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Will managerial optimism affect the investment efficiency of a firm?

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Abstract

We follow the measurement of Campbell et al. (2011) for managerial optimism and investigate the influences of the different levels of managerial optimism on improving the investment efficiency when firms tend to under-invest or over-invest. The results indicate that an under-invested firm with a CEO that has a high level of managerial optimism can improve the firm's investment efficiency by reducing the degree of underinvestment, further increasing the value of a firm.

Keywords: **Managerial optimism; Investment efficiency; Overinvestment; Underinvestment**

1. Introduction

Making investment decisions are an integral and vital part of managing a firm, and thus an efficient investment decision is expected to enhance firm valuations. How managerial psychological tendencies affect a firm's investment efficiency has not been fully explored yet. Our study aims to fill this gap. We hypothesize that an under-invested firm with a higher level of managerial optimism tends to invest more, given that an optimistic manager is usually willing to invest more (Glaser et al. 2008). We follow the research of Campbell et al. (2011), which extends the work of Malmendier and Tate (2005), and develop the measure of CEO optimism. We also follow Biddle et al. (2009), using an aggregated measure of ex-ante characteristics of a firm's cash and leverage ratios, to classify the under- and over- investment level of sample firms.

The main findings in this study are summarized as follows: First, based on our optimism measurement, we find most CEOs are optimistic in our sample, which is consistent with prior papers (e.g., Campbell et al., 2011). In addition, a firm with a highly optimistic CEO will invest more than firms whose CEOs have lower

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levels of optimism; the finding remains the same both based on our univariate analysis and multiple regression analysis. Last but not least, our findings indicate that an under-invested firm with a CEO that has a high level of managerial optimism improves the firm's investment efficiency by reducing the amount of underinvestment, and thereby increases firm value; this is consistent with our hypotheses. However, when firms tend to over-invest, our results do not provide sufficient evidence to support the other hypotheses, that is, an over-invested firm with a CEO that has a low level of managerial optimism is not found to effectively improve the firm's investment efficiency and increase firm value by reducing the level of overinvestment. We also investigate how CEO optimism affects investment decision for firms under financial constraints.

2. Literature review and hypotheses development

Many literatures show that most investors and managers may expect optimistically regarding prospective outcomes (Heaton, 2002; Lin et al., 2005; Barros and Silveira, 2007; Shefrin, 2001; Glaser, 2008). Managerial behavior tendency could affect firm's investment decisions. Jensen (1986) states the concept of agency cost of free cash flow and predicts that managers may invest in negative NPV projects due to self-interest. If the information cannot be conveyed to the capital market, managers may forgo investing in positive NPV projects for fear of negatively affecting the firm's share value, resulting in underinvestment (Myers and Majluf, 1984). This information asymmetry problem could either limit firms' ability to finance a potential project (Hubbard, 1998; Bertrand and Mullainathan, 2003) or allow managers to invest inefficiently by making inferior project selections, consuming perquisites, or even expropriating resources (Stein, 2003).

When managerial optimism is considered in corporate investment decision, studies such as Malmendier and Tate (2005a, b), Glaser et al., 2008, and Malmendier and Tate (2008) suggest that managerial overconfidence accounts for corporate investment distortions and a firm with optimistic managers may cause them to invest more, and thereby expose the firm to risk, than a firm with no optimistic managers.

