

# Financial Crisis, Control Rights and Cash Flow of Investment Sensitivity: The Chinese Perspective<sup>1</sup>

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## Abstract

*The investment cash flow sensitivity is considered with firm's control right and the impact of financial crisis at the end of 2008. Compared with the classic model by ownership, the model with control rights is more efficient and stable. The empirical study also shows the change in model structure before and after the financial crisis. Considering this change, firm-level CFS is estimated based on ownership and control right respectively. The result implies that manufacturing firm conclusion is extendable only when the model is based on control rights. The difference between Chinese companies and US companies is, there are massive negative cash flow sensitive companies in China, while positive sensitive companies are a great part of the companies in US. This indicates the irrational corporate strategies in the emerging market of China.*

**Keywords:** *Corporate governance, Control rights, Resolution mechanism, Controlling shareholding*

**JEL classification:** *G30, G31, G32*

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<sup>1</sup> We thank, without implicating, Zuoping Xiao, Zhigang Zheng, Yujun Lian, William T. Lin, Guangping Gu for helpful comments. Some parts of this article were reported at Chinese Financial annual meeting (2009), Chinese Economic annual meeting (2009), International symposium for corporate governance(2009), Conference on Financial Markets and Prospects (2010), and Chinese Econometric annual meeting(2010). Corresponding author, Xiaoqian Zhang, gratefully acknowledges financial support from Zhejiang Provincial Natural Science Foundation of China (No. Y7100307 ), and Ministry of Education Projects.

## 1 Introduction

Since Fazzari, Hubbard and Petersen (1988) documented the sensitivity of investment to cash flow, a significant interest toward the factors underlying this phenomenon has shown in the financial economics literature. These factors includes dividend payout ( Fazzari et al., 1988), size or age (Devereux and Schiantarelli, 1990; Oliner and Rudebusch, 1992; Vogt, 1994; Kadapaddam, Kumar and Riddick, 1998), availability of debt rating (Whited, 1992), ownership structure ( Pawlina and Reneboog, 2005), CEO pay-performance sensitivity (Broussard, Buchenroth, and Pilotte, 2004), affiliation with industrial groups (Hoshi, Kashyap, and Scharfstein, 1991; Shin and Park, 1999) and etc. However, some other studies challenge this view by demonstrating that the link between cash flow sensitivity and financial constraints is sensitive to how firms are classified into constrained and unconstrained groups ( Kaplan and Zingales, 1997; Cleary, Povel and Raith, 2007).

Recently, Hovakimian (2009) examines a large number of characteristics which assesses the statistical and economic significance of all factors related to cash flow sensitivity. Unlike the investment regressions approach based on a priori classification, she put forward a firm-level estimation of investment-cash flow sensitivity on which she classified firms into groups of positive sensitive, negative sensitive and insensitive one. Her studies on US manufacturing firms showed that a large number of firms demonstrate strong positive investment-cash flow sensitivity and a small fraction of them demonstrate a strong negative relationship between investment and cash flows. Firms classified as negative cash flow sensitive have the lowest cash flows, highest growth opportunities and appear the most financially constrained.

The factors in Hovakimian (2009) includes market-to-book ration, sales growth ,firm size, age, leverage, asset tangibility, dummy for bond rating, dividend payout and financial slack. Nevertheless, firm's strategies in investment and finance are more related with its control right which is not considered in her article.

Tirole (2001) defines control right as the right for a player to affect the firm's action. The real controller is the large shareholder or the insider. Hadlock(1998) studies the impact of insider shareholdings on the investment-cash flow sensitivity of US firms. He finds an inverted U-shaped relationship. Pawlina and Renneboog (2005) investigate the investment-cash flow sensitivity of a large sample of the UK listed firms and confirm that investment is strongly cash flow sensitive. They find that the sensitivity results mainly from the agency costs of free cash flow and the magnitude depends on insider ownership in a non-monotonic way.

Unlike the low shareholding of the largest shareholder in US and UK, the average shareholding of the largest shareholder in China is over 30%, which means the Chinese companies are ownership controlled by the largest shareholder and the existing conclusion may not hold in China.

As an emerging market, Chinese companies have some other characteristics, such as high growth rate, converging on investment, irrational marketing performance, etc. The factors in existing literatures may not affect the investment-cash flow sensitivity for Chinese companies. In addition, Chinese firms can be divided into two categories, state-owned or private, which

show different investment-cash flow sensitivity.

Financial crisis happened in 2008. In this worldwide event, there is the weakest impact on Chinese firms. This article wants to find: (i) is there any changes in investment-cash flow sensitivity; (ii) what are the main factors in this change; (iii) what kind of firms can go through this crisis.

