Managerial Overconfidence and Risk

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Abstract

In this study, I use a large sample containing 1,868 firms, 1,790 CEOs, 1,079 CFOs and 22,355 officers & directors to test my hypothesis concerning overconfidence and risk. Specifically, the paper examines the impact of risk in the selection of overconfident managers. The results show that overconfident CEOs are preferred by firms that face a high level of unsystematic risk. However, there is no clear association between overconfidence and systematic risk. In addition, I do not find a clear relationship between overconfidence and risk for other senior managers.

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1.Introduction

Overconfidence means "individuals believe that positive events are more likely to happen compared to the average" (Larwood and Whittaker,1977; Drake,1984). Since the 1980s, a few studies have explored the influence of managers' overconfidence on corporate policies. Largely, these papers have focused on the negative effects of overconfidence. Malmendier and Tate (2005) find that managerial overconfidence can cause corporate investment distortion. Goel and Thakor (2008) find that overconfident CEOs make value-destroying investments. Malmendier and Tate (2008) also provide supportive evidence for this statement by showing that the market reacts more negatively to acquisitions undertaken by overconfident CEOs than to those undertaken by rational CEOs. Adam, Fernando and Golubeva (2015) conduct a study about overconfidence and corporate hedging. They find that even after speculative losses, optimist CEOs do not change their managerial self-attribution bias. Although there could be some advantages to overconfidence - for example, overconfident CEOs could be successful innovators (Hirshleifer et al., 2012; Galasso and Simcoe, 2012) - the cumulative evidence on the negative effects of overconfidence appears overwhelming. Surprisingly, there are no papers that have directly addressed the relationship between overconfidence and risk. I would like to explore the possibility that the level of risk could significantly affect the choice of managers who get appointed at senior levels.

Malmendier and Tate (2005) classify managers as either rational or overconfident. I assume that boards of directors have their own preferences about which type to hire based on the level of risk for the firms. I regard overconfidence as a dependent variable and regard risk as my main predictor. It is commonly accepted that boards would choose rational managers because their governance

decisions are not biased. However, managers have non-diversifiable human capital and possible wealth in the form of equity and option grants and as a result, they are forced to bear a cost due to any risk. Because of the financial incentive - that overconfident CEOs would require relatively lower compensation for bearing the risk - boards of directors might choose overconfident managers. I apply this rationale to CEOs, CFOs and officers. Other factors can also affect the managerial overconfidence. Such factors are firm size, return on asset (ROA), growth opportunities, fixed asset, cash holdings and age and I control for these factors in my tests.

In order to explore the relationship among overconfidence, risk and control variables, I compare the manager and firm characteristics between overconfident and rational managers. Then I employ logistic and linear regression models. To fully examine the relationship between overconfidence and risk, I divide risk into idiosyncratic risk and systematic risk. I also winsorize applicable variables and conduct median regression as robustness tests.

This paper contributes on two levels to previous empirical literature. First, this paper relates overconfidence and risk directly. Until now, the literature related to optimism has focused on consequences of overconfidence such as repurchase (Andriosopoulos et al., 2013), dividends (Deshmukh et al., 2013), acquisitions (Ferris et al., 2013; Kolasinski and Li, 2013), compensation (Otto, 2014) and financial crisis (Ho et al., 2016; Aktas et al., 2009). Secondly, this paper broadens and extends its scope to include non-CEO managers - both CFOs and officers. Bertrand and Schoar (2003) find that for investment and financial policy, CFOs fixed effects in their regression are significant. Frank and Goyal (2010) conclude that the effect of CFOs is more powerful than CEOs on corporate leverage. In contrast, the literature on overconfidence has largely focused its attention

on the CEO. I contribute to this literature by examining the role of CEOs, CFOs as well as other senior officers.

The rest of the paper is organized as follows. In section 2, I summarize the literature and I develop my hypotheses in section 3. Section 4 describes the process of data selection and describes the variables. Section 5 establishes the methodology and presents the empirical results. Robustness tests are described in Section 6 and I conclude in Section 7.

2. Literature Review

2.1. CEO Overconfidence Literature

One of the earliest and the most frequently cited studies is by Malmendier and Tate (2005). Subsequently, a number of studies have extended this theme. Andriospoulos and Hoque (2013) find that overconfidence is related to the share buyback completion rate. Shu, Yeh, Chiang and Huang (2012) also argue that overconfident managers repurchase stocks more frequently. Yim (2013) finds that CEOs would like to make more acquisitions earlier in their career because a larger number of acquisitions is associated with a more permanent increase in their compensation. Ferris, Jayaraman and Sabherwal (2013) claim that overconfidence is an important determinant of international mergers.

There are some good conclusions about overconfident CEOs. Kolasinski and Li (2013) demonstrate that overconfident CEOs don't always make mistakes. Their financial failure experience helps them make better merger decisions. Gervais, Heaton and Odean (2011) demonstrate that firms are more interested in overconfident managers than rational managers.

Especially for innovative industries, overconfidence is a positive determinant of company development (Hirshleifer, Low, and Teoh, 2012; Galasso and Simcoe, 2012). Phua, Tham and Wei (2018) show that CEO overconfidence attracts stakeholders because overconfident CEOs can achieve stakeholders' commitment better.

However, other studies have highlighted the negative aspects of overconfidence. Roll (1986) and Ho (2010) indicate that overconfident managers tend to make biased decisions. Malmendier and Tate (2008) state that the market reacts worse to an overconfident CEO than to a rational one. McCarthy, Oliver and Song (2017) conclude that more overconfident a CEO is, the less he or she invests in activities that pertain to corporate social responsibility. Ho, Huang, Lin, and Yen (2016) note that overconfident CEOs underestimate the risk of banks. Therefore, companies adjust the CEO's compensation structure to provide them with different incentives (Humphery-Jenner et al., 2016).

Besides the diverging comments about overconfidence, Goel and Thakor (2008) provide a more precise idea of how overconfidence can influence the companies. They demonstrate that overconfidence increases a firm's value to some extent, but the association is not monotonic. Also, Tate and Yan (2011) claim that life experience can affect CEOs' overconfidence.

Based on all the studies discussed, the overconfidence of managers appears to impact many aspects of a firm's performance. However, it is not clear whether the net impact is a positive or negative one.

2.2 Measurements of Overconfidence

A key aspect of this study is overconfidence of managers and in order to progress further, we need a metric of overconfidence. Prior research has suggested multiple ways of measuring overconfidence. These include measures that are option-based, earning forecast-based and public media-based based. Below, I review all methods to measure overconfidence to see if they are applicable.

The first option-based measure is the "holder67" measure created by Malmendier and Tate (2005). CEOs would typically have a significant and undiversifiable investment of human capital in their firm. It follows, therefore, that rational CEOs would exercise their stock option right away when it is exercisable. If a CEO hasn't exercised any in the last year of vesting period, even though the option is more than 67% in-the-money, the manager is classified as being overconfident. The critical value 67% is obtained by "using a detailed dataset on executive stock option holding and exercise decisions" (Hall and Murphy 2002). Subsequently, Campbell et al., (2011), Hirshleifer et al., (2012) and McCarthy et al., (2017) employ "holder67". Unfortunately, I am not able to use it for my large sample as I do not have all the variables necessary to construct it.

The second option-based measure is "longholder". Malmendier and Tate (2005) determine if a CEO is overconfident by how long the CEO holds his or her options. If it is held until the last year before the expiry date even though the stock price has increased by at least 40 percent, the CEO is considered to be overconfident. In 2007, Malmendier, Tate and Yan separate "longholder" into "post-longholder" and "pre-longholder". Dummy variable "post-longholder" takes value 1 when the options are kept not only until the last year of expiration but also is at least 40 percent in-the-

money. When "longholder" equals to 1 and "post-longholder" equals to 0, then "pre-longholder" is 1. Deshmukh, Goel and Howe (2013) also apply the improved measurement to figure out if overconfident CEOs reduce more dividends in firms with lower growth opportunity and lower cash flow. Since the Execucomp (Stock Option Grants) database does not provide detailed data about how long a CEO holds options, I discard this measurement "longholder".

