfidence and Intangible Corporate Investments," we extend the corporate investment and CEO overconfidence literature by examining how CEO overconfidence affects investment-cashflow sensitivity using a new measure of Tobin's q and cashflow. Specifically, we incorporate intangible capital, which neo-classical investment theory mostly ignores, in the empirical analysis. We develop three overconfidence measures and their interaction with the respective standard and new cashflow settings to capture the investment-cashflow sensitivity effect of CEO overconfidence. We use three investment measures (physical, intangible, and total investments) and find that the effect of managerial overconfidence on investment-cashflow sensitivity is more prominent for corporate intangible investments than physical investments. Moreover, our results show that the standard measure of physical capital weakly explains the intangible investment-cashflow density. Our study offers useful insights in that it explains the reason why investment-cashflow sensitivity has been weaker in recent years. We also show that investment-cashflow sensitivity is stronger when intangible capital is incorporated into the analysis. Chapter 2 is entitled "Diversity Reputation and Firm Performance." The modern American workplace is a microcosm of modern American society. The increasing diversity of the American workforce has made the increasing diversity of the American workplace a necessity. We explore the impact of diversity reputation on firm performance. We measure a firm's diversity reputation by its inclusion in *DiversityInc's* list of Top 50 Companies for Diversity. We measure firm performance by various accounting measures (return on assets, return on investment, and return on sales) as well as one market-based measure, Tobin's Q. We find that firms that have a better diversity reputation outperform firms that do not.

Keywords: Intangible Capital, Intangible Investment, Total Cashflow, Total Q, CEO Overconfidence, Diversity, Diversity Reputation, Firm Performance

Chapter 1

CEO Overconfidence and Intangible Corporate Investments

1. Introduction

The empirical studies of investment theory predominantly focus on physical capital, barely incorporating intangible capital into the analysis. Over the past 30 years, most advanced countries have shifted from the brick-and-mortar economic system to the technology and service-oriented economy. One of the key reasons for not including intangible capital in empirical tests of investment theory is that it is difficult to reliably measure the price and future benefits of these capital assets. Fortunately, Peters and Taylor (2017) (hereafter, P-T) have developed a methodology that proxies intangible capital and brings it into neoclassical investment theory. An empirical test of their theory suggests that almost 44% of capital stock in U.S. Compustat firms consists of intangible capital. They find that neoclassical Tobin's q (standard q) theory, developed to measure physical investment opportunities, is still effective in explaining total investments (intangible investments plus physical investments). However, a new proxy (total q) to measure intangible investments provides better investment regression results.

To understand the industry and firm level determinants of investments, researchers in recent times have focused on the agency problem and the role CEOs play in investment and financing decisions at the personal level[1]. While these studies primarily use the neo-classical theory of investment, which emphasizes physical investments, to examine CEO characteristics and distortions in firm investment policies (Malmendier & Tate, 2005), we study the sensitivity of

[1] Malmendier & Tate, (2005), Malmendier & Tate, (2005a), Friedman, (2007), Eichholtz & Yonder, (2015), Lin, et al., (2005), Huang, et al., (2016)

corporate investment to cashflow of optimistic CEOs, who tend to overestimate the future returns of their companies. We conduct our analysis using two different approaches—the literature's standard Tobin's q (Erickson & Whited, 2012), and P-T's total q. We segregate the firm's investment decisions into three categories—namely physical investments, intangible investments, and total investments, to test the impact of CEO personal characteristics on distortions of firms' investment decisions.

In their studies of agency theory, Jensen (1986) and Jensen & Meckling (1976) argue that misalignment of interests between managers and owners cause distortions in the firm's investment decisions. On the other hand, Myers & Majluf (1984) blame such distortions on information asymmetry between managers and the capital market. Both information asymmetry and agency costs cause investments to be sensitive to a firm's cashflow. While under the agency cost theory managers overinvest to maximize their own benefits and engage in empire building, under the information asymmetry theory managers restrict external financing to prevent dilution of shares of their company. In the latter approach, increased cashflow would increase investments by reducing distortions. Several corporate finance studies identify imperfections in the capital market as the key reason for investment-cashflow sensitivity, but the relation between investment and cashflow remains a controversial issue (Fazzari, et al., 2000) & (Kaplan & Zingales, 1997). Malmendier & Tate (2005) take a different route in explaining investment-cashflow sensitivity. They look to the personal characteristics of the CEO, who is the top decision-making insider. They argue that overconfident CEOs will overestimate the returns of their investment decisions. Therefore, given sufficient internal funds in the absence of corporate governance, an overconfident CEO will overinvest. In the absence of sufficient internal funds, overconfident CEOs are reluctant to raise funds through equity issues as they perceive that any new equity issue will cause the market to undervalue their company stocks.

Malmendier & Tate (2005) extend Heaton's (2002) study, which asserts that the key cause of investment distortions is managers overestimating their investment returns, by further developing and extending the model to investigate the relation between capital structure and CEO overconfidence. Both Malmendier & Tate (2005) and Heaton (2002) test physical investments and CEO overconfidence. In this study, we further extend their studies by incorporating the intangible capital measure of P-T into the literature's standard investment measures. We also use two different measures of firm value and cashflow. The standard measure, which consists of physical capital, uses Tobin's q (standard q) and cashflow (standard cashflow). Our new, more comprehensive measure, which we will call [P-T], uses Tobin's q (total q) and cashflow (total cashflow) and consists of both physical and intangible capital.

The CEO overconfidence concept used in this study stems from the social psychology literature—the "better than average" effect (Malmendier & Tate, 2005). That is, individuals overestimate their ability and consider themselves to be above average (Alicke, 1985). Because of the "better than average" effect, individuals express unrealistic optimism about future events (Weinstein, 1980) and overestimate their chance of success even in the economic decision-making process (Camerer & Lovallo, 1999). Evidence of this overestimation phenomenon, where a CEO overestimates the future performance of their corporation, exists in the behavioral corporate finance literature (Malmendier & Tate, 2005).

The literature on managerial overconfidence provides significant evidence that overconfident CEOs impact corporate investment decision-making of firms (Huang, et al., 2016). Roll (1986) first coined the term managerial "hubris" to explain the value-destroying activities managers undertake. The term "hubris" is analogous to managerial overconfidence in the sense that "hubris" makes the manager too optimistic about the success of their mergers and acquisitions. A similar finding from Malmendier & Tate (2008) states that overconfident CEOs accept value destroying M&A deals because they overestimate their firm's ability to generate returns. Heaton (2002) shows that in the absence of information asymmetry, optimistic managers overestimate the performance of their corporate projects and invest in negative NPV projects even though they remain loyal to shareholders. Malmendier et al. (2011) find that overconfident CEOs prefer debt over equity because they believe that equity is more undervalued than debt. This belief of overconfident CEOs leads to higher than average leverage. Campbell et al. (2011) show theoretically that the level of optimism in CEOs is linked to their corporate investment decision-making. High (low) optimism in CEOs leads to over (under) investments.

Our CEO overconfidence study enhances the overconfidence-based investment distortions literature in several ways. Our new measures of investment and cashflow explain overconfident CEO behavior better than the literature's standard investment and cashflow sensitivity measures, which only consider tangible capital. Malmendier & Tate (2005) reveal an important result—even if a CEO's incentives are perfectly aligned and she operates in a non-information asymmetry environment, she may choose to investment sub-optimally. We show that such sub-optimal investments are more likely to happen to intangible corporate investments. Thus, if achieving the optimal investment levels that maximize shareholders' interests is the goal, it is imperative to establish organizational policies through the formation of an active board of directors and impose restrictions on the use of free-cashflow for intangible investments.

2. Hypothesis development

An overconfident CEO's investment decision is motivated by the cash position of the firm (Malmendier et al., 2011). Investment increases when the firm has more internally generated cash. We test our investment and CEO overconfidence relationship with the prediction that positive investment (physical, intangible, and total investment) and cashflow (both standard and total cash-flow) arise from CEO overconfidence. We develop the following hypotheses:

Hypothesis 1: Total q (q^{tot}) and total cashflow (c^{tot}) explain the investment-cashflow sensitivity of overconfident CEOs better than standard q (q^*) and standard cashflow (c^*).

Hypothesis 2: The effect of CEO overconfidence on intangible investment-cashflow sensitivity is higher than its effect on physical investment-cashflow sensitivity.

Hypothesis 3: Total q (q^{tot}) and total cashflow (c^{tot}) explain the investment-cashflow sensitivity of overconfident CEOs better than standard q (q^*) and standard cashflow(c^*) when the firms operate under financial constraint.

3. Empirical Approach

3.1 Overconfidence Measures

Measuring the confidence level of a CEO is not straightforward. To construct the measures of CEO overconfidence, we follow a modified Malmendier & Tate (2005, 2008) methodology that holds that an overconfident CEO's revealed preferences are reflected in her option exercising behavior. CEO total compensation includes a large number of stocks and options, which they can hardly diversify through trading or short-selling. It is rational to assume that given non-diversification, a risk-averse CEO should exercise her options early whenever the options are sufficiently in the money. Hall & Murphy (2002) state that the exact option exercising behavior depends on numerous factors such as CEO age, health, wealth, risk-appetite, remaining option period duration, and scope of diversification. Taking these factors into consideration, Malmendier and Tate (2005, 2008) find that a subset of CEOs fails to exercise in the money options early. This late-exercising behavior motivated Malmendier and Tate (2005, 2008) to develop their overconfidence measure. To minimize the effect of endogeneity in our overconfidence study, we use additional controls and show that our results are not caused by industry/firm effects or firm characteristics such as size and level of financial constraint. Malmendier and Tate (2005, 2008) use Holder67 and Longholder as the two proxies to measure overconfidence. However, Malmendier et al. (2011) conclude that Longholder is the best measure to proxy CEO overconfidence. Based on this, we use longholder40 as our CEO overconfidence measure in this study. Longholder40[2] is a dummy variable which takes the value 1 if the CEO ever held an option to the final year of its duration and the option is at least 40% in the money entering its final year, otherwise it takes the value 0. Following Campbell et al. (2011), we apply two additional overconfidence measures. Whereas longholder40 identifies overconfident CEOs, the 100% cutoff (longholder100) is our proxy for the CEOs who are even

[2] Hall & Murphy (2002) and Huang et al. (2016) use the 40% threshold under the assumption of a Constant Relative Risk Aversion (CRRA) coefficient of 3. It also assumes that 67% of the CEOs' wealth are in their own company stocks.

more overconfident. Longholder100 requires that a CEO fails to exercise options given 100% moneyness of the options and repeats the behavior at least twice during the sample period.

3.2. Calculation of the Moneyness of options

We calculate option moneyness using Compustat - Capital IQ from Standard & Poor's Execucomp database. The database does not have the option grant specific exercise price. To overcome this, we follow the approximation methodology that the average stock price of the options is the realizable value per option, which is the estimated value of in the money unexercised exercisable options (Execucomp data item OPT_UNEX_EXER_EST_VAL) divided by the number of unexercised exercisable options (Execucomp data item OPT_UNEX_EXER_NUM) (Humphery-Jenner et al., 2016; Campbell et al., 2011).

$$Realizable\ value\ per\ option = \frac{OPT\_UNEX\_EXER\_EST\_VAL}{OPT\_UNEX\_EXER\_NUM}$$

We then compute the average exercise price of the option by subtracting the realizable value per option from the fiscal year-end stock price (CRSP data item: prcc_f) and obtain the estimated average exercise price of the options:

$$Estimated\ average\ exercise\ price\ of\ option = (Prcc\_f\ - Realizable\ value\ per\ option).$$

Finally, to compute the average percentage of the moneyness of the options, we divide the realizable value per option by the estimated average price of the options:

$$Average\ percentage\ of\ the\ moneyness\ of\ option = \frac{Realizable\ value\ per\ option}{Estimated\ average\ exercise\ price\ of\ option}$$

We include the measure longholder_low as a compliment to longholder100. We define a longholder_low CEO as one who exercises her stock options that are less than 30% in the money and who does not hold any other options that are more than 30% in the money (Campbell, et al., 2011). Similar to the longholder100, a CEO must exhibit the relevant exercising behavior at least twice in the sample period. To compute the moneyness of exercised options of a longholder_low CEO, we divide the value realized on options exercised (OPT_EXER_VAL) by the number of shares acquired on the exercised options (OPT_EXER_NUM) to get the per option value realized from the exercise:

$$Per\ option\ value\ realized\ from\ the\ exercise = \frac{OPT\_EXER\_VAL}{OPT\_EXER\_NUM}$$

The value of the estimated average exercise per exercised option is computed by subtracting the per option value realized from the exercise from the fiscal year end stock price:

$$Estimated\ average\ exercise\ per\ exercised\ option = (Prcc\_f\ - Per\ option\ value\ realized\ from\ the\ exercise).$$

Finally, the average percentage of moneyness of the exercised option is measured as:

$$\frac{Per\ option\ value\ realized\ from\ the\ exercise}{Estimated\ average\ exercise\ per\ exercised\ option}.$$

3.3 Definition of other variables

To reduce the possibility of an omitted variables effect in our main results, we use a set of control variables including the natural log of total assets (Malmendier & Tate 2005); market to book value (Brockman, et al., 2010); natural log of delta (lndelta); natural log of vega (lnvega); stock ownership (Huang et al., 2016; Core & Guay, 2002); firm characteristics such as Tobin’s q (standard and total q), cashflow (standard and total cashflow), and the investment variables of P-T; the Z-score of Brockman et al. (2010); and the modified governance index of Cory A. et al.

(2012). Our investment variables are physical, intangible, and total investment. The reason for using three forms of investment is to measure the magnitude of sensitivity of CEO overconfidence to these different types of investments. The definition, computation, motivation, and sources of the control variables are provided in the Appendix.

3.4. Sample selection and data sources

We use several databases to construct our main sample. We obtain monthly stock prices from CRSP; firm financial and accounting information from Compustat; CEO options, stocks, and compensation information from Execucomp; and risk-free rates from the Federal Reserve Bank website[3]. To create a governance index consisting of the Board of Directors and relevant information, we use Institutional Shareholder Services (ISS) data from WRDS. To compute a firm's total q ratio and the replacement cost of the firm's intangible capital, we use P-T's Tobin q proxy from WRDS. Our sample covers the period of 2007-2017. The sample begins in 2007 because ISS data on directors and governance data regarding financial experts on Boards for S&P 1500 companies are available from 2007. Moreover, Execucomp provides CEO compensation package-level option holding data beginning in 2006[4] because of a change in the reporting requirements by FSA-123R. CEO package-level option holding data is essential for computing the proxies for our CEO overconfidence variable. We then combine the CEO data from Execucomp with CRSP stock price data and risk-free rate data obtained from the Federal Reserve Bank website to construct our overconfidence proxies and compute the CEO personal control variables.

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[3] Risk-free rates are obtained from the Fed Reserve website at http://www.federalreserve.gov/releases/h15/data.htm.

[4] Execucomp provides executive compensation data since 1992. However, for the purpose of constructing our CEO overconfidence proxies, we need CEO package-level option holding data, which is available from 2006.

In the next step, we merge the dataset with the Compustat database to compute the firm-level control variables. We combine this database with P-T's Tobin q proxy for intangible capital and the Governance & Board database obtained from WRDS. P-T use the perpetual inventory of past investments in R&D and SG&A to compute the replacement cost of a firm's intangible capital. Following P-T, we exclude regulated utilities firms [SIC:4000-4999], financial firms [SIC: 6000-6999], and special firms [SIC: 9000+] from the main sample as these firms may not be appropriate for intangible capital measures. We exclude any firms with missing total q as well as firms with missing or negative book value/sales/physical assets. Following the suggestion of P-T, we winsorize total q as well as all regression variables at the 1% level, except dummy variables.

3.5. Model specification and methods

To test our main hypothesis that the intangible investment of overconfident CEOs is more sensitive to standard cashflow than the physical investment of overconfident CEOs, we develop the following regression model;

$$I_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 Q_{it} + X'_{it}\beta_4 + \beta_5 \Delta_{it} + \beta_6 C_{it} \cdot \Delta_{it} + \varepsilon_{it} \qquad (1)$$

Where C is the cashflow (standard cashflow [c*] or total cashflow [c^{tot}]); Q is the Tobin's q (standard q [q*] or total q [q^{tot}]); X is the vector of additional control variables used in the model; and Δ is the proxy variables for CEO overconfidence measures. The vector X includes Z-score, governance index, lndelta, lnvega, stock-ownership, and the log of total assets. All variables are defined in the Appendix. We do not include firm-fixed effects in our proxies for CEO overconfidence, which require CEOs to have a long tenure in their firm in order to be identified as overconfident (Huang, et al., 2016). The inclusion of firm-fixed effects in the regression model would lack the time series variation necessary to measure the effect of overconfidence. However, to control for the time-variant industry effects, we use Fama-French 12 industry[5]-fixed effects. We also use year-fixed effects to control unobserved macroeconomic shock factors. To eliminate possible serial correlation and heteroskedasticity, we apply the regression model in two steps. First we run a baseline OLS, then we run a separate regression controlling for the industry- and year-fixed effects. As a check of robustness, we compute within-firm clustered standard errors, which effectively eliminates any serial correlation.