This study has three aims. First, we investigate the impact of largest shareholder's control right on investment-cash flow sensitivity. Since we adjusted Cubbin- Leech's probabilistic voting model, the control right is measured in a dynamic environment instead of ownership in existing literatures.

Second, some factors related to cash flow sensitivity either in the existing literatures or from Chinese characteristics are tested. This is the difference between emerging market and mature market. And some evidence of Chinese firms going through financial crisis is put forward.

Thirdly, to investigate whether there is irrational investment in Chinese listed companies. We classify firms into groups of high, low and negative sensitivity. In fact, negative sensitivity means irrational investment. There are massive firms with negative cash-flow-sensitivity in China.

The rest of the paper is organized as follows. Section 2 measures the control right by an adjusted probabilistic voting model. Section 3 described the impact of financial crisis on control rights and other variables, and the difference between industries. Section 4 tests the impact of control rights on ICF, and the changes on the model structure by the crisis. Section 5 estimates the firm-level CFS, and be compared with US firms. Section 6 presents our conclusions.

## **2 Measurement of Control Rights**

### *2.1 Adjusted Probabilistic Voting Model*

Control right is one of the critical issues in corporate governance. Unfortunately, the measurement of control rights is still a difficult problem which is also one of major issues to be faced by the Chinese capital market after the full-flowed reform. It is defined as abilities of the large shareholder's efficient control on firm's decisions.

The definition is still difficult to reach an agreement. Berle and Means (1932) defined it as a large shareholder's right to choose the members of the board through exercising statutory power or his influence. Blumberg (1983) thought it as a right to choose the most of the board and direct the firm's management. Loss (1988) considered it as a right to direct the firm's business operations and decision-making. La Porta, Lopez and Shleifer (1999) gave its definition as abilities of the large shareholder's efficient control on firm's decisions. Tirole (2001) thought it as a right to influence on the firm's operation process.

Many articles concerned its relationship with ownership, cash flow right, residual control right or controlling stake. Berle and Means (1932) firstly concerned the separation of ownership and control empirically. But many recent researches showed there is no separation in modern companies, especially in stock companies with dispersed ownership structure. Blair (1995) considered corporate ownership as a sum of residual demanding right and control right. Tirole (2001) replaced finite cash flow rights with control rights. Then a lot of literatures discussed these relationships.

Actually, control right is not only related with firm's ownership structure, but also its decision making mechanism. For limited joint stock companies, the board will be responsible to shareholders, implement their resolutions and report to them. The board exercises the following specific terms, deciding the company's business plan and investment program, developing the company's annual financial budget for the program accounts, establishing the distribution of profits and making up for the loss, internal management decision to set up institutions to decide the appointment of senior management and compensation matters. The board can be day-to-day decision making, but the resolution of major issues must be brought to the final resolution of the shareholders' meeting. Moreover, the board is also constituted by the voting resolution of shareholders' meeting. Therefore, control right is embodied in largest shareholder's effectively controlling on the company's day-to-day decision and operations, but more importantly in effectively control on the outcome of the vote.

In fact, the special resolution and major issues embodying the true control competition and its bounds is ultimately a matter for General Assembly's vote. Hence, we can conclude that the controlling ability of the general assembly's voting resolution is fundamentally the final embodiment of control rights. Its measurement is related not only with ownership structure, but also with decision making mechanism, the views of shareholders, the shareholders' attending in General Assembly, etc. The measure is indicated as a 0-1 dummy variable initially, to five categories by share proportion, then to a continuous variable as Herfindahl index or concentration ratio. The above classifications or measurements take approximation of ownership proportion. They are unable to describe control rights accurately. And they are also unable to explicit the shareholder's control on the firm's decisions and the least share to realize the efficient control.

Cubbin and Leech (1983) put forward a degree of control in a probabilistic voting model, and derived the size of a controlling shareholding. This article shows a scientific measure of control right making up the above methods. The degree based on shareholding structure also takes into account the shareholders attending the meeting and voting status. But there are two assumptions to be expanded. The first is the assumption of a constant H index, which is critical to the model's approval. In fact, it must be in a dynamic ownership structure. Secondly, control right is realized when the agreement votes is more than one half of the attending share instead of the total share.

Suppose shareholder  $i$ , where  $i = 1, \dots, N$ , holds  $S_i$  shares (and commands  $S_i$  votes) and the largest bloc of shares is  $S_1$ . There are  $N+1$  blocs such that  $S_1 \geq S_2 \geq \dots \geq S_N$ . The total number is  $T = \sum_{i=1}^N S_i$ .  $P_i$  is the  $i$ th shareholder's proportional holding. According to the Chinese practice, the assumptions are as following.