Dezsö and Ross (2012) come up with the third option-based measure, which is constructed as "a natural log transformation of the ratio of a given CEO's vested in-the-money option value to the total compensation". I choose to use this measurement and the details are reported in Section 4.
The fourth option-based measure is "average moneyness". It does not create a dummy variable, instead calculate a number to reflect CEO confidence. There are slight differences among different studies that adopt this approach. According to Campbell et al., (2011); Lee, Hwang and Chen (2017), "average moneyness" is calculated as "the per-option average realizable value divided by the estimated average exercise price". The per-option average realizable value is computed by dividing the total realizable value of the options by the number of the options which a CEO holds. The estimated average exercise price is computed by subtracting the per-option average realizable value from stock price. According to Hirshleifer et al., (2012), "average moneyness" equals to the ratio of stock price to the estimated average exercise price minus one. Among these measurements, I will the one in Hirshleifer et al., (2012) in my robustness test.

The fifth is "insider purchase", which is that regardless of the risk of stock options granted, CEOs continue to buy company stocks, then CEOs are considered as overconfident CEOs. The sixth is "management earnings forecasts". The true earnings are compared to earnings forecast. If the

forecast is higher, then the CEOs will be determined to be overconfident. Lee, Hwang and Chen (2017) apply the earning forecast measure and suggest that founder CEOs are more overconfident than professional CEOs. But they are both not applicable as I was not able to obtain all variables needed to compute them.

The last measure is "tone of tweets or public opinions" about CEOs. CEOs who use fewer negative words are defined as being overconfident. With the help of database Factiva, Lee, Hwang and Chen (2017) browse the tweets posted by CEOs and compare them with negative words listed by Loughran and McDonald (2011). Brown and Sarma (2007) obtain the public opinions of CEOs and record the description in Australian leading business press of CEOs such as "confident, optimistic, reliable and cautious" to analyze CEOs. Shu et al., (2012) use this measure and find that in Taiwanese companies, overconfident CEOs repurchase more. Considering the sample size, it is infeasible to hand collect public options about the CEO's optimism.

3. Hypothesis Development

I develop the hypothesis about manager selection under the circumstances of unsystematic risk as below.

> Hypothesis: When firms face high risk, the companies will choose overconfident executives.

It is straightforward to understand that a company would choose rational managers. There is a substantial literature that suggests that overconfident CEOs make biased investment decisions. For

example, according to Malmendier and Tate (2008), overconfident CEOs overpay for targets. As a result, the market reacts more negatively when overconfident CEOs announce acquisitions. In addition to mergers, the market also has a negative reaction at announcements of dividend increases (Deshmukh et al., 2013). Also, Heaton (2002) claims that optimistic managers tend to overestimate returns and underestimate risk related to investments. In summary, there is a fairly substantial literature that highlights the downsides of appointing an overconfident CEO.

The opposite thesis - that overconfident CEO may actually be preferred in some situations has been less explored. It assumes that overconfident managers could generate more positive influence on companies which means that boards of directors would vote for overconfident managers when firms face high unsystematic risk. The reason is that overconfident executives can be a better option for risky firms. Consider a firm that operates with high risk. Typically, a senior executive in such a firm would have a significant and undiversifiable investment in the firm in the form of human capital as well as performance related compensation in the form of stock grants and option. Since the executive must bear the costs of the absence of diversification, they would require higher compensation overall or, in extreme cases, may opt to seek alternative employment. In contrast, overconfident executives would undervalue such costs and would be a better choice for such firms. In support of this conjecture, Janice, Robert and Luis (2002) find that diversifiable and undiversifiable risk have effects on CEO compensation. Albuquerque et al., (2018) conclude that "CEOs are paid more on average with riskier pay package." Also, Goel and Thakor (2008) demonstrate that overconfident directors have more possibilities to be promoted under value-maximizing policies. Since not only CEOs but also CFOs and officers manage firms, the same reasoning is applied to CEOs, CFOs and officers.

4. Data

4.1 Data Source

My sample contains all companies listed in both Compustat and the Center for Research in Security Prices (CRSP) database from 1992, when Execucomp starts to have data, to the last month of 2017. After cleaning, my final dataset contains 1,868 firms with 133,425 firm-year observations. To measure overconfidence, the vested stock option information is from Execucomp. To construct risk, I download daily stock price from CRSP and Fama-French three-factor data from the website Kenneth R. French. Since other factors can also be related to managers' overconfidence, I include control variables of managers and firms (the age of managers, firm size, return on asset, growth opportunity, plant property & equipment divided by asset and cash holdings divided by asset). The data of manager characteristics are from Execucomp. Other control variables are from Compustat.

4.2 Overconfidence Measurement

After considering the feasibility of overconfidence measures in Section 3, I decide to create a continuous value as done by Dezsö and Ross (2012). From Execucomp, I download 287,058 firm-year observations of exercisable but unexercised options (OPT_UNEX_EXER_EST_VAL). After dividing the vested in-the-money options by total compensation (TDC1), the most comprehensive representation of compensation (Bebchuk, Cremers, and Peyer, 2011), I take the natural log of the quotient to reduce skewness. In order to satisfy the domain of natural logarithm function, I add 0.01 to the value of unexercised in-the-money options as well as TDC1 just in case they are zero.

As a robustness measure, following Schrand and Zechman (2012) and Lee et al., (2017), I create a dummy variable based on the first measure. After obtaining the natural log as indicated in the

previous paragraph, I compare each value to its industry median of this value. If the value is bigger than its median, the manager is deemed to be overconfident, otherwise not. Firms are classified into 12 industries according to the broader industry classifications. (The industry is divided according to the broader industry classifications as follow: 0100-0999 agriculture, forestry and fishing; 1000-1499 mining; 1500-1799 construction; 1800-1799 not used; 2000-3999 manufacturing; 4000-4999 transportation, communications, electric, gas and sanitary service; 5000-5199 wholesale trade; 5200-5999 retail trade; 6000-6799 finance, insurance and real estate; 7000-8999 services; 9100-9729 public administration; 9900-9999 non-classifiable). I follow the standard practice and exclude financial institutions, regulated firms and public administration because governances of regulated institutions are supervised by governments and the risk characteristic of financial firms differs from that of other firms (Kamiya, Kim and Park, 2018; Krishnaswami, Spindt and Subramaniam, 1999; Wagner and Fain, 2018). Financial institutions (6000-6799) include finance, insurance and real estate companies. Regulated firms (4900-4999) include electric, gas and sanitary companies (Frank, & Goyal, 2003). After that I have 223,140 observations.

Previous psychological and financial literature indicates that men are more optimistic than women. Lenney (1977) as well as Carr, Thomas, and Mednick (1985) demonstrate that females tend to underestimate their abilities, therefore, they reveal lower confidence than men. Men attribute their achievements more internally. While women attribute more to good luck and task ease (LaNoue and Curtis, 1985). A few financial papers based on this psychological theory are published subsequently. Barber and Odean (2001) find that men trade more than women. According to Huang and Kisgen (2013), male executives are more likely to hold stock options

until expirations compared to women, showing more overconfidence than women too. Gender is a good proxy for overconfidence. I create a "male" dummy variable. If a manager is male, it will be 1, otherwise 0.