Prior studies have indicated that managers with higher level of optimism are more sensitive to the cash flows, and they may forgive positive net present value projects if they don't have enough internal funds (Heaton, 2002; Malmendier and Tate, 2005a, b; Glaser et al., 2008). Meanwhile, studies suggest that managers with certain degree of optimism tend to undertake a risky project because they overestimate the future payoff, so they increase the investment (Heaton, 2002; Barros and Silveira, 2007; Shefrin, 2001; Goel and Thakor, 2008). Based on the above analyses, we predict that an optimism CEO of firm with plenty of cash flow (under-invest) is less concerned about costly external financing and thus is more willing to take a risky project expected to have higher return. On the other hand, an over-invested firm with a lower optimism CEO is expected to become more conservative about their investment policies, and thus it is predicted that s/he will decrease the capital expenditure. Thus, we propose the first hypothesis:

> $H1_a$: *A firm with a high possibility for underinvestment and whose CEO is highly optimistic will invest more than a similar firm whose CEO has a low level of optimism.*

> $H1_b$: *A firm with a high possibility for overinvestment and whose CEO has a low level of optimism will invest less than a similar firm whose CEO is highly optimistic.*

As a distorted investment may reduce the investment efficiency of a firm, managerial sentiment may thus also impact a firm's value. Goel and Thakor (2008) theoretically show that a CEO with moderate overconfidence help diminish underinvestment inefficiency because an overconfident CEO may overestimate a project with the probability of high payoff and thus is more willing to bear risk in accepting a project. As an overconfident CEO is more willing to invest in projects with low probabilities of high payoff, this turns out investment efficiency could be improved for an underinvested firm, and enhances shareholders' wealth. Thus, we propose the second hypothesis:

H2$_a$: The value of a firm with a high possibility for underinvestment and whose CEO is highly optimistic will be greater than that of a similar firm whose CEO has a low level of optimism.

H2$_b$:The value of a firm with a high possibility for overinvestment and whose CEO has a low level of optimism will be greater than that of a similar firm whose CEO is highly optimistic.

3. Data and variables

In this section, we present the sample and data used to test our hypotheses, and then introduce the measures of managerial optimism and over- or under-investment. All variables used in this study are as defined in Table I.

Table 1. Definitions of variables used in this study.

Variable	Definition
Investment (*I*)	Capital expenditures divided by lagged total assets (following Glaser et al., 2008).
Firm value (*V*, Tobin's Q)	Market value of equity plus total assets minus book value of equity divided by total assets (following Baker, Stein and Wurgler, 2003)
High-optimism CEO indicator *(Ho)*	An indicator variable that equals 1 for all years if the CEO exercises stock options at (or more than) 100% moneyness, and 0 otherwise.
Low-optimism CEO indicato*r (Lo)*	An indicator variable that equals 1 for all years if the CEO exercises stock options at (or less than) 30% moneyness, and 0 otherwise.
OverInvest*(OverI)*	A ranked variable that is based on the average of ranked value of cash and leverage (two partition variables); firms are prone to over-invest if the ranked value is close to 1.
UnderInvest*(UnderI)*	A ranked variable that is based on the average of ranked value of cash and leverage (two partition variables); firms are prone to under-invest if the ranked value is close to 0.
Firm size	Natural log of book total assets.
M/B	Market value of equity divided by book value of equity and used to measure the growth opportunity of a firm. Book equity is calculated as total assets minus total liabilities minus preferred stock liquidating value plus deferred taxes and investment tax credit (following Malmendier and Tate, 2005a).
Leverage	The firms that have the same SIC 3-digit industry; used to measure industry leverage.
CF	The ratio of cash flow from operations divided by sales and used to measure the asset management efficiency of a firm.
Operating Cycle	The log of receivables to sales plus inventory to COGS multiplied by 360.
Dividend	An indicator variable that equals 1 if the firm paid a dividend that year, and 0 otherwise.
Slack	The ratio of cash divided by PPE and used to measure the financial slack of a firm.
CEO ownership	The fraction of outstanding shares held by the CEO.
CEO-equity-based pay	The percentage of equity-based compensation (stock option and restricted stock grants) in a CEO's total compensation.
GIM index	It is taken from Gompers et al. (2003), based on 24 antitakeover provisions as the proxy for antitakeover provisions. Higher index levels correspond to more managerial power.
Institution Own	The fraction of outstanding shares held by institutional owners.
Pension Own	The fraction of outstanding shares held by the 18 largest public pension funds (as in Cremers and Nair, 2005).
Analysts	The number of analysts following the firm.
Capx	Ratio of capital expenditures divided by sales.
Profitability	Ratio of operating income before depreciation divided by total assets.

