

The effect of stock market mispricing on investment —Evidence from China

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Abstract: -Using a large panel of Chinese listed firms, we introduce market timing theory and investigate if mispricing in the stock market has an impact on firm-level investment. The article discusses the relationship between equity mispricing and equity dependence. A significantly positive relation is documented between investment and the proxies for mispricing, suggesting that overpriced (underpriced) firms tend to overinvest (under-invest). Furthermore, we find that based on financing constrains index equity-dependent firms which display a more pronounced sensitivity of investment to stock misevaluation than do non-equity-dependent firms. Our findings show that mispricing in Chinese capital markets may have significant influence on the real economy, and the influence works though an equity-financing channel.

Key-words: -Investment- Q ; Equity dependence; Investment; Chinese listed firms

1 Introduction

It is a well-established finding that a firm's market valuation is positively related to its capital investment, which is called " Q " theory. " Q " is defined as the market value of assets divided by their replacement costs. Researchers explain investment with Tobin's Q under the assumption of efficient capital markets, where stock price fully reflects a firm's capital investment. When the money supply increases, the stock price rises and Tobin also increases. In this case, it brings the expansion of business investment and national income. One of the reasons that affect monetary policy is that the market value of assets to their replacement value of the ratio and also can be used to measure whether the market value of asset is overvalued or undervalued.

However, with the development of behavioral finance, recent events and research findings increasingly reflect that actual practices of investors and managers may depart from the efficient market paradigm. In particular, the stock market is found to be not only driven by news about fundamentals but also by non-fundamental elements such as investor sentiment. The interaction between investor sentiment and managers in such a world may cause corporate investment to deviate from the optimal level. Especially since the global financial crisis occurs, more scholars have observed that investor

irrational behavior exists in capital market and begin to study the impact of capital market mispricing on the real economy.

The above studies on this equity-financing channel focus on the U.S market. This paper seeks to detect the existence of the equity-financing channel in Chinese context. Suppose our set of Chinese firms consists of a larger proportion of firms in the energy and materials sectors and fewer firms in the information technology and telecommunications sectors. Due to more tangible assets in the energy and raw materials sectors, they are relatively more transparent and less subject to mispricing. Therefore, if stock market mispricing only plays a marginal role in affecting firms' investment, one should not expect to observe a significant relationship between investment and mispricing in China.

In the paper, there follow two issues. Firstly, we hypothesize that the influence of market equity mispricing on real investment works through an equity-financing channel. Second, using two measures of equity dependence and one proxy for stock mispricing, we consistently document whether there is a positive relationship and more pronounced for equity-dependent firms.

The reminder of the paper is organized as follows. Section 2 briefly reviews the previous literature. Section 3 describes the sample selection and data. Section 4 presents the empirical relation between the

investment and Tobin Q as well as mispricing. And Section 5 concludes the paper and gives some suggestions.

2 Literature review

2.1 Investment and mispricing

With the rising of behavior corporate finance, a lot of literatures explore investor sentiment and limited arbitrage pricing errors that cause mispricing in capital market have an impact on company's investment decisions. Stein (1996) proposes an equity-financing channel through which stock market mispricing affects investment decisions. In his model, if a firm has low cash holdings and debt capacity, it will be equity-dependent and therefore has to rely on external equity financing for its capital investment. The resulting effect is a positive relation between non-fundamental component of its stock price and the level of new investment. On the other hand, less equity-dependent firms can insulate their investment decisions from irrational gyrations in their stock prices because they can rely on internal financing or tap the debt market relatively easily [1]. Baker et al (2003) use a simple model to outline the conditions under which corporate investment is sensitive to non-fundamental movements in stock prices. The key prediction is that stock prices have a stronger impact on the investment of "equity-dependent" firms—firms that need external equity on finance marginal investments. Using an index of equity dependence based on the work of Kaplan and Zingales, they find support for this hypothesis. [2]

Shleifer and Vishny(2003)present a model of mergers and acquisitions based on stock market misvaluations of the combining firms. The model explains who acquires whom, the choice of the medium of payment, the valuation consequences of mergers, and merger waves. They argue that stock price overvaluations leads to more investment in the form of mergers because an overvalued firm may wish to acquire another firm by offering stock. [3]

Polk and Sapienza(2004)also explore the positive relationship between stock-market inefficiency and corporate investment. However, they assume that all firms are financially unconstrained, their model predicts that the impact of stock mispricing on investment is independent of firms' financial status. [4]