Assumption 1 The largest shareholder will be attended for certain. Other large shareholders and minor shareholders will be attended with probability  $\pi_1$  and  $\pi_2$ , and  $\pi_1 \geq \pi_2$ .

Assumption 2 The probability supporting the largest shareholder of the other shareholder is  $\pi/2$ .

Assumption 3 The voting is independent.

Let  $X_i$  be the number of votes in support of the largest shareholder cast by shareholder  $i$ . Votes in opposition are counted as negative. Then

$$X_i = \begin{cases} S_i & \text{with probability } \pi/2 \\ 0 & \text{with probability } 1-\pi \\ -S_i & \text{with probability } \pi/2 \end{cases}, \quad i=2,3,\dots,N \quad (1)$$

The margin is

$$M = S_1 + \sum_{i=2}^N X_i = S_1 + Y \quad (2)$$

where  $Y = \sum_{i=2}^N X_i$ .  $Y$  is a random variable with mean zero and variance  $\sigma_y^2 = \pi \sum_{i=2}^N S_i^2$ .

To adjust the second assumption of Cubbin-Leech model, the attending share, denoted as  $T$ , should be derived. From assumption a, we get

$$T' = S_1 + \sum_{i=2}^N A_i \quad (3)$$

where

$$A_i = \begin{cases} S_i & \text{with } \pi_1 \text{ or } \pi_2 \\ 0 & \text{with } 1-\pi_1 \text{ or } 1-\pi_2 \end{cases} \quad (4)$$

So  $T'$  is a random variable. To simplify the model, we use its expectation.  $N_1$  is denoted as the number of large shareholders.

$$\begin{aligned} E(T') &= S_1 + \pi_1 \sum_{i=2}^{N_1} S_i + \pi_2 \sum_{i=N_1}^N S_i \\ &= T - (1-\pi_1) \sum_{i=2}^{N_1} S_i - (1-\pi_2) \sum_{i=N_1}^N S_i \leq T \end{aligned} \quad (5)$$

The expectation of the proportion attending is

$$Q = \frac{E(T')}{T} = \frac{S_1 + \pi_1 \sum_{i=2}^{N_1} S_i + \pi_2 \sum_{i=N_1}^N S_i}{T} = P_1 + \pi_1 \sum_{i=2}^{N_1} P_i + \pi_2 \sum_{i=N_1}^N P_i \quad (6)$$

The voting result in Cubbin-Leech model is divided by the total number of shares. We adjusted it as following.

$$M' = \frac{M}{T'} = \frac{M}{T} \cdot \frac{T}{T'} \approx \frac{M}{T} \cdot \frac{T}{E(T')} = \frac{\left( P_1 + \sum_{i=2}^N \frac{X_i}{T} \right)}{Q} \quad (7)$$

$M'$  is a random variable with mean zero and variance  $\sigma_y^2 / (QT)^2$ . Therefore, the probability when the voting result is more than a pre-assigned level  $m$ , can be obtained by

$$\Pr[M' > m] = \Pr \left[ F > \frac{mQ - P_1}{\sigma_y / T} \right] = 1 - \Phi \left( \frac{mQ - P_1}{\sigma_y / T} \right) \quad (8)$$

where  $\Phi$  is standard normal distribution function.

## 2.2 Degree of Control and Controlling Shareholding

There are two patterns for Chinese listed companies, regular resolution and special resolution. Regular resolution should be agreed by more than 1/2 shareholders attending in the shareholders' meeting. Special resolution should be agreed by more than 2/3 shareholders attending. The degree of control in Cubbin and Leech (1983) is only hold for regular resolution. The degree of control in this article is the adjustment of Cubbin-Leech's in regular resolution.

For regular resolutions,  $m=0$ . Therefore, the largest holder's degree of control is

$$\alpha = \Pr[M' > 0] = \Phi\left(\frac{P_1 T}{\sigma_y}\right) \quad (9)$$

A controlling shareholding is defined as one of size  $P^*$  equal to the critical proportion of shares which, if it is held as the largest bloc, has a pre-assigned degree of control,  $\alpha$ , which is high enough ( $\alpha = 90\%$ , say) for it to be said to dominate the company.  $P^*$  is defined by the condition :

$$P^* = Z_\alpha \frac{\sigma_y}{T} = Z_\alpha \sqrt{\pi \sum_{i=2}^N P_i^2} = Z_\alpha \sqrt{\pi(H - P_1^2)} \quad (10)$$

where  $Z_\alpha = \Phi^{-1}(\alpha)$ . In fact,  $P^*$  is determined by the current ownership structure.