3.1. Sample and data

Our variable of interest is CEO optimism. To measure CEO optimism (information regarding CEOs compensation and options held) we collect US based CEO-firm-year data found in Compustat ExecuComp database from 1992 to 2009. We collect the data on ownership structure from the Compact D/SEC database, Thomson Reuters, and Corporate Library. The number of analyst following is collected from I/B/E/S

database. Accounting data is collected from Compustat. We delete firm-years that have missing data related to our dependent variables, independent variables and any of our optimism measures. We further exclude firms in financial industries (i.e., SIC codes between 6000 and 6999) due to their special capital structure and investment characteristics.

3.2. The Measurement of managerial optimism and over- and under-investment

We follow Campbell et al. (2011) and apply optimism measures based on stock option holdings and exercise data constructed from ExecuComp database and follow Biddle et al. (2009) in using an aggregated measure of ex-ante characteristics of firm cash and firm leverage to classify a firm as being more prone to over- or under-invest. The initial sample in the database contains over 12,000 CEO-year observations. For each CEO-firm-year, we first calculate the realizable value per option as the exercisable option's total realizable value divided by the number of exercisable options held by the CEO. We then use the stock price at the fiscal year end and deduct from it the realizable value per option to obtain the estimated average exercise price. Finally, we use the realizable value per option divided by the estimated average exercise price to obtain the average percent moneyness. CEOs who hold stock options more than 100% deep in the money are identified as overly optimistic. When a CEO's exercised stock options are less than 30% in the money and the CEO does not hold other exercisable options that are more than 30% in the money, the CEO is identified as having a low level of optimism. Furthermore, when a CEO holds and/or exercises options with average percentage moneyness between 30% and 100% the CEO is identified as being moderately optimistic.

4. Methodology

We apply multiple panel regressions to test the relation between investment (*I*) and CEO optimism when firms are more prone to under- or over-invest in the overall sample. The estimated models are:

$$I_{it} = \alpha_0 + \alpha_1 Ho_{it} + \alpha_2 UnderI_{it} + \alpha_3 Ho_{it} * UnderI_{it} + \Sigma Controls_{it} + \varepsilon_{it} \tag{1a}$$

$$I_{it} = \beta_0 + \beta_1 Lo_{it} + \beta_2 OverI_{it} + \beta_3 Lo_{it} * OverI_{it} + \sum Controls_{it} + \varepsilon_{it} \tag{1b}$$

Our first hypothesis states that different levels of CEO optimism will reduce under- and over-investment when firms are more prone to under- or over-invest. Thus we use model (1a) to test H1a by estimating whether the coefficient α_3 is larger than zero, and we use model (1b) to test H1b by estimating whether the coefficient β_3 is smaller than zero. (H1a: $\alpha_3 > 0$ when firms are prone to under-invest; H1b: $\beta_3 < 0$ when firms are prone to over-invest.)

In order to test the relation between firm value and CEO optimism when firms are more prone to over- or under-invest, we use similar models as above, but the dependent variable is firm value, which is represented by Tobin's Q (*V*). Thus the estimated models are:

$$V_t = \delta_0 + \delta_1 Ho_{it} + \delta_2 UnderI_{it} + \delta_3 Ho_{it} * UnderI_{it} + \sum Controls_{it} + \varepsilon_{it} \tag{2a}$$

$$V_{it} = \lambda_0 + \lambda_1 Lo_{it} + \lambda_2 OverI_{it} + \lambda_3 Lo_{it} * OverI_{it} + \sum Controls_{it} + \varepsilon_{it} \tag{2b}$$

According to our second hypothesis, CEO optimism contributes to the value of a firm when firms are classified as more prone to over- or under-invest. We use model (2a) to test H2a by estimating whether the coefficient δ_3 is larger than zero, and we use model (2b) to test H2b by estimating whether the coefficient λ_3 is larger than zero. (H2a : δ_3 >0 when firms are prone to under-invest; H2b : λ_3 >0 when firms are prone to over-invest.)

