北京师范大学经济与工商管理学院

工作论文（working paper）系列

管理类 No.5

陈超、夏冬林、朱松：Corporate Pyramid, Capital Investment and Firm Performance

2010 年 7 月

Corporate Pyramid, Capital Investment and Firm Performance

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Abstract: Business groups organized by pyramids enable the ultimate shareholders to control a portfolio of firms with lower cash requirements. Further, a corporate pyramid structure generates an internal capital market that makes capital transfer more convenient within the pyramid. In China, the government and business groups control a large number of listed firms through a pyramidal ownership structure. What role does the corporate pyramid play in firms' investment decisions? What is its influence on firm performance? This paper investigates capital investment and firm performance in relation to pyramidal ownership structures. We find that as the layer of the corporate pyramid increases, the capital overinvestment declines. The negative relations between pyramid and overinvestment exist for both state-owned enterprises (SOEs) and non-state-owned enterprises (NSOEs), which indicates that increasing the layers within a corporate pyramid reduces the likelihood of overinvestment for the listing firm and improves investment efficiency. Moreover, we show that increasing the layers of the corporate pyramid yields different effects for SOEs and NOSEs. For SOEs, increasing the layers of the pyramid results in less government interference on the listed firm and more operating flexibility. Increasing pyramidal layers is thus positively related to accounting performance. NSOEs use the pyramidal structure in order to build an internal capital market for the ultimate shareholder's capital investment. Although pyramiding may reduce overinvestment for the listing firm, agency costs may offset the positive effects and lead to lower accounting performance.

Keywords: Pyramidal ownership structure; Capital investment; Internal capital market; Firm performance

JEL Classification: G31, G32

Corporate Pyramid, Capital Investment and Firm Performance

1. Introduction

In a free market, the optimization of resource allocation is critical for value creation of a firm. The efficiency of an external capital market can be realized by allocating capital to the most profitable investment projects (Sudip et al., 2009). However, due to the market imperfections and information asymmetry, external capital market involves "lemon" premiums (Myers and Majluf, 1984). As a result, external financing is much costly (Brennan and Subrahmanyam, 1996; Easley and O'Hara, 2004). But fortunately firms can turn to rely on the internal capital market (Williamson, 1975; Stein, 1997). Business groups organized along corporate pyramids enable the ultimate shareholders to control a portfolio of firms in the pyramid with limited cash requirements (La Porta et al., 1999; Claessens et al., 2000). This generates an internal capital market and makes capital transfer more efficiently within the pyramid by alleviating restrictions on external financing and reducing financing costs. Thus, this organizational structure can be critical for firms' operation, including financing and investing activities. Another issue related to corporate pyramid is that different incentives for creating corporate pyramid may lead to distinguished economic consequences (Bianco and Casavola, 1999; Khanna and Palepu, 2000; Attig et al., 2003; Fan et al., 2005). To investigate the influence of corporate pyramid, we may have to pay attention to the creation incentive of pyramid and the influence of pyramid on investment and affect on performance.

China has grown to become the second largest economy in the world, and the activities of Chinese firms have attracted more attentions. How those firms finance and use the capital are important and influence the investment opportunities of others. In addition, Chinese securities market are open to the world, and many foreign investors, individuals or qualified foreign institutional investors (QFII), are investing in China, therefore, they also care about the operation of Chinese firms. In China, the government and entrepreneurs control a large number of listed firms through pyramidal ownership structures. They have different incentives, however, for creating this pyramid structure within their organizations (Fan et al., 2005; Zhu, 2006). SOEs use the pyramidal structure to reduce government interference on listed firms, allowing themselves greater operating flexibility in a free market system. For NSOEs, ultimate shareholders use the pyramid to control those firms with less cash flow to create an internal capital market within the pyramid (Bianco and Casavola, 1999; Fan et al., 2005; Zhu, 2006). The pyramidal ownership structure, ultimate shareholders, and control chains in China can be illustrated by two typical cases as reported in Figure 1 and Figure 2. Figure 1 (Figure 2) presents a SOE (NSOE) with a three-layer (four-layer) control chain.

(Insert Figure 1 and Figure 2 about here)

This paper investigates the following issues: What role does the pyramidal ownership structure play in a firm's investment decisions? Do more layers in the pyramid result in more capital investments due to lower financing costs? What is the impact of increasing layers in the pyramid on a firm's performance?

In order to study the effects of pyramidal ownership structure on capital investment, this paper uses two methods: the cash flow-investment sensitivity based on Fazzari et al. (1988) and direct measurement of inefficient capital investment (overinvestment and underinvestment) based on Richardson (2006). When using cash-investment sensitivity as the inefficient investment proxy (Biddle and Hilary, 2006), we find that as the corporate pyramid increases in layers, the inefficient investment decreases since the sensitivity decreases. And for direct measurement, our evidence indicates that as the corporate pyramid increases in layers, both capital investment and inefficient investment, especially the overinvestment, decrease. That is, overinvestment is negatively related to the pyramid measured by the layers of control chain. However, pyramid structure does not alleviate the underinvestment of listed firms, showing no supporting role of ultimate shareholders to listed firms. We also find that the influences of pyramiding on the accounting performances of SOEs and NSOEs differ. For SOEs, the pyramid is positively related to accounting performance, not only due to the decrease in government interference but also due to the decrease in overinvestment that results from the pyramidal structure. For NSOEs, the pyramid structure may hurt accounting performance because the agency cost may supersede its positive effects on inefficient investment, the overinvestment.

This paper expands on existing studies in the following ways: First, we study the relationship between corporate pyramids and firms' capital investment, showing the capital allocation role played by ICM, particularly the business groups in emerging market. And we further examine the influence of pyramidal ownership structure on firm performance of SOEs and NSOEs, taking into account the different incentives they have for creating corporate pyramids, discussing the influence of pyramid on firms operation. As the SOEs firms in all countries, especially in emerging market as China, play great important role in the economy, more researches should be done for those kinds of firms, which should comply with the market mechanism and also commit to the regulation of government to a great extent. Our results show different function played by pyramid in different nature of firms. In all, we investigate the role of internal capital markets within pyramidal ownership structures, giving more evidence for the role of internal capital market and the business groups. Our work is not just focusing on the role of ICM on firm performance, but also shows the relation among ICM, the capital investment and their economic consequence on performance, especially on accounting earnings, giving overall influences of ICM on the individual firms within business groups.

Our work also has political implication. Using Chinese data, we show that for SOEs firms, a longer pyramid structure may be beneficial for their operation, since it will reduce government direct interference and let firms operation under more flexible market mechanisms. More government interference will increase the social burden imposed on firms and result in negative effects on firm performance. Operating under a free market system without government intervention enhances the profitability of firms. For pyramid structure of NSOEs, tunneling incentive seems to be more obvious and popping incentive, regulation authorities should pay their attention to the in-transparency of this structure and its deleterious effect on firm value and performance.

The rest of the paper is organized as follows: Section 2 reviews related literature on internal capital markets. Section 3 presents our hypothesis. Our empirical results are reported in Section 4 and Section 5. Finally, in Section 6 we summarize our findings.

2. Literature Review

Lee et al. (2009) propose two competing views for the internal capital market in business groups: First, the value-added view suggests that internal capital markets can enhance firm value. Second, the tunneling view suggests that internal capital markets can hinder capital allocation efficiency. The value-added view claims that by creating an internal capital market, the headquarters of a business group can best allocate group resources to those member firms with the most growth opportunities. In this way, internally-generated cash flows can be effectively pooled among member firms or different business divisions (Lee et al., 2009). In ideal circumstances, the internal capital market of a diversified firm would allow it to fund profitable projects that could not be financed through the external capital market due to information asymmetry and agency costs. The segments of diversified firms should thus be more efficient in their financial decisions as compared to the efficiency-level of equivalent stand-alone firms. If firms have limited funds available for investment because external funds involve more costs than internal funds, an efficient internal capital market allocates funds to maximize shareholder wealth (Shin and Stulz, 1998). The internal capital market's efficiency increases if it is used for "winner picking," where capital is relocated to finance operations that have solid growth prospects but are underfunded when operated as standalone units (Williamson, 1975; Stein, 1997). The tunneling view (Johnson et al., 2000), on the other hand, predicts that the internal capital allocation that transfers resources from a healthy member firm to a weaker one creates inefficiencies (Lee et al., 2009). If a firm's management pursues its own objectives instead of seeking to maximize shareholder wealth, it might use the firm's internal capital market to finance projects with negative net present values (NPV). It might subsidize losing divisions. Moreover, the internal capital market could fail because each division is treated as a standalone firm that relies primarily on its own cash flow to finance its projects. Divisional managers may expend substantial resources in rent-seeking and internal politics, thereby allocating resources inefficiently and creating deadweight costs. Divisional managers might direct resources to weaker divisions in order to personally benefit at the expense of the firm. When resources are allocated within a firm in such a way that the most profitable projects or projects with the most growth-potential do not have priority, the benefit of having an internal capital market disappears (Shin and Stulz, 1998). Given the mixed viewpoint, the issue of whether or not diversified firms allocate capital efficiently remains unresolved, and that issue reflects the efficiency of internal capital market.