4.3 Risk Measurement

4.3.1 Idiosyncratic Risk Measurement

From CRSP, I download 7,558,189 daily stock prices of 15,308 firms for the period 1992 - 2017. For the measurement of idiosyncratic risk, I follow the method in Fu (2009) and the standard deviation of the residuals in Fama-French three-factor model is defined as non-diversifiable risk. From the website Kenneth R. French I download risk-free return and daily Fama-French three factors (R_{mt} - r_t, SMB_t, HML_t). "R_{mt}-r_t" is the excess return on a broad market portfolio on day t. "SMB_t" is the difference between the return on a portfolio of small stocks and the return on a portfolio of large stock on day t. "HML_t" is the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks on day t. I regress the daily excess return of different stock on the three daily factors for every stock for every year. After getting the regression, the standard deviation of all the residuals ε_{it} for one stock in one year is defined as the idiosyncratic risk of a firm in one year.

$$R_{it} - r_t = \alpha_{it} + \beta_{it}(R_{mt}-r_t) + s_{it}SMB_t + h_{it}HML_t + \varepsilon_{it}$$

4.3.2 Systematic Risk Measurement

After analysing unsystematic risk, I want to explore the association between systematic risk and overconfidence. Systematic risk is the β value in Capital Asset Pricing Model (CAPM). I

download daily stock prices from CRSP for the period 1993 - 2016 as well as daily equity market premium from Kenneth R. French. I regress the daily expected return on the three daily factors for every stock every year. The coefficient of market excess return β is the systematic risk.

$$\text{Expected return}_{i,t} = \alpha_{it} + \beta_{it}(R_{mt} - r_t)$$

4.4 Other Variables

From Compustat, I download a series of proxies of manager characteristics and firm characteristics. Totally I get 305,084 firm-year observations from 1992 to 2017. Since this paper regards the overconfidence as a dependent variable, few papers can be referred to help determine control variables directly. Therefore, I search for the factors which can affect CEO compensation to be my control variables. The executive characteristics control variables include:

- Age: Directly downloaded from Compustat. I expect a negative relationship between overconfidence and age because I assume that irrational managers will learn from experience to become rational. (Brown and Sarma 2007). "Overconfidence level would decrease with age" (Kovalchik et al., 2005; Forbes, 2005).

The firm characteristic control variables include:

- Firm size: Calculated as a natural log transformation of the fiscal year total asset. I expect a positive relationship. As Core, Holthausen and Larcker (1999) indicate, "larger firms pay CEO higher compensation."
- Return on asset (ROA): Calculated from Compustat. I expect a positive coefficient since it is easily understood that the higher revenue one company makes, the higher the salary its managers obtain.

- Growth opportunities: Tobin's q is chosen to proxy growth opportunities. It is calculated as total asset plus the market value of equity minus CEQ (book value of equity) then divide this value by total asset in the previous year. I expect a positive relationship. According to Core, Holthausen and Larcker (1999), "with higher growth opportunities, firms will pay CEO more compensation."
- PPE/asset: Downloaded from Compustat. It is the value of tangible fixed assets (plant, property and equipment) divided by total asset in one fiscal year. Since managers are insiders, they have more private information about future projects. This ratio is one way to show that. Therefore, the fact that managers postpone to exercise in-the-money options might not necessarily mean overconfidence. So we control this variable.
- Cash/asset: Downloaded from Compustat. It is the value of cash holdings divided by total asset in one fiscal year. The reason to add this control is the same as "PPE/asset". Managers might have a good sense of future. So we control this variable as well.

In order to explore the relationship among those variables above, I merge data from Execucomp, Compustat and CRSP. After merging 223,140 observations in Execucomp and 305,084 observations in Compustat, I obtain 221,457 observations. After merging the previous result with CRSP, I obtain 141,827 observations. The definitions of each variable are described in Table 1.

Insert Table 1 here

4.5 Descriptive Statistics

The final sample contains 133,425 firm-year observations with 1,790 CEOs and 1,079 CFOs and 22,355 directors after excluding total 8,402 observations of the year 1992 and 2017 because of the 1-year lag.

Table 2 provides an overview of my sample. As shown in table 2, there are 13,934 observations for CEOs, 6,359 observations for CFOs and 113,132 observations for officers and directors. Due to the data of stock option missing in Execucomp, the numbers of overconfident and rational executives do not add up to the total observations. Note that the total observations for overconfident and rational executives are for executive-year level while for the total number of male and female executives is for individual level. One interesting finding is that there are 6,880 overconfident CEOs, more than 5,843 rational CEOs, meaning that companies need more overconfident CEOs. It is the same for CFOs. In contrast, there are 15,277 overconfident officers and directors, fewer than rational ones. One possible reason is that the option-based measure works better for c-level executives. The other is that the overconfidence of CEOs and CFOs need to be compensated by rational officers and directors. Table 2 also shows that there are more male managers than female which is consistent with my assumption before.

Insert Table 2 here

Table 3 presents more detailed statistics than Table 2 by year. Since the data of the year 1992 and 2017 are no longer the subject of my study, the summary is only from 1993 to 2016. In the first several years, there are more rational c-level executives than overconfident ones while as time

goes by overconfident executives become the majority. Another finding is that male managers are overwhelmingly more than female for all managers. All the findings above accord with Table 2. In panel B, the sample is right-skewed because the majority of means are larger than medians. Especially with unsystematic risk, means are significantly larger than their medians, meaning there are some outliers.

Insert Table 3 here

In order to initially determine whether risk has an effect on overconfidence or not, I compare the manager characteristics as well as the features of firms with overconfident managers versus those with rational managers. I divide overconfident and rational executives here by the first measure of overconfidence. I perform equality tests and present the results in Table 4. The mixed facts that the mean of unsystematic risk of firms with overconfident managers are lower than those with rational managers, while the medians of overconfident managers are higher than rational, indicate that the sample has some extreme outliers in all three panels. Overconfident managers are slightly older than rational, which is against my assumption that young managers easily have self-biased attribution. But the age gap is small. With regard to firm size, it has a positive impact on CEOs and director overconfidence. A possible explanation is that in previous years, firms with bigger size tended to choose overconfident CEOs and directors. But for CFOs the results for the two measures of overconfidence differ.

Insert Table 4 here

Before analyzing the data, in order to know the multicollinearity relationship among all the variables, I perform Pearson correlation analysis. The results are shown in Table 5. Since all absolute values of the correlation coefficient are smaller than 0.3, the correlation among them is weak, meaning there is no multicollinearity issue.

Insert Table 5 here

5. Methodology and Empirical Results

5.1 Unsystematic Risk

5.1.1 Unsystematic Risk Regression

To firstly examine the association among idiosyncratic risk, gender and other control variables, I employ natural logistic and linear regression. I need to use logit regression for my indicator variables for overconfidence "OC1" and gender dummy "male". Overconfidence can be also measured as a continuous variable OC2. Therefore, diversifiable risk SD is regressed on OC1, OC2 and "male" respectively like Equation (1), (2) and (3):

$$OC1_t = \beta_1 SD1_{,t-1} + \beta_2\ Age_t + \beta_3\ Firm\ size_{t-1} + \beta_4\ ROA_{t-1} + \beta_5\ Tobins'q_{t-1} + \beta_6(PPE/asset)_{t-1} + \beta_7(Cash/asset)_{t-1} + Industry\ dummies + Year\ dummies + \varepsilon_t \quad (1)$$

$$OC2_t = \beta_1 SD1_{,t-1} + \beta_2\ Age_t + \beta_3\ Firm\ size_{t-1} + \beta_4\ ROA_{t-1} + \beta_5\ Tobins'q_{t-1} + \beta_6(PPE/asset)_{t-1} + \beta_7(Cash/asset)_{t-1} + Industry\ dummies + Year\ dummies + \varepsilon_t \quad (2)$$

$$Male = \beta_1 SD1_{,t-1} + \beta_2\ Age_t + \beta_3\ Firm\ size_{t-1} + \beta_4\ ROA_{t-1} + \beta_5\ Tobins'q_{t-1} + \beta_6(PPE/asset)_{t-1} + \beta_7(Cash/asset)_{t-1} + Industry\ dummies + Year\ dummies + \varepsilon_t \quad (3)$$

In the three specifications, OC1 is a dummy variable, which is 1 if one manager is considered to be overconfident and is 0 if this manager is taken as rational. OC2 is the value of the log of vested but unexercised option divided by total compensation. “Male” is one if one manager is a man, otherwise 0. SD1 is the standard deviation of residual of Fama-French three-factor model. Industry dummies and year dummies present industry fixed effects and year fixed effects. Except for optimism variables and age, I take 1-year lag for all remaining variables. CEOs, CFOs and officers are analyzed respectively.

5.1.2 Raw Data Results

Firstly, I run the logistic regression for CEOs in Table 6 Panel A. In the first two specifications, unsystematic risk is positively associated with overconfidence at the 0.1 level, indicating that the higher risk firms have, the bigger possibility that they would choose overconfident CEOs, which is strongly consistent with my hypothesis. The coefficient of age is significantly negative at the 0.1 level, meaning younger CEOs are more likely to be overconfident. The coefficients of remaining variables firm size, ROA and Tobin’s q are all significantly negative at the 0.01 level in the first two columns. Since in Table 4 - univariate test there is some conflict about whether the unsystematic risk is higher for optimist managers or rational ones, here there is the same issue. For “male” measure, the estimated sign of SD1 is negative, even though it is not significant. The coefficient sign of firm size is positive, different from the first two columns, while “PPE/asset” is positive, the same as the second specification. With regard to variable “cash/asset”, it is not significant in all three specifications.