The efficient controlling shareholding  $P^{**}$  is the lowest shareholding to assuring the largest shareholder's controlling. Cubbin-Leech model is under constant H, let  $P^{**} = P^* = P_1$  to get  $P^{**}$ . This assumption means the ownership structure is fixed which does not always hold in practice.

The excessive shareholding is  $\Delta x = P_1 - P^{**}$ . If  $\Delta x > 0$ , the largest shareholder will decrease his shares. Therefore, the other shareholder will increase  $\Delta x$ . When the largest shareholder adjusts his shares to  $P^{**}$ , H-index will be

$$H' = (P_1 - \Delta x)^2 + \sum_{i=2}^N (P_i + \Delta P_i)^2 \quad (11)$$

Since

$$\sum_{i=2}^N \Delta P_i = \Delta x \quad (12)$$

therefore,

$$H' = (P_1 - \Delta x)^2 + \sum_{i=2}^N (P_i + \Delta P_i)^2 = H + 2\left(\sum_{i=2}^N P_i - P_1\right) \cdot \Delta x + (\Delta x)^2 + \sum_{i=2}^N (\Delta P_i)^2 \quad (13)$$

Thus, Cubbin-Leech's assumption on constant H may not hold, i.e. H-index may not be fixed as a constant. The difficulty to expand their assumption is that, as  $\Delta x$  is absorbed by other shareholders, there are many probable states of the ownership structure. We consider the case when all the  $\Delta x$  is absorbed by the second largest shareholder, which is the most intimidatory for the largest shareholder. In this case, the second largest shareholder will hold  $P_2 - P^{**} + P_1 = C_2 - P^{**}$ , while the others remain their shares.

According to the dynamic adjustment of ownership structure, the efficient controlling shareholding will be the solution of the following equations. For regular resolutions, it is

$$P^{**} = Z_{\alpha} \sqrt{\pi[(C_2 - P^{**})^2 + (H - H_2)]} \quad (14)$$

The model of control right in this article is adjustment of Cubbin-Leech's. There are two contributions in our model. Firstly, the degree of control right is the probability of voting result proportion to the shares attending instead of Cubbin-Leech's total shares. The second contribution is the extension to Cubbin-Leech's constant H-index assumption.

### 3 Discussion and Definition of Variables

#### 3.1 Sample Selection

The sample consists of all Chinese listed firms in A-share market, which IPO before December 31, 2007, and still exist until November 25, 2008. According to the annual reports in 2006, 2007 and 2008, we choose only firms that have complete records.

The financial crisis happened in the third quarter of 2008. Therefore, we use the cross-sectional data in 2007 and 2008 to describe the Chinese listed companies before and after the crisis. Data come from WIND, which is the Chinese financial database. The final sample is a balanced panel dataset of 2178 observations representing 1089 firms.

#### 3.2 Ownership and Control Right before/after Financial Crisis

Table 1 reports the change of the largest shareholder's ownership and control right.  $P_1$  denotes the largest holder's proportional holding. It demonstrates the great change in ownership. Although the mean remains about 35.7%, a great number of the largest shareholders increase or decrease their share. These companies are 39.1% of the total sample.

As for control right, the mean of the degree decrease 2.46%, but it is still very high. It is over 94% no matter if the financial crisis happens or not. The S.D. increased to 11.62 from 5.62, which demonstrate that the difference for control right management ascended. There are 86.1% companies are controlled by the largest shareholder before financial crisis. The proportion goes to 87% after the crisis. Although about one third of the largest shareholders adjusted their shares, the real change in control right has little change. 94.8% companies has no change in control right. Among other companies, the largest shareholders lost their control in 24 companies, and achieved their control in 33 companies.

By the efficient control shareholding  $P^{**}$ , the overage shareholding  $P_1 - P^{**}$  are report in panel A. The mean is 11%, which shows that the largest shareholders in China have no efficient control right management and hold too much shares which can be invested in other resource. Moreover there is no change with the crisis, as we can see in the mean and S.D. of overage shareholding.

#### 3.3 Other Variables before/after Financial Crisis

Hovakimian (2009) concludes the other factors on investment, market-to-book ratio, real sales growth, firm size, age, leverage, asset tangibility, dummy for bond rating, dividend payout, and financial slack. Because China lacks in the disclosure of the latter three variables, they are not included in this article. Otherwise, as a emerging market, there is no difference in age between Chinese companies, so age is excluded.