Researches on internal capital market in the developed markets are focusing on the multi-divisional structures, since the agency problem among headquarter and divisional managers is very important in the stock diversified markets where the manager market is highly competitive, while this agency problem is not as important as it is in emerging market, like Asia. In emerging market, the most important agency problem is between the large shareholders or the ultimate shareholders and the minority shareholders. Thus the internal capital market obvious exhibits in the business group constructed by pyramid structures. The ultimate shareholders can build their empire through pyramiding with limited costs. This phenomenon is more prevalent in countries and regions with weaker regulatory laws and more undeveloped economies (La Porta et al., 1999; Claessens et al., 2000; Khanna, 2000; Faccio and Lang, 2002). Pyramid structures are popular because they limit individual responsibility while yielding private control right benefits. Ultimate shareholders can decrease their risk burden through the pyramid structure by manipulating the number of layers within the pyramid such that high-risk projects are further from the top of the pyramid. Moreover, the ultimate shareholders can gain the private benefits that result from the divergence between control rights and cash flow rights (Attig et al., 2003). By allocating resources within a group more efficiently, the pyramid structure enables the ultimate shareholders to have more assets with limited capital, Almeida and Wolfenzon (2006) suggest that under a pyramidal structure, the new firm is owned by all the shareholders of the original firm. As a result, although the family shares the security benefits of the new firm with nonfamily shareholders of the original firm, it has access to all of the retained earnings (cash) of the original firm. Bianco and Casavola (1999) point out that the pyramid structure makes it easier for firms within the group to obtain external capital and the internal capital market created by the pyramid can help the launch of investment projects. Khanna and Palepu (2000) suggest that purpose for the pyramid structure is that it can compensate for market inefficiencies. When a market is underdeveloped, the pyramid group generates its own capital market, managerial market and intangible assets market. The internal capital market can thus reduce a firm’s reliance on external financing (Williamson, 1975; Stein, 1997). When the external financing market is more constrained, the internal capital market is more convenient (Almeida and Wolfenzon, 2006). Fan et al. (2005) and Zhu (2006) suggest that the reason for creating a pyramidal ownership structure in China differs for SOEs and NSOEs. For SOEs, the pyramid is created to reduce government intervention, which allows for more flexible operation by developing its own market mechanisms. For NSOEs, the purpose of the pyramidal ownership structure is to create an internal capital market. However, how the different incentives of creating pyramid in China affect the economic decisions of firms is not further investigated.

3. Hypothesis

Figure 3 provides a theoretical framework for the relationship among pyramid ownership structure, capital investment, and firm performance.

(Insert Figure 3 about here)

Concerning the effect of pyramiding on capital investment, a pyramid with multiple layers could restrict the investment of listed firms, reducing the inefficient investment, lessening the potential for overinvestment or alleviating the underinvestment.

For SOEs, a shorter pyramid means more direct intervention from the government. The executives of listed SOEs are likely to be government-appointed.

These government officer-executives are politically motivated to safeguard their careers by meeting political performance markers. To achieve this, they thus seek to build and expand the empires, since scale and growth is important indicators for their evaluation, thus potentially resulting in overinvestment. Organizing under a pyramid structure reduces government influence on and increases managerial control of a firm. The incentive for creating empires is much lower than that of the executive directly appointed by the government. And concerning the ability to build their empire, executive directly appointed by the government has closer relation with government and more power to seek rent from government than those managers in firms in the bottom of a longer pyramid. And also closer relation with government will provide them with more financing convenient, lowering the financing constraints and sometime may stimulate the overinvestment. Therefore, as the increase of pyramid in SOEs, capital investment may be reduced and is less likely to be overinvested.

For NSOEs, the purpose of creating a pyramid is to establish an internal capital market that reduces a firm's reliance on external financing (Stein, 1997). The internal capital market enables the efficient transfer of resources and capital among firms within the group, allowing them to meet the strategic development requirements of ultimate shareholders. For NSOEs, the decision to build an empire is not controlled by the management of the listed firms. Thus a listed firm can hardly expand in size through an internal capital market if the ultimate shareholder considers the listed firms just as a cash machine. The ultimate shareholders may deprive resources from their listed firm whenever there is a need for capital elsewhere. This behavior is known as “tunneling”. Thus, investments in listed firms are restricted by the decisions of ultimate shareholders. Overinvestment is easier to control through a longer pyramid. Longer pyramid will enable ultimate shareholders to transfer assets and resources from listed firms more easily and less transparently if the tunneling incentive exists for ultimate shareholders. And sometime this may lead to underinvestment of listed firms.

In all, considering the influence of pyramid on capital investment, we hypothesis that:

Hypothesis 1a: The pyramid will restrict the capital investment of listed firms and improve the efficiency of investment.

Hypothesis 1b: Overinvestment of listed firms is more likely to be restricted through a longer pyramid.

Capital investments are necessary for firms’ persistent operation and future growth. Profitable long-term investments enhance a firm’s future cash flow; therefore a capital investment requirement for expansion is positively related to firm performance. In East Asia, however, a firm’s management, its controlling shareholders or its ultimate shareholders may pursue their own objectives at the expense of other shareholders’. They might thus use the firm’s internal capital market to finance the projects with negative net present value (NPV). For example, they may subsidize losing divisions or overinvest. When resources are allocated within a firm such that capital is expended on unprofitable projects, overinvestment will reduce firm performance due to resource waste, which diminishes the firm’s future financing capability. Thereby, overinvestment can lower accounting performance.

Firms constrained by external financing may find themselves lacking the necessary resources for expansion or failing to find funding for certain profitable projects. As result, such firms may be forced to concede the opportunity to its competitors. Over time, fierce competitions in the market will decrease the firm's market share and diminish profits. Caught in this cycle, firm performance will be hurt. Thus, underinvestment can also lower accounting performance.

While investments are necessary for firm expansion, both overinvestment and underinvestment can lead to downward cycles in current and future operations. Thus we suggest that:

Hypothesis 2: Inefficient investment (overinvestment and underinvestment) will lower the accounting performance.

For SOEs, as the size of the pyramid increases, less government direct intervention is found in listed firms (Fan et al., 2005; Zhu, 2006). Pyramiding reduces the incentive and power of SOE managers to build empires, thus decreasing the likelihood of overinvestment. That is, listed firms will more likely invest in profitable projects to earn higher profits and use available capital more efficiently. Therefore, more layers may reduce overinvestment and enhance firm performance. In another perspective, SOEs build pyramids to reduce government direct interference, to let firms operation under more flexible market mechanisms. More government interference will increase the social burden imposed on firms and result in negative effects on firm performance. Operating under a free market system without government intervention enhances the value and profitability of firms.

For NSOEs, as the pyramid-size increases, the internal capital market will become more powerful (Stein, 1997), facilitating capital and resource transfers. For NSOEs, creating a pyramid establishes an internal capital market that reduces the reliance on external financing in which the cost of capital is higher. In theory, this structure benefits listed firms, but in actuality, where weaker laws in underdeveloped economies often exist, ultimate shareholders can tunnel from a firm while avoiding detection. The influence of pyramid on NSOEs depends on the efficiency of the internal capital market and the tunneling effect.

For both SOEs and NSOEs, a problem related to the pyramid structure is the multi-layer agency problem (Zhu, 2006). With the increase of layers, more agency problems arise. An agent in one layer is also a principal in a lower layer, and each principal-agency relation increases agent costs and reduces efficiency. In addition, the multi-layer principal-agent problem obstructs the flow of information, resulting in higher information costs. Agents in each layer may thus pursue private benefits using their information advantages. Efforts to offset the agency problem will also increase monitoring costs. Moreover, the incentive problem is more severe in a multi-layer principal-agency relation. Firm performance tends to decrease without a strong incentive mechanism.

Although SOEs generally have pyramids with more layers, a proportion of agency costs, such as monitoring costs, are assumed by the government. For SOEs, we assume that the positive effects of less government intervention and diminished social burden prove to be more significant than the multi-layer principal-agency problem. That is, that for SOEs, pyramiding positively influences firm performance. For NSOEs, we hypothesize that they face more severe principal-agent problems and that the agent cost exceeds the benefits from the internal capital market. As a consequence, pyramiding will have a negative influence on firm performance. Therefore, we suggest that:

Hypothesis 3: For SOEs, pyramid is positively related to performance, while for NSOEs, the relation is negative.

4. Variables and Data

4.1. Variable Definition

4.1.1. Pyramidal Ownership Structure, Capital Investment and Performance

The pyramidal layer (CHAIN) is the number of layers between the listed company and the ultimate shareholder as defined by Fan et al., (2005) and Zhu (2006), and is illustrated in Figure 1 and Figure 2.

Capital investment is a proxy that uses the following two different measures. $\mathbf{I_1}$ is the increase of long term assets standardized according to the beginning assets on the balance sheet[1]. $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets minus the cash flow from the sale of fixed assets, intangible assets and other assets standardized according to the beginning assets. The data comes from the cash flow statement and balance sheet.