The result of regressing CFO optimism on SD1 is in Table 6 Panel B. The interesting result is that according to the dummy overconfidence measure, the sign of SD1 is positive but not significant. In the second column, SD1 is significantly negative while, for the last measure, SD1 is significantly positive. For variable age, it is only negative in "male" measure. The estimates for firm size and ROA accord with my result in Table 4, showing the positive explaining power on CFO overconfidence. Tobin's q is negatively related to overconfidence in the first column but is positive in the second column.

In Panel C, for officers and directors, the sign of risk in first column is positive, implying that the riskier in the previous year, the higher possibility of overconfident officers. All three coefficient estimates for age, -0.024, -0.047and -0.033 are significant, meaning that younger officers are more likely to be overconfident, in accord with Brown and Sarma, 2007; Kovalchik et al., 2005 and Forbes, 2005. The estimates for firm size, ROA, Tobin's q and "PPE/asset" are negative. It is opposite in specification 2, the estimates for firm size, ROA, Tobin's q are positive, which agrees with my previous assumptions. For the last specification, again the regression results of measure "male" are diverse. The coefficient estimate for SD1 is negative and for firm size and Tobin's q, they are significantly negative while, for ROA and "PPE/asset", they are positive.

Insert Table 6 here

5.1.3 Winsorized Data Results

Given the mixed findings and results in Table 4 and Table 6, I winsorize all variables (except dummy overconfidence, age and dummy "male") at the 5%, 95% level to mitigate the concern of

outliers. After running the regressions (1), (2), (3) but with winsorized variables, the results are presented in Table 7. The results of CEOs are similar. As we can see, the signs of coefficients of winsorized SD are only significantly positive for the first two specifications. Except for age, the signs of firm size, ROA and Tobin's q are opposite of that in the second measure of optimism. "PPE/asset" is positively associated with overconfidence, probably meaning the more investment CEOs make, the more likely they are overconfident. Again, even the winsorized "cash/asset" is not significant among three specifications.

In Panel B, the coefficient estimates on adjusted SD are all insignificant. The signs of age, firm size, ROA, Tobin's q and "PPE/asset" are all negative but only the coefficients of firm size and Tobin's q are significant. For the second column, only firm size, Tobin's q and "PPE/asset" have a positive relationship with CFO overconfidence. For the last column, only age, firm size and ROA are significant.

In Panel C, the results are similar with Table 6 Panel C. The signs of winsorized SD1 are significantly positive, different from the ones in the last two columns. Only age has significant negative signs for all three specifications. For firm size, ROA and Tobin's q, they are all negative in the first specification but not for the second one. "PPE/asset" is the same, positive in the first column but negative in the second one.

Insert Table 7 here

One main result can be obtained from those analyses above. Unsystematic risk has a completely different influence on overconfidence for CEOs, CFOs as well as officers. Overall, overconfident CEOs are preferred by risky firms.

5.2 Systematic Risk

5.2.1 Systematic Risk Regressions

To further explore risk, systematic risk and other control variables are regressed on three measures of overconfidence like equation (4), (5) and (6) below:

$$OC1_t = \beta_1 SD2_{,t-1} + \beta_2\ Age_t + \beta_3\ Firm\ size_{t-1} + \beta_4\ ROA_{t-1} + \beta_5\ Tobins'q_{t-1} + \beta_6(PPE/asset)_{t-1} + \beta_7(Cash/asset)_{t-1} + Industry\ dummies + Year\ dummies + \varepsilon_t \quad (4)$$

$$OC2_t = \beta_1 SD2_{,t-1} + \beta_2\ Age_t + \beta_3\ Firm\ size_{t-1} + \beta_4\ ROA_{t-1} + \beta_5\ Tobins'q_{t-1} + \beta_6(PPE/asset)_{t-1} + \beta_7(Cash/asset)_{t-1} + Industry\ dummies + Year\ dummies + \varepsilon_t \quad (5)$$

$$Male = \beta_1 SD2_{,t-1} + \beta_2\ Age_t + \beta_3\ Firm\ size_{t-1} + \beta_4\ ROA_{t-1} + \beta_5\ Tobins'q_{t-1} + \beta_6(PPE/asset)_{t-1} + \beta_7(Cash/asset)_{t-1} + Industry\ dummies + Year\ dummies + \varepsilon_t \quad (6)$$

5.2.2 Empirical Results

I run three regressions (4), (5), (6) and report the results in Table 8. From Table 8 Panel A, SD2 is not significant for all three measures. While in the first specification, age, firm size, ROA and Tobin's q are all significantly negative at the 0.05 level. "PEE/asset" is positive. These signs are almost completely opposite of those in the second specification. With regard to "male" measure, only firm size and "PPE/asset" have positive relationship with CEO optimism. Panel B is similar to Panel A. No systematic risk has an explanatory power on overconfidence. Only the signs of firm

size and “ROA” are significantly negative at the 0.01 level. Again, the signs with regard to continuous overconfidence variable are all opposite. For “male”, firm size as well as ROA have common signs. Age and Tobin’s q have common signs. In Panel C, it is the same that systematic risk has no influence on officer overconfidence.

Insert Table 8 here

Given outlier concerns and the power of regression (4), (5) and (6), I winsorise SD2 and other continuous variables at the 5%, 95% level. The winsorized result is displayed in Table 9. For CEOs and CFOs, the estimated signs of “win beta” remain not significant. But for officers and directors, the signs turn significantly positive. The results of other variables are similar to before. For continuous measure of optimism, the coefficient signs of control variables are different from those in the first column.

Insert Table 9 here

6. Robustness Tests

Median regression does not have requirements for the distribution of data sample as strict as the least square method. In order to obtain a better result as well as to check the robustness of my previous analyses, median regression is conducted among the same variables. The result of regressing median continuous overconfident on diversifiable risk is in Table 10. The estimated signs of “SD1” for CEOs and officers are both significantly positive, but for CFOs, it is not significant. Since I only use continuous variables here, age has a positive impact on CEO and

officer overconfidence, indicating the older managers are, the more likely they turn overconfident. The estimates for other control variables firm size, ROA and Tobin's q are all positive and for "PPE/asset" it is negative except for CFOs. As usual, "cash/asset" is not significant.

Insert Table 10 here

As mentioned in the literature review, another option-based measure called "average moneyness" is considered in robustness tests. According to Hirshleifer et al., (2012), "average moneyness" is constructed as follow. I get the average realizable value per option through dividing the total realizable value of the options (OPT_UNEX_EXER_EST_VAL) by the number of options (OPT_UNEX_ EXER_NUM). The estimated strike price equals to the annual closing stock price of one fiscal year (PRCC_F) minus the average realizable value per option. Then the average moneyness of the options is the ratio of "PRCC_F" to the estimated strike price minus 1. After obtaining the value of every executive every year in my sample and taking the lag, I employ the median regression of "average moneyness" on idiosyncratic risk and the same control variables. The results are presented in Table 11.

As we can see, except for some control variables, the key explanatory variable remains significantly positive. What's more, the coefficient of directors becomes even stronger. But age and firm size are no longer significant. The signs of ROA and Tobin's are still positive while the signs of "PPE/asset" are negative. These robustness tests help to obtain one conclusion that overconfident CEOs and officers are preferred, when firms face high idiosyncratic risk.

Insert Table 11 here

As an extension of Table 11, we also consider the tenure of CEOs, because longer CEOs stay in the position, the better they know about their companies. Probably, the reason to hold longer exercisable options is that they have certain confidence but not overconfidence. Unfortunately, we are not able to get good amount of valid observations. With "tenure" included in the control variables, our unreported results show the same result that facing diversifiable risk, overconfident CEOs and officers are chosen, consistent to my hypothesis. But it has no relationship with CFO overconfidence.