4. Empirical Results

Table 1

Table 1-A

To measure physical capital stock (K^{phy}) and intangible capital stock (K^{int}), we use the Peters and Taylor Total Q database from WRDS, available through December 2017. Other firm-level data is obtained from Compustat Global data from 2007-2017. Intangible intensity is the ratio of intangible capital stock (K^{int}) scaled by the total capital stock ($K^{phy}+K^{int}$). All the new measures in the table below are scaled by the total capital stock while all the standard measures are scaled by the physical capital stock. The numerator for the both the total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity (Compustat item prcc_f*csho) minus short-term assets (Compustat item act). The denominators for the total q and standard q are total capital stock and physical capital stock, respectively. The numerator for physical investment (ι^{phy}) and intangible investment (ι^{int}) are capital expenditure (Compustat item capx) and R&D (Compustat item xrd) plus 30% of selling, general, and administrative expenses, respectively. Total investment is the sum of ι^{phy} ι^{int}. The numerator of total cash flow is calculated as the earnings before extraordinary items (Compustat item ib) plus depreciation (Compustat item dp). We add the tax adjusted ι^{int} to get the numerator of the standard cashflow (c^{*}) to get the numerator of the total cash flow (c^{tot}). Other firm characteristics variables are defined in the Appendix.

Variables	Mean	Median	St.Dev	Min	Max	Skewness
Intangible capital stock (millions of dollars)	4606.47	1071.91	11545.72	29.73	84330.44	4.92
Physical capital stock (millions of dollars)	4312.69	795.79	10843.42	17.44	73304.00	4.37
Intangible intensity	0.57	0.63	0.26	0.01	0.95	-0.59
Knowledge capital/intangible capital	0.16	0.05	0.21	0.00	0.78	1.26
New measures						
Total q (q^{tot})	1.40	0.95	1.52	-0.23	9.03	2.64
Physical investment (ι^{phy})	0.04	0.03	0.04	0.00	0.24	2.35
Intangible investment (ι^{int})	0.09	0.08	0.06	0.00	0.31	0.92
Total investment (ι^{tot})	0.13	0.12	0.07	0.02	0.41	1.29
Total cash flow (c^{tot})	0.17	0.15	0.11	-0.14	0.59	0.90
Standard measures						

[5] Our results remain qualitatively the same even if we use Fama-french 48 industries. The FF12 industry classification is obtained from Professor French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html

Standard q (q∗)	6.00	2.49	9.87	-0.98	60.44	3.39
CAPX/PPE (ι∗)	0.10	0.09	0.06	0.02	0.36	1.53
Standard cash flow (c ∗)	0.37	0.25	0.51	-1.12	2.78	1.89
Other firm characteristics						
Asset Size ($B)	7.80	1.52	4.89	7.66	11.88	0.42
Z-Score Dummy	0.92	0.28	0.00	1.00	1.00	-3.03
G-Score	3.58	0.97	1.00	4.00	6.00	-0.12

4.1. Summary Statistics

4.1.1. Firm-level summary statistics

Table 1-A presents firm-level summary statistics. The mean size of the sample firm-year intangible capital stock (K^{int}) and physical capital stock (K^{phy}) is USD 4607.862 million and USD 4314.724 million, respectively. We find that about 57.30% of the total capital stock (K^{phy}+K^{int}) consists of intangible capital. This means more than half of the capital in our sample firm-year data is intangible. Knowledge capital—a part of intangible capital (K^{int}) comprising R&D—is about 16.3% of the intangible capital, leaving about 83.7% in organization capital. The median knowledge capital is only 5.1% because almost 43% of our sample firms do not report R&D. The average total q (q_{it}^{tot}) is smaller than standard q (q_{it}^{*}) because the denominator of total q is on average 2.06 times larger than the denominator of standard q. 25% of our sample has a standard q larger than 6.00 and only 5% of the sample firms has a total q greater than 6. We observe a high standard deviation in the standard q (9.87) compared to the total q (1.52). This suggests that total q is more consistent and reliable than standard q. When standard deviations are scaled by the mean value of the respective Tobin’s q, we observe the standard deviation of the total q is 52% lower than the standard deviation of the standard q. The average intangible investment (.09) is more than twice the average physical investment (.04). Intangible investment has a slightly higher standard deviation than physical investment , but the physical investment is more skewed to the right. The average asset size (USD 7.8 billion) of the sample firms is relatively large because our sample consists mainly of S&P1500 firms.

Figure 1

The figure below shows the mean capital intangibility for the period of 2007 to 2017. We use Fama-French five industries for our analysis. Intangible intensity is the ratio of intangible capital stock (K^{int}) scaled by the total capital stock ($K^{phy}+K^{int}$).

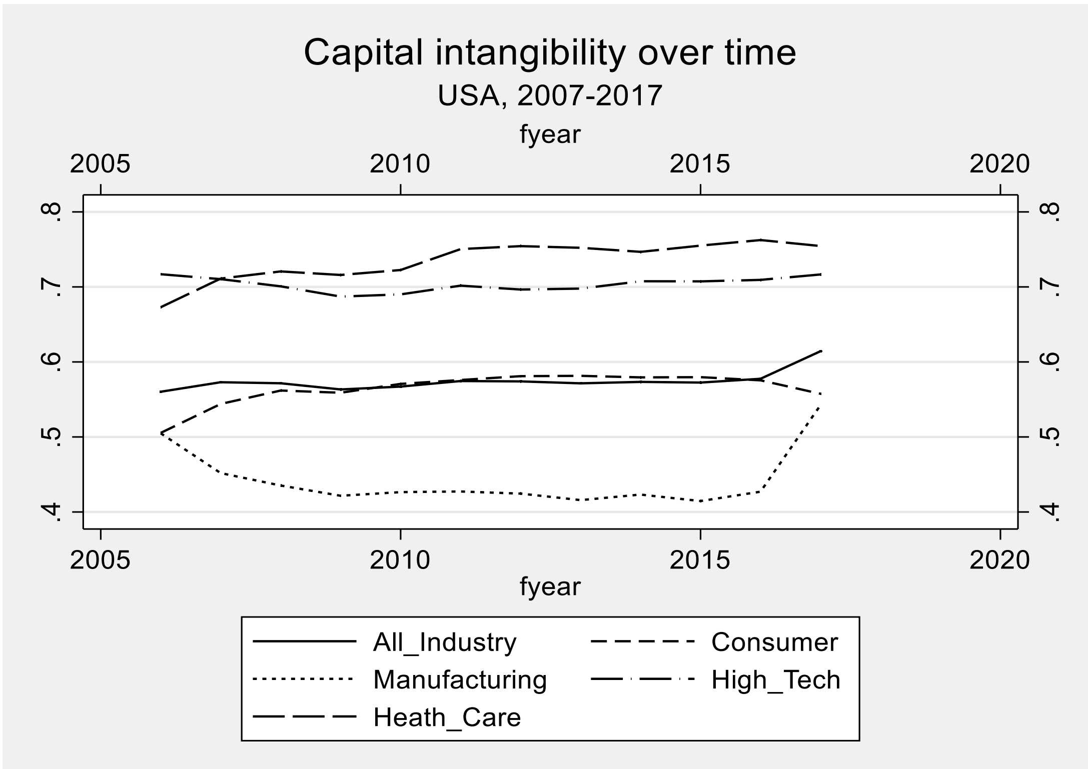

Figure 2

The figure below shows the mean total q and standard q for the period of 2007 to 2017. The numerator for the both the total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity [Compustat item prcc_f*csho] minus short-term assets [Compustat item act]. The denominators for the total q and standard q are total capital stock and physical capital stock, respectively.

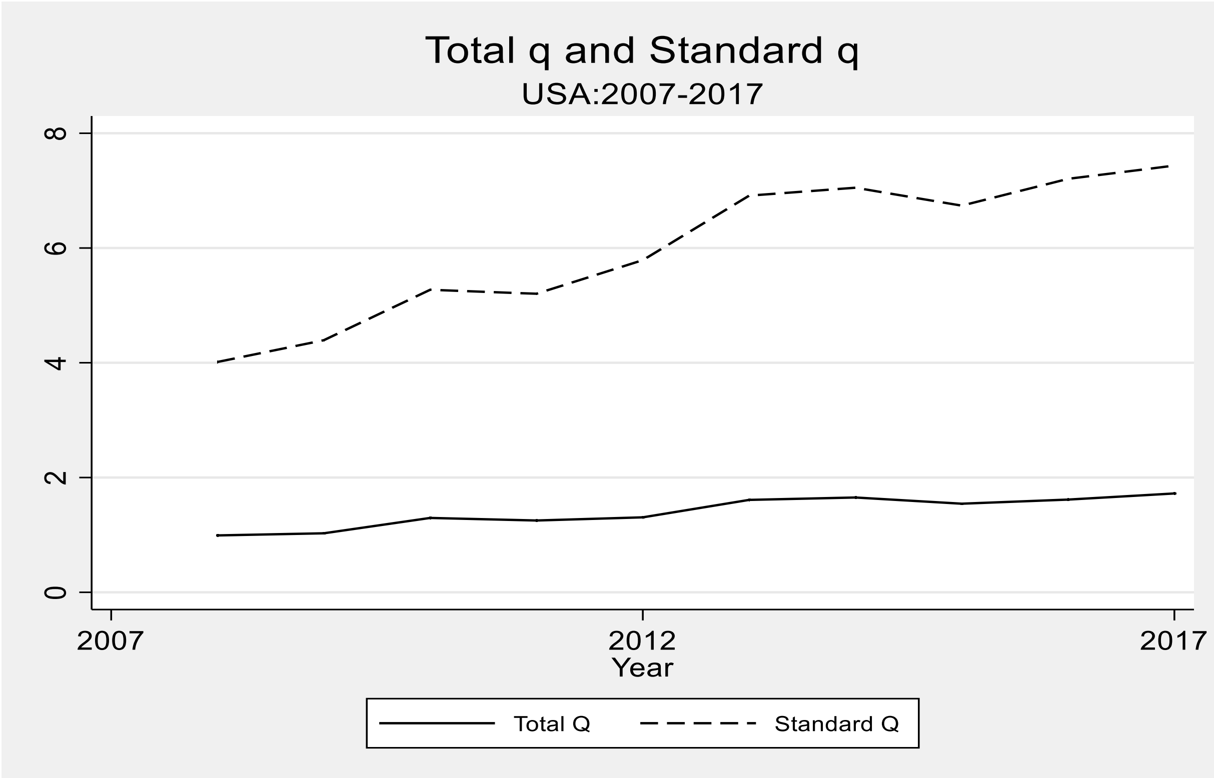

Figure 1 shows that after 2015, we see a faster increase of intangible capital across all industries except the consumer industry. Figure 2 shows the movement of total q and standard q over time. It is apparent from Figure 2 that as the intangible capital intensity increases, the gap between total q and standard q widens. For this reason, we see the gap between these two variables widen as the intangible capital intensity increases over the period. Suzuki & Chida (2017) measure Tobin's q by subtracting current assets from the denominator, which is a better proxy than simply using totals asset as the denominator (Erickson & M. Whited, 2006). However, as Suzuki & Chida (2017) do not consider intangible capital stock in Tobin's q, their measure can only isolate the investment opportunities in physical capital stock, not in the total capital stock.

4.1.2. CEO summary statistics

Table 1-B

Panel A provides CEO-level summary statistics for the full sample. We further partition the sample into non-overconfident (Panel B) and overconfident (Panel C) CEOs. Longholder40 is a dummy variable that takes the value of 1 if the CEO ever held an option to the final year of its duration and the option is at least 40% in the money entering its final year, otherwise the value is 0. Longholder100 is a dummy variable that takes the value of 1 if the CEO ever held an option to the final year of its duration and the option is more than 100% in the money at least twice during the option holding period, otherwise 0. Longholderlow is a dummy variable that takes the value of 1 if the CEO exercises stock options that are less than 30% in the money and the CEO does not hold other exercisable options that are more than 30% in the money, otherwise 0. Gender is a dummy variable takes a value of 1 for male and 0 otherwise. Stock ownership is measured as the number of shares owned by the CEO, excluding options, divided by the common shares outstanding at the end of the fiscal year. Option ownership is measured as the number of exercisable options owned by the CEO divided by the common shares outstanding at the end of fiscal year. Total compensation is Execucomp item TDC1. Age and Tenure are CEO age and tenure, respectively. Delta and Vega are defined in the Appendix. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full sample

	N	Mean	Std. dev	Min	Median	Max	Skewness
Longholder40	9394	0.402	0.490	0.000	0.000	1.000	0.402
Longholder100	9199	0.173	0.378	0.000	0.000	1.000	1.729
LongholderLow	9397	0.045	0.208	0.000	0.000	1.000	4.365
Gender	9397	0.964	0.186	0.000	1.000	1.000	-5.000
Age	9393	56.253	6.897	32.000	56.000	88.000	0.332
Tenure	9376	11.737	7.827	0.083	10.167	55.833	1.492
Delta($000)	9397	618.573	1182.754	0.544	224.836	8120.253	4.380
Vega($000)	9397	91.523	198.790	0.000	16.328	1154.286	3.623
Stock Ownership	9366	0.015	0.036	0.000	0.003	0.244	4.368
Option Ownership	9396	0.009	0.011	0.000	0.005	0.063	2.280
Total Compensation ($000)	9397	6388.943	5588.980	328.582	4761.806	29497.570	1.857

Panel B: Non-overconfident CEOs

	N	Mean	Std. dev	Min	Median	Max	Skewness
Gender	5622	0.962	0.190	0.000	1.000	1.000	-4.867
Age	5618	56.197	6.904	32.000	56.000	84.000	0.357
Tenure	5608	11.322	7.783	0.083	9.833	55.833	1.464
Delta($000)	5622	400.316	905.155	0.544	139.173	8120.253	6.027
Vega($000)	5622	87.520	177.030	0.000	20.272	1154.286	3.653
Stock Ownership	5596	0.014	0.035	0.000	0.003	0.244	4.426
Option Ownership	5621	0.008	0.011	0.000	0.004	0.063	2.393
Total Compensation ($000)	5622	5967.369	5339.254	328.582	4377.852	29497.570	1.926

Panel C: Overconfident CEOs (Longholder40)

	N	Mean	Std. dev	Min	Median	Max	Skewness
Gender	3772	0.967	0.178	0.000	1.000	1.000	-5.240
Age	3772	56.339	6.888	34.000	56.000	88.000	0.295

Tenure	3765	12.360	***	7.852	0.250	10.667	55.833	1.550
Delta($000)	3772	944.311	***	1444.625	2.530	456.349	8120.253	3.362
Vega($000)	3772	97.561	***	227.338	0.000	10.970	1154.286	3.433
Stock Ownership	3767	0.015	*	0.037	0.000	0.003	0.244	4.276
Option Ownership	3772	0.011	***	0.011	0.000	0.007	0.063	2.225
Total Compensation ($000)	3772	7018.881	***	5888.079	328.582	5348.157	29497.570	1.758

Table 1-B presents CEO-level summary statistics. We find approximately 40% of the CEOs in our sample are longholder40. The mean Delta (portfolio price sensitivity) for the full sample is 619—very close to what is reported (691.4) by Brockman et al. (2010) and slightly higher than that reported (577.46) by Huang et al. (2016). Our mean Vega (portfolio volatility sensitivity) is 92—slightly lower than the Vega (110.8) reported by Brockman et al. (2010). Since our sample begins in 2007 and is recession free for most of the time, the volatility sensitivity is lower. The average stock ownership of the CEOs in our sample is 1.5% and the average option ownership is 0.9%. Most of the CEOs in our sample are male (96%) and middle-aged (average age 56.25 years). The average CEO tenure is 11.74 years and total compensation is about USD 6.389 million.

Panels B and C of Table 1-B present the summary statistics for the non-overconfident and overconfident CEOs, respectively. The average overconfident CEOs are slightly older and male-dominated, but both belong to the middle-aged group. We would expect the overconfident CEOs to be older and have more tenure than the non-overconfident CEOs, given that the overconfident CEOs hold on to their options until the final year of the options' expiration. Our subsample of overconfident CEOs has a higher Delta and Vega than the non-overconfident subsample—a result similar to Huang et al. (2016). As expected, we find the overconfident CEOs have higher Delta and Vega given their higher stocks and options ownership. Though we observe statistically significant differences between overconfident and non-overconfident CEOs with regard to tenure and total compensation, we do not include these variables in the investment regression as control variables because, to the best of our knowledge, no empirical justification for doing so exists in the literature.