[1] Since in China the R&D expense is not disclosed, we cannot measure the capital investment precisely as Richardson (2006), thus we use other computation method.

Performance is the accounting performance measured by the net income and income before extraordinary items. ROA, the net income divided by the average assets, and EBXIOA, net income before extraordinary items divided by the average assets; ROE, the net income divided by the average equity, and EBXIOA, net income before extraordinary items divided by the average equity.

4.1.2. Other Variables

The following are control variables: $\mathbf{I_{t-1}}$ is the capital investment of the prior year; CF is the beginning cash flow from operation divided by beginning assets; LEV, the debt ratio at the beginning of year; Size is the natural log of beginning assets. Q is Tobin's Q, which is calculated by the market value of assets divided by book value at year beginning;[2] Sale is the prior year's sales revenue divided by beginning assets; Ret is the prior year's market return; Age is the time span from IPO year; FCF, the free cash flow, is cash flow from operation minus expected capital investment derived from Richardson's (2006) expected investment model; STATE is a dummy variable, an SOE is denoted by 1 and all else by 0; V is the total voting rights of the ultimate shareholder in a listed company; CV is the deviation of cash flow right from voting right, measured by the cash flow right divided by voting right as La Porta et al. (1999), Claessens et al. (2000) and Fan and Wong (2002) and shown in Figure 1 and 2; Years is the yearly dummy (5 dummy variables for 6 year samples); Inds is the industrial dummy (after dropping the finance industry, there are 11 dummy variables for 12

[2] In China's A-share market, prior to 2005, not all stock was circulated in the market. Therefore the market value of equity can be difficult to obtain. Researchers often compute the market value of equity using the following method: market value of equity is the market value of circulated stock plus the book value of uncirculated stock, therefore the Tobin's Q is calculated as: (market value of circulated stock + book value of un-circulated stock + book value of debt)/book value of assets.

industries which is defined by the China Securities Regulatory Commission).

4.2. Sample

We first select all listed firms in China's A-share market from 2001 to 2006[3]. Then, we exclude those firms (1) without information on ultimate shareholders, (2) in the finance industry, (3) not listed in the previous year, (4) issues other kind of shares, like B/H/S/ADR[4], (5) with leverage ratio greater than 5 in the previous year[5]. This criterion yields 6,213 firm-year observations. The samples by year are reported in Table 1.

(Insert Table 1 about here)

Information on ultimate shareholders is collected manually from the annual reports of all listed firms. Other data are obtained from the Wind and CSMAR database.

In order to avoid the influence of outliers, we winsorize observations of the top and bottom 1% for capital investment, I_1 and I_2, and top and bottom 2% for accounting performance, ROA, EBXIOA, ROE and EBXIOE[6].

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[3] In 2001 some accounting standards are revised and after 2006 the accounting numbers are much different due to the new accounting principle implemented since Jan 1, 2007 in China. Therefore to make accounting numbers consistent during our research period; we use samples between 2001 and 2006.

[4] The computation of Tobin's Q for these companies is far too complicated. In addition, these firms face different legal environments and investors from those that only issue A shares, thus their financing constraints differ. To avoid the inconsistencies of the Q for these firms, we thus drop those samples.

[5] If adding those samples, our results are the same and significance levels for interested variables are even stronger.

[6] 1% or 2% does not affect our results. In the robustness check, we winsorize by 1%, and the results remain the same.

5. Empirical Test

5.1. Descriptive Statistics

Table 2 shows the statistics for those regression variables. The average profitability of sample firms is low with only around 3.2% for ROE and 2.61% for earnings excluding extra-ordinary items. For return on assets, it is much lower. Average capital investment is about 6% for the measure based on balance sheet, while this rate is 11% for the proxy based on cash disbursement. These two proxies differ considerably; therefore we should use two proxies for robustness tests. Pyramid layers for sample firms are 2.4, which mean that there is at least one firm existing between ultimate shareholders and listed firms. For some samples, ultimate shareholders control the listed firm directly, while there are seven firms from the apex to the bottom of the pyramid.

(Insert Table 2 about here)

For other fundamental aspects, sample firms differ much on leverage, scale, growth, market valuation, life cycle and so on, and all those will significantly influence the investment and performance besides the influence of pyramid and ownership structure.

5.2. Correlation Analysis

Table 3 shows the correlation coefficients for pyramid, capital investment and firm performance for SOEs and NSOEs, respectively. Accounting performance is significantly positively related to capital investment since more investments will lead to larger economies of scale and more productive assets. This positive relation holds true for both SOEs and NSOEs.

Pearson and Spearman correlation coefficients show that capital investments are negatively related to pyramid, CHAIN, for both SOEs and NSOEs. Hypothesis 1a is partially supported, indicating that pyramid may constrain capital investments.

For the relation between pyramid and accounting performance, we find different signs for SOEs and NSOEs. For SOEs, this relation is significantly positive, which indicates that increasing layers in pyramid leads to better performance. In contrast, the relation is significantly negative for NSOEs, with increasing layers in pyramid resulting in lower profitability. Hypothesis 3 is supported by the correlation analysis.

(Insert Table 3 about here)

5.3. Pyramid Structure and Capital Investment

Correlation analysis shows the relation between pyramid and investment, but whether the pyramid can improve investment efficiency by restricting overinvestment or alleviating underinvestment is not clear. To test this, we use two methods to investigate the influence of pyramid on investment activities: the investment-cash flow sensitivity and direct measurement of inefficient investment (overinvestment and underinvestment)[7].

5.3.1. Investment-Cash Flow Sensitivity Analysis

The first method is the investment-cash flow sensitivity used first by Fazzari et al.

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[7] Bergstresser (2006) has discussed the Richardson (2006) method and pointed out some problems. However, how to measure the inefficient investment is indeed a trouble. With no other better measure, we borrow the Richardson (2006) method. However, we make some revision for that model.

(1988). Higher sensitivity indicates an overinvestment tendency according to the free cash flow hypothesis (Jenson, 1986; Vogt, 1994). It also indicates an underinvestment tendency for those firms with financing constrains (Myers and Majluf, 1984). In all the sensitivity of investment-cash flow can be a proxy measure for inefficient investment (Biddle and Hilary, 2006). If the pyramid reduces investment, especially overinvestment by listed firms, and it may also alleviate underinvestment, then it lowers the sensitivity of investment-cash flow. Table 4 shows the influence of pyramid on investment- cash flow sensitivity using a model based on Fazzari et al. (1988). The first two columns show how the pyramids influence the capital investment basing on the two investment measurements. The last two columns show the results for the investment-cash flow sensitivity regressions.

(Insert Table 4 about here)

After controlling for other influences, pyramid layers can reduce the capital investment of listed firms indicated by the negative coefficients for CHAIN, although for I_2 it is not significant. Investments of listed firms are restricted by the decisions of ultimate shareholders; longer control chain may lower the capital investment level.

The cross terms of CHAIN and CF[8] are negatively related to capital investment for all regressions, significant at 0.01 levels, which means pyramid layers can reduce the cash flow-investment sensitivity that is the proxy for investment inefficiency. Pyramiding can restrict the overinvestment activities and/or alleviate the underinvestment level for both capital investment proxies, improving the investment

[8] We also add the current cash flow from operating and the results are basically the same, not shown in tables.

efficiency proxy by the cash flow-investment sensitivity (Biddle and Hilary, 2006).

We further divide samples into SOEs and NSOEs to find the influence of pyramid on the cash-investment sensitivities. Regression for SOEs and NSOEs are shown in Table 5.

(Insert Table 5 about here)

It shows that the restrictive role of pyramid on inefficient capital investment is significant for both SOEs and NSOEs using the cash-investment sensitivities as the inefficient investment proxy. Results in Table 5 indicate that as the pyramid layers increase, the inefficient investment decreases and this negative relation holds for both SOEs and NSOEs after controlling for other determinants of capital investments. Hypothesis 1 is thus supported. Specifically, it shows that the pyramid structure can constrain the capital overinvestment of listed firms and/or alleviating underinvestment, improving investment efficiency.

5.3.2. Inefficient Investment (Overinvestment and Underinvestment) Measurement

Though table 4 and table 5 show that pyramid can improve the capital investment efficiency, whether it restricts overinvestment or alleviates underinvestment is not clearly understood. The problem is associated with the indiscernible of cash-investment sensitivity tests. In order to give more evidence for the role of pyramid, we use another method to directly proxy for the inefficient investment (overinvestment and underinvestment) which is used by Richardson (2006). Bergstresser (2006) give a comprehensive discussion of the method and point out the problems with that model, however this method can directly measure the capital investment efficiency for a single firm at a specific year, therefore we use Richardson (2006) model to calculate the inefficient investments, however we also make some adjustments. Regressions for the inefficient investment measurement are shown in Table 6. Although our measurement of investment is a little different from that Richardson (2006) uses, the results are basically the same as Richardson's (2006) prediction.