Gilchrist et al (2005) develop a framework for estimating the extent to which the predictive power of cash flow can be attributed to its role as a "fundamental" versus its role in alleviating credit frictions. They find the perfect capital markets model

of investment can fully account for the role of cash flow and use other forms of proxy variables and confirm that through equity financing channels irrational investors affect investment behavior. [5]

Li Jieyu and Wang Meijin(2006)found the speculative bubble and the actual investment were significantly correlated, where they depend on shareholder value. In large sample of out-standing shares, the companies cater to the demand of speculative shareholder, there is a significant impact between speculative bubble and real investment [6]. Liu and Chen (2006) draw the stock price has a significant positive impact on long-term firm-level investment behavior. If there is more equity dependence, the company's long-term investment behavior is much more sensitivity to market valuation [7]. Chang et al (2007) verify that there is a significantly positive relation between investment and the proxies for mispricing, suggest that overpriced (underpriced) firms tend to overinvest (under-invest). According to four equity-dependent criteria, they find that equity-dependent firms display a more sensitivity of investment to stock misvaluation than do non-equity-dependent firms. [8]

Zhang Ge and Wang (2007) verified the mispricing in Chinese stock market that brought about by investor sentiment has an impact on the company's actual investment. Inversion mechanism for meeting the demand plays a dominant role in Chinese stock market. In order to cater for the strong investor sentiment, companies express more control purposes for actual investment. [9]

2.2 Investment- Q sensitivity

Ben S. Bernanke and Mark Gertler (2001) find stock price rising (falling) causes the relative replacement cost of the capital value increasing (decreasing), thereby stimulating (limiting) company's investment need.[10]

T.Berg and Berger (2005) argue that major changes in economic policy have resulted in a more market driven demand for housing investment in Sweden. Their results indicate that there exists a high degree of correlation between the Q ration and the (log) two different variables for housing investment. [11]

L. Guido and W. Karl (2007) develop a model of investment with financial constraints and use it to investment and Tobin' q . They find that when wealth is scarce, insiders earn a rate of return that is higher than the market rate of return and they receive a quasi-rent on investment capital. This rent is priced

into the value of the firm, so Tobin's q is driven by two forces: changes in the value of invested capital, and changes in the value of the insiders' future rents per unit of capital. And this weakens the correlation between Tobin Q and investment, relative to the frictionless benchmark. [12]

Ding Shouhai (2006) use VAR model and the method of decomposition of mixed shock to test the relationship between investment and Tobin's Q . Both the impulse reaction and co-integration relation indicates that the Tobin's hypothesis does not come into existences. In contrast, there is apparently a reverse version of Tobin's hypothesis. [13]

Mei Dan (2005) show that classic investment theory is applicable to China's Listed Companies. Investment scale depends on investment opportunity, internal cash flow and leverage. And there exists a significant relationship among different variables. Enterprises in different industries and different sizes have their own characteristics in investment scale decisions. [14]

3 Empirical methodology

We empirically test the cross-sectional implication of this hypothesis by comparing sensitivities of investment to stock mispricing across firms with different degrees of equity dependence. This section presents our empirical methodology. We first discuss our empirical models of investment- Q sensitivity, followed by the definitions of one direct proxy for stock mispricing. The section is concluded with an elaboration on equity-dependence criteria.

3.1 Empirical of models of investment- Q

Baker et al (2003) find that the sensitivity of investment to variation in Q is indeed greater for equity-dependent firms by using Q as a proxy for mispricing. Following their methodology, we set up our empirical model of investment- Q sensitivity as follows (See Appendix A for detailed definitions of financial variables):

$$LN_{it} = \alpha_1 Q_{it-1} + \alpha_2 CashFlow_{it-1} + \alpha_3 Leverage_{it-1} + \alpha_4 Cash_{it-1} + \sum_i firm_i + \sum_t year_t + \varepsilon_{it} \quad (1)$$

Investment is defined as the ratio of fixed assets cost, construction materials and construction in progress to total assets. Q is computed as the market value of assets divided by the book value of assets. Cash flow is earnings from operating

activities. It is included to control for investment-cash flow sensitivity and the fundamental not captured by Q . Cash holdings are intended to capture the effect of corporate liquidity. Lang et al (1996) find the importance of controlling for firm leverage and draw investment is negatively related to leverage. Throughout our empirical tests, we explicitly control for possible simultaneity biases stemming from unobserved individual heterogeneity by including firm-specific dummies (firm). We also add year dummies (year) to capture business-cycle influences and unspecified time effects. The standard errors we use in the calculation of the t-statistics are based on the heteroskedastic-consistent Huber-White sandwich estimator and allow for firm-level clustering of observations.