Table 1-C

This table presents the distribution of overconfident CEOs across the Fama-French 12 industry groups

Distribution Across Fama-French Industry Groups	Non-overconfident CEOs	Overconfident CEOs	Full Sample
Consumer Nondurables	4.50%	3.15%	7.65%
Consumer Durables	1.88%	1.34%	3.23%
Manufacturing	9.00%	6.50%	15.50%
Energy	3.36%	1.69%	5.06%
Chemicals and Allied Products	2.41%	2.13%	4.53%
Business Equipment	13.52%	9.02%	22.54%
Telephone and Television Transmission	1.35%	0.60%	1.95%
Shops	9.66%	6.11%	15.77%
Health	4.93%	5.10%	10.03%
Other	9.24%	4.51%	13.75%
Total	59.85%	40.15%	100.00%

Table 1-C presents the distribution of overconfident CEO across the Fama-French 12 industry groups. The distribution of the overconfident CEO subsample is similar across the 12 industries with a standard deviation of .04. This suggests orthogonality of the overconfidence measures to the firm characteristics across the 12 Fama-French industries.

Table 2

Pairwise Correlation among the three overconfidence measures (longholder40, longholder100, longholder_low) and firm and CEO characteristics

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Longholder40	1											
(2) Longholder100	0.573*	1										
(3) Longholder_low	-0.179*	-0.101*	1									
(4) Physical (ι^{phy})	0.034*	0.065*	0.006	1								
(5) Intangible (ι^{int})	0.072*	0.098*	-0.029*	-0.185*	1							
(6) Total (ι^{tot})	0.087*	0.131*	-0.024*	0.452*	0.782*	1						
(7) Total q (q^{tot})	0.242*	0.277*	-0.067*	0.122*	0.366*	0.404*	1					
(8) Standard q (q^*)	0.195*	0.234*	-0.053*	-0.142*	0.426*	0.303*	0.727*	1				
(9) Total cash flow ($c^{to}t$)	0.193*	0.202*	-0.033*	0.152*	0.566*	0.598*	0.648*	0.443*	1			
(10) Standard cash flow (c^*)	0.172*	0.175*	-0.028*	-0.107*	0.344*	0.244*	0.497*	0.691*	0.691*	1		
(11) LogAsset	0.050*	-0.031*	0.030*	0.051*	-0.334*	-0.271*	-0.030*	-0.050*	-0.089*	0.022	1	
(12) G-score	-0.025*	-0.037*	0.008	-0.025*	-0.097*	-0.101*	-0.050*	-0.033*	-0.045*	0.006	0.162*	1
(13) Z_Score_dummy	0.116*	0.061*	-0.034*	-0.090*	0.188*	0.104*	0.078*	0.013	0.283*	0.169*	-0.098*	-0.006
(14) Gender	0.012	0.028*	0.00	-0.018	0.024*	0.01	0.038*	0.028*	0.016	0.027*	0.012	-0.018
(15) Age	0.01	-0.003	0.016	-0.024*	-0.109*	-0.112*	-0.057*	-0.062*	-0.072*	-0.067*	0.080*	0.034*
(16) Tenure	0.065*	0.114*	0.039*	0.050*	0.102*	0.121*	0.063*	0.068*	0.069*	0.047*	-0.143*	-0.115*
(17) Delta	0.225*	0.220*	-0.040*	0.092*	0.039*	0.088*	0.253*	0.173*	0.140*	0.109*	0.277*	-0.039*
(18) Vega	0.025*	-0.055*	0.019	-0.050*	-0.044*	-0.073*	0.028*	0.025*	0.009	0.042*	0.381*	0.082*
(19) Stock-ownership	0.015	0.063*	-0.006	0.073*	0.095*	0.131*	0.037*	0.018	0.044*	-0.011	-0.224*	-0.147*
(20) Option-ownership	0.126*	0.141*	0.023*	-0.090*	0.156*	0.085*	-0.011	0.077*	-0.007	-0.001	-0.336*	-0.102*
(21) Total Compensation	0.092*	0.041*	0.009	-0.008	-0.100*	-0.097*	0.129*	0.122*	0.053*	0.130*	0.702*	0.145*

Variables	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(14) Gender	-0.023*	1						
(15) Age	0.049*	0.052*	1					
(16) Tenure	0.027*	0.072*	0.317*	1				
(17) Delta	0.079*	0.031*	0.165*	0.327*	1			
(18) Vega	0.021	-0.024*	0.030*	-0.015	0.256*	1		
(19) Stock-ownship	0.024*	0.025*	0.191*	0.472*	0.476*	-0.067*	1	
(20) Option-ownship	-0.025*	0.01	0.035*	0.243*	0.097*	0.061*	0.192*	1
(21) Total Compensation	-0.009	-0.025*	0.075*	-0.043*	0.351*	0.404*	-0.125*	-0.149*

* shows significance at the 5% level

4.2. Pairwise Correlation

In Table 2, we present the correlations among the three overconfidence measures, firm characteristics, and CEO personal characteristics. As predicted, we find the correlation between longholder40 and longholder100 is strong (0.57) and statistically significant at the 5% level. The correlation of longholder40 and longholder100 with longholderlow is negative (-0.179 and -0.101, respectively) and highly statistically significant. All the longholders are positively correlated with physical investment while longholderlow is negatively correlated with intangible investment. Overall, these relations suggest that, unlike longholderlow, the overconfidence measures longholder40 and longholder100 capture the same effect. Cashflow is strongly positively correlated with longholder40 and longholder100 and negatively correlated with longholderlow. Governance (G-score) acts as a speed breaker for CEO overconfidence as we see G-score is only positively correlated with longholderlow and strongly negatively correlated with other two longholders. Although we cannot simply test whether an overconfident CEO destroys firm value or not because of endogeneity, we see a strong and positive correlation of Tobin's q and longholder40 and longholder100. Tobin's q is strongly negatively correlated with longholderlow. Overall, we find several dependable correlations between the overconfidence measures and firm and CEO characteristics. However, these relationships are not always consistent among all the subsamples. This suggests that we cannot reliably use the CEO overconfidence measures as proxies for the observable firm or CEO characteristics. Technically, an overconfident CEO such as a longholder40 or longholder100 who delays the exercising of options usually increases her ownership in the firm. However, there are other firm and CEO characteristics that play a significant role in holding these positions. These counterintuitive relationships among the subgroups make it plausible that there are inconsistent correlations among the stock or option ownership measures and the longholder measures.

5. Persistence of Option Exercising Behavior

Our longholder measures may be biased estimators in the case of CEOs with insider information. If the CEO has positive insider information, the option exercising may be delayed. If the CEO possesses negative insider information, sometimes the CEO may choose to exercise options early. We can test the behavior of the CEO by running a probit regression that explains the circumstances affecting whether a Longholder40 has ever held an option to the final year of its duration, with that option being at least 40% in the money entering its final year. Similarly, the probit regression can shed light on the factors surrounding a Longholder100 holding an option to the final year of its duration with the option being more than 100% in the money at least twice during the option holding period, as well as when a Longholderlow exercises stock options that are less than 30% in the money while the CEO does not hold other exercisable options that are more than 30% in the money.

Table 3

In Panel A & B, the dependent variables the three overconfidence (longholder) measures. Longholder40 is a dummy variable that takes the value 1 if the CEO has ever held an option to the final year of its duration with that option being at least 40% in the money entering its final year, otherwise it takes the value 0. Longholder100 is a dummy variable that takes the value 1 if the CEO has ever held an option to the final year of its duration with that option being more than 100% in the money at least twice during the option holding period, otherwise it takes the value 0. Longholderlow is a dummy variable that takes the value 1 if the CEO exercises stock options that are less than 30% in the money provided that the CEO does not hold other exercisable options that are more than 30% in the money, otherwise it takes the value 0. Total q (q^{tot}) and Standard q (q^{*}) are two measures of Tobin's q. Earnings/price ratio is the earnings to price ratio during the fiscal year. Panel C represents the summary of the longholder's persistence of late exercise behavior.

Panel A: Random Effects Probit Regression

	Sample: Observations with Longholders		
	Longholder40	Longholder100	Longholder_low
Past exercise behavior	0.2177***	0.492***	0.0770***
	(0.017)	(0.042)	(0.016)
Total q (q^{tot})	0.4617***	0.616***	-0.227***
	(0.030)	(0.045)	(0.042)
Earnings/price ratio	1.7305***	3.327***	0.437*
	(0.271)	(0.696)	(0.257)

Panel B: Random Effects Probit Regression

	Longholder40	Longholder100	Longholder_low
Past exercise behavior	0.222***	0.474***	0.0798***

	(0.02)	(0.04)	(0.02)
Standard q (q^*)	0.0503***	0.0631***	-0.0239***
	(0.004)	(0.006)	(0.006)
Earnings/price ratio	1.923***	3.072***	0.288
	(0.26)	(0.60)	(0.26)
Observations	6,897	6778	6898
Number of CEOs	1765	1749	1765

Table 3 presents the random effects probit regression results. In Panels A and B, the dependent variables are the three overconfidence (longholders) measures. Total q (q^{tot}) and Standard q (q^*) are two measures of Tobin's q. Earnings/price ratio is the earnings to price ratio during the fiscal year. Past exercise behavior tells us the number of times a CEO delayed exercising in the money options in the past. The past exercise behavior coefficients for all the longholders are strongly significant with p-values less than .01. This result supports our argument that longholders exhibit persistence in their option exercising behavior. As a robustness check, we include total cashflow and standard cashflow in Panels A and B, respectively, along with the earnings/price ratio. Malmendier & Tate, 2005 argue that a high value of Tobin's q indicates market overvaluation and is negatively correlated with past exercise behavior. If the firm is overvalued, a CEO should not delay exercising exercisable unexercised options. We observe the same predicted relationship between Tobin's q and longholderlow and longholder100. On the contrary, the earnings/price ratio and delayed option exercising behavior trend in the same direction. In Panels A and B, the earnings/price ratio is significant for longholder40 and longholder100.

Longholder: We estimate our model using the three different versions of longholders as our proxy measures for CEO overconfidence. The definitions of the three categories of longholders are provided in the Appendix. We run two sets of base regressions for each of the three types of investment dependent variables. We run the regression on the existing literature's standard cashflow (c*) and standard q (q*) with industry and year fixed effects, first with no controls and then with controls for lndelta, lnvega, stock-ownership, G-score, Z-score, logAssets, and longholders interactions with the cashflow. It is important to keep in mind that the measures of standard cashflow and standard q do not include intangible capital in the calculation. The results are presented in the Table 4, Panel A.

Table 4

Panel A

This table presents the results of the ordinary least squares regression of the column variables on the beginning of the year Tobin's q, cashflow, firm and CEO characteristic variables, longholders, and industry and year fixed effects. All the column variables in the table below are scaled by total capital stock ($K^{phy}+K^{int}$). The numerator for both the total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity [Compustat item prcc_f*csho] minus short-term assets [Compustat item act]. The denominators for the total q and standard q are total capital stock ($K^{phy}+K^{int}$) and physical capital stock (K^{phy}), respectively. The numerator for physical investment (ι^{phy}) and intangible investment (ι^{int}) are Capital expenditure [Compustat item capx] and R&D [Compustat item xrd] plus 30% of selling, general, and administrative expenses, respectively. Total investment (i^{tot}) is the sum of ι^{phy} and ι^{int}. Longholder40 is a dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration and the option is at least 40% in the money entering its final year, otherwise 0. Longholder100 is a dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration and the option is more than 100% in the money at least twice during the option holding period, otherwise 0. Longholderlow is a dummy variable that takes the value 1 if the CEO exercises stock options that are less than 30% in the money and the CEO does not hold other exercisable options that are more than 30% in the money, and otherwise 0. Other control variables are defined in the Appendix. The regression results for total q (q^{tot}) and total cash flow (c^{tot}) are presented in Panel A while the results for standard q (q^{*}) and standard cashflow (c*) are presented in panel B. Standard errors are in parentheses. P-values are indicated as *** p<0.01, ** p<0.05, * p<0.1.

Panel A:	Base Regression						Longholder40					
	ι^{phy}		ι^{int}		ι^{tot}		ι^{phy}		ι^{int}		ι^{tot}	
VARIABLES	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls
Total cashflow (c^{tot})	0.0662***	0.0723***	0.2587***	0.2638***	0.3312***	0.3441***	0.0730***	0.0823***	0.2308***	0.2376***	0.3097***	0.3281***
	(0.0054)	(0.0056)	(0.0353)	(0.0068)	(0.0079)	(0.0080)	(0.0062)	(0.0064)	(0.0076)	(0.0077)	(0.0090)	(0.0091)
Total q (q^{tot})	0.1066**	0.0196	0.234	0.4198***	0.3708***	0.4749***	0.1127***	0.0411	0.2055***	0.3602***	0.3482***	0.4367***
	(0.0416)	(0.0429)	(0.3944)	(0.0523)	(0.0605)	(0.0613)	(0.0425)	(0.0435)	(0.0522)	(0.0528)	(0.0617)	(0.0621)
Log Assets		-0.0132		-0.0825***		-0.1064***		-0.0126		-0.0828***		-0.1058***
		(0.0134)		(0.0163)		(0.0191)		(0.0134)		(0.0162)		(0.0191)
Lndelta		0.1597***		-0.6319***		-0.5039***		0.1419***		-0.6073***		-0.5026***
		(0.0369)		(0.0450)		(0.0527)		(0.0398)		(0.0483)		(0.0568)
Lnvega		-0.1282***		0.1074***		-0.026		-0.1273***		0.1092***		-0.0224
		(0.0211)		(0.0257)		(0.0301)		(0.0213)		(0.0258)		(0.0304)
Stock-ownship		0.0718***		0.2087***		0.2918***		0.0764***		0.2002***		0.2888***
		(0.0151)		(0.0184)		(0.0215)		(0.0153)		(0.0186)		(0.0218)
G-score		-0.1308***		-0.2898***		-0.4123***		-0.1310***		-0.2889***		-0.4114***
		(0.0468)		(0.0570)		(0.0669)		(0.0468)		(0.0569)		(0.0668)
Z-score		-1.0155***		0.1588		-1.0169***		-1.0598***		0.2697		-0.9530***
		(0.1686)		(0.2053)		(0.2407)		(0.1690)		(0.2052)		(0.2412)
Longholder40							0.5348***	0.5490***	-2.1339***	-1.2860***	-1.6225***	-0.6861***
							(0.1731)	(0.1788)	(0.2127)	(0.2172)	(0.2514)	(0.2553)
(Longholder40)*(c^{tot})							-0.0229***	-0.0296***	0.0934***	0.0771***	0.0716***	0.0466***
							(0.0088)	(0.0088)	(0.0109)	(0.0107)	(0.0128)	(0.0126)

Year Fixed effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6,898	6,898	6,898	6,898	6,898	6,898	6,897	6,897	6,897	6,897	6,897	6,897
Adj. R-squared	0.266	0.282	0.453	0.482	0.398	0.434	0.267	0.283	0.4605	0.4856	0.4018	0.4353

Table 4: Panel A …continued

	Longholder100						Longholder_low					
	ι^{phy}		ι^{int}		ι^{tot}		ι^{phy}		ι^{int}		ι^{tot}	
VARIABLES	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls
Total cashflow (c^{tot})	0.0655***	0.0726***	0.2459***	0.2522***	0.3168***	0.3324***	0.0678***	0.0733***	0.2641***	0.2689***	0.3380***	0.3502***
	(0.0057)	(0.0059)	(0.0070)	(0.0072)	(0.0083)	(0.0084)	(0.0056)	(0.0057)	(0.0069)	(0.0069)	(0.0081)	(0.0081)
Total q (q^{tot})	0.0764*	0.0127	0.1983***	0.3564***	0.3005***	0.4007***	0.1046**	0.0194	0.2139***	0.4021***	0.3488***	0.4572***
	(0.0429)	(0.0439)	(0.0530)	(0.0534)	(0.0623)	(0.0625)	(0.0417)	(0.0431)	(0.0516)	(0.0524)	(0.0607)	(0.0614)
Log Assets		-0.0081		-0.0854***		-0.1026***		-0.014		-0.0807***		-0.1055***
		(0.0135)		(0.0164)		(0.0192)		(0.0134)		(0.0163)		(0.0191)
Lndelta		0.1444***		-0.6122***		-0.5042***		0.1610***		-0.6355***		-0.5062***
		(0.0390)		(0.0474)		(0.0555)		(0.0369)		(0.0449)		(0.0527)
Lnvega		-0.1189***		0.1098***		-0.0114		-0.1294***		0.1121***		-0.0227
		(0.0220)		(0.0268)		(0.0314)		(0.0211)		(0.0257)		(0.0301)
Stock-ownship		0.0756***		0.2018***		0.2893***		0.0712***		0.2084***		0.2909***
		(0.0152)		(0.0186)		(0.0217)		(0.0151)		(0.0184)		(0.0215)
G-score		-0.1309***		-0.2988***		-0.4215***		-0.1316***		-0.2898***		-0.4132***
		(0.0472)		(0.0574)		(0.0672)		(0.0468)		(0.0570)		(0.0668)
Z-score		-0.9578***		0.1973		-0.9257***		-1.0092***		0.1715		-0.9980***
		(0.1703)		(0.2072)		(0.2426)		(0.1686)		(0.2051)		(0.2405)
Longholder100	0.189	0.045	-2.2903***	-1.3981***	-2.1724***	-1.3588***						
	(0.2518)	(0.2558)	(0.3110)	(0.3112)	(0.3657)	(0.3643)						
(Longholder100)*(c^{tot})	0.0106	0.0046	0.1008***	0.0817***	0.1172***	0.0899***						
	(0.0116)	(0.0115)	(0.0143)	(0.0140)	(0.0168)	(0.0164)						
Longholder-low	0.189	0.045	-2.2903***	-1.3981***	-2.1724***	-1.3588***	0.6625*	0.6133*	1.0222**	1.0090**	1.7004***	1.6316***
							(0.3664)	(0.3628)	(0.4529)	(0.4414)	(0.5329)	(0.5175)
(Longholder-low)*(c^{tot})							-0.029	-0.021	-0.1046***	-0.1017***	-0.1344***	-0.1218***
							(0.0216)	(0.0214)	(0.0267)	(0.0260)	(0.0314)	(0.0305)
Year Fixed effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6,778	6,778	6,778	6,778	6,778	6,778	6,898	6,898	6,898	6,898	6,898	6,898
Adj. R-squared	0.2693	0.2837	0.4569	0.4837	0.4032	0.4379	0.2664	0.2822	0.4542	0.4831	0.3998	0.4355