5. Empirical analysis

5.1. Summary statistics

Figure 1(a) presents the summary statistics of CEOs with different level of optimism. We find that about 29.5% of the CEOs have a high level of optimism and about 9% of the CEOs have a low level of optimism. 61.5% of the CEOs are classified as moderately optimistic. The distribution of CEO optimism is close to the analysis of Campbell et al. (2011). For the entire sample period, the average proportions of high- and low-optimism CEOs are about 25% and 12.5%, respectively. Overall, the proportion of high-optimism CEOs is larger than the proportion of low-optimism CEOs every year, consistent with the findings of Malmendier and Tate (2005a) and Glaser et al. (2008). We also find that the proportion of high-optimism CEOs is significantly lower than the proportion of low-optimism CEOs in 2008 and 2009. The proportion of high-optimism CEOs are around 13% in 2008 and 11% in 2009, while the proportion of low-optimism CEOs increases to about 26% in 2008 and 19% in 2009, as shown in Fig. 1(b).
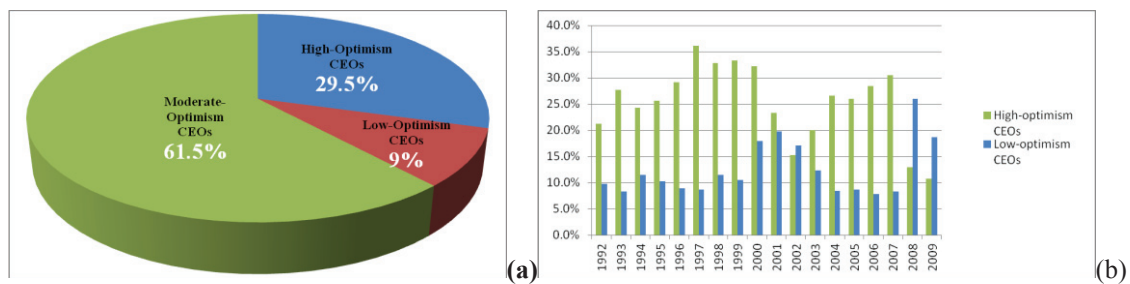

Fig. 1. (a) Proportion of CEOs at different levels of optimism. (b) Distribution of high- and low-optimism CEOs from 1992 to 2009.

5.2. Univariate Analysis

Table 2 presents the mean (median) investment ratio and Tobin's Q for firms that tend to under-invest and firms that tend to over-invest. The mean investment ratio of firms that are prone to over-invest and have high-optimism CEOs is significantly higher than one with low high-optimism CEOs, however the median investment ratio within over invested firms with different level of CEO optimisms is not significantly different. We also find that the mean (median) Tobin's Q of firms with high-optimism CEOs is significantly higher than one with low high-optimism CEOs for both under-invested and over-invested firms. That implies firms generally have higher firm valuations if they have high-optimism CEOs. The univariate comparisons show that managerial tendency or behavior biases, such as optimism, could alleviate investment inefficiency for firms that are prone to under-invest, but managerial optimism won't significantly affect investment behavior for firms that are prone to over-invest.

5.3. Multiple Regression Analyses

Panels A and B of Table 3 present the regression coefficients and p-value results for our tests of hypotheses H1a and H1b. In Panel A of Table 3, under the results of Model 1, we find the coefficient of Ho is 0.016 which is statistically significant at the 1% level, indicating a firm with a high-optimism CEO will invest more than CEOs with other levels of optimism. Panel B of Table 3 shows results for the subsamples of firms that are prone to under- or over-invest. The coefficients of Ho are significantly positive at the 1% level under

the results of Model 1, which is consistent with the prediction of H1a. However, the coefficients of Lo are not significantly negative, although its sign is consistent with our prediction under H1b. In sum, we find partial evidence supporting our hypothesis that when firms are more prone to under-invest, high levels of optimism will help improve a firm's investment efficiency. However, there is not sufficient evidence to show that when firms are more prone to over-invest, low levels of optimism will help improve a firm's investment efficiency.