3.2 Proxies for mispricing

How to measure stock mispricing is a difficult thing for behavioral corporate finance theory. Some scholars have used Tobin decomposition methods, Tobin Q equals company's market value to replacement value of fixed assets. Because Q not only contains future investment opportunities, but also equity mispricing errors which brought about by the investor sentiment. Our analysis critically hinges upon identifying situations where firms are mispriced. As suggested by Baker et al(2003), differences in the sensitivity of investment to Q can arise for reasons other than the hypothesized equity-financing channel because Q contains both a non-fundamental component and a fundamental component.

Zhang et al (2007) use Tobin Q decomposition method, which includes fitted values $Q(Q^f)$ as fundamental variables and also error residual $Q^r = Q - Q^f$ as a proxy variable of mispricing. However, this method has also disadvantages. Q^r is not only a measure of market mispricing, but includes some components that do not capture Q^f and industry dummy variables [9]. To address the above concern, we argue our investment equation with one direct proxy for mispricing namely discretionary accruals. Accruals are defined as the difference between a firm's accounting earnings and its underlying cash flows. Prior studies suggest that managers use the grey area in the accounting rules to adjust accruals in order to manipulate earnings and boost stock prices. Examining a sample of IPO firms, Teoh et al (1998) and Rangan(1998) document that managers choose positive abnormal accruals to opportunistically increase earnings before initial

public offerings or seasoned equity offerings ,and that the market overprices these abnormal accruals.[15]

Sloan (1996) finds the market fails to appreciate fully the lower persistence of the accruals component of earnings and overprices total accruals [16]. Using quarterly data, Collins and Hribar(2000)also find the market overprices total accruals [17]. Hong Xie (2001) examines the market pricing of Jones (1991) model estimated abnormal accruals to test stock prices rationally reflect the on-year-ahead earnings implications of these accruals. And they find that the market overestimates the persistence, of abnormal accruals and consequently overprices these accruals. The market overprices the portion of abnormal accruals stemming from managerial discretion [18]. Chan et al (2006) find that firms whose earnings are inflated by variables. The accruals are decomposed two parts namely nondiscretionary discretionary accruals have poor subsequent returns. The empirical evidence of both studies justifies the use of discretionary accruals as a good proxy for mispricing. [19]

Accounting accruals may help identify stocks with extreme book-to-market ratios due to expectational errors for two reasons. First, accruals follow a mean reversion process, usually low (high) accruals are likely to reverse and thus to increase (decrease) future earning and book values. Second, the level of accruals may indicate the integrity of the reported book-value number. This follows because generally accepted accounting principles give company managers reporting flexibility, which may be used to inflate accounting income, and thus book values, by inflating accruals. Consequently, a high book-to-market ratio together with low accruals imply a higher intrinsic book value than a high book-to-market and high accruals, and a low book-to-value ratio together with high accruals imply a lower intrinsic book value than a low book-to-market and low accruals. This suggest that if the superior returns produced by the book-to-market strategy represent mispricing, a strategy that considers book-to-market and accruals jointly can perform better because it will allow to pick high book-to-market firms and low book-to-market firms that are more likely to be mispriced.

We employ an extension of the cross-sectional Jones (1991) model to decompose accruals into discretionary and nondiscretionary components [20]. This model which is based on the modified Jones model adds intangible assets and other long-term assets to the independent accrual and discretionary accruals. Non-discretionary accruals mainly are affected by two factors which include operating

income and fixed asset level. The decomposition details are outlined as follows.

(1) The formula is: total accruals

$$TA_{it} = (NP_{it} - CFO_{it}) / A_{it-1} \quad (2)$$

Where, TA_{it} is the total accruals that lag total assets adjusted by company i at year t ; NP_{it} is net profit by company i at year t ; CFO_{it} is net cash flows from operating activities by company i at year t ; A_{it-1} is total asset by company i at year t .