(Insert Table 6 about here)

Richardson's (2006) method ignore the measurement error in proxy for the inefficiency investment, thus we divided the residues into three groups by the descending order of its scale. The group where the residues are in the first one third is called overinvestment, the middle group is called proper investment, and the lowest group is called underinvestment. In order to explain conveniently, we use the absolute value of residuals; the larger the absolute value, the more overinvestment or the more underinvestment.

Table 7 presents the results of the relation between pyramid and inefficient capital investment (overinvestment and underinvestment), which are derived from the expected investment model by Richardson (2006). The first three columns show regression results using the first proxy for investment and the last three columns are results for the second measurement for investment. Under each investment proxy, we regress for total samples, firms overinvest and firms under invest[9].

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[9] Actually, we also use all the samples where residuals from Richardson (2006) are positive as the overinvestment and others as the underinvestment. Results for this category are basically the same as we shown in main text.

(Insert Table 7 about here)

Controlling for the free cash flow problem during investment proposed by Jenson (1986), the influence of ownership structure and other fundament of capital investment determinants, we find that as the pyramid increases, inefficient capital investment is reduced, which is shown by the negative coefficients for CHAIN when dependent variables are ARESI, the absolute value for residuals from Richardson (2006) expected investment model. It is indicating that pyramid can reduce the inefficient investment, overinvestment or underinvestment. To further investigate the role of pyramid in reducing inefficient investment, we regress for overinvest and underinvest firms separately. It shows that coefficients for overinvestment are negative, significant for I_1 but not significant for I_2. While for firms under invested, coefficients for overinvestment are negative, significant for I_2 but not significant for I_1. In all, Hypothesis 1 is supported. The internal capital market will constrain the capital investment of listed firms, restricting overinvestment tendencies and alleviating the underinvestment, thus improving investment efficiency.

We also regress separately for SOEs and NSOEs, shown in Table 8. The coefficients for CHAIN are negative, however only significant for I_1 for NSOEs.

(Insert Table 8 about here)

5.3.3. Corporate Pyramid, Capital Investment and Performance

We then investigate the relation among pyramid, capital investment and accounting performance. Since the internal capital market created by the pyramid structure may limit the capital investment of listed firms, operating performance is affected. Table 9 shows how the accounting performance is influenced by the pyramid structure. We use four accounting returns to measure the performance allowing for the manipulation of different proxies. We first examine the effect of inefficient investment (overinvestment and underinvestment) for Hypothesis 2. In the next regression, we test the agency problem associated with pyramid[10], and in the final regression we test the net effect of pyramid on accounting performance through its restriction on overinvestment (underinvestment) and the agency problem referred to in Hypotheses 3. When testing the influence of pyramid on performance, we first use a dummy variable to estimate the different influences of pyramid for SOEs and NSOEs.

(Insert Table 9 about here)

Table 9 shows that accounting performance is positively-related to capital investment since more investments lead to larger economies of scale and more productive assets. However, overinvestment may allocate resources to projects with negative NPVs, causing inefficiency in investment, which leads to poorer performance. At the same time, underinvestment also hurts future growth and value-added activities, leading to lower market share and weaker performance. This influence is called the "inefficient investment effect". We find that more inefficient investments will have a negative influence on accounting performance as indicated by the significantly negative coefficients for RESI, in 0.01 levels. Hypothesis 2 is supported. R^2 for this regression is 27.48% based on ROA. Since the internal capital

[10] Actually it is hardly to isolate the "agency effect". For regression in this column, we just exclude investment parameters in regression to see how the pyramid influences the performance if we do not look at the effect of investment. It is indeed not the pure agency effect, but here we just try to show the different influence of pyramid through distinguished channels.

market created by the pyramidal ownership structure may limit the overinvestment of listed firms and improve investment efficiency, as Table 4 and Table 5 show, we find that pyramid benefits firm performance by reducing inefficient investment.

In the second column, we investigate the agency costs associated with the creation of internal capital market, which is one of the negative effects of pyramiding. We find that for all firms, increasing layers of the pyramid increases the effects of the agency problem. For SOEs, a longer pyramid or control chain may help to lessen the agency problem. With less government intervention, the benefits from more layers supersede the detriments, leading to a positive effect on performance. Coefficients for CHAIN are significantly negative, at 1% levels, and positive for STATE × CHAIN.

In the third column, we combine the benefits of pyramid with to the cost of the agency problem to measure the net effect of pyramid. We find that after controlling for other factors, the relations between pyramid and accounting performance continue to differ for SOEs and NSOEs. The net effect on NSOEs remains negative. That is, agency costs associated with pyramid dominate the benefits of reducing inefficient investment, which is confirmed by the significantly negative coefficients for CHAIN. For SOEs, less government intervention supersedes agency costs. Combined with the benefits of restricting inefficient investment, increasing pyramid for SOEs is positively related to firm performance, indicating by the significantly positive coefficients for STATE × CHAIN. Thus Hypothesis 3 is supported. Since many firms use extraordinary items to manipulate their real performances, the ROA measured by net income may be distorted to some extent. To minimize the influence of earnings management, we use income before extraordinary items as the proxy of real profitability. The last three columns in Table 9 also show the results using the income before extraordinary items to calculate ROA, and the other two performance measures by using the return on equity ROE. Regression results are basically the same as those of the former, showing that even removing the income with by extraordinary items or using return for stockholders as the performance, pyramid still has an opposite effect on the performance of listed firms for SOEs and NSOEs. For SOEs, increasing pyramid improves accounting performance since pyramid may reduce overinvestment government intervention, both of which benefit operations. For NSOEs, pyramid may reduce capital investment, but greater agency costs offset this effect, potentially yielding lower overall performance.

We also investigate the influence of pyramid for SOEs and NSOEs respectively in table 10 using ROA as the performance proxy, and results for other return proxy are consistent with results for ROA. To be concise, we just report for regression for the ROA. The effects of pyramid on accounting performance are not the same for SOEs and NSOEs.

(Insert Table 10 about here)

Looking at SOE sub-samples, coefficients for CHAIN are positive but insignificant. For SOEs, the pyramid helps firm performance, not only by decreasing government intervention, but also by restricting overinvestment. This positive effect will compensate for more agency costs due to longer pyramid structure, thus the influence of pyramid will not significantly negative. For NSOEs, however, the pyramid negatively affects accounting performance though it has a positive influence on overinvestment; its positive effect is offset by higher agency costs related to the pyramid, leading to a negative relation between performance and pyramid. That is, pyramid has a negative effect on NSOEs, which suggests more layers in the pyramid tend to lower performance.

In summary, the results in Table 9 and Table 10 using the first investment measure are consistent with Hypothesis 2 and Hypothesis 3.

5.4. Robustness

5.4.1. Alternative Measure of Capital Investment

Using another proxy for the measurement of capital investment which is based on cash flow statement, and other performance proxy separately for SOEs and NSOEs we find that regression results in Table 11 are consistent with what we find in Table 9 and Table 10. Robust tests show that the relationships between pyramid and performance of the listed firms are not the same for SOEs and NOSEs. For SOEs, the pyramid is positively-related to performance because as the pyramid increases, overinvestment is less likely, resulting in a positive effect on firm performance. For NSOEs, pyramiding also reduces capital investment as the pyramid increases. But the greater negative effects of the agency problem lower performance.

(Insert Table 11 about here)

We also divided all firms into two sub-groups in Table 12, overinvestment group and underinvestment group as in Table 7. Both overinvestment and underinvestment will reduce accounting performance, showing by the significant negative coefficients for RESI in the regressions. Underinvestment will cause firms to loss opportunities to enlarge their operation and scale and overinvestment will waste firms' resources and limited capitals, both of which will then lead to reduced competition for firms in the market. Again we find that after controlling for other factors, the relations between pyramid and accounting performance continue to differ for SOEs and NSOEs. Consistent with all samples regression, for SOEs, a longer pyramid or control chain may help to lessen the agency problem. With less government intervention, the benefits from more layers supersede the detriments, leading to a positive effect on performance. The positive effect of longer pyramid on performance can also be supported by the sign and significance of coefficients for STATE. Since government interference will bring negative effect on firms' operation, longer pyramid can lower this negative influence, which will be beneficial for firm performance. The net effect of pyramid on NSOEs remains negative. That is, agency costs associated with pyramid dominate the benefits of reducing overinvestment, which is confirmed by the significantly negative coefficients for CHAIN.

(Insert Table 12 about here)

5.4.2. Non-linear Relationship

For both SOEs and NSOEs, pyramid structure has its benefits and also has its shortages, thus the influence of pyramid on performance may be not linear as effect of the management ownership on performance. Table 13 shows the non-linear regression results using the two investment proxies, and we show non-linear for CHAIN, for STATE×CHAIN, and for both.

(Insert Table 13 about here)

The first two columns are results of the non-linear for CHAIN. Both coefficients for CHAIN and CHAINSQ are negative and not significant, exhibit no non-linear relation (at least for the square form of non-linear relation). While for STATE× **CHAIN**, the coefficients are still significantly positive.

The results in the middle two columns are for the non-linear of STATE× CHAIN, still showing no non-linear relation, and for CHAIN, the regression coefficients remain significantly negative, indicating the linear relation of pyramid for NSOEs.