7. Conclusions

Prior literature has indirectly indicated that overconfidence should be linked to higher risk. But few researches explore the relationship between overconfidence and risk directly. In this paper, I have attempted to directly address the link between these two. I find that the link is not expecting as indicated by prior research. I measure risk as unsystematic and systematic risk. Executives are divided into CEOs, CFOs and officers. Overall, I find that unsystematic risk has a positive influence on manager overconfidence but systematic risk does not. What's more, risky firms would prefer optimist CEOs and officers. My study suggests that future research should consider the possibility that the link between executive overconfidence and firm risk is a nuanced one and that it is necessary to consider the overconfidence or lack thereof for the CEOs, CFOs as well as other officers, as well as the interplay between them in order to properly understand the link between overconfidence and risk.

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Table 1 Definitions of Dependent and Independent Variables

Variable Name	Definitions
Dependent variables	
Overconfidence 1 (OC1)	Dummy variable. If the natural log of the ratio of unexercised exercisable options of a manager of one firm to total compensation (TDC1) is bigger than the industry median, overconfidence=1, otherwise overconfidence=0. According to the broader industry classifications, I divide companies into 12 sectors
Overconfidence 2 (OC2)	Continuous variable. In the robustness test, it is treated as a substitute for the dummy overconfidence variable. It is the natural log of the ratio of unexercised exercisable options of a manager to total compensation (TDC1)
Male (OC3)	Dummy variable. If a manager is male, the dummy variable is 1, otherwise 0. "Male" is the third proxy for overconfidence
Independent variables	
Idiosyncratic risk (SD1)	The standard deviation of the residuals of Fama-French three-factor model in the previous year
Systematic risk (SD2)	The β value in Capital Asset Pricing Model (CAPM) in the previous year
Control variables	
Age	The age of the executive as reported in the annual proxy statement
Firm Size	The natural logarithm of total assets of one firm in the previous year
Return on asset (ROA)	Net income divided by shareholders' asset of one firm in the previous year
Tobin's q	Calculated as total asset plus the market value minus the book value of equity (CEQ), then divide it by total asset in the previous year
PPE/asset	The total tangible fixed asset divided by asset in the previous year
Cash/asset	The cash holdings divided by asset in the previous year

Table 2 Sample Overview

This table reports the number of overconfident/rational (OC/R) managers, total observations (obs) of executives, the number (num) of male/female managers, total number of managers and the mean/median of manager age from 1993 to 2016. Note that total observations for overconfident and rational executives are for executive-years. The numbers for overconfident and rational executives do not add up to the total number because of the data of stock option missing in Execucomp.

	Number					
	OC	R	Total Obs	Male	Female	Total Num
CEO	6,880	5,843	13,934	1,727	63	1,790
CFO	2,945	2,778	6,359	993	86	1,079
Officers	15,277	18,113	113,132	20,852	1,503	22,355

Table 3 Summary Statistics

This table provides the summary statistics of manager and firm characteristics. Panel A reports the percentage (per) of overconfident/rational (OC/R) managers and total percentage as well as the number (num) of male/female managers and total number from 1993 to 2016 respectively. Panel B reports the mean and median of the measure of idiosyncratic risk (SD1), firm size, ROA and Tobin's q from 1993 to 2016 respectively. Note that the total percentage for overconfident and rational managers are not 100% because of the data of stock option missing in Execucomp.

Panel A Manager Characteristics

Year	CEOs						CFOs					
	OC	R	Total Per	Male	Female	Total Num	OC	R	Total Per	Male	Female	Total Num
1993	44.6%	50.7%	95.3%	98.8%	1.2%	408	30.0%	70.0%	100.0%	100.0%	0.0%	10
1994	43.3%	48.3%	91.6%	98.7%	1.3%	453	30.8%	69.2%	100.0%	92.3%	7.7%	13
1995	46.2%	46.2%	92.3%	98.4%	1.6%	507	40.0%	60.0%	100.0%	90.0%	10.0%	20
1996	42.8%	36.4%	79.2%	98.1%	1.9%	568	34.5%	65.5%	100.0%	89.7%	10.3%	29
1997	59.9%	40.1%	100.0%	97.3%	2.7%	591	40.5%	59.5%	100.0%	92.9%	7.1%	42
1998	40.2%	43.0%	83.2%	97.6%	2.4%	614	47.5%	52.5%	100.0%	91.5%	8.5%	59
1999	42.7%	38.5%	81.2%	96.9%	3.1%	585	42.3%	57.7%	100.0%	94.4%	5.6%	71
2000	45.3%	37.6%	82.9%	96.7%	3.3%	550	43.5%	55.4%	98.9%	93.5%	6.5%	92
2001	35.8%	45.6%	81.3%	96.8%	3.2%	562	41.8%	58.2%	100.0%	92.6%	7.4%	122
2002	52.9%	41.0%	93.9%	96.9%	3.1%	607	47.7%	52.3%	100.0%	88.9%	11.1%	153
2003	49.5%	43.7%	93.3%	96.6%	3.4%	654	46.2%	53.3%	99.5%	89.9%	10.1%	199
2004	49.4%	39.1%	88.5%	96.7%	3.3%	668	53.0%	47.0%	100.0%	90.0%	10.0%	219
2005	49.8%	41.0%	90.8%	96.5%	3.5%	631	50.2%	48.9%	99.1%	88.8%	11.2%	233
2006	55.2%	34.4%	89.6%	97.2%	2.8%	719	43.5%	41.1%	84.6%	90.1%	9.6%	384
2007	50.9%	42.5%	93.4%	97.2%	2.8%	861	49.1%	39.4%	88.5%	91.3%	8.7%	495
2008	57.6%	37.5%	95.1%	96.7%	3.3%	901	49.9%	41.8%	91.7%	90.6%	9.4%	519
2009	57.9%	37.4%	95.4%	96.2%	3.8%	927	48.1%	44.2%	92.3%	91.0%	9.0%	543
2010	59.4%	35.1%	94.4%	96.3%	3.7%	950	50.9%	40.0%	90.8%	90.7%	9.3%	568
2011	59.3%	36.0%	95.2%	96.1%	3.9%	987	54.2%	38.0%	92.2%	91.5%	8.5%	613
2012	57.3%	34.3%	91.6%	96.0%	4.0%	1027	53.6%	39.3%	92.9%	90.2%	9.8%	676
2013	58.1%	37.7%	95.8%	96.2%	3.8%	1091	53.7%	40.2%	94.0%	89.2%	10.8%	761
2014	54.3%	39.8%	94.1%	96.0%	4.0%	1158	49.7%	42.6%	92.3%	89.7%	10.2%	892
2015	49.3%	44.9%	94.2%	96.1%	3.9%	1196	45.1%	48.3%	93.5%	91.1%	8.9%	1008
2016	22.6%	57.2%	79.8%	95.9%	4.1%	1207	23.2%	55.7%	79.0%	92.1%	7.9%	1123

Continued Panel A

Officers and directors					
OC	R	Total Per	Male	Female	Total Num
39.4%	51.6%	91.0%	98.0%	2.0%	4940
35.4%	49.3%	84.7%	97.2%	2.8%	5620
34.9%	48.8%	83.7%	96.5%	3.5%	5938
33.3%	48.4%	81.7%	96.1%	3.9%	6252
33.8%	48.7%	82.5%	95.9%	4.1%	6531
32.6%	48.4%	81.0%	95.3%	4.7%	6838
32.3%	46.3%	78.6%	94.6%	5.4%	6814
33.5%	45.4%	78.8%	94.2%	5.8%	6566
35.1%	49.3%	84.4%	93.6%	6.4%	6422
35.4%	49.8%	85.2%	93.5%	6.5%	6490
34.9%	48.2%	83.1%	93.3%	6.7%	6603
37.6%	43.3%	80.9%	93.1%	6.9%	6106
36.7%	42.3%	79.0%	93.0%	7.0%	5153
42.4%	42.1%	84.5%	107.9%	7.9%	5292
37.1%	42.8%	79.9%	92.6%	7.4%	6503
39.5%	40.0%	79.5%	92.5%	7.5%	6233
39.9%	42.2%	82.1%	92.4%	7.6%	5898
40.8%	40.9%	81.7%	91.9%	8.1%	5650
39.9%	42.1%	82.0%	91.9%	8.1%	5519
37.9%	42.6%	80.5%	91.7%	8.3%	5441
36.2%	41.5%	77.7%	91.5%	8.5%	5333
34.7%	40.5%	75.2%	91.5%	8.5%	5150
30.8%	41.6%	72.4%	93.0%	7.0%	4902
17.4%	40.4%	57.9%	93.9%	6.1%	4396