(2) nondiscretionary accrual:

$$NDA_{it} = \hat{\beta}_0 [1 / A_{it-1}] + \hat{\beta}_1 [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \hat{\beta}_2 [PPE_{it} / A_{it-1}] + \hat{\beta}_3 [IA_{it} / A_{it-1}] \quad (3)$$

Where, NDA_{it} is nondiscretionary accrual that lag total assets adjusted by company i at year t ; ΔREV_{it} is changes of operating income; ΔREC_{it} is changes of receivable accounts; PPE_{it} is fixed assets by company i at year; IA_{it} is intangible assets and other long-term assets; $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$ are corresponding coefficients that equal $\beta_0, \beta_1, \beta_2, \beta_3$ in ordinary least squares estimates:

$$TA_{it} = \beta_0 [1 / A_{it-1}] + \beta_1 [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \beta_2 [PPE_{it} / A_{it-1}] + \beta_3 [IA_{it} / A_{it-1}] + \varepsilon_{it} \quad (4)$$

(3) discretionary accruals: $DA_{it} = TA_{it} - NDA_{it}$

We incorporate discretionary accruals for mispricing into our investment Eq(1) and estimate the following Eq(2). We expect that the sensitivity of investment to mispricing, captured by the coefficient α_3 , will generally increase in equity dependence:

$$LN_{it} = \alpha_1 Q_{it-1} + \alpha_2 CashFlow_{it-1} + \alpha_3 DA_{it} + \alpha_4 Leverage_{it-1} + \alpha_5 Cash_{it-1} + \sum_i firm_i + \sum_t year_t + \varepsilon_{it} \quad (5)$$

3.3 Equity-dependence criteria

Baker, Stein and Wurgler (2003) study equity dependence based on market timing theory and draw that equity-dependence firm investment is more sensitive than non-equity dependence. However, when calculating the equity dependence indicators, if we only use predecessors, universality needs to be improved. We inspect the impact of stock mispricing

on investment through equity financing in order to determine equity dependent companies.

The definition of equity dependence is $W - K(1 - D) < 0$, which means equity-dependent firms tend to have low cash balance and cash flows, high growth potentials, high leverage and hence low debt capacity. A firm is more likely to be dependent on equity when W is low (which translates into low profitability, cash balances, or previously untapped debt capacity), when K is high (growth opportunities are good), and when the incremental debt capacity of new assets D is low. Therefore, a sensible empirical measure of equity dependence should probably be negatively related to operating cash flow, positively related to proxies for growth opportunities, positively related to actual leverage net of cash on hand, and negatively related to the debt capacity of assets.

To examine the equity-financing channel through which stock market mispricing affects investment, we need to categorize firms according to a priori measures of equity dependence. The concept of equity dependence requires some financing frictions that make certain firms more reliant on outside equity. There are several possible measures that satisfy most of these criteria. We use two different schemes to partition our sample into equity-dependent and non-equity-dependent groups.

(1) **Firm size:** In each year, firms are divided into two groups, based on the size of their reported total assets. Small firms (equity dependent) are those having below-median book value of assets and large firms (non-equity dependent) are those having above-median book value of assets. Frank and Goyal(2003), Chang and Dasgupta(2003), and Lemmon and Zender(2004)document that small firms do not behave according to the peaking theory, instead, they finance most of their deficits with equity [21]. Morck et al (1990) look for a financing channel using firm size as their only proxy for equity dependence. They argue that the hypothesis predicts that the influence of the stock market should be particularly great for smaller firms, which rely to a greater extent on external financing [22]. Gilchrist et al (1995) and Almeida, et al (2004) also use similar methods. Almeida (2004) rank firms based on their asset size and assign to the financially constrained (unconstrained) group those firms in the bottom (top) three deciles of the size distribution [23]. Gilchrist and Himmelberg (1995) distinguish between groups of financially constrained and unconstrained firms on the basis of size. The argument for size as a good observable measure of financial constraints is that small firms are typically young, less well known, and thus more vulnerable to capital market imperfections [24]. The paper tries to sort the firm size according to

Almeida (2004) which shows the higher index indicates larger firm size.

(2) **KZ index:** Kaplan and Zingales (1997)use a logit model regression to relate their qualitative ranking to the above five variables, namely cash-flow, cash, dividend, leverage and Tobin Q . And then rank the sample firms in the order of financial constraints according to estimated coefficients [25]. The coefficient estimates are taken as the weights to construct the KZ index. The KZ index possesses intuitive features which portray an equity-dependent firms has low operating cash flow. They find that firms that appear less financially constrained exhibit significantly greater sensitivities than firms that appear more financially constrained. And suggest that higher sensitivities cannot be interpreted as evidence that firms are more financially constrained.