The last two columns show the non-linear for both CHAIN and STATE× CHAIN, for STATE× CHAIN, the coefficients are significantly positive, and the square form is not significant. While for both CHAIN and CHAINSQ, the regression coefficients are not significant, indicating no non-linear relation exists (at least for the square form of non-linear relation). In sum, results in Table 13 support our hypothesis, showing no non-linear relationship exists for pyramid and firm performance.

5.4.3. Model Selection

Petersen (2008) points out that in most panel data regressions, the residuals may be correlated across firms or across time, and OLS standard errors can be biased. When presenting a firm's fixed effect, both OLS and Fama-MacBeth standard errors are biased downward. The Newey-West standard errors, as modified for panel data, are also biased but the bias is small. When presenting an unobserved time effect, the Fama-MacBeth standard errors are unbiased. While accounting studies increasingly rely on panel data where both cross sectional and time-series dependence are present, the econometric literature shows that two-way cluster robust standard error (CL-2) is robust to both time-series and cross-sectional correlation (Cameron et al., 2006; Thompson, 2006; Petersen, 2008), Gow et al. (2009) find that in a variety of accounting-specific applications, CL-2 is necessary to produce valid inferences. In order to show the robustness of our model selection, we show the results using multiple regression methods in Table 14, OLS, Fama-MacBeth and CL-2.

(Insert Table 14 about here)

The first two columns show the results for OLS regression, the two columns in the middle are for Fama-Macbeth method, and the last two columns are for CL-2 regression. No matter what model or method we choose, the sign for regression coefficients are consistent with what we find above and all the coefficients are highly significant as expected, indicating that our data set is not significantly influenced by the cross-sectional and time-series dependence problem. Therefore, our hypotheses are supported.

5.4.4. Long-Term Performance

Since cross-section analysis using short-term data may have many noises and the firm structure may be constant during several accounting period or change dramatically due to market strategy or capital restrictions, we investigate the long-term effect of pyramid structure on firm performance in Table 15. AROA is the average ROA for each firm during the sample period. Because some firms launch IPO and some are delisted during the sample period, thus our final sample for long term effect is just 1,199. All other variables in Table 15 are average for each firm during the sample period.

(Insert Table 15 about here)

The first two columns are the results for all 1,199 sample firms using both investment measures. Coefficients for AI, ARESI, ACHAIN and ASTATE × CHAIN are consistent with what we find in previous tables, suggesting that the relations between pyramid and accounting performance continue to differ for SOEs and NSOEs.

The last two columns are the results for 823 firms that are listed all the times after dropping those were delisted or IPO firms during the sample period. Again, all coefficients for our interested variables are consistent with expectation. In sum, the results in table 16 are consistent with Hypothesis 2 and Hypothesis 3.

5.4.5. Endogenous Problem

The structure choice may not be exogenous, while instrumental variable (IV) estimation is the standard textbook solution to mitigating the inconsistency in parameter estimates caused by endogeneity, the appropriateness of the IV method in typical accounting research is not obvious, and a proper IV is very difficult to choose (Larcker and Rusticus, 2010). To minimize this issue, we first use the pyramid for the previous year to investigate the influence on performance[11], showing in the first two columns in table 16. For both investments, results are consistent with previous that the relationships between pyramid and performance of the listed firms are not the same for SOEs and NOSEs. For SOEs, the pyramid is positively-related to performance

[11] Since we use the data for the previous year, we lost one year sample.

because as the pyramid increases, overinvestment is less likely, resulting in a positive effect on firm performance. For NSOEs, pyramiding also reduces capital investment as the pyramid increases. But the greater negative effects of the agency problem lower performance.

We also pick all firms that do not have ownership structure change (the controlling shareholders in each level and the ultimate shareholder do not change) as the subsample to test our hypothesis, since the pyramid structure and ownership is given since their IPO (Fan et al., 2005). Given pyramid structure, how does it influence the investment and performance can be an exogenous issue. The regression results for those exogenous subsamples are shown in the second two columns in Table 16.

(Insert Table 16 about here)

For both investment proxies, the signs for each interested variables are the same as we find in Tables 9 to 12, and are all significant at least at 0.05 levels for the Newey-West adjusted Fama-MacBeth standard errors. For this group of samples, the pyramid structure is given since the IPO, the endogenous problem is minimized. Results in these two columns are consistent with above, still supporting our hypothesis[12].

In order to analyze how pyramid structure changes affect the performance, we also run the regression of firms that changed their ownership structure (the controlling shareholders in each level and the ultimate shareholder changed), showing in the last

[12] Results for other performance proxies are basically the same as shown in table 12. To be succinct, we don't report all results.

two columns in Table 16. Except for some variables for I_2 regression, the results for other interested variables are basically the same as above, still supporting our hypothesis, which also indicates that the endogenous issue in our data is not severe.

6. Conclusions

A business group structured according to a corporate pyramid enables ultimate shareholders to control the portfolio firms in the pyramid with less cash requirement. Thus, the business group creates an internal capital market and manages capital and resource allocation within the corporate pyramid. This helps business groups alleviate restrictions from external financing and reduces financing cost. Stein (1997) argues that using a pyramid structure to build an internal capital market may mitigate the reliance on external financing. When the external financing market is constrained, the internal capital market becomes more convenient (Almeida and Wolfenzon, 2006). This paper attempts to answer the following questions: How does the internal capital market influence capital investment? What are the economic consequences of the pyramidal ownership structure? Do corporate pyramids affect the performance of listed firms?

We investigate the relationship among capital investment, firm performance and pyramidal ownership structure in China. Our empirical results indicate that more layers in a pyramid reduce the likelihood of overinvestment. The increase in layers in the pyramid may restrict overinvestment and improve investment efficiency, resulting in better firm performance. Furthermore, different incentives for creating a pyramid structure may yield different effects on performance for SOEs and NSOEs. For SOEs, the corporate pyramid results in less government interference, thereby allowing for more freedom for firms operating in a free market environment. Therefore, pyramiding may enhance the profitability of SOEs. For NSOEs, although a corporate pyramid may limit overinvestment, higher agency costs dominate the positive effect of pyramiding on overinvestment and lead to lower accounting performance.

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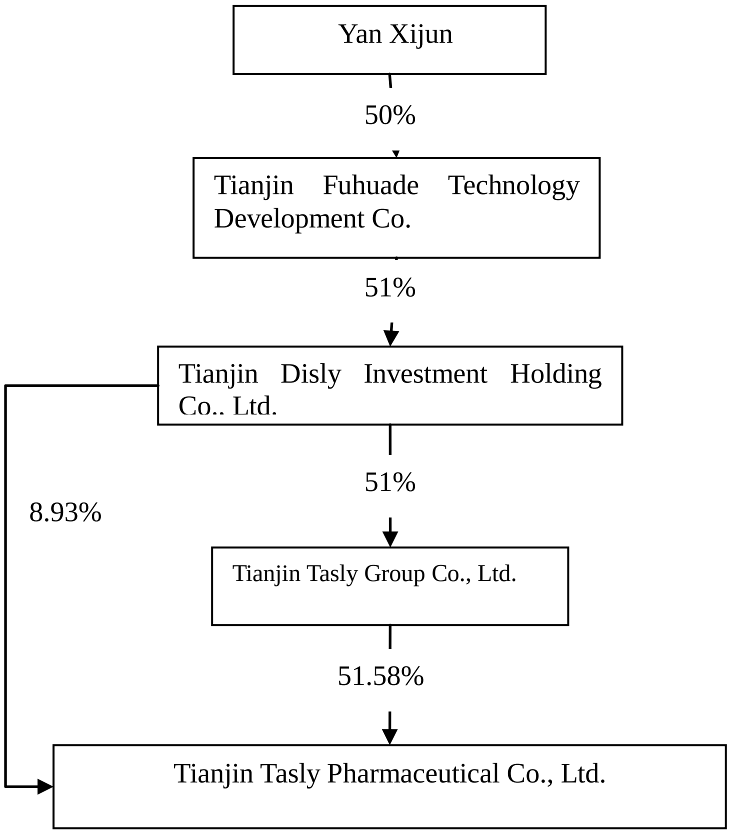
Figure 1
Ultimate Shareholder and Control Chain: A SOE
SINOTRANSAIR Transportation Development Co., Ltd. (Code 600270)

The characteristics of ultimate controlling shareholder: State (state=1)
Control right (V): 70.36%
Cash flow right (C): 70.36%*57.9%*100%=40.74%
The deviation of cash flow right and control right (CV): 40.74%/70.36%=0.579
Control chain (Chain): 3 layers. The first layer is SINOTRANS Co., Ltd., the second layer is China National Foreign Trade Transportation Group Corporation, and the third layer is the ultimate shareholder State-Owned Assets Supervision and Administration Commission of the State Council.