Panel B Firm Characteristics

Year	Unsystematic Risk		Firm Size		ROA		Tobin's q	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1993	5.963	3.006	6.553	6.365	0.040	0.049	2.131	1.687
1994	54.611	4.170	7.888	7.756	0.035	0.047	1.932	1.581
1995	6.070	3.007	6.619	6.494	0.043	0.059	2.181	1.673
1996	11.511	3.234	6.660	6.578	0.043	0.059	2.252	1.732
1997	54.611	4.170	7.888	7.756	0.035	0.047	2.481	1.887
1998	19.039	4.740	6.751	6.611	0.032	0.053	2.565	1.700
1999	20.092	4.303	6.879	6.700	0.037	0.054	3.407	1.674
2000	20.260	4.635	7.026	6.858	0.027	0.056	2.554	1.641
2001	18.918	3.509	7.031	6.833	-0.026	0.033	2.217	1.666
2002	19.184	3.441	7.044	6.838	-0.012	0.033	1.762	1.418
2003	18.496	3.131	7.096	6.898	0.022	0.044	2.159	1.710
2004	22.377	2.816	7.209	7.051	0.038	0.053	2.161	1.746
2005	24.901	2.722	7.293	7.159	0.043	0.061	2.167	1.771
2006	24.526	2.997	7.303	7.157	0.053	0.061	2.164	1.824
2007	26.575	3.235	7.198	7.079	0.043	0.055	2.123	1.725
2008	29.876	4.553	7.206	7.076	-0.014	0.046	1.556	1.281
2009	22.984	3.285	7.256	7.125	0.017	0.038	1.796	1.513
2010	28.615	2.737	7.357	7.237	0.052	0.056	1.978	1.603
2011	29.252	3.118	7.462	7.346	0.050	0.060	1.841	1.511
2012	30.463	2.718	7.547	7.449	0.041	0.054	1.910	1.561
2013	40.151	3.423	7.643	7.545	0.045	0.053	2.219	1.783
2014	46.483	3.319	7.735	7.637	0.042	0.053	2.209	1.792
2015	50.820	3.751	7.784	7.685	0.023	0.048	2.081	1.682
2016	54.611	4.170	7.888	7.756	0.035	0.047	2.164	1.752

Continue Panel B

Year	PPE/asset		Cash/asset	
	Mean	Median	Mean	Median
1993	0.622	0.555	0.080	0.045
1994	0.620	0.564	0.071	0.041
1995	0.609	0.550	0.076	0.038
1996	0.560	0.532	0.085	0.044
1997	0.576	0.512	0.092	0.042
1998	0.577	0.495	0.085	0.040
1999	0.557	0.481	0.086	0.041
2000	0.541	0.500	0.089	0.04
2001	0.550	0.461	0.105	0.057
2002	0.562	0.474	0.134	0.077
2003	0.554	0.456	0.124	0.089
2004	0.517	0.428	0.112	0.079
2005	0.508	0.422	0.110	0.078
2006	0.511	0.427	0.104	0.066
2007	0.490	0.390	0.116	0.072
2008	0.530	0.430	0.123	0.082
2009	0.558	0.458	0.141	0.109
2010	0.546	0.442	0.137	0.107
2011	0.547	0.432	0.128	0.432
2012	0.552	0.433	0.126	0.090
2013	0.553	0.437	0.127	0.099
2014	0.546	0.432	0.121	0.091
2015	0.587	0.431	0.113	0.080
2016	0.590	0.429	0.116	0.086

Table 4 Univariate Tests

This table shows the results from tests of means and medians of the variables (idiosyncratic risk, age, the log of firm size and ROA and Tobin's q between firms with overconfident managers and rational managers as well the significance of the difference. T-tests and Wilcoxon tests are conducted. Here, dummy overconfidence measure and "male" are used to classify overconfidence or not. "OC" in the table means overconfident managers, "R" means rational managers. Panel A, B, C present CEOs, CFOs and officers separately. T-value is for mean difference and z-value is for the difference of medians. Corresponding p-values are reported under the test values. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

Panel A CEOs

	Unsystematic Risk		Age		Firm Size		ROA		Tobin's q	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
OC1	14.859	3.499	52.95	53	7.184	7.044	0.041	0.057	2.233	1.769
R	137.514	3.054	52.405	52	7.036	6.918	0.014	0.041	1.978	1.508
t/z value	3.47***	-11.32 ***	-4.19***	-5.646***	-8.19***	-7.401***	-14.21***	-21.3***	-11.21***	-22.7***
P value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Male	67.585	3.343	52.739	52	7.123	6.984	0.03	0.051	2.127	1.657
Female	4.721	3.102	52.29	52	7.113	6.947	0.038	0.061	2.151	1.754
t/z value	-4.17***	-0.926	-1.27	-2.178**	-0.15	-0.597	1.31	4.047***	0.42	2.181**
P value	<.0001	0.355	0.203	0.029	0.882	0.551	0.19	<.0001	0.676	0.029

Panel B CFOs

	Unsystematic Risk		Age		Firm Size		ROA		Tobin's q	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
OC1	5.531	3.503	50.264	50	7.383	7.243	0.045	0.056	2.121	1.727
R	282.539	3.048	50.084	50	7.192	7.014	0.023	0.044	1.881	1.529
t/z value	4.13***	-2.23**	-1.16	-1.396*	-6.61***	-6.329***	-9.09***	-12.47***	-9.34***	-13.2***
P value	<0.001	0.022	0.247	0.081	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Male	143.523	3.273	50.268	50	7.273	7.108	0.034	0.05	2.006	1.632
Female	6.995	3.44	49.33	49	7.526	7.456	0.048	0.064	2.083	1.739
t/z value	-4.08***	2.23**	-3.71***	-3.44***	3.95***	3.364***	2.64***	6.12***	1.67*	3.707***
P value	<.0001	0.022	<.0001	<.0001	<.0001	<.0001	0.008	<.0001	0.096	<.0001

Panel C Officers and Directors

	Unsystematic Risk		Age		Firm Size		ROA		Tobin's q	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
OC1	9.33	3.538	53.419	53	7.231	7.112	0.038	0.057	2.291	1.749
R	13.709	3.221	52.544	52	7.114	6.968	0.018	0.044	2.065	1.561
t/z value	1.29	-31.13***	-14.16***	-17.09***	-17.92***	-17.51***	-36.56***	-54.71***	-26.86***	-58.25***
P value	0.196	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Male	13.562	3.406	53.172	53	7.171	7.037	0.031	0.052	2.18	1.656
Female	4.718	3.279	50.249	50	7.05	6.911	0.036	0.054	2.254	1.679
t/z value	-4.36***	-5.569***	-26.79***	-22.59***	-6.8***	-6.718***	3.16***	3.28***	2.93***	2.561***
P value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.002	<.0001	0.003	0.01

Table 5 Correlation Matrix

This table is the result of Pearson Correlation Analysis between the variables. The corresponding p-values are reported under its correlation coefficients. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

	1	2	3	4	5	6	7	8	9	10	11
1.Dummy Overconfidence (OC1)	1										
2.Continuous Overconfidence (OC2)	0.866***	1									
3.Male (OC3)	0.005	0.008	1								
4.Unsystematic Risk (SD1)	-0.017**	-0.007	0.005	1							
5.Systematic Risk (SD2)	-0.004	-0.005	0.018***	-0.001	1						
6.Age	0.097***	0.081***	0.068***	0.081***	-0.027***	1					
7.Firm Size	0.01***	0.066***	0.023***	0.056***	-0.016**	0.08***	1				
8.ROA	0.118***	0.136***	-0.01	0.115***	-0.006	0.028***	0.18***	1			
9.Tobin's q	0.115***	0.139***	0.012**	0.162***	0.003	-0.042***	-0.124***	0.278***	1		
10.PPE/asset	-0.064***	-0.039***	-0.004**	-0.088**	0.008	-0.017*	-0.122	-0.157**	-0.147**	1	
11.Cash/asset	0.016*	0.034*	-0.009*	-0.004	0.006**	-0.057*	-0.32**	0.014*	0.292*	-0.198*	1