Due to the original *KZ* index focus on a small sample of 49 American low dividend manufacturing firms. One may argue that the *KZ* index may not be an appropriate measure of equity dependence for a broader set of firms in China. Baker et al (2003) suggest that the original *KZ* index does not have to be a perfect measure of equity dependence because of missing variables or incorrect weights. And they modify the original index by dropping Q without adjusting the coefficient on the other four variables, to avoid ambiguity in that Q potentially contains information both about mispricing and a firm's investment opportunities. But it could still be of practical use because the component variables are indicative of equity dependence and they have signs of coefficients economically meaningful.

To show that the precise weights are not really the issue, we reassign the weights so that each of the four variable accounts for one-fourth of the variation in the index. There exists some difference among financing constraints and firm characteristics between Chinese companies and foreign. This article does not apply to previous the parameters to build index, but according to index construction ideas to reassess the parameters of the sample index, and adjusted index reflects the characteristic of our sample, the companies are divided into equity and non-equity dependent. Last, we apply ordered logit model to estimate cash, operating cash flow, cash dividends and asset-liability ratio. The dependent variable is *KZ* index, $KZ1=1$ if there is no cash dividend; if cash and cash-flow are respectively below the median, $KZ2=1$ and $KZ3=1$.last, $KZ4=1$ If leverage is above the median. And then establish ordered logistic regression model to construct

financing constraint index, the resulting “adjusted” *KZ* index is listed below:

$$KZindex = -3.31 * Cash - 10.71 * Cashflow - 7.38 * Div - 4.51 * Lev \quad (6)$$

However, the coefficient of asset-liability ratio is negative, which is opposite to foreign research. The reason may be led by characteristics of Chinese listed companies.

3.4 Proxy for Tobin *Q*

Tobin *Q* is often defined as the ratio of company’s market value to their replacement costs. However, if we calculate Tobin value based on strict definitions, the data of Chinese listed companies is difficult to obtain. Generally, we apply the approximate value of Tobin *Q* to measure enterprise value. Due to stock market tradable period in China, it is difficult to determine the market value of non-tradable shares. Net assets per share are often used as approximate prices of non-tradable shares. The book value of assets is used as an approximation of the replacement cost. In this paper, we calculate $Q = (\text{market value of total assets}/\text{replacement cost} = (\text{stock market capitalization} + \text{non-tradable shares representing the amount of the net assets} + \text{long-term debt} + \text{short-term liabilities})/\text{total assets}$.

4 Empirical results

4.1 Sample characteristics

We consider the universe of firms listed on the Chinese Stock Exchange over the 2002-2011 periods with data available from Djinn financial databases and Phoenix Finance website. We exclude missing data and issuing B shares, H shares, S shares and N shares of the company. At the same time, we also exclude book leverage greater than 1 or less than 0 of the company, because of the book value, the former is said to insolvent and the latter may be data anomalies, so our sample consists of 582 firms, and it is diversified across industries as measured by the SFC code: 17 in the forestry, animal husbandry and fishery sector, 30 in the mining sector, 12 in the communication and culture sector, 60 in the electricity and water supply sector, 100 in real estate sector, 18 in the building sector, 47 in transportation and warehousing sector, 92 in the wholesale and retail trade sector, 35 in social services sector, 49 in information technology, 70 in manufacturing sector and 52 in comprehensive sector. All financial data as

equity data, as well as market transactions data are used at the end of year. All variables have been winsorized at the 1st and 99th percentiles. This approach mitigates the impact of extreme observations by assigning the cut-off value to values beyond the cut-off point.

Table 1 displays descriptive statistics among variables (2002-2011). Details of the calculation of the financial variables are introduced in Appendix A. From the table, we can see the median of investment is almost 0, which suggests sample distribution is relatively uniform. The scope of the leverage is from 0 to 1. The min value of discretionary accruals is -2.54, and the max is 9.4, which suggest profit manipulation of companies is much larger. The mean of firm size is 21.59 and SD is 1.23, which reflects that the size of listed companies is less different in China. In addition, while removing the abnormal data that leverage ratio is greater than 1 and less than 0, we find that the mean is 0.5, which is higher than optimal leverage ratio. In our sample, Tobin *Q* mean is 1.68 and the max value is 41.57. That shows that the market value of listed companies in China is overvalued as well as investor hold a positive attitude on the behavior of business investment.