Table 2. Differences test in investment ratio (I) and Tobin's Q (V) between high-optimism CEOs and low-optimism CEOs.

		CEO with High Optimism	CEO with Low Optimism	Difference	Difference Test
Panel A: Firms are prone to under-invest					
Investment (I)	Mean	0.099	0.074	0.025	(<0.01)***
	Median	0.072	0.053	0.019	(0.03)**
Tobin's Q (V)	Mean	1.445	1.13	0.315	(<0.01)***
	Median	1.361	1.056	0.305	(<0.01)***
Panel B: Firms are prone to over-invest					
Investment (I)	Mean	0.085	0.062	0.023	(0.01)**
	Median	0.06	0.046	0.014	(-0.21)
Tobin's Q (V)	Mean	3.795	2.321	1.474	(<0.01)***
	Median	3.316	1.889	1.427	(<0.01)***

Similar to what was described above, Panel C of Table 3 shows the whole sample results, where Model 1 shows the coefficient of *Ho* to be significant and positive, as expected, at 1.488. In Model 1 the interaction term *Ho*UnderI* is significantly positive, which is consistent with our prediction. The coefficient of interaction term *Lo*OverI* of Model 2 is not significantly, which do not support *H2b*. Panel D of Table 3 shows results for the subsamples of firms that are prone to under- or over-invest. The coefficient of *Ho* is significantly at the 1% level, which is consistent with our prediction. However the coefficient of *Lo* is still not consistent with our predicted sign. In sum, when firms are prone to under-invest, their firm value increase when they have a highly optimistic CEO, but when firms are prone to over-invest, there is insufficient evidence to support firm value will increase when their CEO has a low level of optimism.

6. Discussion and Conclusions

In this study, we investigate whether managerial optimism affects a firm's investment efficiency and its association to firm valuation. We measure the level of CEO optimism (Campbell et al., 2011) and identify firms that are prone to under-invest or over-invest (Biddle et al., 2009), and find that most CEOs are optimistic in our sample, which is consistent with prior studies (e.g., Glaser 2008). The firms with a highly optimistic CEO will invest more than firms whose CEOs have lower levels of optimism; the finding remains the same both based on our univariate analysis and multiple regression analysis. Last but not least, our findings indicate that an under-invested firm with a CEO that has a high level of managerial optimism improves the firm's investment efficiency by reducing the amount of Under investment, and thereby increases firm value; this is consistent with our hypotheses. However, when firms tend to over-invest, our results do not provide sufficient evidence to support the other hypotheses, that is, an over-invested firm with a CEO that has a low level of managerial optimism is not found to effectively improve the firm's investment efficiency and increase firm value by reducing the level of over investment. We also find that an optimism CEO tends to increase firm investment even under financial constraint, which also leads to increase in firm valuation.

Table 3. The relation between Investment/firm value and the different levels of optimism.