Table 6 Empirical Results on Unsystematic Risk

This table reports the results of regressing managers' overconfidence on unsystematic risk (SD1) previous year as well as other control variables from 1993 to 2016. There are three ways to measure overconfidence. "OC1" is the dummy variable by comparing the unexercised exercisable option divided by total compensation to the industry median. If the value is higher than median then the dummy is one, otherwise 0. "OC2" is the continuous value of unexercised exercisable option divided by total compensation. The last one is "OC3", the "male" dummy variable. If a manager is male, then I consider it as overconfident. SD is the standard deviation of the residuals of Fama-French three-factor model. There are 3 specifications below. Column (1) shows the result of dummy overconfidence. Column (2) shows the result of continuous overconfidence. Column (3) report the result of gender on SD1. The results of CEOs, CFOs and officers are displayed in Panel A, B, C respectively. Corresponding standard error are reported in parentheses. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

Panel A CEOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Unsystematic Risk (SD1)	0.017***	0.018***	-0.03
	0.005	0.012	0.015
Age	-0.014***	-0.0128***	-0.007
	0.005	0.012	0.012
Firm Size	-0.228***	-0.227***	0.13*
	0.024	0.058	0.058
ROA	-1.684***	-1.623***	0.850
	0.346	0.750	0.813
Tobin's q	-0.161***	-0.168***	-0.046
	0.036	0.090	0.071
PPE/asset	0.33***	0.33**	0.573**
	0.002	0.004	0.006
Cash/asset	-0.352	-0.377	0.400
	0.313	0.782	0.626
Constant	7.055***	6.964***	14.58***
	1.334	2.194	1.136
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	13,349	13,349	13,349
Pseudo R squared /R-squared	0.114	0.008	0.0552

Panel B CFOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Unsystematic Risk (SD1)	0.003	-0.017**	0.014**
	0.005	0.013	0.007
Age	-0.010	0.019	-0.025**
	0.006	0.016	0.010
Firm Size	0.249***	0.472***	0.158***
	0.027	0.065	0.045
ROA	0.604*	2.044**	4.179***
	0.360	0.851	0.891
Tobin's q	-0.186***	0.562***	-0.129
	0.041	0.102	0.057
PPE/asset	-0.013	0.002	0.117
	0.002	0.005	0.003
Cash/asset	0.087	-1.151	4.733
	0.352	0.855	0.501
Constant	5.286***	-12.40***	-14.135
	1.092	2.535	0.85
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	6,359	6,359	6,359
Pseudo R squared /R-squared	0.090	0.080	0.080

Panel C Officers and directors

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Unsystematic Risk (SD1)	0.007***	0.027***	-0.012*
	0.002	0.007	0.008
Age	-0.024***	-0.047***	-0.033**
	0.002	0.006	0.004
Firm Size	-0.171***	0.339***	-0.034
	0.012	0.030	0.020
ROA	-1.385***	2.946***	0.576**
	0.182	0.356	0.276
Tobin's q	-0.223***	0.682***	-0.07***
	0.017	0.043	0.030
PPE/asset	-0.105*	-0.004*	0.327**
	0.001	0.002	0.001
Cash/asset	-0.191	-0.263	-0.165
	0.157	0.411	0.273
Constant	3.561***	-12.98***	-0.647
	0.433	1.175	0.811
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	113,132	113,132	113,132
Pseudo R squared /R-squared	0.081	0.075	0.059

Table 7 Winsorized Empirical Results on Unsystematic Risk

This table reports the results of regressing managers' overconfidence on unsystematic risk (SD1) in the previous year as well as other control variables from 1993 to 2016. All continuous variables are winsorized at the level of 5% and 95%. There are three ways to measure overconfidence. "OC1" is the dummy variable by comparing the unexercised exercisable option divided by total compensation to the industry median. If the value is higher than median then the dummy is one, otherwise 0. "OC2" is the continuous value of unexercised exercisable option divided by total compensation. The last one is "OC3", the "male" dummy variable. If a manager is male, then I consider it as overconfident. Win SD1 is the winsorized standard deviation of the residuals of Fama-French three-factor model. Column (1) shows the result of dummy overconfidence. Column (2) shows the result of continuous overconfidence. Column (3) report the result of gender on winsorized SD1. The results of CEOs, CFOs and officers are displayed in Panel A, B, C respectively. Corresponding standard error are reported in parentheses. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

Panel A CEOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Win SD1	0.045***	0.111***	-0.022
	0.010	0.026	0.001
Age	-0.013***	0.022*	-0.006
	0.005	0.011	0.000
Win Firm Size	-0.253***	0.574***	0.005**
	0.025	0.060	0.002
Win ROA	-3.028***	6.145***	-0.002
	0.579	1.465	0.055
Win Tobin's q	-0.273***	0.762***	0.000
	0.046	0.106	0.004
Win(PPE/asset)	0.315	0.002***	0.827***
	0.005	0.013	0.000
Win(Cash/asset)	0.002	0.000	-0.100
	0.003	0.008	0.000
Constant	6.814***	3.48***	-11.040
	1.232	1.882	0.042
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	13,934	13,934	13,934
Pseudo R squared /R-squared	0.115	0.114	0.050

Panel B CFOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Win SD1	0.012	-0.032	-0.037
	0.012	0.029	0.002
Age	-0.008	-0.023	-0.024**
	0.006	0.015	0.001
Win Firm Size	-0.280***	0.632***	0.116**
	0.028	0.068	0.004
Win ROA	-0.691	2.882	6.611*
	0.663	1.644	0.080
Win Tobin's q	-0.238***	0.662***	0.112
	0.051	0.122	0.006
Win(PPE/asset)	-0.010	0.661**	-0.161
	0.006	0.015	0.001
Win(Cash/asset)	0.001	-0.002	0.000
	0.004	0.009	0.000
Constant	5.130***	-14.85***	-13.070
	0.894	1.887	0.070
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	6,359	6,359	6,359
Pseudo R squared /R-squared	0.010	0.096	0.066

Panel C Officers and directors

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Win SD1	0.025***	-0.073**	-0.24**
	0.005	0.013	0.001
Age	-0.024***	-0.061***	-0.032***
	0.002	0.006	0.000
Win Firm Size	-0.195***	0.449***	-0.013
	0.012	0.031	0.002
Win ROA	-2.56***	5.905***	0.030
	0.291	0.738	0.036
Win Tobin's q	-0.316***	0.856***	-0.063
	0.022	0.054	0.003
Win(PPE/asset)	0.223**	-0.008*	0.43**
	0.003	0.007	0.000
Win(Cash/asset)	0.002	-0.003	0.002
	0.002	0.005	0.000
Constant	3.300***	-13.38***	-0.815*
	0.345	0.848	0.037
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	113,132	113,132	113,132
Pseudo R squared /R-squared	0.094	0.085	0.027

Table 8 Empirical Results on Systematic Risk

This table reports the results of regressing managers' overconfidence on systematic risk previous year from 1993 to 2016. There are three ways to measure overconfidence. "OC1" is the dummy variable by comparing the unexercised exercisable option divided by total compensation to the industry median. If the value is higher than median then the dummy is one, otherwise 0. "OC2" is the continuous value of unexercised exercisable option divided by total compensation. The last one is "OC3", the "male" dummy variable. If a manager is male, then I consider it as overconfident. As for systematic risk, SD2 is the beta value in CAPM for the last month in one fiscal year. Column (1) shows the result of dummy overconfidence. Column (2) shows the result of continuous overconfidence. Column (3) report the result of gender on SD2. The results of CEO, CFO and officers are displayed in Panel A, B, C respectively. Corresponding standard error are reported in parentheses. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