Panel B

	Base Regression						Longholder40					
	ι^{phy}		ι^{int}		ι^{tot}		ι^{phy}		ι^{int}		ι^{tot}	
VARIABLES	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls
Standard cash flow (c*)	-0.0016	-0.0022*	0.0057***	0.0045***	0.0040**	0.0024	0.0002	-0.0003	0.0119***	0.0108***	0.0122***	0.0109***
	(0.0012)	(0.0012)	(0.0016)	(0.0016)	(0.0020)	(0.0021)	(0.0014)	(0.0014)	(0.0019)	(0.0019)	(0.0024)	(0.0024)
Standard q (q*)	-0.0455***	-0.0615***	0.2022***	0.2155***	0.1627***	0.1594***	-0.0458***	-0.0590***	0.2145***	0.2262***	0.1751***	0.1731***
	(0.0066)	(0.0066)	(0.0088)	(0.0088)	(0.0112)	(0.0111)	(0.0067)	(0.0067)	(0.0090)	(0.0089)	(0.0114)	(0.0113)
Log Assets		-0.0356***		-0.0925***		-0.1398***		-0.0331**		-0.0909***		-0.1354***
		(0.0134)		(0.0179)		(0.0227)		(0.0134)		(0.0179)		(0.0227)
Lndelta		0.4451***		-0.3516***		0.0811		0.3931***		-0.4129***		-0.041
		(0.0358)		(0.0476)		(0.0605)		(0.0389)		(0.0517)		(0.0657)
Lnvega		-0.1983***		0.0445		-0.1637***		-0.1888***		0.0551*		-0.1419***
		(0.0210)		(0.0280)		(0.0356)		(0.0212)		(0.0282)		(0.0358)
Stock_ownship		0.0316**		0.1695***		0.2096***		0.0406***		0.1815***		0.2321***
		(0.0151)		(0.0201)		(0.0256)		(0.0153)		(0.0203)		(0.0258)
Gvscore		-0.1633***		-0.3934***		-0.5529***		-0.1593***		-0.3818***		-0.5365***
		(0.0470)		(0.0627)		(0.0796)		(0.0470)		(0.0625)		(0.0793)
Z-score		-0.3714**		2.5148***		2.0584***		-0.4199**		2.3906***		1.8771***
		(0.1665)		(0.2218)		(0.2819)		(0.1670)		(0.2219)		(0.2817)
Longholder40							0.8982***	0.4687***	0.5000***	0.8310***	1.4425***	1.3804***
							(0.1141)	(0.1214)	(0.1528)	(0.1614)	(0.1937)	(0.2049)
(Longholder40)*(c*)							-0.0059***	-0.0047***	-0.0159***	-0.0158***	-0.0224***	-0.0214***
							(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Year Fixed effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6898	6898	6898	6898	6898	6898	6,897	6,897	6,897	6,897	6,897	6,897
Adj. R-squared	0.24	0.27	0.34	0.37	0.16	0.20	0.2519	0.2764	0.3471	0.3777	0.1665	0.2033

Table 4: Panel B…continued

	Longholder100						Longholder_low					
	ι^{phy}		ι^{int}		ι^{tot}		ι^{phy}		ι^{int}		ι^{tot}	
VARIABLES	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls	Fixed Effects, No Controls	Fixed Effects, Controls
Standard cash flow (c*)	-0.0010	-0.0017	0.0088***	0.0077***	0.0077***	0.0064***	-0.0009	-0.0016	0.0055***	0.0043***	0.0044**	0.0028
	(0.0013)	(0.0013)	(0.0017)	(0.0017)	(0.0021)	(0.0022)	(0.0012)	(0.0012)	(0.0016)	(0.0016)	(0.0021)	(0.0021)
Standard q (q*)	-0.0531***	-0.0646***	0.2163***	0.2279***	0.1693***	0.1690***	-0.0470***	-0.0626***	0.2021***	0.2155***	0.1613***	0.1585***
	(0.0068)	(0.0068)	(0.0091)	(0.0091)	(0.0116)	(0.0115)	(0.0066)	(0.0066)	(0.0088)	(0.0088)	(0.0112)	(0.0112)
Log Assets		-0.0284**		-0.0978***		-0.1364***		-0.0356***		-0.0913***		-0.1387***
		(0.0136)		(0.0180)		(0.0229)		(0.0134)		(0.0179)		(0.0228)
Lndelta		0.3919***		-0.3907***		-0.0196		0.4447***		-0.3543***		0.0783
		(0.0381)		(0.0505)		(0.0642)		(0.0358)		(0.0477)		(0.0606)
Lnvega		-0.1719***		0.0587**		-0.1190***		-0.1987***		0.0471*		-0.1617***
		(0.0220)		(0.0292)		(0.0371)		(0.0211)		(0.0281)		(0.0357)
Stock_ownship		0.0400***		0.1704***		0.2201***		0.0311**		0.1703***		0.2099***
		(0.0152)		(0.0202)		(0.0257)		(0.0151)		(0.0201)		(0.0256)
Gvscore		-0.1663***		-0.3879***		-0.5502***		-0.1662***		-0.3914***		-0.5535***
		(0.0474)		(0.0629)		(0.0799)		(0.0470)		(0.0627)		(0.0797)
Z-score		-0.3315**		2.4177***		1.9897***		-0.3658**		2.5081***		2.0569***
		(0.1681)		(0.2230)		(0.2833)		(0.1665)		(0.2218)		(0.2819)
Longholder100	-0.0010	-0.0017	0.0088***	0.0077***	0.0077***	0.0064***	-0.0009	-0.0016	0.0055***	0.0043***	0.0044**	0.0028
	(0.0013)	(0.0013)	(0.0017)	(0.0017)	(0.0021)	(0.0022)	(0.0012)	(0.0012)	(0.0016)	(0.0016)	(0.0021)	(0.0021)
(Longholder100)*(c*)	-0.0531***	-0.0646***	0.2163***	0.2279***	0.1693***	0.1690***	-0.0470***	-0.0626***	0.2021***	0.2155***	0.1613***	0.1585***
	(0.0068)	(0.0068)	(0.0091)	(0.0091)	(0.0116)	(0.0115)	(0.0066)	(0.0066)	(0.0088)	(0.0088)	(0.0112)	(0.0112)
Longholder_low		-0.0284**		-0.0978***		-0.1364***		-0.0356***		-0.0913***		-0.1387***
		(0.0136)		(0.0180)		(0.0229)		(0.0134)		(0.0179)		(0.0228)
Longholder_low*(c*)		0.3919***		-0.3907***		-0.0196		0.4447***		-0.3543***		0.0783
		(0.0381)		(0.0505)		(0.0642)		(0.0358)		(0.0477)		(0.0606)
Year Fixed effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6,778	6,778	6,778	6,778	6,778	6,778	6,898	6,898	6,898	6,898	6,898	6,898
Adj. R-squared	0.2548	0.2778	0.3499	0.3802	0.1696	0.2051	0.2455	0.2755	0.3436	0.3742	0.1588	0.1968

In Table 4, Panel B, we repeat the methodology of Panel A but replace total cashflow (c^{tot}) and total q (q^{tot}) with standard cashflow (c*) and standard q (q*). The first base regression in Panel B reconfirms the prevailing view found in the literature on investment-standard q sensitivity—namely, that standard q has strong explanatory power for physical investments. Moreover, our results also confirm that total cashflow (c^{tot}) can explain the intangible and total investments of a firm better than total q (q^{tot}). The denominator for both q^{tot} and c^{tot} is K^{tot} (total capital stock). Among the control variables, delta indicates the change in a CEO's stock and option portfolio due to a 1% increase in the price of the firm's common stock. Vega represents the changes in a CEO's stocks and options due to a 1% increase in the annualized standard deviation of the firm's stock return. The relationship between delta and vega is negative. High delta discourages CEO risk taking, whereas high vega encourages risk taki/ng. Generally, higher portfolio volatility sensitivity and higher use of stock options make intangible investments more sensitive than physical investments. We find that CEO stock ownership and vega are less sensitive to physical investments than intangible investments. The negative sign of delta for intangible investments confirms greater risk-taking behavior on the part of CEOs. We observe that the more overconfident the CEO of a company, the more sensitive the relationship between total cashflow (c^{tot}) and physical investments. Our findings are similar to Malmendier & Tate (2005) who only consider physical investments. Our additional contribution to the literature is revealing that such a relationship becomes stronger when a CEO makes decisions about intangible investment. Governance and Z-score play a role in there being lower levels of intangible investment compared to physical investment. In an environment with greater corporate governance, CEOs tend to invest less in intangibles.

Our results are weaker in Table 4, Panel B compared to Panel A. In Panel B, we scale standard q (q^*) and standard cashflow (c^*) by physical capital stock (K^{phy}) instead of the total capital stock (K^{tot}) we use in Panel A. A significant difference between the results of these two tables is consistent with the findings of P-T, who document that in general, total q (q^{tot}) delivers a higher R^2 than q^*. This means that using total q (q^{tot}) explains investment opportunities better than using standard q (q^*). The negative coefficient of logged total assets suggests that firms decrease investments when the firm size is large (Huang, et al., 2016). One possible interpretation here is that size captures the greater financing constraints in the investment (Malmendier & Tate, 2005).

Next, we explain the coefficients obtained from the interaction between the three types of overconfidence measures (longholders) and cashflow sensitivity. In Table 4, Panel A, the interaction terms with the control variables are significant and coefficients are positive and higher for longholder100 than longholder40 for intangible and total investments. For longholderlow, the coefficients are significant and negative for intangible and total investments, but insignificant for physical investments. We can interpret such results as meaning that a longholderlow CEO has lower investment-cashflow sensitivity. In fact, longholderlow displays negative investment-cashflow sensitivity for intangible and total investments. The results also suggest that unlike intangible and total investment, physical investment is more sensitive to cashflow when the CEO is a longholder40. On the other hand, longholder100 CEOs display similar behavior regarding physical investments as longholderlow CEOs, but unlike longholderlow CEOs they show positive and significant investment-cashflow sensitivity for intangible and total investments. This is not surprising, as one would expect that longholderlow and longholder100, being the two extremes of the overconfidence measure, would exhibit contrasting results, whereas the longholder40 measure sufficiently explains investment-cashflow sensitivity for all three types of investments.

6. What else may cause the investment and overconfidence relationship?

Our overconfidence measures are based on the CEO's option exercise behavior. It is reasonable to ask whether our results are correlated with other omitted variables. The results could come from the CEO's insider information, CEO's casual behavior (very unlikely), or other factors than the CEO's overconfidence. To justify our conclusions about investment-cashflow sensitivity for our longholder measures, we provide alternative explanations that may cause the results (Huang, et al., 2016). We show that our findings are robust to these alternative explanations.

The first alternative explanation is private information. Why might a CEO delay the exercise of an option? Does the CEO have private information? Malmendier & Tate (2005) rule out this possibility, arguing that private information is mostly transitory and hardly survives when we use fixed effects controls. Therefore, it is unlikely that a CEO would display repeated late exercise behavior over a considerably large period; thus, an option-based measure of CEO overconfidence is not biased towards private information (Huang, et al., 2016).

Another potential alternate explanation has to do with risk-taking. Is a CEO actually a risk taker rather than merely being overconfident? Our longholder40 measure explains the CEO's option exercising behavior by depicting the scenario in which a CEO does not exercise options even if they are 40% in the money. One may argue that longholder100 describes extreme risk tolerant behavior in that such CEOs delay exercising their options at least twice during the option holding period even if the options are 100% in the money. It may seem obvious that what we label as "overconfident" CEOs are risk takers rather than overconfident, assuming a constant relative risk aversion (CRRA) 3 for all CEOs (Hall & Murphy, 2002). This risk-taking behavior of overconfident CEOs lead to them being imprudent and rash about increasing exposure to firm-specific risk. In the next section we will show that CEOs of financially constrained firms are less likely to increase investment—a finding that completely contradicts the risk tolerance hypothesis. The above explanation concludes that overconfidence is different from risk taking behavior.

We also reject the hypothesis that CEO overconfidence is simply part of an organized strategy to signal the market. This hypothesis holds that a CEO may be motivated by their own self-interest or may acquiesce to pressure from the Board of Directors to hold deep in the money unexercised exercisable options as a way to signal the market about the positive prospects of the firm. According to Malmendier & Tate (2005), the signaling theory does not effectively capture the investment-cashflow sensitivity in most cases. If overconfidence is used as a signaling device, then it should remove information asymmetry and eradicate investment-cashflow sensitivity for the overconfident CEO's firm.

Table 5

Table 5 presents the results of the ordinary least squares regression of the column variables on the beginning of the year Tobin's q, cashflow, firm and CEO characteristics, longholders,, and industry and year fixed effects. Firms are sorted into quartiles following the Kaplan–Zingales index. Quartile 1 indicates least financially constrained and Quartile 4 indicates most financially constrained. All column variables in the table below are scaled by total capital stock ($K^{phy}+K^{int}$). The numerator for both total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity [Compustat item prcc_f*csho] minus short-term assets [Compustat item act]. The denominators for the total q and standard q are total capital stock ($K^{phy}+K^{int}$) and physical capital stock (K^{phy}), respectively. The numerator for physical investment (ι^{phy}) and intangible investment (ι^{int}) are Capital expenditure [Compustat item capx] and R&D [Compustat item xrd] plus 30% of selling, general, and administrative expenses, respectively. Total investment (i^{tot}) is the sum of ι^{phy} and ι^{int}. Longholder40 is a dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration with the option being at least 40% in the money entering its final year, and otherwise takes the value 0. Longholder100 is a dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration with the option being more than 100% in the money at least twice during the option holding period, and otherwise takes the value 0. Longholderlow is a dummy variable that takes the value 1 if the CEO exercises stock options that are less than 30% in the money provided the CEO does not hold other exercisable options that are more than 30% in the money, and otherwise takes the value 0. Other control variables are defined in the Appendix. The regression results on total q (q^{tot}) and total cashflow (c^{tot}) are presented in Panel A while the results of standard q (q^*) and standard cashflow (c^*) are presented in Panel B. Standard errors are in parentheses. P-values are indicated as *** p<0.01, ** p<0.05, * p<0.1.