Table 1 descriptive statistics among variables (2002-2011)

	Obs	Mean	SD
<i>Ln</i>	5820	-3.18e-10	1
<i>Q</i>	5820	1.68	1.89
<i>Cash</i>	5820	0.0347	0.19
<i>Cashflow</i>	5820	0.05	0.11
<i>Div</i>	5820	0.0189	0.08
<i>Lev</i>	5820	0.5	0.19
<i>Size</i>	5820	21.59	1.23
<i>DA</i>	5820	-0.00032	0.22
<i>KZ</i>	5820	-3.07	1.64

	Min	Max
<i>Ln</i>	-30.425	38.73
<i>Q</i>	0.156	41.57
<i>Cash</i>	-1.48	3.25
<i>Cashflow</i>	-0.585	1.02
<i>Div</i>	0	2.54
<i>Lev</i>	0	0.99
<i>Size</i>	17.50	28.28
<i>DA</i>	-2.54	9.4
<i>KZ</i>	-25.87	5.78

Table 2 shows correlations among variables used in the subsequent regression analysis, as well as

those used as equity dependence criteria (size, KZ) for firm classifications. Details of the calculation of the financial variables are included in Appendix A. Investment is negatively correlated with Tobin's Q . However, we find no significant correlation between investment and discretionary accruals. Greater availability of internally generated fund leads to more capital investment. KZ index is negatively associated with cash and cash flow and other variables. Unreported results show that the financial constraint is much better for the proxy of equity mispricing, and lower KZ index tend to less equity-dependent companies.

Table 2 correlation analysis among variables (2002-2011)

	<i>Ln</i>	<i>Cash</i>	<i>Cashflow</i>
<i>ln</i>	1.0000		
<i>Cash</i>	-0.0338*	1.0000	
<i>Cashflow</i>	0.0243*	0.1456*	1.000
<i>Lev</i>	0.0234*	0.0060	-0.1169*
<i>Div</i>	0.0067	0.1161*	0.0838*
<i>Q</i>	-0.0451*	0.1607*	-0.0116
<i>Size</i>	0.0412*	-0.0130	0.0374
<i>KZ</i>	-0.0169	-0.5248*	-0.6526*
<i>DA</i>	-0.0134	-0.0408	-0.3559

	<i>Lev</i>	<i>Div</i>	<i>Q</i>
<i>Lev</i>	1.0000		
<i>Div</i>	0.0547*	1.000	
<i>Q</i>	-0.0106	0.0786*	1.000
<i>Size</i>	0.2223*	0.0427*	0.2688*
<i>KZ</i>	0.4397*	0.4271*	0.0777*
<i>DA</i>	-0.008	-0.0138	0.0383*

	<i>Size</i>	<i>KZ</i>	<i>DA</i>
<i>Size</i>	1.0000		
<i>KZ</i>	-0.1211*	1.0000	
<i>DA</i>	0.0470*	0.2485*	1.0000

(A full description of other variables is included in Appendix A. Correlations significant at 1% level are marked with * in superscripts)

4.2 Investment- Q sensitivity

We begin with a test of the equity-financing channel. If stock market mispricing affects investment via an equity-financing channel and Q contains a component of mispricing, the investment of equity-dependent firms should be more sensitive to Q than that of non-equity-dependent firms.

Table 3 presents the results obtained from the estimation of our baseline regression model (Eq(1)) of investment- Q for the overall sample and for each of the two sample partitions. Column I reports the regression estimates for the entire sample. Overall, Chinese firms' investment decisions are sensitive to both stock market valuation (as measured by Q) and the availability of internal cash flows. The estimated investment- Q sensitivity is -0.016 . Consistent with other studies, we also find positive investment-cash flow sensitivity (the Cash flow coefficient is 0.423), suggesting that the availability of internal funds affects firm's investment decisions. There is no positive relationship between Tobin Q and investment, and even inverse relationship exists between them. Foreign researches study the relationship is positive between investment and Tobin Q . The reason is that the business investment is rational. As China is undergoing the economic system transition period, many non-market factors restrict the investment of Chinese enterprises, resulting in an "anti-Tobin Q ".