Figure 2
Ultimate Shareholder and Control Chain: A NSOE

Tianjin Tasly Pharmaceutical Co., LTD: (Code: 600535)



The characteristics of the ultimate shareholder: NSOE (state=0)
Control right (V): 51.58%+8.93%=60.51%
Cash flow right (C): (51.58%*51%+8.93%)*51%*50%=8.99%
The deviation of cash flow right and control right (CV): 8.99%/60.51%=0.15
Control Chain (Chain): 4 layers. The first layer is Tianjin Tasly Group Co., Ltd., the second layer is Tianjin Disly Investment Holding Co., Ltd., the third layer is Tianjin Fuhuade Technology Development Co., and the fourth layer is the ultimate controlling shareholder: Yan Xijun

Figure 3
Theoretical Framework on the Relationships among Pyramid, Capital Investment and Firm Performance

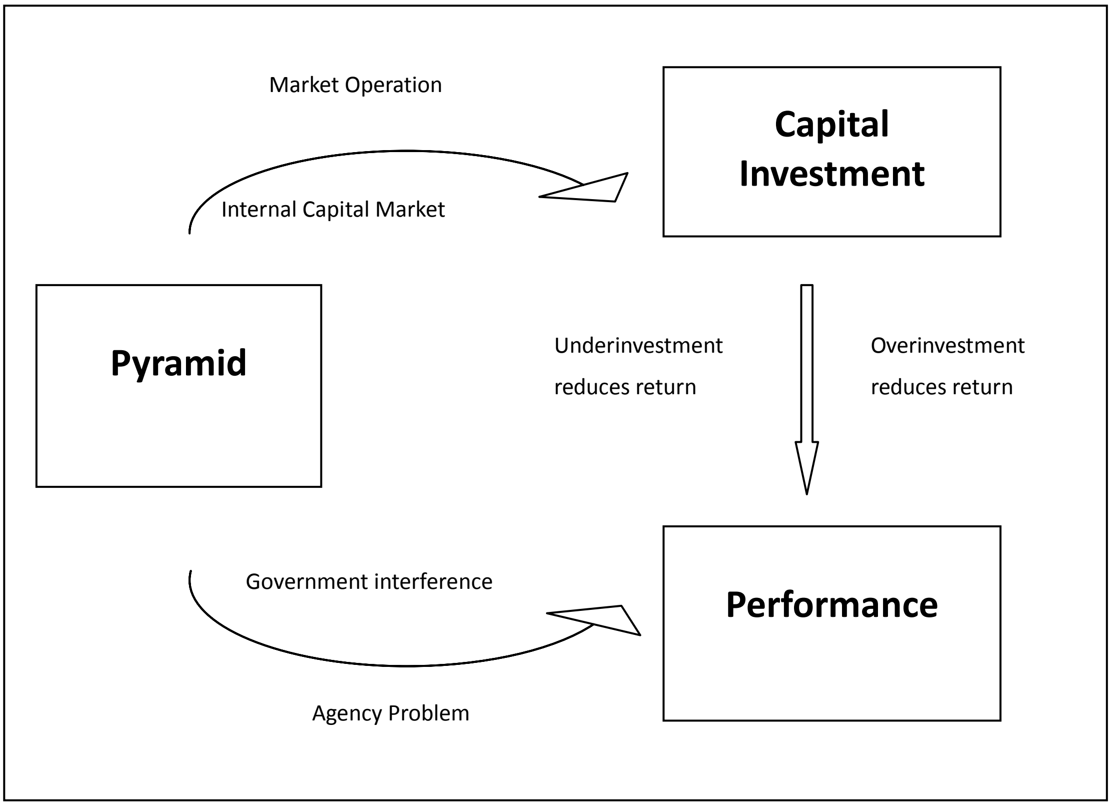


Table 1

Number of Firm-Year Observations by SOEs and NSOEs: 2001-2006

	2001	2002	2003	2004	2005	2006	Total
Total	861	935	1,010	1,073	1,164	1,170	6,213
SOEs	716	737	759	760	793	761	4,526
NSOEs	145	198	251	313	371	409	1,687

Table 2

Descriptive Statistics for Variables

ROA, the net income divided by the average assets, and **EBXIOA**, net income before extraordinary items divided by the average assets; **ROE**, the net income divided by the average equity, and **EBXIOE**, net income before extraordinary items divided by the average equity; $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets; **CHAIN** is the number of layers from listed company to the ultimate shareholder. **CF** is the beginning cash flow from operation divided by beginning assets; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; **Age** is the time span from IPO year.

	N	Mean	Sd	Min	Median	Max
ROA	6213	0.0170	0.0640	-0.2344	0.0244	0.1284
EBXIOA	6213	0.0140	0.0585	-0.1999	0.0202	0.1236
ROE	6213	0.0321	0.1656	-0.7163	0.0568	0.3214
EBXIOE	6213	0.0261	0.1512	-0.6230	0.0475	0.3103
I_1	6213	0.0609	0.8008	-0.2059	0.0568	0.4467
I_2	6213	0.1125	0.1175	-0.0318	0.0774	0.5816
CHAIN	6213	2.3544	0.7551	1	2	7
CF	6213	0.0453	0.0873	-1.3058	0.0455	1.0192
Lev	6213	0.4821	0.2583	0.0081	0.4704	4.3427
Size	6213	21.0119	0.8674	17.4965	20.9520	25.7343
Q	6213	1.4632	0.5832	0.7030	1.2857	11.7343
Sale	6213	0.5749	0.4549	0	0.4529	5.1237
Age	6213	6.0900	3.1414	1	6	16

Table 3

Correlation Coefficients of Performance, Capital Investment and Corporate Pyramid

ROA, the net income divided by the average assets, and **EBXIOA**, net income before extraordinary items divided by the average assets; **ROE**, the net income divided by the average equity, and **EBXIOE**, net income before extraordinary items divided by the average equity; $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets; **CHAIN** is the number of layers from listed company to the ultimate shareholder. Above the diagonal are Spearman correlations, and under the diagonal are Pearson correlations. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

Panel A-SOEs

	ROA	EBXIOA	ROE	EBXIOE	I_1	I_2	CHAIN
ROA					0.3537***	0.4136***	0.0308**
EBXIOA					0.3733***	0.4189***	0.0262*
ROE					0.3257***	0.3505***	0.0307**
EBXIOE					0.3423***	0.3576***	0.0344**
I_1	0.2988***	0.3267***	0.2475***	0.2693***			-0.0343**
I_2	0.2996***	0.3138***	0.2395***	0.2566***			-0.0270*
CHAIN	0.0267*	0.0190	0.0370**	0.0407***	-0.0418***	-0.0261*	

Panel B-NSOEs

	ROA	EBXIOA	ROE	EBXIOE	I_1	I_2	CHAIN
ROA					0.3875***	0.4307***	-0.2192***
EBXIOA					0.4204***	0.4447***	-0.2294***
ROE					0.2408***	0.2604***	-0.1521***
EBXIOE					0.2695***	0.2784***	-0.1683***
I_1	0.3625***	0.3962***	0.2069***	0.2348***			-0.1292***
I_2	0.3115***	0.3254***	0.2015***	0.2071***			-0.1369***
CHAIN	-0.1752***	-0.1860***	-0.1343***	-0.1374***	-0.0826***	-0.1152***	

Table 4

Pyramid, Internal Capital Market and Capital Investment

I, the dependent variable, is the capital investment; $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets; **CF** is the beginning cash flow from operation divided by beginning assets; **CHAIN** is the number of layers from listed company to the ultimate shareholder; **CHAIN× CF** is the cross-term of CHAIN and CF. Control variables include: **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year samples; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	Investment Level		Investment Sensitivity	
	I_1	I_2	I_1	I_2
CF	**0.1285**	**0.1856**	**0.3136**	**0.3863**
	(5.69)* **	**(6.26)*** **	**(5.96)*** **	**(11.61)*** **
CHAIN	**-0.0063**	**-0.0042**		
	(-6.48)* **	**(-1.91)* **		
CHAIN× CF			**-0.0773**	**-0.0846**
			(-5.69)* **	**(-6.20)*** **
Lev	-0.0667	-0.0883	-0.0678	-0.0896
	(-10.86)***	(-8.76)***	(-11.50)***	(-9.44)***
Size	0.0120	0.0112	0.0120	0.0110
	(3.29)***	(5.46)***	(3.29)***	(5.39)***
Q	0.0284	0.0310	0.0277	0.0302
	(1.64)	(2.65)***	(1.61)	(2.67)***
Sale	0.0062	-0.0010	0.0063	-0.0011
	(1.83)*	(-0.35)	(1.94)*	(-0.43)
Age	-0.0087	-0.0075	-0.0088	-0.0076
	(-10.86)***	(-11.79)***	(-11.14)***	(-12.28)***
Years	Control	Control	Control	Control
Inds	Control	Control	Control	Control
N	6213	6213	6213	6213
F	32.78	47.07	33.17	47.86
R^2	0.0864	0.1489	0.0872	0.1510