Table 2 reports the other variables before or after the financial crisis. Cash flow/K was changed to -0.711 from 0.380. Negative movement may mean massive companies face financial constraints after the crisis. Sales growth drops, leverage rose slightly, and financial slack/K was down to 0.281 from 0.341. These indicate that Chinese companies' sale revenue continue to worsen, facing the difficulty in cash flow and little loan resource, fixed asset devaluated or resold. After the financial crisis, Chinese companies are facing great financial constraints.

On the other hand, companies still go on expanding investment. Investment/K rose from 0.676 to 0.820. Overall, there's an irrational phenomenon that Chinese companies are still expanding investment while they are facing financial constraints' shock.

### *3.4 Difference with Industries*

Table 3 reports the difference in investment and cash flow with industries. Investment was high in real estate, social services, construction and IT before the crisis. After the crisis, it drops a lot in real estate and social service. The decrease is also in transportation and IT. On the contrary, the investment in Chinese companies still shows continuous increase, such as in comprehensive industry, construction, wholesale/retail trade and mining.

On the other hand, table 3 shows the change in cash flows. Before the crisis, companies in real estate have abundant cash flow while those in manufacturing and agriculture/forestry/livestock farming/fishery are facing financial constraint. After the crisis, real estate was struck whose cash flow drops from 4.531 before the crisis to -15.162 after the crisis. The decrease also appears in the other industries. Only social service increases from 0.271 to 2.662.

## **4 Financial Crisis, Control Rights and investment-cash Flow Sensitivity**

### *4.1 Control Right's Impact on ICF*

Hovakimian (2009) summarized the factors on ICF. But she didn't consider control right's impact on ICF, which is studied in this section. Since the difference in industries showed in section 3, this factor is controlled in our model.

Since control right are induced in ICF model, another important factor with it will be considered too. It is a special feature for Chinese companies, i.e. ownership characteristic. It is divided into two categories, state owned and private owned, which induce the companies different in corporate governance.

Although there are seldom articles about control right's impact on ICF, ownership right are studied in a few articles. The impact of ownership started from Schaller (1993). But the conclusions in existing articles are different, some studies considering it as a linear relation, while the others thought it as an inverse-U relationship. Therefore, the two relationships are both modeled in this article.

To be compared with the existing article, control rights and ownership rights are considered respectively. The models of ownership right are as following:

Model O<sub>1</sub>:

$$\frac{I_{it}}{K_{i,t-1}} = \beta_{0t} + \beta_{1t} \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \beta_{2t} FC \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \beta_{3t} P \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + f(\text{controlled variables}) + \varepsilon_{it} \quad (15)$$

Model O<sub>2</sub>:

$$\frac{I_{it}}{K_{i,t-1}} = \gamma_{0t} + \gamma_{1t} \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \gamma_{2t} FC \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \gamma_{3t} P \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \gamma_{4t} P^2 \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + g(\text{controlled variables}) + \nu_{it} \quad (16)$$

The models of control right are as following:

Model C<sub>1</sub>:

$$\frac{I_{it}}{K_{i,t-1}} = \tilde{\beta}_{0t} + \tilde{\beta}_{1t} \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{\beta}_{2t} FC \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{\beta}_{3t} Controlright \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{f}(\text{controlled variables}) + \tilde{\varepsilon}_{it} \quad (17)$$

Model C<sub>2</sub>:

$$\frac{I_{it}}{K_{i,t-1}} = \tilde{\gamma}_{0t} + \tilde{\gamma}_{1t} \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{\gamma}_{2t} FC \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{\gamma}_{3t} Controlright \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{\gamma}_{4t} Controlright^2 \times \left( \frac{CF_{it}}{K_{i,t-1}} \right) + \tilde{g}(\text{controlled variables}) + \tilde{\nu}_{it} \quad (18)$$

Table 4 reports the regression results.

#### 4.2 Financial Crisis's Impact on ICF

The regression results show that the model based on control rights are more efficient than the one based on ownership. The factors in model C are less than those in model O. The multi-collinearity and serial correlation are improved. In addition, model C includes a lot of information which is not in model O, such as ownership structure.

Reinhart and Rogoff (2008) showed that standard indicators for the United States, such as asset price inflation, rising leverage, large sustained current account deficits, and a slowing trajectory of economic growth, exhibited virtually all the signs of a country on the verge of a financial crisis—indeed, a severe one. Their (2009) examination of the aftermath of severe financial crises shows deep and lasting effects on asset prices, output, and employment. Unemployment rises and housing price declines extend out for five and six years, respectively.