Panel A

Longholder40 (OLS with Fixed Effect)

	Physical investment (ι^{phy})				Intangible investment (ι^{int})				Total investment (ι^{tot})			
VARIABLES	Least Constrained(1)	2	3	Most Constrained(4)	Least Constrained(1)	2	3	Most Constrained(4)	Least Constrained(1)	2	3	Most Constrained(4)
Total cashflow (c^{tot})	0.0869***	0.0740***	0.0718***	0.0890***	0.3047***	0.2535***	0.2771***	0.2749***	0.3927***	0.3306***	0.3601***	0.3735***
	(0.0129)	(0.0134)	(0.0138)	(0.0172)	(0.0151)	(0.0172)	(0.0192)	(0.0211)	(0.0170)	(0.0190)	(0.0208)	(0.0244)
Total q (q^{tot})	0.0746	-0.0059	-0.1243	0.2713**	-0.3734***	0.2653*	-0.0344	0.0851	-0.2855**	0.3174**	-0.1664	0.4120**
	(0.0892)	(0.1067)	(0.1285)	(0.1277)	(0.1041)	(0.1365)	(0.1779)	(0.1570)	(0.1173)	(0.1509)	(0.1931)	(0.1810)
Log Assets	0.0273	-0.0029	-0.01	-0.018	-0.0414*	-0.0484	-0.2025***	-0.0341	-0.0149	-0.0599	-0.2082***	-0.055
	(0.0202)	(0.0289)	(0.0319)	(0.0338)	(0.0236)	(0.0370)	(0.0442)	(0.0416)	(0.0266)	(0.0409)	(0.0480)	(0.0480)
Lndelta	0.2401***	0.2532***	0.2756***	-0.010	-0.2617***	-0.5181***	-1.1170***	-0.4927***	-0.010	-0.2833**	-0.8566***	-0.5714***
	(0.0709)	(0.0855)	(0.0965)	(0.0969)	(0.0827)	(0.1093)	(0.1337)	(0.1192)	(0.0932)	(0.1208)	(0.1451)	(0.1374)
Lnvega	-0.0993***	-0.1660***	-0.1683***	-0.0504	0.0374	0.0994*	0.2516***	0.0379	-0.0626	-0.0607	0.0914	-0.0353
	(0.0312)	(0.0449)	(0.0524)	(0.0511)	(0.0364)	(0.0574)	(0.0726)	(0.0628)	(0.0411)	(0.0635)	(0.0788)	(0.0724)
Stock-ownship	-0.0384	0.0421	0.0452	0.1613***	0.1192***	0.2357***	0.2672***	0.0491	0.0787**	0.2854***	0.3156***	0.2294***
	(0.0300)	(0.0310)	(0.0326)	(0.0354)	(0.0350)	(0.0396)	(0.0452)	(0.0435)	(0.0395)	(0.0438)	(0.0490)	(0.0501)
G-score	-0.3494***	-0.1169	-0.0329	-0.0023	-0.1414	-0.198	-0.4707***	-0.5084***	-0.4937***	-0.3227**	-0.5086***	-0.4773***
	(0.0832)	(0.0988)	(0.1035)	(0.1049)	(0.0971)	(0.1264)	(0.1434)	(0.1290)	(0.1094)	(0.1397)	(0.1557)	(0.1487)
Z-score	-1.1896***	-1.9960***	-0.8892	-0.4959	-0.7902**	0.1068	1.0908	-0.5187	-2.0306***	-2.2151***	0.1008	-0.9158
	(0.3444)	(0.4668)	(0.6667)	(0.5345)	(0.4017)	(0.5970)	(0.9233)	(0.6574)	(0.4528)	(0.6601)	(1.0023)	(0.7577)
Longholder40	0.3766	-0.0972	-0.6168	-0.3722	-0.7586**	-1.5444***	-0.0725	-1.0429**	-0.376	-1.8161***	-0.4579	-1.5175**
	(0.3304)	(0.4147)	(0.4316)	(0.4268)	(0.3855)	(0.5303)	(0.5977)	(0.5250)	(0.4345)	(0.5864)	(0.6488)	(0.6051)
(Longholder40)*(c^{tot})	-0.0395**	-0.0006	0.0373*	-0.0002	0.0560***	0.0973***	0.0592**	0.0387	0.0145	0.1076***	0.0828***	0.0438
	-0.0162	-0.0207	-0.0207	-0.0220	-0.0189	-0.0264	-0.0286	-0.0271	-0.0213	-0.0292	-0.0311	-0.0312

Year Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,521	1,331	1,137	1,421	1,521	1,331	1,137	1,421	1,521	1,331	1,137	1,421
Adj. R-squared	0.3758	0.264	0.2658	0.3288	0.6078	0.4913	0.468	0.452	0.5588	0.4706	0.4566	0.4393

Panel B

Longholder40 (OLS with Fixed Effect)

	Physical investment (ιphy)				Intangible investment (ιint)				Total investment (ιtot)			
VARIABLES	Least Constrained(1)	2	3	Most Constrained(4)	Least Constrained(1)	2	3	Most Constrained(4)	Least Constrained(1)	2	3	Most Constrained(4)
Standard cash flow (c*)	0.0001	(0.0047)	(0.0012)	0.0008	0.0321***	0.0292***	0.0625***	0.0151**	0.0320***	0.0249***	0.0611***	0.0182**
	(0.0035)	(0.0033)	(0.0052)	(0.0057)	(0.0044)	(0.0040)	(0.0064)	(0.0063)	(0.0056)	(0.0050)	(0.0078)	(0.0088)
Standard q (q*)	-0.0749***	-0.0736***	-0.0778*	-0.1817***	0.1358***	0.1646***	0.1797***	0.3816***	0.0709**	0.0890***	0.1337**	0.2260***
	(0.0200)	(0.0226)	(0.0422)	(0.0531)	(0.0251)	(0.0272)	(0.0521)	(0.0587)	(0.0322)	(0.0338)	(0.0642)	(0.0817)
Log Assets	0.0079	0.0125	-0.0537	-0.0488	-0.037	-0.0708**	-0.1031**	-0.1279***	-0.0373	-0.0628	-0.1585***	-0.2017***
	(0.0222)	(0.0284)	(0.0350)	(0.0385)	(0.0279)	(0.0341)	(0.0432)	(0.0425)	(0.0359)	(0.0423)	(0.0533)	(0.0591)
Lndelta	0.4497***	0.3700***	0.4998***	0.6172***	-0.2500***	-0.4690***	-0.7952***	-0.7104***	0.2086*	-0.126	-0.3731**	-0.102
	(0.0731)	(0.0874)	(0.1025)	(0.1036)	(0.0919)	(0.1051)	(0.1265)	(0.1144)	(0.1181)	(0.1306)	(0.1558)	(0.1593)
Lnvega	-0.1643***	-0.1906***	-0.2492***	-0.2020***	0.0262	0.0497	0.1996***	0.0155	-0.1452***	-0.1391**	-0.0467	-0.2190**
	(0.0339)	(0.0445)	(0.0554)	(0.0604)	(0.0426)	(0.0535)	(0.0684)	(0.0667)	(0.0547)	(0.0664)	(0.0842)	(0.0929)
Stock_ownship	-0.0338	0.053	0.1066***	-0.0524	0.1218***	0.1862***	0.2468***	0.1634***	0.0842*	0.2549***	0.3697***	0.1321**
	(0.0316)	(0.0392)	(0.0352)	(0.0366)	(0.0397)	(0.0472)	(0.0434)	(0.0405)	(0.0510)	(0.0586)	(0.0535)	(0.0563)
Gvscore	-0.4158***	-0.0867	0.0515	-0.1214	-0.2941***	-0.0891	-0.5851***	-0.4129***	-0.7269***	-0.135	-0.4986***	-0.4962***
	(0.0891)	(0.1012)	(0.1131)	(0.1196)	(0.1120)	(0.1216)	(0.1396)	(0.1320)	(0.1439)	(0.1511)	(0.1720)	(0.1839)
Z-score	-1.5128***	-0.473	0.3789	0.9178*	1.0341**	1.3303***	1.6827**	0.7411	-0.6998	0.918	2.1541**	1.6718**
	(0.3407)	(0.3750)	(0.5601)	(0.5053)	(0.4282)	(0.4508)	(0.6913)	(0.5581)	(0.5501)	(0.5602)	(0.8517)	(0.7771)
Longholder40	0.1432	0.4101	0.3622	0.6438*	0.5397*	0.4521	0.7654*	0.1148	0.6885*	0.8875**	1.2873**	0.8739*
	(0.2390)	(0.2663)	(0.3293)	(0.3347)	(0.3004)	(0.3201)	(0.4064)	(0.3696)	(0.3859)	(0.3978)	(0.5008)	(0.5147)
(Longholder40)*(c*)	-0.0076*	-0.0039	-0.0048	-0.0025	-0.0036	-0.0042	-0.0246***	0.0123	-0.0121*	-0.0079	-0.0299***	0.0042
	(0.004)	(0.005)	(0.008)	(0.008)	(0.005)	(0.006)	(0.009)	(0.009)	(0.007)	(0.007)	(0.012)	(0.012)
Year Fixed effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,510	1,415	1,237	1,423	1,510	1,415	1,237	1,423	1,510	1,415	1,237	1,423
Adj. R-squared	0.3599	0.2798	0.2431	0.3312	0.4806	0.371	0.3853	0.3758	0.2727	0.1792	0.2505	0.1975

7. The relationship between CEO overconfidence and financial constraints

We hypothesize that investment-cashflow sensitivity is higher for intangible investments than physical investments. Our overconfidence measure is especially applicable to firms that are primarily equity-dependent. If a firm is cash-rich or has enough utilized debt limits to finance all its desired projects, it should be less sensitive to investment-cashflow. Following Malmendier & Tate (2005) and Baker et al. (2003), we construct the K-Z index developed by Kaplan & Zingales (1997) for our sample firms. The K-Z index is a logit measure of financial constraint that classifies whether a firm is financially constrained or not. Five accounting ratios are used to calculate the K-Z index: cashflow to capital, Tobin's q, leverage, dividend to capital, and cash holding to capital. To capture the sensitivity of intangible capital and compare its effect to that of the physical capital measure, we construct two different versions of K-Z:

$$KZ^{tot} = -1.001909 * C^{tot} + .2826389 * q^{tot} + 3.139193 * levrage^{6} - (39.3678 * (dvc + dvp)^{7}/K^{tot}) - (1.314759 * che^{8}/K^{tot}) \quad (2)$$

$$KZ^{*} = -1.001909 * C^{*} + .2826389 * q^{*} + 3.139193 * levrage - (39.3678 * (dvc + dvp)/K^{phy}) - (1.314759 * che/K^{phy}) \quad (3)$$

Where in KZ^{tot} we apply total capital (k^{tot}) and in KZ^{*} we apply physical capital (k^{phy}) in the denominator. As we mention earlier, total cashflow (C^{tot}), standard cash-flow (C^{*}), total q (q^{tot}) and standard q (q*) are measured following P-T (2017) and defined in the Appendix. A higher value of KZ denotes higher financial constraint. We sort the KZ index into quartiles where

[6] COMPUSTAT data item: leverage=(item 9+ item 34)/ (item 9+ item 34+ item 216)
[7] COMPUSTAT data item: dvc+dvp= item 21 + item 19
[8] COMPUSTAT data item: Che = item 1

Quartile 1 firms are the least constrained and Quartile 4 are the most constrained. We use longholder40 as the proxy for overconfidence in this test, as we have shown earlier that this is the most moderate of our three measures of overconfidence. Compared to previous studies, our results explain investment-cashflow sensitivity in more detail as we consider the impact of financial constraints not only on physical investments but also on intangible and total investments. Table 5, Panel A presents the regression results measured using total cashflow (C^{tot}) and total q (q^{tot}). As predicted, we find that the effects of overconfidence on investment-cashflow sensitivity are significant for intangible and total investment under the KZ index measure. This suggests that the effect of overconfidence on investment-cashflow sensitivity is more prominent for intangible investments than physical investments.

As before, we repeat the process of Panel A by replacing total cashflow (c^{tot}) and total q (q^{tot}) with standard cashflow (c*) and standard q (q*) in Panel B. As predicted, we find that q^{tot} and c^{tot} explain investments better than c* and q*. For example, the coefficient of the interaction term for the most constrained case in Table 5, Panel A (intangible investment column) is stronger and more highly statistically significant than the same intangible investment column in Table 5, Panel B. Further, the Adjusted R^2 for the statistically significant coefficients in Panel B are low relative to the Adjusted R^2 in Panel A. Our findings extend the Malmendier & Tate (2005) results that suggest investment-cashflow sensitivity is more pronounced for overconfident CEOs operating in a more financial constrained condition. We add that P-T's measure of cashflow and Tobin's q explain intangible and total investment-cashflow sensitivity more efficiently than the literature's standard cashflow and Tobin's q measures.

Table 6

Table 6 presents the results of the ordinary least squares regression of the column variables on the beginning of the year Tobin's q, cashflow, firm and CEO characteristic variables, longholders, and industry and year fixed effects. Firms are sorted into quartiles based on their intangible intensity measured as $K^{int}/(K^{int}+K^{phy})$. Quartile 1 represents the least intangible intensity whereas Quartile 4 represents the highest intangible intensity. All the column variables in the table below are scaled by total capital stock ($K^{phy}+K^{int}$). The numerator for both total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity [Compustat item prcc_f*csho] minus short-term assets [Compustat item act]. The denominators for total q and standard q are total capital stock ($K^{phy}+K^{int}$) and physical capital stock (K^{phy}), respectively. The numerator for physical investment (ι^{phy}) and intangible investment (ι^{int}) are Capital expenditure [Compustat item capx] and R&D [Compustat item xrd] plus 30% of selling, general and administrative expenses, respectively. Total investment (i^{tot}) is the sum of ι^{phy} and ι^{int}. Longholder40 is a dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration with the option being at least 40% in the money entering its final year, and otherwise takes the value 0. Longholder100 is a dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration with the option being more than 100% in the money at least twice during the option holding period, and otherwise takes the value 0. Longholderlow is a dummy variable that takes the value 1 if the CEO exercises stock options that are less than 30% in the money provided the CEO does not hold other exercisable options that are more than 30% in the money, and otherwise takes the value 0. Other control variables are defined in the Appendix. The regression results on total q (q^{tot}) and total cash flow (c^{tot}) are presented in Panel A while the results of standard q (q^{*}) and standard cashflow (c^{*}) are presented in Panel B. Standard errors are in parentheses. P-values are indicated as *** p<0.01, ** p<0.05, * p<0.1.

	Panel A: Total q and Cashflow total OLS with Fixed Effect				Panel B: Standard q and Cashflow standard OLS with Fixed Effect			
	Total (ιtot)				Total (ιtot)			
VARIABLES	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Intangible Intensity	19.39%	52.13%	71.52%	86.10%	27.18%	42.74%	74.80%	82.44%
Cashflow	0.3566***	0.3677***	0.3346***	0.2737***	0.2093***	0.0877***	0.0192***	(0.0037)
	(0.0615)	(0.0160)	(0.0176)	(0.0171)	(0.0174)	(0.0080)	(0.0059)	(0.0033)
Tobinq	0.9139	-0.4721***	0.3862***	0.8648***	0.8143***	0.1622***	0.4386***	0.1789***
	(0.8407)	(0.1171)	(0.1172)	(0.1067)	(0.1495)	(0.0606)	(0.0308)	(0.0152)
Log Assets	-0.0831**	-0.0348	-0.0940***	-0.2048***	-0.0990**	-0.0516	-0.1059**	-0.1916***
	(0.0359)	(0.0303)	(0.0361)	(0.0405)	(0.0422)	(0.0353)	(0.0417)	(0.0495)
Lndelta	-0.170	-0.107	-0.8032***	-0.9430***	-0.071	-0.075	-0.7847***	-0.4043***
	(0.3141)	(0.0910)	(0.1061)	(0.1252)	(0.1249)	(0.1050)	(0.1241)	(0.1512)
Lnvega	-0.2628**	-0.0346	-0.0204	0.1856***	-0.2946***	-0.0659	-0.027	0.0158
	(0.0815)	(0.0493)	(0.0560)	(0.0648)	(0.0687)	(0.0572)	(0.0643)	(0.0791)
Stock_ownship	0.1809	0.2233***	0.4631***	0.3094***	0.1819***	0.2540***	0.4858***	0.2995***
	(0.1410)	(0.0332)	(0.0448)	(0.0469)	(0.0488)	(0.0385)	(0.0522)	(0.0573)
Gvscore	-0.0957	-0.2701**	-0.4315***	-0.7132***	-0.0886	-0.4197***	-0.4823***	-0.7176***
	(0.2222)	(0.1052)	(0.1274)	(0.1447)	(0.1476)	(0.1223)	(0.1472)	(0.1768)
Z-score	-1.7426**	0.0712	-0.5522	-0.1937	-1.0805***	1.4334***	2.4395***	4.0240***
	(0.6588)	(0.4687)	(0.6413)	(0.5432)	(0.4068)	(0.5420)	(0.7396)	(0.6665)
Longholder40	1.529	-2.2668***	-0.9236*	-1.4465***	1.5602***	-0.6567*	0.2116	1.6703***
	(0.9586)	(0.4430)	(0.5098)	(0.5417)	(0.5148)	(0.3960)	(0.4652)	(0.5137)
Longholder40*ctot	-0.078	0.1110***	0.0538**	0.0827***	-0.0696**	0.0265**	0.004	-0.0186***
	(0.079)	(0.022)	(0.023)	(0.024)	(0.029)	(0.012)	(0.009)	(0.004)
Year Fixed effect	Yes	yes	yes	yes	yes	yes	yes	yes

Industry Fixed Effect	Yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,828	1,703	1,717	1,649	1,828	1,703	1,717	1,649
Adj. R-squared	0.3715	0.5263	0.4965	0.4691	0.3251	0.3568	0.3284	0.212

8. Comparing subsamples

In this section, we compare the results of subsamples using the intangible intensity (II) measure. In Table 6, we sort the sample firms into quartiles based on their amount of intangible capital.

$$II = K^{int} / (K^{int} + K^{phy})$$

Quartiles 1 and 2 denote the lowest and highest amounts of II, respectively. The q^{tot} and c^{tot} used in this paper fit the data better in settings not only with intangible capital but with physical capital as well. The portfolio volatility sensitivity proxy, vega, is higher and more statistically significant in the q^{tot} and c^{tot} settings relative to the q* and c* settings. More of the coefficients for longholder40 and the interaction term are significant when we use q^{tot} and c^{tot}. We observe that q* and c* cannot explain the sensitivity of the longholder40 and the interaction term in a high intangible capital environment. Also, the R^2 for the statistically significant coefficients are higher in the in q^{tot} and c^{tot} settings relative to q* and c*. These results suggest that traditional q* and c* are inefficient at measuring investment-cashflow sensitivity. Our results answer the question of Chen & Chen (2012), who observe a weaker relationship between the investment-cashflow sensitivity in recent years. We suggest that this weaker relation is partially caused by the increasingly large share of intangible capital at the firm level that cannot be explained efficiently by standard q* and c*. P-T argue that intangible capital adjusts more slowly relative to physical capital in response to changes in investment opportunities because of adjustment-cost convexities, which is a key reason why q^{tot} and c^{tot} explain investment-cashflow sensitivity better than q* and c*.