Table 5

Pyramid, Internal Capital Market and Capital Investment-Robust Test

I, the dependent variable, is the capital investment; $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets; **CF** is the beginning cash flow from operation divided by beginning assets; **CHAIN** is the number of layers from listed company to the ultimate shareholder; **CHAIN× CF** is the cross-term of CHAIN and CF. Control variables include: **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year samples; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	SOEs		NSOEs	
	I_1	I_2	I_1	I_2
CF	**0.2347**	**0.2792**	**0.4402**	**0.5181**
	(3.60)* **	**(6.18)*** **	**(5.30)*** **	**(7.98)*** **
CHAIN× CF	**-0.0492**	**-0.0458**	**-0.1146**	**-0.1175**
	(-2.74)* **	**(-2.53)** **	**(-5.19)*** **	**(-7.03)*** **
Lev	-0.0568	-0.0991	-0.1051	-0.0970
	(-10.64)***	(-11.03)***	(-4.40)***	(-4.84)***
Size	0.0110	0.0103	0.0215	0.0233
	(1.96)**	(3.36)***	(3.21)***	(3.08)***
Q	0.0330	0.0290	0.0216	0.0275
	(1.69)*	(3.71)***	(1.72)*	(2.01)**
Sale	0.0034	-0.0019	0.0058	-0.0033
	(2.87)***	(-1.29)	(0.50)	(-0.50)
Age	-0.0082	-0.0067	-0.0096	-0.0089
	(-6.72)***	(-7.70)***	(-15.05)***	(-9.93)***
Years	Control	Control	Control	Control
Inds	Control	Control	Control	Control
N	4526	4526	1687	1687
F	18.28	32.87	14.59	19.24
R^2	0.0698	0.1438	0.1382	0.2101

Table 6
Inefficient Investment Projection

I, the dependent variable, is the capital investment; $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets; $\mathbf{I_{t-1}}$ is the capital investment of the prior year; **CF** is the beginning cash flow from operation divided by beginning assets; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Ret** is the prior year's market return; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year samples; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	I_1		I_2	
I_{t-1}	0.1435	8.38***	0.2889	8.78***
CF	0.1004	3.32***	0.1367	3.58***
Lev	-0.0601	-7.19***	-0.0669	-7.57***
Size	0.0062	2.34**	0.0026	1.65*
Q	0.0196	1.34	0.0167	2.20**
Ret	0.0462	4.13***	0.0348	5.00***
Age	-0.0054	-7.23***	-0.0024	-4.35***
Years	Control		Control	
Inds	Control		Control	
N	6213		6213	
F	44.94		98.83	
R^2	0.1185		0.2659	

Table 7

Inefficient Investment and Pyramidal Ownership Structure

ARESI, the dependent variable, is absolute of the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment (overinvestment or underinvestment); $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **CHAIN** is the number of layers from listed company to the ultimate shareholder. **FCF**, the free cash flow, equals to cash flow from operation this year minus expected capital investment derived from Richardson (2006) expected investment model; **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; C**LEV**, the debt ratio at year end; **Size** is the nature log of assets at year end. **Years**, 5 dummy variables for six year samples; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

		$ARESI_1$			$ARESI_2$	
	$ARESI_1$	$OverI_1$	$UnderI_1$	$ARESI_2$	$OverI_2$	$UnderI_2$
CHAIN	**-0.0046**	**-0.0073**	-0.0009	**-0.0030**	-0.0057	**-0.0012**
	(-2.35)**	**(-2.99)*****	(-0.62)	**(-4.34)*****	(-1.13)	**(-2.51)****
FCF	0.0403	0.1118	-0.0406	-0.0409	0.0303	-0.1254
	(3.44)***	(5.86)***	(-5.93)***	(-2.44)**	(1.84)*	(-8.17)***
V	0.0081	0.0193	0.0002	0.0110	0.0010	0.0029
	(2.01)**	(1.36)	(0.04)	(1.23)	(0.07)	(1.38)
CV	-0.0198	-0.0257	-0.0181	-0.0132	-0.0201	-0.0060
	(-2.98)***	(-1.96)**	(-2.07)**	(-4.10)***	(-2.88)***	(-1.82)*
CLev	0.0121	0.0234	0.0079	-0.0106	-0.0177	-0.0222
	(3.43)***	(3.24)***	(3.93)***	(-1.71)*	(-2.62)***	(-5.48)***
CSize	-0.0012	0.0088	-0.0096	-0.0009	-0.0018	-0.0006
	(-0.58)	(3.36)***	(-6.48)***	(-0.62)	(-0.48)	(-0.81)
Years	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control
N	6213	2071	2071	6213	2071	2071
F	10.33	6.26	7.75	13.29	3.67	25.48
R^2	0.0248	0.0424	0.0627	0.0451	0.0379	0.2149

Table 8

Inefficient Investment and Pyramidal Ownership Structure-Different Ultimate Shareholders

ARESI, the dependent variable, is absolute of the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment (overinvestment or underinvestment); $\mathbf{I_1}$ is the increase of long term assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **CHAIN** is the number of layers from listed company to the ultimate shareholder. **FCF**, the free cash flow, equals to cash flow from operation this year minus expected capital investment derived from Richardson (2006) expected investment model; **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; C**LEV**, the debt ratio at year end; **Size** is the nature log of assets at year end. **Years**, 5 dummy variables for six year samples; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	SOEs		NSOEs	
	I_1	I_2	I_1	I_2
CHAIN	-0.0017	0.0001	**-0.0039**	-0.0036
	(-0.86)	(0.25)	**(-2.26)****	(-1.38)
FCF	0.0451	-0.0515	0.0248	-0.0167
	(5.79)***	(-2.92)***	(1.34)	(-0.79)
V	0.0235	0.0114	-0.0037	0.0402
	(8.33)***	(1.71)*	(-0.37)	(3.86)***
CV	-0.0068	-0.0001	-0.0096	-0.0096
	(-1.24)	(-0.05)	(-2.91)***	(-2.33)**
CLev	0.0244	-0.0213	0.0032	-0.0072
	(11.22)***	(-6.26)***	(0.72)	(-1.57)
CSize	0.0006	-0.0005	-0.0035	0.0016
	(0.23)	(-0.24)	(-1.31)	(0.37)
Years	Control	Control	Control	Control
Inds	Control	Control	Control	Control
N	4526	4526	1687	1687
F	9.10	11.77	4.88	6.05
R^2	0.0336	0.0449	0.0544	0.0740

Table 9

Pyramid, Capital Investment and Performance

ROA, the dependent variable, the net income divided by average assets; and **EBXIOA**, net income before extraordinary items divided by the average assets; **ROE**, the net income divided by the average equity, and **EBXIOE**, net income before extraordinary items divided by the average equity; $\mathbf{I_1}$ is the increase of long term fixed assets standardized by the beginning assets; $\mathbf{RESI_1}$ is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment (overinvestment or underinvestment)**; CHAIN** is the number of layers from listed company to the ultimate shareholder; **STATE× CHAIN** is the product of STATE and CHAIN, and **STATE** is a dummy variable, 1 indicates SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	ROA			EBXIOA	ROE	EBXIOE
	Inefficiency Effect	Agency Effect	Net Effect	Net Effect	Net Effect	Net Effect
I_1	**0.5127**		**0.5095**	**0.5052**	**1.1903**	**1.1959**
	(7.54)* **		**(7.82)*** **	**(6.36)*** **	**(6.91)*** **	**(7.06)*** **
$RESI_1$	**-0.4318**		**-0.4291**	**-0.4321**	**-1.0166**	**-1.0339**
	(-6.25)* **		**(-6.43)*** **	**(-5.49)*** **	**(-5.79)*** **	**(-6.08)*** **
CHAIN		**-0.9004**	**-0.7010**	**-0.5526**	**-1.7861**	**-1.5452**
		(-5.49)* **	**(-5.48)*** **	**(-4.71)*** **	**(-5.38)*** **	**(-3.98)** **
STATE× CHAIN		**1.0705**	**0.9409**	**0.7372**	**2.5878**	**2.3906**
		(14.23)* **	**(13.14)*** **	**(8.30)*** **	**(12.51)*** **	**(11.98)*** **
STATE	-0.3190	-2.9336	-2.5327	-2.1918	-7.4697	-6.7607
	(-2.55)**	(-11.28)***	(-8.08)***	(-7.86)***	(-10.10)***	(-15.25)***