Under different degree of equity-dependent firms, the effect expresses differences. According to two different equity-dependent criteria, Tobin Q and internal cash flow are important investment decisions. Investment- Q with smaller firms is much more sensitive than that of larger. The coefficient of small companies is -0.03 , while the larger is -0.013 . The investment of equity-dependent firms (low KZ) is positive with Tobin- Q , whereas the Q coefficient (high KZ) is negative and the difference in sensitivity is significant at the 1% level. The reason is that when companies have high financing index, the willingness of investment is not high. The investment of equity-dependent firms is negative to Tobin Q . Companies with low KZ index have more opportunity, therefore investment- Q sensitivity show no significant impact on firm investment.

Table 3 Investment- Q sensitivities

Investment	Total sample
Q	-0.016** (-1.95)

<i>Cashflow</i>	0.423*** (3.31)
Leverage	0.78*** (5.06)
Cash	-0.1749*** (-3.00)

Investment	Firm size	
	Small	Large
<i>Q</i>	-0.03*** (-2.78)	-0.013 (-0.43)
<i>Cashflow</i>	0.5465*** (3.30)	0.517** (2.13)
Leverage	0.5495*** (2.52)	0.8929*** (3.05)
Cash	-0.0877 (-1.14)	-0.158 (-1.17)

Investment	KZ index	
	High KZ	Low KZ
<i>Q</i>	-0.105*** (-4.27)	0.0059 (0.91)
<i>Cashflow</i>	0.896** (2.19)	-0.1786 (-0.96)
Leverage	1.416*** (3.56)	0.80*** (4.64)
Cash	0.01 (0.04)	-0.152*** (-2.77)

(Coefficients significant at 10%, 5% and 1% levels are marked with *, **, *** respectively in superscripts. T-statistics are reported in brackets)

4.3 Investment sensitivities to mispricing-DA

To address the above concerns, we now run additional tests with the investment equations with explicit proxy for stock mispricing, while still keeping *Q* as a control for investment fundamentals. Note that by including *Q* in the regression equations, our direct proxy for mispricing will capture the sensitivity of investment to mispricing beyond that captured by *Q*.

In other words, controlling for the effect of *Q* on corporate investment in the regression makes it more difficult to interpret the sensitivity of investment to mispricing in the agency theory framework. As suggested by prior literature, we now turn to one variable which proxies for the largely unobservable deviation from fundamentals: discretionary accruals (DACCR).

Table 4 displays the estimate of investment-DA

sensitivity is 0.012 but statistically insignificant for the overall sample. Consistent with previous findings, equity-dependent firms which are based on KZ index stand out for having a significant relationship between investment and mispricing.

Table 4 presents results of estimating Eq (2) where we use discretionary accruals (DA) as a proxy for the non-fundamental component of stock prices. From the sub-sample regression results, the effect of DA at high KZ is obvious stronger than that of low KZ index ($0.024 > -0.369$). This shows when the degree of financing constraints is high, if investors are pessimistic and bearish speculation opportunities, the company's stock price is undervalued in general. In order to stabilize stock prices, managers may use information superiority for earnings manipulation which affect the judgment of outside investors and lead to price overvalued. And it is favor of business investment.

In contrast, under low financing constraints, it is easier for companies to operate external financing surpluses when the stock price is overvalued, surplus operation causes mispricing that has little impact on the investment-sensitivity.

When dividing equity-dependent companies based on firm size, we find that equity mispricing has no significant impact on investment of companies as well as the coefficient is inconsistent, which is differ with international market research results. This possibly reflects the characteristic of the emerging and less-developed capital market in China.

Baker, Stein and Wurgler(2002)show that the coefficient of sample which is overestimated and underestimated is positive and declining with the equity dependent. But it is also proved from another angle that mispricing of large companies is much stronger sensitivity to investment, investors tend to pay attention to price volatility of large companies.