Their international comparison excludes China. The shock of the crisis impacting on China is studied in this article. Table 5 reports the regression after the crisis.

Compared with the regression before the crisis (table 4), we can see the following changes. First is the impact of cash flow on investment is significantly enhanced. Second is that inverse-U relationship with ownership appears. The event window by financial crisis shows the switching condition between linear model and inverse-U model. When cash flow is constrained, it will be inverse-U rather than linear, which may be used to explain the discussion of the existing articles.

The comparison before/after the crisis also shows the stability of model C. The symbol and significance don't change in model C based on control right.

## 5 Investment-cash Flow Sensitivity

### 5.1 Firm-Level Estimates of Investment-cash Flow Sensitivity

Hovakimian (2009) measured investment-cash flow sensitivity, estimated individually for each sample firm. We extend her measure based on control rights. Another difference is that we add the impact of financial crisis. Since the structure change of the model by financial crisis, as we showed in the former section, the coefficients are different. So we put different weight in the measurement, which is the estimation of the coefficients. In this measurement, we choose linear relationship. The firm-level estimation of investment-cash flow sensitivity is as follows.

$$CFS\_O_i = \left( \frac{(CF/K)_{i1} \times b_{11}}{(CF/K)_{i1} \times b_{11} + (CF/K)_{i2} \times b_{12}} \times \varepsilon_{i1} + \frac{(CF/K)_{i2} \times b_{12}}{(CF/K)_{i1} \times b_{11} + (CF/K)_{i2} \times b_{12}} \times \varepsilon_{i2} \right) - \frac{1}{2}(\varepsilon_{i1} + \varepsilon_{i2}) \quad (19)$$

Denote CFS \_O and CFS \_C as the CFS based on ownership and control right respectively.

### 5.2 Manufacturing Companies Result's Extendable

Table 6 reports the mean CFS in descending order of different industries, which shows the significant difference between the model based on ownership and the one based on control right. By ownership, manufacturing and IT companies have higher CFS, while CFS is negative in utilities, mining, agriculture/forestry/farming/ fishery social services, and comprehensive industries. By control rights, CFS is high in wholesale/retail trade, construction, communication/cultural industry, IT, while it is negative in transportation, mining, manufacturing, social services, comprehensive and real estate. This implies that it is not right to use the largest shareholder's proportion to indicate control rights.

Based on ownership, CFS in manufacturing is high up to 3.670, while there is no significant difference between other industries which are all around 0. A few articles studied manufacturing companies. Table 6 shows that based on ownership, other industries' investment may be insensitive to cash flow, and the conclusions from manufacturing companies may not be extendable. On the hand, CFS based on control rights is better. Since the CFS of manufacturing companies based on control rights is close to the mean of the total, the conclusions can be extendable to other industries.

### 5.3 Comparison with US Companies

Hovakimian (2009) estimated firm-level CFS of US manufacturing companies. To be compared with her conclusions, we focus the sample to Chinese manufacturing companies. As the above studies, the conclusions based on control right can be extended to the total. The manufacturing sample covers 618 companies. The regression of ICF before/after crisis is shown in Table 7. The models are based on control rights.

Based on the error term and coefficients from the regression, the firm-level CFS is estimated. The mean, median is 0.057, -0.008, respectively. The St. D. is 2.052. It seems that there's little difference between Chinese manufacturing companies. But you may get different conclusions with different indicator, positive sensitive with the mean, negative sensitive with the median, or insensitive overall.

The cause is that the sample should be separated with different levels. In fact, there are 283 companies having positive CFS, 52.1% to the manufacturing samples. The other 45.8% of the samples have negative CFS. Similar to Hovakimian (2009), we use 0.02 and -0.02 as cutoff levels. The sample are divided into three groups, positive cash flow sensitive, cash flow insensitive and negative cash flow sensitive firms, denoted as PCF-sensitive, CF-insensitive and NCF-sensitive. The number of the firms is 91,239,288, respectively, while it is 1602, 1385,458 US firms in Hovakimian (2009).

Thus, we found the difference between Chinese manufacturing firms and US ones. There are massive PCF-sensitive firms, while the number in China is really low. On the other hand, few US firms are negative-sensitive, while there are massive these kind of firms in China. Negative-sensitive actually means irrational corporate strategies. The difference is not only because we introduce factors on control rights and financial crisis, but also dependent on the Chinese characteristic. As an emerging market, there are a lot to be improved in the investment strategies, corporate governance and capital market for China.

## **6 Conclusion**

Investment cash flow sensitivity based on control rights is studied in this article. First, the control right is measured by a probabilistic voting model. Cubbin-Leech model is extended in the dynamic ownership structure, and the realized threshold is adjusted to the proportion with the attending share instead of the total share.