Table 7: Errors in variables correction

Table 7 presents the biased (errors in variables -EIV) corrected results. Base regression, longholder40, longholder100, and longholderlow models using the cumulant estimator include three investments dependent variables (ι^{phy}, ι^{int}, ι^{tot}) and firm and year fixed effects. In Panel A, the independent variables are c^{tot} and q^{tot} and the set of control variables used in the base regression. For each of the longholder models, regressions using the cumulant estimator include the base regression variables plus the respective longholder and its interaction term with c^{tot}. In Panel B, the process is similar to Panel A, except that we include c^* and q^* instead of c^{tot} and q^{tot}. The cumulant estimator for each investment dependent variable is measured with and without control variables. The numerator for the both the total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity [Compustat item prcc_f*csho] minus short-term assets [Compustat item act]. The denominators for the total q and standard q are total capital stock ($K^{phy}+K^{int}$) and physical capital stock (K^{phy}), respectively. The numerator for physical investment (I^{phy}) and intangible investment (I^{int}) are Capital expenditure [Compustat item capx] and R&D [Compustat item xrd] plus 30% of selling, general, and administrative expenses, respectively. Total investment (i^{tot}) is the sum of I^{phy} and I^{int}. R&D [Compustat item xrd] includes missing values and is scaled by total capital stock. Capital expenditure [Compustat item capx] is scaled by physical assets (K^{phy}). ρ^2 and τ^2 denote the within-firm R^2 from a hypothetical regression of investment on true variables, and a hypothetical regression of proxy variables on true variables, respectively. We also present the within R^2 obtained from the ordinary least squares regression for comparison.

	Specification		Panel A: New Measures (c^{tot} and q^{tot})					Panel B: Standard Measures (c^* and q^*)					Improvement: A over B	
			R^2	ρ^2	τ_1^2	τ_2^2	*J statistic*	R^2	ρ^2	τ_1^2	τ_2^2	*J statistic*	R^2	ρ^2
1. Base Regression	ι^{phy}	Fixed Effects	0.04	0.33	0.41	0.87	3.96	0.02	0.02	0.57	0.82	5.61	180%	1490%
		Fixed Effects with Controls	0.06	0.30	0.60	0.72	10.36	0.06	0.04	0.96	2.41	8.91	16%	586%
	ι^{int}	Fixed Effects	0.29	0.43	0.70	1.36	24.27	0.14	0.16	0.28	0.89	18.29	101%	178%
		Fixed Effects with Controls	0.32	0.44	0.75	26.38	41.57	0.18	0.20	0.35	0.91	20.56	77%	126%
	ι^{tot}	Fixed Effects	0.33	0.45	0.78	0.72	30.85	0.06	0.08	0.55	0.84	21.64	440%	495%
		Fixed Effects with Controls	0.37	0.53	0.69	0.14	43.77	0.11	0.12	0.55	0.87	27.81	251%	354%
2. Longholder40	ι^{phy}	Fixed Effects	0.04	0.03	0.69	0.66	5.87	0.02	0.04	0.76	0.69	7.98	80%	-24%
		Fixed Effects with Controls	0.07	0.14	0.79	0.60	7.01	0.06	0.06	0.33	1.01	14.94	10%	145%
	ι^{int}	Fixed Effects	0.30	0.35	0.89	1.37	29.05	0.15	0.17	0.99	0.83	16.08	101%	106%
		Fixed Effects with Controls	0.33	0.38	0.89	0.43	35.91	0.19	0.21	1.06	0.85	18.09	74%	80%
	ι^{tot}	Fixed Effects	0.33	0.29	1.14	0.35	31.36	0.07	0.10	0.84	0.75	14.78	375%	182%
		Fixed Effects with Controls	0.37	0.25	0.54	0.82	36.98	0.11	0.14	0.78	0.81	18.60	227%	78%
3. Longholder100	ι^{phy}	Fixed Effects	0.05	0.14	0.68	0.64	13.15	0.03	0.03	0.32	0.97	8.55	69%	390%
		Fixed Effects with Controls	0.07	0.29	0.67	0.68	5.64	0.06	0.04	1.06	3.89	9.28	12%	561%
	ι^{int}	Fixed Effects	0.29	0.37	0.84	0.70	29.21	0.15	0.15	0.41	0.94	17.55	95%	139%
		Fixed Effects with Controls	0.32	0.40	0.84	1.02	41.97	0.19	0.20	0.58	0.93	19.99	71%	103%
	ι^{tot}	Fixed Effects	0.33	0.36	0.94	0.39	34.01	0.07	0.09	0.63	0.84	19.83	364%	319%

		Fixed Effects with Controls	0.37	0.48	0.79	0.29	47.45	0.11	0.13	0.61	0.88	26.36	227%	284%
4. Longholder_low	ι^{phy}	Fixed Effects	0.04	0.18	0.58	0.71	9.07	0.02	0.02	0.57	0.82	5.99	167%	762%
		Fixed Effects with Controls	0.06	0.29	0.62	0.71	4.24	0.06	0.04	0.94	1.03	8.40	15%	584%
	ι^{int}	Fixed Effects	0.29	0.43	0.68	16.45	19.72	0.14	0.16	0.62	0.86	19.11	101%	164%
		Fixed Effects with Controls	0.33	0.46	0.72	0.44	32.96	0.18	0.20	0.91	0.87	21.72	77%	124%
	ι^{tot}	Fixed Effects	0.33	0.46	0.74	1.29	28.88	0.06	0.08	0.62	0.81	22.83	439%	476%
		Fixed Effects with Controls	0.37	0.49	0.77	0.57	45.02	0.11	0.12	0.63	0.83	28.99	251%	305%

9. Errors in variables correction

In Table 7, we discuss the variation in R^2 results between the new and standard measures of Tobin's q and cashflow. We also present evidence that while total q (q^{tot}) is a better proxy to measure the true q than standard q (q*) is, the results obtained by using q^{tot} are not error-free. We apply the Erickson, Jiang, and Whited (2014); Erickson & Whited (2012); Erickson & Whited (2000); and Erickson & Whited (2002) error in variables cumulant estimator to correct any measurement error in our β estimates. The cumulant estimators generate consistent ordinary least square estimates by analyzing the higher order cumulants data[9]. Errors in the measurement and proxy independent variables of OLS provide inconsistent estimators. The cumulant estimator overcomes this shortcoming of OLS by generating unbiased estimates of β through the following two models:

$$\iota_{it} = a_i + q_{it}\beta + z_{it}\alpha + u_{it} \quad (4)$$

$$p_{it} = \gamma + q_{it} + \varepsilon_{it} \quad (5)$$

In equation 4, z represents a vector of perfectly measured control variables. In equation 5, p is a noisy proxy of the unobservable true q. The underlying assumptions are p_{it} has non-zero skewness, β is not equal to zero, and u_{it} and ε_{it} are independent of each other and independent of q_{it} and z_{it}. In the commonly used finance literature, the standard investment (ι^*) and standard q (q^*) both suffer from measurement error as they do not include intangible capital stock (K^{int}) in their calculation. The presence of the errors is correlated and violates the cumulant estimator's assumption that u_{it} and ε_{it} are uncorrelated[10]. To overcome this, we use a new proxy of q_{it} with

[9] The cumulant estimator is more useful than the Erickson & Whited (2002) higher order moment estimator because cumulant estimators are based on polynomial rings. The estimator is based on two step generalized method of moments (GMM) and minimum distance approach where the moments are equivalent to higher order cumulants of the regression variables. Cumulant estimators are asymptotically similar to higher order moments but have better finite sample properties and convenient closed form.

[10] For further details about the cumulant estimator, refer to Erickson et al. (2014).

fewer measurement errors. We present the bias-corrected estimation results in Table 7. The base regression, longholder40, longholder100, and longholderlow models using the cumulant estimator include three investment-related dependent variables (ι^{phy}, ι^{int}, ι^{tot}) and firm and year fixed effects. The cumulant estimator for each investment dependent variable is measured with and without control variables.

The following equation describes the base regression model with year and industry fixed effects but no controls:

$$I_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 Q_{it} + \varepsilon_{it} \qquad (6)$$

Equation 7 is the base regression model with year and industry fixed effects and controls:

$$I_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 Q_{it} + X'_{it}\beta_4 + \beta_5 \Delta_{it} + \beta_6 C_{it} \cdot \Delta_{it} + \varepsilon_{it} (7)$$

Equation 8 is the Longholders (longholder40, longholder100, longholder-low) regression model with year and industry fixed effects but no controls:

$$I_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 Q_{it} + \beta_4 \Delta_{it} + \beta_5 C_{it} \cdot \Delta_{it} + \varepsilon_{it} (8)$$

And equation 9 is the Longholders (longholder40, longholder100, longholder-low) regression model with year and industry fixed effects but no controls:

$$I_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 Q_{it} + X'_{it}\beta_4 + \beta_5 \Delta_{it} + \beta_6 C_{it} \cdot \Delta_{it} + \varepsilon_{it} (9)$$

In equations 6-9, I_{it} represents physical, intangible, or total investment respectively. *C* is the cashflow (either standard cashflow [c*] or total cash-flow [c^{tot}]). *Q* is the Tobin's q (standard q [q*] or total q [q^{tot}]). *X* is the vector of additional control variables used in the model. Δ is the proxy variables for our CEO overconfidence measures. The vector *X* includes Z-score, governance index, lndelta, lnvega, stock ownership, and the log of total assets. All variables are defined in the Appendix. In Panel A, the independent variables are c^{tot} and q^{tot} and the set of control variables used in the base regression. For each of the longholder models, regressions using the cumulant estimator include the base regression variables plus the respective longholder and its interaction term with c^{tot}. In Panel B, the process is similar to Panel A, except that we include c^* and q^* instead of c^{tot} and q^{tot}. The numerator for the both the total q and standard q is calculated as Total debt [Compustat item dltt+dlc] plus market value of equity [Compustat item prcc_f*csho] minus short-term assets [Compustat item act]. The denominators for the total q and standard q are total capital stock ($K^{phy}+K^{int}$) and physical capital stock (K^{phy}), respectively. The numerator for physical investment (I^{phy}) and intangible investment (I^{int}) are Capital expenditure [Compustat item capx] and R&D [Compustat item xrd] plus 30% of selling, general, and administrative expenses, respectively. Total investment (i^{tot}) is the sum of I^{phy} and I^{int}. R&D [Compustat item xrd] includes missing values and is scaled by total capital stock. Capital expenditure [Compustat item capx] is scaled by physical assets (K^{phy}). P^2 and τ^2 denote the within-firm R^2 from a hypothetical regression of investment on true variables, and a hypothetical regression of proxy variables on true variables, respectively. We also present the within R^2 obtained from the ordinary least squares regression for comparison.

P-T state that the smaller the cumulant slope, the higher the adjustment costs. The adjustment costs are highest among the investment variables of Panel A. These results suggest that the adjustment process for intangible investment (R&D) opportunities is slower than for physical investment opportunities. The last column of Panel A provides the slope of the cumulant estimator Capx/K^{phy}. This result strongly supports the claim that this slope provides downward biased estimates of capital adjustment costs. This happens because the regression of Capx/K^{phy} on the standard q used in the standard literature does not include the ratio of physical capital stock to total capital stock. ρ^2 and τ^2 are the within-firm R^2 from a hypothetical regression of investment on true q and a hypothetical regression of a proxy q on true q, respectively. In a perfect relation, P-T's theory predicts that ρ^2=1, indicating that the true observed q perfectly explains the investments. τ^2=1 would indicate that the true q perfectly explains the variation of the proxy q. The cumulant estimation results show that the relation between total investment and q becomes stronger (ρ^2=.7) when we include intangible capital rather than using the standard literature's physical investment and q (ρ^2=.10). This establishes the claim that total q explains investments better than standard q. This result holds even when we control the investment and q relation with contemporaneous cashflow. We also find that the sensitivity of physical investment (.459) to cashflow is much higher when we scale the investment variables by the total capital rather than physical capital (.12). The sensitivity between cashflow and physical investment (.459) is slightly lower than the sensitivity between cashflow and intangible investment. Consistent with the literature, we find in Panel B that R&D has the lowest sensitivity to cashflow. Interpreting the sensitivity between investment and cashflow is a difficult task and the existing literature has still not yet reached a consensus about the exact definition of such sensitivity (Gourio and Rudanko, 2014; Fazzari, Hubbard, and Petersen; 1988). It is difficult to reach an ironclad conclusion as to the nature and causes of investment-cashflow sensitivity, but we can conclude that physical investment is less sensitive to cashflow than standard investment but more sensitive than intangible investment. On the other hand, R&D is less sensitive to cashflow.

10. Summary and conclusion

In this study, we extend the corporate investment and CEO overconfidence literature by examining how CEO overconfidence effects investment-cashflow sensitivity through the new measures of Tobin's q and cashflow. Specifically, we incorporate intangible capital, which neo-classical investment theory mostly ignores in the empirical analysis [P-T, 2017]. Our analysis consists of several new tests. First, we develop the corporate investment model following Malmendier & Tate (2005) and we then extend the analysis beyond physical capital by estimating the regressions using our three measures of investment (i^{phy}, i^{int}, and i^{tot}). We then measure three versions of overconfidence, namely longholder40, longholder100, and longholderlow, using Execucomp data on the personal portfolios of CEOs. In our analysis, we use cashflow and Tobin's q scaled by total and physical capital. In this paper, c^{tot} and q^{tot} denote total cashflow and total q, respectively, and are scaled by total capital. C* and q^* denote standard cashflow and standard q, respectively, and are scaled by physical capital. We regress i^{phy}, i^{in}t, i^{tot} on c^{tot} and q^{tot} as well as on c^* and q^* separately along with a common set of control variables. In addition, we use three overconfidence measures and their interaction with the respective cashflow setting to capture all possible effects that may occur due to differing levels of CEO overconfidence. Similar to Malmendier & Tate (2005), we find a strong and statistically significant relationship between physical investment-cashflow sensitivity and CEO overconfidence. Moreover, our results show that the standalone measure of physical capital weakly explains intangible investment-cashflow density. Our study offers a valuable insight in addressing the concern raised by Chen & Chen (2012) as to why investment-cashflow sensitivity has been weaker in recent years. Empirical evidence on this matter is weak because existing investment studies mostly ignore intangible capital, which continues to grow and now constitutes a significant portion of modern corporate investments. We show that investment-cashflow sensitivity is stronger when we incorporate intangible capital into the analysis. The issue of overconfidence matters most for equity-dependent firms. We show that c^{tot} and q^{tot} explain overconfidence and investment-cashflow sensitivity better than c^* and q^* when the firms operate with financial constraints. Our study has important implications for a firm's investment decision making process as well as CEO stocks and options practices. Specifically, the standard measure of physical capital so prevalent in the literature only weakly explains the intangible capital-cashflow sensitivity given that the CEO is overconfident. Thus, to measure investment-cashflow sensitivity with more precision, firms should incorporate c^{tot} and q^{tot} in their analysis.

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Chapter 2

Diversity Reputation and Firm Performance

1. Introduction

America, the renowned "Mother of Exiles"[11] who promises "world-wide welcome"[12] to all, has long symbolized, if not fulfilled, the promise of inclusive diversity. Defining diversity[13] as a blending of people who have different group identities within the same social system (Fleury, 1999), it is clear that America is a particularly diverse nation, brimming as it is with people of various races, geographic origins, cultural backgrounds, languages, lifestyles, physical capabilities, sexual orientations, and a host of other demographic and cultural characteristics (Seymen, 2006). America has always had an uneasy relationship with its diversity, but the process of reckoning with its past began in earnest with the passage of Title VII of the Civil Rights Act in 1964, which made it illegal to engage in discriminatory employment practices on the basis of race, color, religion, sex, and national origin. The profusion of laws banning discrimination in the 1960s[14] reflected a growing cultural consensus of what the people of America hoped the country of America would be in the future: an inclusive nation, free from the endemic discrimination that had plagued so much of its past.