Table 4 Investment sensitivities to mispricing-discretionary accruals

Investment	Total sample
<i>Q</i>	-0.162** (-1.94)
<i>Cashflow</i>	0.424*** (3.31)
<i>DA</i>	0.012 (0.18)
<i>Leverage</i>	0.779*** (5.05)
<i>Cash</i>	-0.176*** (-3.00)

Investment	Firm Size
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	Small	Large
Q	-0.029*** (-2.72)	-0.005 (-0.14)
<i>Cashflow</i>	0.53*** (3.15)	0.595*** (2.38)
<i>DA</i>	-0.014 (-0.14)	0.039 (0.20)
<i>Leverage</i>	0.47** (2.06)	0.819*** (2.84)
<i>Cash</i>	-0.078 (-1.04)	-0.21 (-1.35)

Investment	KZ index	
	High KZ	Low KZ
Q	-0.08*** (-3.69)	0.006 (0.91)
<i>Cashflow</i>	1.062*** (2.66)	-0.03 (0.875)
<i>DA</i>	0.024** (0.16)	-0.369 (-2.89)
<i>Leverage</i>	1.42*** (3.74)	0.82*** (4.66)
<i>Cash</i>	-0.004 (-0.02)	-0.135***

(Coefficients significant at 10%, 5% and 1% levels are marked with *, **, *** respectively in superscripts. T-statistics are reported in brackets)

4.4 Robustness test

The most important thing for robustness test is to choose substitution variables. In order to ensure the robustness of the findings, the paper is tested from the following aspects: (1) the control variable is limited to only include Tobin Q (2) In order to avoid research differences that caused by the investment measure, the paper tries to use another proxy, namely capital expenditures, selling and administrative expenses to lagged total asset to study the relationship of different variables (3) To remove the share reform on the impact of this study, we remove data of 2005 and then regress the model. Through re-examination, the conclusions are not changed. Then, we regress the panel data and obtain the same conclusions.

5 Conclusion and suggestions

The effect of investor sentiment on real economic activities is an important issue in corporate finance studies. It is particularly important when investor sentiment is market-or industry-wide rather than firm-specific. This paper examines the above

equity-financing channel through which stock mispricing affects a firm's capital investment. Firm investment decisions are examined using unbalanced panels of data for Chinese companies over the period 2002-2011. The investment decisions of equity-dependent firms are more responsive to changes in the stock market valuations, where we classify firms according to the KZ indices. Our results are robust to different measures of mispricing: Q and discretionary accruals (DACCR).

Investment is negatively correlated with Tobin's Q . We find that with the text of Chinese economic and social environment, investment has no positive relationship of Tobin Q , namely investment does not vary with Tobin Q increasing. In contrast, to some extent, investment decreases when Tobin rising, which is called anti Tobin Q . This shows the company's investment is far from rational in China, enterprises' investment is subjected to the government system and irrational factors. Therefore, to create a good investment environment for enterprises is crucial to government.

We find no significant correlation between investment and discretionary accruals. According to two different equity-dependent criteria, Tobin Q and internal cash flow are important investment decisions. Investment- Q with smaller firms is much more sensitive than that of larger. When the degree of financing constraints is high, if investors are pessimistic and bearish speculation opportunities, the company's stock price is undervalued in general. In order to stabilize stock prices, managers may use information superiority for earnings manipulation which affect the judgment of outside investors and lead to price overvalued.

The relationship between financing constraints and investment reflect some phenomenon in China's capital market. Under current market environment, the information of listed companies is opacity, the irrational behavior of managers and investors together affect the stock mispricing. The article only gives a one proxy for the stock mispricing, while the stock mispricing involves many factors, the conclusion also exist some comprehensiveness. The capital market in China is less-developed with sever irrational evidence, and the stock prices do not reflect their fundamental values. Therefore, managers do not regard stock prices as the direction of corporate investment. In this case, corporate investment decision-making responds more to the influence of other factors, such as manufacture market, the behavior of senior managers.

Overall, the thrust of our findings in the Chinese

market is generally consistent with some other researchers that investor sentiment affects real investment. Our evidence supports that the influence of sentiment on real investment works through an equity-financing channel.

Appendix A. Variable definitions

The financial variables utilized are calculated as follows.

Variables	Definitions
Investment	The ration of fixed assets cost, construction materials and construction in progress to total assets.
Total Assets	The book value of total assets
Tobin Q	(Market value of total assets/replacement cost=(stock market capitalization + non-tradable shares representing the amount of the net assets + long-term debt+ short-term liabilities)/total assets.
discretionary accruals	Total accruals – nondiscretionary accrual
Cash flow	The ratio of earnings from operating activities to lagged total assets
Leverage	Book debt / book assets
Cash	The ratio of Cash and cash equivalents to lagged total assets
Dividend	Cash dividend / lagged total assets
Firm size	Natural logarithm of total assets

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