Then control right's impact on investment-cash flow sensitivity is tested by Chinese listed companies. The regressions show the efficiency and stability based on control rights compared with the model based on ownership.

The regressions also show the change in model structure before/after the financial crisis in third quarter of 2008. Considering this change in model structure, firm-level CFS is estimated based on ownership and control right respectively. The result implies that manufacturing firm conclusion's extendable only when the model is based on control rights.

There are massive negative cash flow sensitive companies in China, while positive sensitive companies are a great part of the companies in US. This difference indicates the irrational corporate strategies in the emerging market of China.

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**Table 1 Ownership and Control Right of the largest Shareholders**

<b>Panel A Descriptive Statistics</b>						
	P <sub>1</sub>		Degree of control		Overage shareholding	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2007	35.68%	15.02	96.74%	5.62	11.16%	9.69
2008	35.78%	15.32	94.29%	11.62	11.46%	9.78
△	0.11%	4.80	-2.46%	12.14	0.30%	3.28

  

<b>Panel B Frequency Statistics</b>			
		Number of companies	Proportion to the total
P <sub>1</sub>	increase	205	18.8%
	remain	663	60.9%
	decrease	221	20.3%
2007	Under control	938	86.1%
	Lose control	151	13.9%
2008	Under control	947	87.0%
	Lose control	142	13.0%
Change of the control right	No change	1032	94.8%
	Under control→Lose control	24	2.2%
	Lose control→Under control	33	3.0%

**Table 2 Descriptive Statistics of other Variables**

Data before the crisis are in brackets. Those outside represent the data after the crisis.

	Mean	St. D.	Min	Max
Total asset (in million RMB)	(6224.537) 7228.223	(25169.811) 28592.849	(34.724) 15.941	(718572) 752235
Net fixed assets (in million RMB)	(2322.359) 2712.906	(12781.538) 15815.819	(0.156) 0.393	(361148) 403265
Investment/K	(0.676) 0.820	(12.452) 8.297	(-146.200) -83.768	(244.671) 161.210
Cash flow/K	(0.380) -0.771	(12.809) 12.703	(-225.863) -316.450	(183.730) 77.439
Market-to-book ratio	(0.886) 1.476	(0.128) 2.532	(0.356) -32.341	(1.736) 32.728
Sales growth	(-2.168) -3.576	(48.460) 56.357	(-1339.344) -1781.269	(175.978) 249.269
Leverage	(0.563) 0.609	(0.489) 0.941	(0.0328) 0.0387	(9.7652) 20.247
Financial slack/K	(0.341) 0.281	(0.495) 0.945	(-8.783) -19.421	(0.954) 0.954

**Table 3 Descriptive Statistics of investment and cash flow with Industries**

Industry	Num. of companies	Investment/K in 2007	Investment/K in 2008	Investment change	CF/K in 2007	CF/K in 2008	CF/K change
Mining	22	0.329	0.803	0.474	0.444	0.587	0.143
Communication and Cultural Industry	6	0.006	0.218	0.212	0.359	0.219	-0.141
Utilities	56	0.268	0.452	0.183	0.138	0.230	0.092
Real estate	58	9.814	6.558	-3.256	4.531	-15.162	-19.693
Construction	25	1.019	2.046	1.027	0.343	0.281	-0.062
Transportation	48	0.362	0.176	-0.186	0.223	0.190	-0.033
Agriculture, forestry, livestock farming, fishery	29	0.196	0.259	0.063	0.054	0.156	0.102
Wholesale and retail trade	69	0.212	0.694	0.482	0.440	0.376	-0.064
Social Services	34	1.063	-1.595	-2.659	0.271	2.662	2.391
IT	64	0.801	0.733	-0.068	0.488	0.468	-0.020
Manufacturing	618	0.232	0.234	0.002	-0.013	0.064	0.077
Comprehensive	60	-2.489	3.601	6.090	0.798	-3.232	-4.029
Total	1089	0.676	0.820	0.144	0.380	-0.771	-1.151