Panel A CEOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Beta (SD2)	0.717	-1.171	0.190
	1.264	0.861	0.019
Age	-0.012**	0.015	-0.090
	0.005	0.012	0.000
Firm Size	-0.213***	0.433***	1.16**
	0.024	0.059	0.002
ROA	-1.598***	3.507***	0. 756
	0.343	0.748	0.020
Tobin's q	-0.140***	0.412***	-0.756
	0.035	0.091	0.002
PPE/asset	0.321**	-0.717**	0.584**
	0.002	0.004	0.000
Cash/asset	-0.578	0.739	0.447
	0.312	0.784	0.023
Constant	6.721***	-18.962*	-14.231
	1.153	2.033	2.349
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	13,349	13,349	13,349
Pseudo R squared /R-squared	0.101	0.084	0.047

Panel B CFOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Beta (SD2)	1.785	-0.478	0.056
	2.035	0.417	0.028
Age	-0.009	0.019	-0.002**
	0.006	0.016	0.001
Firm Size	-0.246***	0.457***	0.014***
	0.027	0.065	0.004
ROA	-0.584	1.985**	4.56***
	0.359	0.851	0.037
Tobin's q	-0.183***	0.537***	-0.078**
	0.040	0.101	0.004
PPE/asset	-0.016	0.002	0.086
	0.002	0.005	0.000
Cash/asset	0.076	-1.104	3.981
	0.352	0.855	0.052
Constant	-3.969***	-8.354***	14.074
	1.107	2.569	1.720
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	6,359	6,359	6,359
Pseudo R squared /R-squared	0.100	0.080	0.047

Panel C Officers and directors

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Beta (SD2)	-1.784	-0.162	0.024
	0.120	0.300	0.025
Age	-0.024***	0.047***	0.002***
	0.002	0.006	0.000
Firm Size	-0.166***	0.318***	0.004**
	0.011	0.030	0.001
ROA	-1.361***	2.874***	-0.03*
	0.181	0.354	0.015
Tobin's q	-0.191***	0.654***	0.007***
	0.017	0.042	0.002
PPE/asset	0.439***	-0.294**	0.000
	0.001	0.002	0.000
Cash/asset	-0.206	-0.593	0.010
	0.157	0.411	0.020
Constant	6.012**	-12.18***	-0.015
	2.526	9.340	0.762
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	113,132	113,132	113,132
Pseudo R squared /R-squared	0.080	0.073	0.027

Table 9 Winsorized Empirical Results on Systematic Risk

This table reports the results of regressing managers' overconfidence on systematic risk previous year as well as other control variables from 1993 to 2016. All continuous variables are winsorized at the level 5% and 95%. There are three ways to measure overconfidence. "OC1" is the dummy variable by comparing the unexercised exercisable option divided by total compensation to the industry median. If the value is higher than median then the dummy is one, otherwise 0. "OC2" is the continuous value of unexercised exercisable option divided by total compensation. The last one is "OC3", the "male" dummy variable. If a manager is male, then I consider it as overconfident. As for systematic risk, "win SD2" is the winsorized beta value in CAPM for the last month in one fiscal year. Column (1) shows the result of dummy overconfidence. Column (2) shows the result of continuous overconfidence. Column (3) report the result of gender on "win SD2". The results of CEO, CFO and officers are displayed in Panel A, B, C respectively. Corresponding standard error are reported in parentheses. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

Panel A CEOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Win Beta	3.898	3.404	-9.071
	9.600	24.250	9.131
Age	-0.012***	0.020*	-0.843
	0.005	0.012	0.007
Win Firm Size	-0.225***	0.515***	0.000
	0.024	0.059	0.118
Win ROA	-2.635***	5.279***	-0.002
	0.574	1.471	0.729
Win Tobin's q	-0.238***	0.684***	-0.055
	0.045	0.114	0.015
Win(PPE/asset)	0.367***	-0.005	-0.004
	0.005	0.013	0.853
Win(Cash/asset)	0.002	-0.011	0.000
	0.003	0.008	0.008
Constant	6.415	-18.289*	-13.041
	1.133	1.921	2.230
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	13,349	13,349	13,349
Pseudo R squared /R-squared	0.117	0.010	0.065

Panel B CFOs

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Win Beta	11.700	18.380	12.452
	10.750	19.698	20.657
Age	-0.008	0.024	-0.024
	0.006	0.016	0.001
Win Firm Size	-0.269***	0.619***	0.103*
	0.028	0.067	0.004
Win ROA	-0.515	2.739*	6.484***
	0.660	1.640	0.079
Win Tobin's q	-0.224***	0.643***	0.087*
	0.050	0.122	0.006
Win(PPE/asset)	-0.009	0.645*	-0.176
	0.006	0.014	0.001
Win(Cash/asset)	0.001	-0.005	0.001
	0.004	0.008	0.000
Constant	5.284**	-14.63*	-13.172
	0.944	2.340	12.620
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	6,359	6,359	6,359
Pseudo R squared /R-squared	0.010	0.087	0.063

Panel C Officers and directors

VARIABLES	1 Dummy OC1	2 Continuous OC2	3 Male OC3
Win Beta	13.45***	34.29***	22.147***
	4.503	11.460	8.324
Age	-0.024***	0.061***	0.032***
	0.002	0.006	0.000
Win Firm Size	-0.175***	0.394***	-0.035*
	0.012	0.031	0.002
Win ROA	-2.322***	5.248***	0.119
	0.290	0.715	0.036
Win Tobin's q	-0.291***	0.788***	-0.094***
	0.022	0.056	0.003
Win(PPE/asset)	0.224***	-0.482**	0.432***
	0.003	0.006	0.000
Win(Cash/asset)	0.004	-0.001	0.003
	0.002	0.004	0.000
Constant	2.816***	-12.029***	-1.366**
	1.968	8.925	0.784
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	113,132	113,132	113,132
Pseudo R squared /R-squared	0.092	0.083	0.028

Table 10 Robustness Test - Median Regressions on Unsystematic Risk

This table reports the results of median regression of regressing managers' overconfidence on unsystematic risk previous year as well as other control variables from 1993 to 2016. In this table, unsystematic risk measure is the continuous value of unexercised exercisable option divided by total compensation. Diversifiable risk is the standard deviation of the residuals of Fama-French three-factor model. Corresponding standard error are reported in parentheses. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

VARIABLES	1 CEOs	2 CFOs	3 Officers
Unsystematic Risk (SD1)	0.041**	0.004	0.028**
	0.012	0.019	0.010
Age	0.038**	0.022	0.082***
	0.015	0.030	0.011
Firm Size	0.332***	0.519***	0.563***
	0.075	0.121	0.058
ROA	6.786***	5.979***	4.788***
	1.024	1.689	0.800
Tobin's q	0.455***	0.484***	0.849***
	0.099	0.172	0.077
PPE/asset	-0.196***	-0.109	-0.007**
	0.006	0.010	0.005
Cash/asset	-0.964	-2.014	-1.241
	1.030	1.635	0.823
Constant	-24.52*	-14.223***	-17.394***
	2.614	3.951	1.650
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	13,349	6,359	113,132

Table 11 Robustness Test - Median Regressions with "Average moneyness" as A Measure of Overconfidence on Unsystematic Risk

This table reports the results of median regression of regressing "average moneyness" on unsystematic risk as well as other control variables from 1993 to 2016. In this table, unsystematic risk measure is the "average moneyness" of options. Diversifiable risk is the standard deviation of the residuals of Fama-French three-factor model. Corresponding standard error are reported in parentheses. ***, **, * indicate statistical significance at 0.01, 0.05, 0.1 level respectively.

VARIABLES	1 CEOs	2 CFOs	3 Officers
Unsystematic Risk (SD1)	0.012**	0.003	0.007***
	0.002	0.002	0.001
Age	-0.001	-0.001	0.003***
	0.002	0.003	0.001
Firm Size	-0.012	0.008	-0.017
	0.009	0.012	0.005
ROA	0.755***	0.517***	0.628***
	0.125	0.167	0.072
Tobin's q	0.199***	0.169***	0.212***
	0.013	0.017	0.007
PPE/asset	-0.097**	-0.772***	-0.034**
	0.001	0.001	0.000
Cash/asset	-0.405	-0.746	-0.362
	0.127	0.159	0.069
Constant	0.046	0.215	0.034
	0.361	0.393	0.166
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	13,349	6,359	113,132