The intervening decades since the enactment of Title VII have witnessed a steady expansion of its mandate to include prohibition of discrimination based on age, pregnancy status, disability, sexual orientation[15], and gender identity[16]. Legal decrees certainly expedited the shift from segregation to integration, but the general trend towards inclusiveness could not have been

[11] Emma Lazarus, "The New Colossus," 1883.
[12] Ibid.
[13] As an aside, Malcolm Forbes, noted entrepreneur and publisher of the finance magazine *Forbes*, defined diversity as "the art of thinking independently together."
[14] For instance, the passage of the Equal Pay Act of 1963, the establishment of the Equal Employment Opportunity Commission in 1965, and the passage of the Age Discrimination in Employment Act of 1967.
[15] There is no law explicitly prohibiting discrimination on the basis of sexual orientation, but Supreme Court decisions have been amenable to a broad interpretation of Title VII to encompass sexual orientation as a protected category (see *Price Waterhouse v. Hopkins*, 1989 and *Oncale v. Sundowner*, 1998).
[16] However, the Department of Justice, under new Attorney General Jeff Sessions, announced in October 2017 that it would reverse protection based on gender identity.

achieved without evolving cultural norms. Society at large now considers diversity and inclusion to be laudable characteristics worthy of being implemented far and wide. America is becoming an increasingly diverse place not just due to the inexorable force of demographic factors, but also by design, because Americans prefer things to be that way.

As society becomes more inclusive, as visibility, voice, and power are being granted to a more diverse array of people, so too have the corridors of power in workplaces throughout the country opened up to a more diverse range of people. Diversity, in addition to being an increasingly important cultural issue, is having an increasingly large impact on economic matters. Numerous high-profile boycotts[17] of states[18] and firms[19] that have enacted or supported discriminatory laws speak to the prominent role diversity can play in the economy. Indeed, diversity has become "an economic issue as well as a legal and social concern" (Cox et al., 1991).

While it is clear that a conspicuous segment of American society values diversity both culturally and economically, what does this mean for the financial performance of the individual firm? Compelling theoretical arguments can be found both in agreement with and in opposition to the premise that diversity is economically beneficial to firms (Li and Nagar, 2013). In the absence of a clear theoretical consensus, empirical evidence becomes vitally important. However, obtaining unambiguous evidence of the effects of diversity is problematic. Precisely measuring a firm's actual level of diversity is difficult. Furthermore, the effects of diversity are typically not thought to have a direct effect on the processes or financial outcomes of a firm (Miller et al., 1998). Richard (2000) corroborates that observing a direct, positive relationship between diversity and firm performance is not likely. Rather, the effect of diversity on firm performance is mediated by other intervening variables, such as reputation, which must be studied in order to get a full picture of how diversity impacts firm performance (Miller and Triana, 2009).

[17] Max Ehrenfreund (March 31, 2015). "Businesses didn't always boycott discriminatory laws." *The Washington Post*. Retrieved December 6, 2017, from https://www.washingtonpost.com/news/wonk/wp/2015/03/31/wonkbook-businesses-didnt-always-boycott-discriminatory-laws/?utm_term=.8008f674d04a.
[18] Ellen McGirt (January 9, 2017). "Boycotts by Businesses Can Still Be Effective." *Fortune*. Retrieved December 6, 2017, from http://fortune.com/2017/01/09/boycotts-by-businesses/.
[19] Kim Severson (July 25, 2012). "Chick-fil-A Thrust Back into Spotlight on Gay Rights." *The New York Times*. Retrieved December 6, 2017, from http://www.nytimes.com/2012/07/26/us/gay-rights-uproar-over-chick-fil-a-widens.html.

Signaling theory holds that corporate reputation is valuable in that it reduces stakeholder uncertainty. Due to information asymmetries, the public uses both substantive actions and symbolic gestures to assess a firm's quality (Fombrun and Shanley, 1990). Investors, customers, and other stakeholders do not have the time or resources to do this critique themselves, so they rely on outside sources (such as the media) to do it for them. Reputation acts as a convenient shortcut.

Because firms compete for reputational status just as they compete for customers, one-upping their rivals is a major aspect of a good reputation. In fact, Deephouse and Carter (2005) claim that the concept of reputation is meaningless unless placed within the context of relative position: "Reputation requires a social comparison across companies in order to determine the relative degree of status and prestige that one company possesses." Corporations' longing to outshine their rivals, coupled with the public's reliance on outside sources to gauge the quality of corporations, has resulted in the current environment where there is an abundance of rankings published by various business and finance media[20]. And since American society is interested in diversity and values its presence in the workplace, many of these rankings factor diversity into their analysis. According to signaling theory, a firm's presence on an annual list of Most Diverse companies would send a clear message to the public that the firm is serious about diversity and has pro-diversity policies in place that are better than the average firm.

There is ample evidence that diversity can improve firm performance. To the extent this is true, inclusion on Most Diverse lists would tend to be associated with increased performance. However, there is also evidence that diversity actually hinders performance. We posit that the actual direct effect of diversity notwithstanding, merely being included on a Most Diverse list, that is, a firm merely improving its *Diversity Reputation*, would tend to have a positive effect on firm performance. In this paper, we hypothesize that the concept of diversity is important enough to society that the mere appearance of it can serve to enhance a firm's financial prospects. Specifically, we hypothesize that *Diversity Reputation* positively impacts firm performance.

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[20] For example, a plethora of highly-anticipated year-end lists by the likes of *Fortune, Forbes, Entrepreneur, Business Insider, Bloomberg,* and *The Wall Street Journal*, to name but a few.

Diversity in the workplace is a particularly important issue in America, as it has always been home to a stunningly diverse array of people. The modern American workplace is a microcosm of modern American society. Diversity is generally considered by the public to be a good thing, even though there is no clear-cut empirical consensus on whether its direct impact on firm performance is beneficial. When measuring this impact directly proves to be difficult, it is advisable to examine the effect of diversity on firm performance as mediated through the impact of intervening factors, such as reputation. An easy way to gauge a firm's reputation for diversity is to look at its inclusion in the business media's annual "Most Diverse" lists. By utilizing longitudinal data pulled from such lists, it can be shown that a firm's *Diversity Reputation* has a positive effect on its firm performance as quantified by a variety of accounting and market measures.

The economic value of diversity is unclear. There are theoretical arguments to be made both in favor and against it. Diverse firms are more open to new ideas and opportunities (Hong and Page, 2004). They also improve the decision-making process by reducing self-deceit and overconfidence (Malmendier and Tate, 2005). On the other hand, diverse firms, with a multitude of divergent viewpoints, are more vulnerable to social fracture. Heterogenous organizations are less likely to share common norms and culture, which are both very important to building a community of mutual support and resolving unforeseen complications (Currani et al., 2009).

Ineffective diversity management can result in firms facing discrimination lawsuits. Employee lawsuits can be a signal of flawed HR practices and can cause declines in firm performance (Wright and Gardner, 2000). Wooten and James (2004) propose that firms should learn from their discrimination crises by addressing the barriers that exist in their firms and moving to resolve them by engaging in reflective and reactive learning to prevent discrimination cases in the future. This will enable firms to create a workplace environment where employee differences are considered an asset.

Roberson and Park (2007) find a positive relationship between diversity reputation and book-to-market equity with a U-shaped relationship between leader diversity and net income, book-to-market equity, and revenue. Richard, Murthi, and Ismail (2007) also find a positive, curvilinear, U-shaped relationship between racial diversity and firm productivity in the short-term and racial diversity and firm productivity (as measured by Tobin's Q) in the long-term. However, Julian and Ofori-Dankwa (2014) attempt to replicate Richard, Murthi, and Ismail's results but actually find that a commitment to racial diversity actually decreases firm productivity. Wright, Ferris, Hiller, and Kroll (1995) examine the effects of Department of Labor Awards for exemplary affirmative action on firm performance and find that such awards serve as a signal that these firms have a competitive advantage over firms that experienced announcements of discrimination-related announcements.

Since the theory is divided on the matter, the best way to settle the issue is to conduct an empirical study. Previous studies have shown that a commitment to civil rights and diversity lead to substantive and permanent improvement in firm value and performance. We seek to gather evidence to see if this is indeed the case.

2. Literature Review

Prior literature on the effects of diversity can be generally grouped into two camps: pro and con. In the latter camp, Amason (1996) states that diversity can actually compromise the strategic decision-making ability of an organization due to intergroup conflict and a lack of team integration and cohesion. Currarini et al. (2009) find that people are hard-wired to practice homophily, that is, to have friends who are similar to themselves. They tend to cluster in like-minded groups that share common norms and culture. These homogenous groups are not without their benefit—such environments give rise to communities of mutual support which enable conflict resolution. The addition of diverse elements to groups like these would make them susceptible to splintering, thus increasing conflict while reducing communication, mutual respect, and trust. Jackson et al. (2003) survey several papers that conclude racial and gender diversity can reduce communication and social integration in team settings, thus causing conflict.

Phillips and Liljenquist (2009) find that increased diversity does indeed carry with it increased discomfort, anxiety, and conflict. Interestingly, however, they find that these perceived negative effects are largely illusory and inaccurate. In their experiment, groups consisting of three people sharing a group identity (being members of the same fraternity) were given a task to complete in the allotted time. Partway through the allotted time, a fourth member was introduced into the group. For some groups, the newcomer was a member of the same fraternity as the original three group members, while for other groups, the newcomer belonged to a different fraternity. Groups with newcomers from a different fraternity performed better at the task than groups with newcomers from the same fraternity, even though they viewed their group interactions as more stressful and less effective. This raises the possibility that the negative effects of diversity are overstated, and that even surface-level diversity may have a positive impact on team performance.

There is an extensive body of literature holding that diversity is in fact beneficial to performance. Cox et al.'s (1991) value-in-diversity hypothesis considers diverse groups to enjoy advantages over homogenous groups in the areas of knowledge, information, and perspectives. Hong and Page (2004) find that diverse organizations are more likely to be innovative and avail themselves of new opportunities. Gotsis and Kortezi (2015) realize that a diverse workforce is an "uncontested reality" in America. There is no going back to the old days when firms did not have to worry about policies involving diversity. Thus, firms would be best served to acknowledge the opportunities that diversity grants them to distinguish themselves from their rivals. They should treat diversity as a corporate asset to be cultivated. Firms should shift their emphasis from mere compliance with nondiscrimination laws to a proactive embrace of policies that promote diversity.

Lew Platt, former CEO of Hewlett-Packard, makers of the very computer we are using to type this paper right now, acknowledged the effectiveness of diversity, but also saw the necessity of providing hard evidence to his stakeholders to "make the business case for diversity" (Kochan et al., 2003). For Platt, one value-creating aspect of diversity is that it helps a firm empathize with its customer base. He views the ability to "understand and communicate with them in terms that reflects their concerns" to be a positive characteristic that can help differentiate a firm from its rivals in the market. Richard (2000) agrees that racial diversity can potentially be a way for a firm to be able to better understand a culturally diverse customer base. Dezso and Ross (2012) also admit the need to make the business case for diversity and use 15 years of panel data on a sample of 1,500 public firms in the U.S. to find that gender diversity in top management results in better firm performance.

The existence of these two separate and contradictory bodies of literature regarding the impact that diversity has on firm performance points to the difficulty of directly measuring the effects of diversity on firm performance. This difficulty is due to intervening factors that mediate the relationship between diversity and firm performance (Richard, 2000; Jackson et al., 2003; Miller and Triana, 2009). One such factor is reputation. Miller and Triana (2009) define reputation simply as “an assessment of a firm’s quality or esteem compared to other organizations.” Fombrun (1996) has a more comprehensive idea of reputation, defining it as “a perceptual representation of a company’s past actions and future prospects that describe the firm’s overall appeal to all its key constituents.” When stakeholders are faced with incomplete information about a firm, the firm’s reputation acts as a shortcut to help evaluate the merit of the firm and its chances of future success or failure.

Reputation is one of the most important intangible resources a firm possesses. A good reputation can allow firms to generate superior financial performance (Black et al., 2000; Roberts and Dowling, 2002). Prior literature contains much evidence to bear this out. Rindova et al. (2005) find that prominence conveys positive information about a firm’s fundamental ability to create quality goods or services. They also find that the media is the conduit through which firms achieve their increased prominence. Their findings are consistent with the hypothesis that *Diversity Reputation* can have a positive effect on firm performance because the media releases and distributes the diversity rankings, which in turn increase the included firms’ prominence. This amplifies the signal that these firms produce superior goods, which in turn increases their customer base.

Some studies have found that inclusion on media outlets’ “Best Of” lists has beneficial impacts on financial performance. Filbeck and Preece (2003) find that being awarded a spot on *Fortune’s* “100 Best Companies to Work for in America” list is associated with good relative market and financial performance. They conduct an event study around the announcement date of the award to determine that the awarded firms enjoyed positive buy-and-hold abnormal returns compared to a matched sample over both one- and multi-year time horizons. Brammer et al. (2009) also conduct an event study to find that firms named to *Business Ethics'* "Best 100 Corporate Citizens" experience small cumulative abnormal returns around a 21-day event window. These findings demonstrate that the reputational gains made by firms who are named to the business media's annual best-of lists can result in financial gains.

Certo (2003) finds that board composition sends a signal to the public about the quality of a firm, thus shaping the firm's reputation. A commitment to diversity has been shown to send positive signals about firm quality. Fondas (2000) finds that gender and racial diversity can send powerful signals to the public. Consistent with Richard (2000), Fondas notes that firms are eager to show that they empathize with the public. Thus, they may see the demographic composition of their board as an opportunity to mirror the demographics of their stakeholder population, labor force, and management. Daily and Dalton (2003) find that board demographic diversity does more than send a positive reputational signal—it actually leads to economic benefits. While the absence of women and minorities on the board of directors can lead to negative publicity for a firm, the presence of women and minorities is positively associated with stock returns.

The prior literature is split as to whether diversity has a beneficial effect on firms' financial performance. A reason for this ambiguity is that diversity itself is difficult to pin down. It does not necessarily show its impact on firm performance directly. Rather, the ultimate effect that diversity has on firm performance is mediated through intervening factors such as reputation. Reputation is a convenient and effective signal because it provides a shortcut by which the public can assess complicated issues. That diversity may be a dense, obscure, intractable phenomenon does not matter; the public only needs to know that it likes diversity, and that a given firm has a reputation for being diverse.

Despite some support for an association between corporate diversity reputation and firm performance, little empirical research has investigated this relationship. However, we expect diversity reputation to provide stakeholders with information about diversity and diversity management practices within firms, and therefore to be related to financial performance. For example, a positive diversity reputation may signal that a firm actively recruits women and minorities and focuses on the fair treatment of all employees. Further, diversity reputation may signal a firm's ability to effectively manage diversity among stakeholder groups (e.g., consumers, suppliers, etc.). Therefore, stakeholders may be induced to purchase goods and services from, and invest in, firms with positive diversity reputations. We hypothesize:

H1: Diversity reputation is positively correlated with firm performance.

A firm's commitment to diversity can be easily gauged by the public by the business media's annual rankings of Most Diverse firms. Inclusion on these lists enhances a firm's *Diversity Reputation*, which in turn has a beneficial effect on its financial performance.

3. Data and Methodology

Following the methodology of Roberson and Park (2006), Richard, Murthi, and Ismail (2007), and Julian and Ofori-Dankwa (2014), we use longitudinal data to test the hypothesis that our independent variable, *Diversity Reputation*, has a positive effect on firm performance. We measure Diversity Reputation based on a firm's inclusion on *DiversityInc's* list of Top 50 Companies for Diversity. A firm's presence on the *DiversityInc* list not only reflects that its corporate practices encourage and embody diversity, it also reflects that they have been rewarded and recognized for this by society. The *DiversityInc* list is based on empirical data gathered through firms submitting a survey of over 200 questions in four areas of diversity management: talent pipeline, talent development, leadership accountability, and supplier diversity. The stated purpose of the survey is to "better assess initiatives to hire, retain, and promote women, minorities, people with disabilities, LGBT, and veterans."[21] Unlike other popular surveys such as those conducted by *Fortune*, *DiversityInc* requires firms to submit detailed information, the accuracy of which must be attested to by a high-ranking corporate officer. The *DiversityInc* ranking, while not as well-known as *Fortune*, is more objective and still highly regarded by the media, corporations, government agencies, academics, and the public at large.

[21] Retrieved December 6, 2017, from http://www.diversityinc.com/diversityinc-top-50-methodology/

In our dataset we code the *Diversity Reputation* variable based on a firm's inclusion to the *DiversityInc* list each year. A firm is coded with a "1" for each year it made the list and a "0" for each year it did not. Following Julian and Ofori-Dankwa (2014), we then take the square root of the sum of the number of years a company is included on the lists. This number becomes our *Diversity Reputation* measure, which is our independent variable of interest and will be described in more detail below. Our diversity reputation data covers the years 2010-2015 while our Compustat financial performance data covers the years 2011-2015. Following Roberson and Park (2006), the reason we lag reputation for one year is to give the reputational effects of appearing on the list some time to manifest themselves and to prevent potential issues with endogeneity. The total sample includes 78 firms. Of these, 20.25% appeared on the lists only 1 year, 15.19% appeared 2 years, 12.66% appeared 3 years, 2.53% appeared 4 years, 8.86% appeared 5 years, and 39.24% appeared all 6 years.

We then manually match the firms with their gvkey in Compustat, allowing me to pull relevant financial data on each firm. All firm performance data is obtained from Compustat. We look at the period 2011-2015. Of the 78 firms included in the *Diversity Reputation* database, 12.8% had missing data in Compustat, bringing the total number of firms we examine to 68.