	Dependent Variable=Investment (I)				Dependent Variable=Toibn's Q (V)			
	Panel A: Whole sample		Panel B: Subsample are prone to under- or over-invest		Panel C: Whole sample		Panel D: Subsample are prone to under- or over-invest	
	Model 1	Model 2	Model 1 (under-invest)	Model 2 (over-invest)	Model 1	Model 2	Model 1 (under-invest)	Model 2 (over-invest)
Intercept	0.163 (<.0001)***	0.218 (<.0001)***	0.16 (<.0001)***	0.154 (<.0001)***	3.179 (<.0001)***	2.018 (<.0001)***	1.173 (<.0001)***	4.180 (<.0001)***
Ho	0.016 (<.0001)***		0.004 (<.0001)***		1.488 (<.0001)***		0.284 (<.0001)***	
UnderI	0.006 (0.085)*				-0.729 (<.0001)***			
Ho*UnderI	0.008 (0.128)				1.191 (<.0001)***			
Lo		-0.0002 (0.975)		-0.01 (0.369)		-0.219 (0.177)		-0.991 (0.001)***
OverI		-0.016 (0.012)**				1.452 (<.0001)***		
Lo*OverI		-0.006 (0.646)				-0.767 (0.106)		
Firm size	-0.009 (<.0001)***	-0.01 (<.0001)***	0.002 (<.0001)***	-0.004 (0.225)	-0.139 (<.0001)***	-0.150 (<.0001)***	-0.030 (0.003)***	-0.266 (0.002)***
Ind. leverage	0.03 (0.007)***	0.04 (0.074)*	0.013 (0.233)	0.148 (<.0001)***	-1.481 (<.0001)***	-1.008 (0.032)**	-0.623 (<.0001)***	-2.010 (0.055)*
CF/Sale	0.083 (<.0001)***	0.111 (<.0001)***	0.012 (<.0001)***	0.052 (0.007)***	0.570 (0.005)***	0.458 (0.212)	0.247 (<.0001)***	2.012 (0.027)**
CEO ownership	-0.016 (0.414)	0.051 (0.263)	0.033 (0.757)	0.053 (0.353)	-0.830 (0.043)**	-2.103 (0.035)**	-0.217 (0.309)	-2.867 (0.064)*
CEO-equity-based pay	-0.0002 (0.961)	0.001 (0.900)	0.0056 (0.873)	-0.006 (0.529)	0.496 (<.0001)***	0.52 (0.001)***	0.157 (<.0001)***	0.455 (0.088)*
GIM index	-0.002 (<.0001)***	-0.004 (<.0001)***	0.001 (<0.001)***	-0.004 (<0.001)***	0.001 (0.892)	-0.004 (0.824)	0.005 (0.197)	-0.013 (0.679)
Institutional Own	0.008 (0.184)	0.014 (0.226)	0.008 (0.218)	0.013 (0.425)	-0.98 (<.0001)***	-0.725 (0.004)***	-0.034 (0.496)	-1.213 (0.006)***
Pension Own	0.047 (0.414)	0.052 (0.687)	0.088 (0.201)	0.023 (0.898)	-3.722 (0.003)***	-7.827 (0.005)***	-0.372 (0.515)	-11.637 (0.013)**
Analyst	0.002 (<.0001)***	0.001 (0.001)***	0.0003 (<0.001)***	0.0004 (0.444)	0.047 (<.0001)***	0.058 (<.0001)***	0.009 (<.0001)***	0.083 (<.0001)***
M/B (Panel A/B) Profitability (Panel C/D)	0.0005 (0.465)	0.004 (<.0001)***	0.001 (0.007)***	0.004 (0.006)***	3.368 (<.0001)***	5.435 (<.0001)***	1.999 (<.0001)***	6.575 (<.0001)***
Dividend	-0.004 (0.125)	-0.010 (0.034)**	0.0003 (<.0001)***	-0.014 (0.048)**				
Slack	-0.006 (<.0001)***	-0.008 (<.0001)***	0.007 (0.046)**	-0.008 (<.0001)***				
Operating Cycle	-0.032 (<.0001)***	-0.047 (<.0001)***	0.005 (<.0001)***	-0.034 (<.0001)***				
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	No	No	No	Yes
Industry Fixed Effects	No	No	No	Yes	No	No	No	Yes
N	8327	8327	4161	4161	8327	8327	4161	4161
R^2 (%)	24.88%	25.12%	33.84%	25.35%	54.70%	53.19%	32.20%	38.09%

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