**Table 4 Regressions before the Financial Crisis**

	Model O <sub>1</sub>	Model O <sub>2</sub>	Model C <sub>1</sub>	Model C <sub>2</sub>
CF/K	1.385 (18.107)***	1.428 (9.977)***	-2.246 (-4.355)***	-1.071 (-3.792)***
(CF/K)*P(Controlright)	-0.023 (-12.739)***	-0.025 (-3.171)***	0.027 (5.023)***	
(CF/K)*P <sup>2</sup> (Controlright <sup>2</sup> )		-3.755E-5 (-0.357)		1.477E-4 (5.021)***
FC*(CF/K)	-1.347 (-17.224)***	-1.348 (-17.220)***		
M/B	-1.149 (-0.458)	-1.144 (-0.456)		
Salegrowth	-1.179E-5 (-0.185)	-1.192E-5 (-0.187)	-9.519E-6 (-0.132)	-9.414E-6 (-0.131)
Assettangibility	0.003 (0.073)	0.003 (0.083)	0.002 (0.246)	0.002 (0.222)
LEV	0.004 (0.097)	0.004 (0.109)		
SIZE	0.594 (2.113)**	0.595 (2.114)**		
IND	-0.174 (-1.581)	-0.172 (-1.567)	-0.267 (-2.208)**	-0.267 (-2.206)**
	F=61.063*** Adj. R <sup>2</sup> =0.332 D.W.: 2.019	F=54.925*** Adj. R <sup>2</sup> =0.332 D.W.: 2.020	F=38.198*** Adj. R <sup>2</sup> =0.146 D.W.: 1.997	F=38.194*** Adj. R <sup>2</sup> =0.146 D.W.: 1.997

**Table 5 Regressions after the Financial Crisis**

	O <sub>1</sub>	O <sub>2</sub>	C <sub>1</sub>	C <sub>2</sub>
Constant	-4.698 (-0.845)	-4.763 (-0.855)	2.604 (2.422)**	2.609 (2.427)**
CF/K	1.385 (18.107)***	1.428 (9.977)***	-2.246 (-4.355)***	-1.071 (-3.792)***
(CF/K)*P(Controlright)	-0.023 (-12.739)***	-0.025 (-3.171)***	0.027 (5.023)***	
(CF/K)*P <sup>2</sup> (Controlright <sup>2</sup> )		-3.755E-5 (-0.357)		1.477E-4 (5.021)***
FC*(CF/K)	-1.347 (-17.224)***	-1.348 (-17.220)***		
M/B	-1.149 (-0.458)	-1.144 (-0.456)		
Salegrowth	-1.179E-5 (-0.185)	-1.192E-5 (-0.187)	-9.519E-6 (-0.132)	-9.414E-6 (-0.131)
Assettangibility	0.003 (0.073)	0.003 (0.083)	0.002 (0.246)	0.002 (0.222)
LEV	0.004 (0.097)	0.004 (0.109)		
SIZE	0.594 (2.113)**	0.595 (2.114)**		
IND	-0.174 (-1.581)	-0.172 (-1.567)	-0.267 (-2.208)**	-0.267 (-2.206)**
	F=61.063*** Adj.R <sup>2</sup> =0.332 D.W.: 2.019	F=54.925*** Adj.R <sup>2</sup> =0.332 D.W.: 2.020	F=38.198*** Adj.R <sup>2</sup> =0.146 D.W.: 1.997	F=38.194*** Adj.R <sup>2</sup> =0.146 D.W.: 1.997

**Table 6 CFS in Different Industries**

IND	CFS_O	IND	CFS_C
Manufacturing	3.670	Wholesale and retail trade	1.580
IT	0.559	Construction	0.581
Real estate	0.272	Communication and Cultural Industry	0.572
Communication and Cultural Industry	0.271	IT	0.524
Wholesale and retail trade	0.251	Utilities	0.109
Transportation	0.150	Agriculture, forestry, livestock farming, fishery	0.071
Construction	0.091	Transportation	-0.014
Utilities	-0.005	Mining	-0.086
Mining	-0.070	Manufacturing	-0.341
Agriculture, forestry, livestock farming, fishery	-0.076	Social Services	-0.750
Social Services	-0.249	Comprehensive	-0.810
Comprehensive	-0.291	Real estate	-2.333

**Table 7 Regressions before/after the crisis based on control rights**

	2007		2008	
	coefficients	<i>t</i>	coefficients	<i>t</i>
Constant	0.295	0.594	-3.412	-4.425***
CF/K	6.007	12.355***	1.003	6.496***
(CF/K)*P(Controlright)	-0.061	-12.333***	-0.011	-6.593***
Salegrowth	3.038E-6	0.599	5.114E-6	0.201
Assettangibility	-0.009	-1.923*	0.008	1.169
LEV	-0.009	-1.951*	0.008	1.180
SIZE	0.060	2.092**	0.235	5.205***
	F=28.525***		F=12.997***	
	Adj. R <sup>2</sup> =0.211		Adj. R <sup>2</sup> =0.105	
	D.W.: 1.988		D.W.: 1.941	