Once we have this sample of firms that have been recognized for their commitment to diversity, we then create another group that includes many more companies in our observations so that we can compare companies that are not on the *DiversityInc* lists with those that are on the list. This data is also sourced from Compustat, which contains 21,405 potential observations from 2011 to 2015. Our first group, consisting of firms that have been recognized by *DiversityInc*, contains 68 firms that have financial statement, stock price, and share information on Compustat, for a total of 322 firm-year observations. Each of these companies also had at least $1,500,000 in revenue and total assets. Thus, our second group (the comparison group) includes companies not on the *DiversityInc* lists only if they have at least $1,500,000 in revenue and assets. Further, to allow us to compare apples to apples, such companies must operate in a 2-digit SIC code represented by a company appearing on a *DiversityInc* list to be included in the sample. All told, this leaves our second group with 1,055 companies for a total of 4,023 firm-year observations. Table 1 gives an overview of our full sample, as well as our two subsamples.

Table 1: Sample Selection

	Firm-Year Observations
Total Compustat firm-year observations, 2011-2015:	21,405
Total # of firms that appear in industries represented on the DiversityInc list, having over $1.5 million in revenues or total assets, and having complete Compustat data:	4,345
Total # of firms in Group 1 (appearing on at least one DiversityInc list from 2011-2015):	322
Total # of firms in Group 2 (not appearing on any DiversityInc lists from 2011-2015):	4,023

For our control variables, we follow closely the methodology of RMI (2007) and Julian and Ofori-Dankwa (2014). We use various control variables gathered from Compustat data from 2011-2015. These include:

LOGAT = log of average total assets in year t;

XRDAT = research and development expenditures in year t divided by average total assets in year t;

$NIAT_t$ = net income divided by average total assets in year t; and

$COGSAT_t$ = cost of goods sold in year t divided by average total assets in year t;

Since we have panel data, we will use a pooled cross-sectional time series regression to test the hypothesis that *Diversity Reputation* is positively related to *Firm Performance*. Specifically, we will use a random-effects GLS estimator in Stata. The following regression models are used to examine the impact of noteworthy diversity efforts on companies' performance and shareholder wealth. The regressions take the form:

$$Firm\ Performance_{it} = \beta_0 + \beta_1 Diversity\ Reputation + \beta_2 LOGAT + \beta_3 XRDAT + \beta_4 NIAT + \beta_5 COGSAT + \varepsilon_{it}$$

where *i*= 1…68 are the firms and *t* is the 5 year period 2011-2015. The regression will be run separately for each different measure of *Firm Performance*, as described below.

The independent variable and control variables are discussed above. Our dependent variable is *Firm Performance*. There are two categories of firm performance we plan on using: accounting measures and market measures. The three accounting measures, which are considered in the literature to be more relevant as a short-term indicator, that we will use are common ones:

ROI: return on investment, measured as net income divided by invested capital. This is considered to be the most comprehensive measure of firm performance and is also commonly used in the prior literature on diversity.

ROS: return on sales, measured as net income divided by net sales. This is considered to be a good measure of competitive advantage between firms.

ROA: return on assets, measured by the operating income after depreciation divided by book value of assets.

We expect the coefficient on *Diversity Reputation* for the regressions of each of these three accounting measures to be positive.

The market-based performance measure we will use is a variation of *Tobin's Q*, defined as ($market\ value\ of\ capital$)/ ($replacement\ cost\ of\ capital$), or ($equity\ market\ value$+$liabilities\ market\ value$)/ ($equity\ book\ value$+$liabilities\ book\ value$). Tobin's Q is a common measure of performance that is calculated from data available in Compustat (*MKTVAL+PSVAL+DEBT)/TA. Where MKTVAL = the number of common shares outstanding multiplied by the share price, PSVAL = the liquidating value of the firm's outstanding preferred stock, DEBT is (Long-Term Debt) + (Short-Term Liabilities – Short-Term Assets), and TA = the book value of the total assets of the* firm). We expect *Tobin's Q* to have a positive coefficient as well, indicating that firms with higher *Diversity Reputation* have higher market-to-book ratios, suggesting that the market is valuing these firms at a level greater than what their book value would warrant. This could indicate that the value of something intangible and off-the-book, such as *Diversity Reputation*, is boosting the market value of these firms above the value of their recorded assets.

4. Findings

Table 2 presents the univariate analysis on diversity reputation. As Table 2 shows, the descriptive statistics for Group 1 (our *DiversityInc* sample) and Group 2 (our sample of firms not listed in *DiversityInc*) are different in interesting ways. Further, an examination of the results of t-tests for differences between means of the groups reveals that these differences are statistically significant. The firms in Group 1 (that is, the firms recognized by *DiversityInc*) had significantly higher logged total assets and net income. However, research and development expenses did not show a significant difference, perhaps because so few firms in either group reported R&D expenses at all. More importantly, as reflected below in Table 2, the means of all our measures of firm performance are significantly higher for firms within our *DiversityInc* group. The increased Tobin's Q for the *DiversityInc* group may signify that firms that make a concerted commitment to diversity see a corresponding increase in shareholder value.

Table 2: Univariate Analysis on Diversity Reputation

Panel A: Diversity Reputation and Firm Performance

Dependent Variable	N	Top 50	N	Not Top 50	Difference [1]-[2]	T-statistic	
Return on Assets	322	0.07	4023	0.05	0.03	3.66	***
Return on Investment	322	0.14	4023	0.12	0.02	2.34	**
Tobin's Q	322	2.19	4023	1.71	0.48	4.46	***
Return on Sales	322	0.12	4023	0.10	0.03	2.17	**

Table 2 reflects the univariate analysis of the impact of Diversity Reputation on Firm Performance. We measure firm performance using Return on Assets, Return on Investment, Tobin's Q, and Return on Sales. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3 presents the results from our regression analyses for the full sample with return on assets, return on investment, return on sales, and Tobin's Q as the dependent variables. Our independent variable of interest here is *Diversity Reputation*, described in detail above. Panel A presents results for the models without fiscal year or 2-digit SIC industry codes as control variables while Panel B includes results for models including 2-digit SIC industry codes and dummy variables for year as control variables. The results in Table 3, Panel A show that the coefficient on *Diversity Reputation* for all our measures of firm performance is positive. It is statistically significant for Tobin's Q, return on assets, and return on investments. More importantly, it is highly significant (p-value <0.001) for Tobin's Q and return on assets. This corroborates our intuition above, namely that firms that have a high level of diversity also enjoy increased performance in both the short- and long-term, especially in the areas of operating efficiency and firm value.

Table 3: Parameter Estimates and Significance from Regression Results

Panel A: Regression Results with Full Sample, no additional controls

Dependent Variable:	**Tobin's Q**		**ROA**		**ROI**		**ROS**	
Diversity Reputation	0.09	***	0.11	***	0.02	**	0.01	
	(0.004)		(0.000)		(0.034)		(0.309)	
LOGAT	-0.1	***	-0.08	***	0.02	***	-0.14	
	(0.000)		(0.000)		(0.001)		(0.157)	
XRDAT	6.31	***	0.35	**	0.47	**	0.61	**
	(0.007)		(0.028)		(0.014)		(0.047)	
NIAT	6.54	***						
	(0.006)							
COGSAT	-0.08	*						
	(0.071)							
n= 4,325								
R square	0.27		0.2		0.17		0.08	

Table 3, Panel A reflects the results of the regression results with no additional controls. P-values are listed in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3, Panel B contains additional controls of dummy variables for years as well as industry codes. The results are neither quantitatively nor qualitatively different from the results in Table

3, Panel A. The coefficient on Diversity Reputation across all four of our productivity measures are positive, although of smaller magnitude across the board. Again, these results are highly statistically significant for Tobin's Q and return on assets.

Table 3: Parameter Estimates and Significance from Regression Results

Panel B: Regression Results with Full Sample, with additional fiscal year and industry controls

Dependent Variable:	**Tobin's Q**		**ROA**		**ROI**		**ROS**	
Diversity Reputation	0.05	***	0.04	***	0.07	**	0.01	
	(0.007)		(0.000)		(0.010)		(0.529)	
LOGAT	-0.07	***	-0.07	***	0.03	**	-0.11	*
	(0.000)		(0.004)		(0.029)		(0.084)	
XRDAT	6.01	***	-0.24	*	-0.07	**	0.42	
	(0.001)		(0.057)		(0.022)		(0.545)	
NIAT	6.18	***						
	(0.001)							
COGSAT	-0.12	***						
	(0.001)							
n= 4,325								
R square	0.37		0.31		0.24		0.2	

Table 3, Panel B reflects the results of the regression results with the additional controls of fiscal year as well as 2-digit SIC code. P-values are listed in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusion

Increased legal protection and the evolution of cultural norms have fostered the development of a society that welcomes diversity and values its presence in the workplace. Though theoretical and empirical evidence of the economic benefits of diversity is mixed, society at large still deems increased diversity to be a commendable goal. The high regard with which society views diversity is evidenced in the popularity and pervasiveness of diversity rankings. Inclusion on these lists sends a signal to the public that a firm is committed to cultivating diversity in the workplace. Regardless of the direct effect of diversity on firm performance, the firm's enhanced *Diversity Reputation*, as measured by inclusion on *DiversityInc's* list of Top 50 Companies for

Diversity in the years 2010-2015, leads to a positive effect on *Firm Performance*, as measured by various accounting measures (ROI, ROS, ROA) and the market measure of Tobin's Q. Our results, while they in no way settle the debate, do provide some evidence bolstering the claim that diversity is beneficial to firm performance. The highly statistically significant finding regarding Tobin's Q merits particular mention. As we expected, Tobin's Q has a positive coefficient in our regressions, indicating that firms with higher *Diversity Reputation* have higher market-to-book ratios, suggesting that the market is valuing these firms at a level greater than what their book value would warrant. This could indicate that the value of something intangible and off-the-book, such as *Diversity Reputation*, is boosting the market value of these firms above the value of their recorded assets.

Further research could be conducted to disentangle the beneficial effects of diversity reputation from the beneficial effects of diversity itself. That is, if there are two similar firms, both of which have a similar commitment to diversity that is reflected in their corporate practices, with the main difference being that one has been recognized for its commitment to diversity (say, through inclusion on a Most Diverse list such as the one published by *DiversityInc*) while the other has not, then the firm that has been recognized for its efforts to promote diversity should have better firm performance that the similarly diverse one that has not been recognized. One way to approach this question is by identifying which companies narrowly missed the cutoff mark for being recognized by *Fortune* or *DiversityInc*. Unfortunately, that information was unavailable at this time, but answering this question offers a potentially fruitful area for future research.

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Appendix

Variable Definitions

LogAsset	(Malmendier & Tate, 2005)	Natural log of the book value of total assets (Total Assets [#6])
Mkt to Book	(Biddle, et al., 2009)	The ratio of the Market value of total assets (Total Assets [#6]+(Common Shares Outstanding [#25] *Share Price[#199])- Total Common Equity [#60]- Deferred Taxes (Balance Sheet) [#74]) to the Book value of total asset[#6]
Z-Score	(Brockman, et al., 2010)	A dummy variable that takes the value of 1 if Altman's Z-score is greater than 1.81, otherwise zero. The Z-score is calculated as 3.3*Operating Income After Depreciation [#178]/Total Assets[#6]+1.2*(Total Current Assets [#4]- Total Current Liabilities [#5])/ Total Assets [#6]+Sales[#12]/ Total Assets [#6]+.6*Share Price[#199]* Common Shares Outstanding [#25]/(Total Long-Term Debt [#9]+ Debt in Current Liabilities [#34])+1.4* Retained Earnings [#36]/Total Assets[#6]
Longholder40	(Huang, et al., 2016)	A dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration and the option is at least 40% in the money entering its final year, otherwise 0.
Longholder100	(Campbell, et al., 2011)	A dummy variable that takes the value 1 if the CEO ever held an option to the final year of its duration and the option is more than 100% in the money at least twice during the option holding period, otherwise 0.
Longholder-low	(Campbell, et al., 2011),	A dummy variable that takes the value 1 if the CEO exercises stock options that are less than 30% in the money and the CEO does not hold other exercisable

		options that are more than 30% in the money, otherwise 0.
Ln(1+Delta)	(Brockman, et al., 2010), (Core & Guay, 2002), (Guay, 1999)	This variable is proxied by the natural logarithm of (1+Delta). Delta is a proxy of CEO's portfolio price sensitivity. Delta indicates the change in the CEO's stocks and options prices due to a 1% increase in the firm's common share price.
Option Ownership	(Datta, et al., 2005)	This variable is measured as the number of exercisable options owned by the CEO divided by the common shares outstanding at the end of the fiscal year
Stock Ownership	(Datta, et al., 2005)	This variable is measured as the number of shares owned by the CEO, excluding options, divided by the common shares outstanding at the end of the fiscal year
Ln(1+Vega)	(Brockman, et al., 2010), (Core & Guay, 2002), (Guay, 1999)	This variable is proxied by natural logarithm of (1+Vega). Vega is a proxy of CEO's portfolio volatility sensitivity. Vega indicates the change in the CEO's stocks and options prices due to a 1% increase in the firm's annualized standard deviation of the firm's stock return
G-Score	(Cory A., et al., 2012)	G-score is a proxy for corporate governance. G-score is consisting of six variables calculated as follows; $G-\text{score} = \sum(\text{BoardInd}, \text{CeoChair}, \text{Attendance75}, \text{FinExpert}, \text{CgDiligence}, \text{NotClassified})$ BoardInd= A proxy variable that takes the value of 1 if the percentage of independent directors is greater than the median percentage of independent directors of the sample firms, otherwise 0. CeoChair= A proxy variable that takes the value of 1 if the CEO is not the chair of the Board, otherwise 0

		Attendance75= A proxy variable that takes the value of 1 if the Board members attend at least 75% of the meetings, otherwise 0. FinExpert= A proxy variable that takes the value of 1 if at least one of the Board members attending is a financial expert, otherwise 0. CgDiligence= A proxy variable that takes the value of 1 if the percentage of corporate governance committee members is greater than the median percentage of corporate governance committee members of the sample firms, otherwise 0. NotClassified= A proxy variable that takes the value of 1 if the Board is not classified, otherwise 0.
Total q	(Peters & Taylor, 2017)	Guided by the theory of P-T, we measure firms' total q (q_{it}^{tot}), which takes intangible capital into consideration. $q_{it}^{tot}=\frac{V_{it}}{K_{it}^{phy}+K_{it}^{int}}$. Where V = $\text{Market value of common stock }[prcc_f * csho] + \text{Book value of debt}[dlc + dltt] - \text{Firm's current assets}[act]$.
Standard q	(Erickson & Whited, 2012)	We measure traditional Tobin's q, which we call standard q in this paper, as $q_{it}^{*}=\frac{V_{it}}{K_{it}^{phy}}$. This measure of standard q takes the property, plant, and equipment (ppegt) [#7] in the denominator and is widely used in the investment q literature
Physical Investment	(Peters & Taylor, 2017)	$\iota_{it}^{phy} = \frac{I_{it}^{phy}}{K_{i,t-1}^{tot}}$. $I_{it}^{phy} = \text{Capx}[\#13],\ K^{tot} = K^{phy} + K^{int}$
Intangible Investment	(Peters & Taylor, 2017)	$\iota_{it}^{int} = \frac{I_{it}^{int}}{K_{i,t-1}^{tot}}$ where $I_{it}^{int} = \text{R\&D}[\#18] + .3 \times \text{SG\&A}[\#189]$

Total Investment	(Peters & Taylor, 2017)	$\iota_{\mathrm{it}}^{tot} = \iota_{\mathrm{it}}^{\mathrm{int}} + \iota_{\mathrm{it}}^{phy}$
Intangible intensity	(Peters & Taylor, 2017)	$II = K^{int} \big/ (K^{int} + K^{phy})$
Standard Cashflow	(Peters & Taylor, 2017), (Erickson and Whited, 2012), (Almeida & Campello, 2007)	$\mathrm{C}_{\mathrm{it}}^{*} = \frac{\mathrm{IB}_{\mathrm{it}}+\mathrm{DP}_{\mathrm{it}}}{\mathrm{K}_{\mathrm{i,t-1}}^{\mathrm{phy}}}$. Income Before Extraordinary Items [#237]+ Depreciation and Amortization[#5]
Total Cashflow	(Peters & Taylor, 2017)	$\mathrm{C}_{\mathrm{it}}^{\mathrm{tot}} = \frac{\mathrm{IB}_{\mathrm{it}}+\mathrm{DP}_{\mathrm{it}}+\mathrm{I}_{\mathrm{it}}^{\mathrm{int}}(1-\mathrm{k})}{\mathrm{K}_{\mathrm{i,t-1}}^{\mathrm{tot}}}$. Where K is the marginal tax rate assumed to be 30%. It is notable that the numerator of the equation treats R&D and SG&A as the operating expenses. To consider the profits available to total investment (ι_{it}^{tot}) we add back the tax adjusted intangible investment [ι_{it}^{int}] to the numerator of the Standard Cashflow equation and scale by the total capital stock (Lev & Sougiannis, 1996). We consider a marginal tax rate of 30% (P-T).

Vita

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