V	3.5360	3.5630	3.5542	2.5797	6.5434	5.1937
	(11.63)***	(10.84)***	(13.20)***	(8.54)***	(7.15)***	(7.93)***
CV	0.3184	-0.0527	0.1441	0.0362	0.0293	0.0130
	(0.61)	(-0.16)	(0.50)	(0.20)	(0.03)	(0.03)
Lev	-1.5514	-3.9920	-1.5116	-2.1154	5.7752	6.4192
	(-2.09)**	(-3.92)***	(-2.08)**	(-3.28)***	(11.11)***	(7.31)***
Size	0.3266	1.0603	0.3348	0.4414	0.4441	0.7096
	(4.81)***	(6.28)***	(4.95)***	(7.15)***	(2.53)**	(3.53)***
Q	1.7365	2.9332	1.7362	1.4192	3.8980	4.4051
	(2.88)***	(2.82)***	(2.79)***	(2.32)**	(1.93)*	(1.87)*
Sale	2.4017	2.4260	2.3692	2.2790	6.0308	5.5202
	(8.50)***	(10.14)***	(8.18)***	(10.05)***	(9.35)***	(8.47)***
PROA	0.0637	0.0982	0.0636	0.0805	0.1306	0.1797
	(2.31)**	(3.09)***	(2.30)**	(2.62)***	(1.89)*	(2.63)***
Age	0.1727	-0.2455	0.1786	0.1749	0.5159	0.4816
	(4.46)***	(-11.36)***	(4.48)***	(12.36)***	(11.59)***	(8.17)***
Years	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control
N	6213	6213	6213	6213	6213	6213
F	88.82	59.64	84.26	118.07	37.85	48.72
R^2	0.2748	0.2066	0.2785	0.3522	0.1514	0.1863

Table 10

Robust Test –Different Ultimate Shareholders

ROA, the dependent variable, the net income divided by the average assets; **I_1** is the increase of long term fixed assets standardized by the beginning assets; **$RESI_1$** is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment (overinvestment or underinvestment)**; CHAIN** is the number of layers from listed company to the ultimate shareholder; **STATE** is a dummy variable, 1 indicates SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	SOEs			NSOEs		
	Inefficiency Effect	Agency Effect	Net Effect	Inefficiency Effect	Agency Effect	Net Effect
I_1	**0.4341**		**0.4362**	**0.5855**		**0.5738**
	(6.34)* **		**(6.54)*** **	**(10.08)*** **		**(9.86)*** **
$RESI_1$	**-0.3638**		**-0.3656**	**-0.4922**		**-0.4836**
	(-5.01)* **		**(-5.13)*** **	**(-8.79)*** **		**(-8.68)*** **
CHAIN		0.2042	0.2510		**-0.8827**	**-0.7239**
		(1.38)	(1.40)		**(-5.19)*** **	**(-5.31)*** **
V	3.0811	3.0317	2.9912	4.6361	4.8196	4.8706
	(8.69)***	(8.32)***	(8.36)***	(6.09)***	(4.48)***	(7.81)***
CV	0.0484	0.4937	0.4991	0.7267	-0.7185	-0.2630
	(0.11)	(1.85)*	(2.01)**	(1.23)	(-1.10)	(-0.49)
Lev	-2.0231	-3.7674	-2.0165	-0.3734	-3.7681	-0.3570
	(-2.40)**	(-3.24)***	(-2.38)**	(-0.45)	(-3.97)***	(-0.45)

Size	0.4269	0.9743	0.4337	-0.3369	0.6842	-0.3623
	(7.43)***	(4.45)***	(7.57)***	(-1.11)	(2.67)***	(-1.19)
Q	2.4725	3.5272	2.4542	0.3509	1.5133	0.3529
	(2.70)***	(2.54)**	(2.65)***	(0.57)	(1.80)	(0.57)
Sale	2.1587	2.0844	2.1517	2.6176	2.7846	2.6069
	(6.14)***	(5.72)***	(6.16)***	(5.02)***	(8.29)***	(5.01)***
PROA	0.1458	0.2043	0.1472	0.0788	0.1020	0.0764
	(2.80)***	(3.44)***	(2.77)***	(3.49)***	(4.40)***	(3.51)***
Age	0.1290	-0.2113	0.1318	0.2978	-0.2019	0.3169
	(3.30)***	(-16.26)***	(3.61)***	(6.49)***	(-2.89)***	(6.93)***
Years	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control
N	4526	4526	4526	1687	1687	1687
F	69.46	50.48	67.16	24.49	16.56	24.50
R^2	0.2837	0.2190	0.2845	0.2680	0.1995	0.2757

Table 11

Robust Test-Cash Capital Investment

ROA, the dependent variable, the net income divided by the average assets, and **EBXIOA**, the dependent variable, net income before extraordinary items divided by the average assets; **ROE**, the dependent variable, the net income divided by the average equity, and **EBXIOE**, the dependent variable, net income before extraordinary items divided by the average equity; **I_2** is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **$ResI_2$** is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment (overinvestment or underinvestment)**; CHAIN** is the number of layers from listed company to the ultimate shareholder; **STATE**× **CHAIN** is the product of **STATE** and **CHAIN**, and **STATE** is a dummy variable, 1 indicates SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, , 11dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	ROA			EBXIOA			ROE			EBXIOE		
	All	SOEs	NSOEs	All	SOEs	NSOEs	All	SOEs	NSOEs	All	SOEs	NSOEs
I_2	**0.2607**	**0.2269**	**0.2730**	**0.2434**	**0.2059**	**0.2426**	**0.5936**	**0.5592**	**0.5355**	**0.5864**	**0.5411**	**0.4889**
	(6.86)* **	**(6.54)*** **	**(5.68)*** **	**(5.15)*** **	**(5.00)*** **	**(4.32)*** **	**(4.93)*** **	**(4.29)*** **	**(4.53)*** **	**(4.83)*** **	**(4.25)*** **	**(3.95)*** **
$RESI_2$	**-0.1830**	**-0.1639**	**-0.1770**	**-0.1815**	**-0.1552**	**-0.1761**	**-0.4093**	**-0.4083**	**-0.3104**	**-0.4237**	**-0.3993**	**-0.3251**
	(-3.95)* **	**(-3.67)*** **	**(-3.79)*** **	**(-3.39)*** **	**(-3.16)*** **	**(-3.17)*** **	**(-2.96)*** **	**(-2.80)*** **	**(-2.16)** **	**(-3.15)*** **	**(-3.00)*** **	**(-2.11)** **
CHAIN	**-0.7487**	0.1938	**-0.7268**	**-0.6010**	0.1399	**-0.5903**	**-1.8812**	**0.7078**	**-1.9659**	**-1.6368**	**0.8114**	**-1.7265**
	(-6.38)* **	(1.41)	**(-5.72)*** **	**(-4.99)*** **	(1.26)	**(-4.90)*** **	**(-6.30)*** **	**(1.69)* **	**(-6.42)*** **	**(-4.22)*** **	**(3.14)*** **	**(-4.19)*** **
STATE× CHAIN	**0.9430**			**0.7425**			**2.6009**			**2.3897**		
	(15.05)* **			**(9.37)*** **			**(15.08)*** **			**(13.10)*** **		
STATE	-2.4413			-2.1285			-7.2837			-6.5550		
	(-10.27)***			(-9.59)***			(-12.36)***			(-18.26)***		
V	3.5513	3.1261	3.9459	2.5686	2.2405	2.8519	6.5431	6.3216	5.3473	5.1780	5.0968	3.9812
	(12.10)***	(9.59)***	(4.35)***	(8.28)***	(5.63)***	(3.25)***	(7.29)***	(6.31)***	(2.25)**	(9.26)***	(5.54)***	(2.35)**
CV	0.0714	0.3737	-0.2370	-0.0389	0.1969	-0.2928	-0.0959	0.1243	-0.2142	-0.1241	0.7304	-1.2564

	(0.22)	(1.51)	(-0.39)	(-0.20)	(0.98)	(-0.70)	(-0.10)	(0.17)	(-0.13)	(-0.21)	(1.39)	(-1.05)
Lev	-2.0185	-2.0821	-1.5874	-2.7582	-2.9488	-1.8460	4.3969	3.5714	10.3433	4.9397	4.7981	9.3212
	(-2.29)**	(-2.11)**	(-1.72)*	(-3.41)***	(-3.22)***	(-1.75)*	(8.52)***	(3.61)***	(4.89)***	(6.50)***	(3.93)***	(9.74)***
Size	0.7093	0.7302	0.1502	0.8380	0.8065	0.3671	1.3397	1.1602	-0.1900	1.6238	1.4215	0.4481
	(5.90)***	(4.88)***	(0.49)	(5.79)***	(4.60)***	(1.27)	(3.84)**	(2.84)***	(-0.20)	(4.26)***	(3.05)***	(0.58)
Q	2.0754	2.7571	0.6999	1.8232	2.2935	0.5502	4.7065	4.8869	2.2962	5.2737	5.8322	2.5366
	(2.78)***	(2.50)**	(1.26)	(2.41)**	(2.34)**	(0.92)	(2.10)**	(1.94)*	(0.99)	(2.03)**	(1.97)*	(0.99)
Sale	2.4118	2.1404	2.7268	2.3335	2.0667	2.4473	6.1214	5.5199	5.9757	5.6384	4.9230	5.6837
	(9.28)***	(6.22)***	(6.87)***	(11.19)***	(6.85)***	(11.59)***	(10.56)***	(7.42)***	(18.51)***	(8.96)***	(6.49)***	(10.15)***
PROA	0.0794	0.1713	0.0907	0.0972	0.2132	0.1072	0.1651	0.4202	0.2067	0.2155	0.4918	0.2720
	(2.90)***	(3.27)***	(4.05)***	(3.22)***	(4.35)***	(3.40)***	(2.47)**	(3.65)***	(2.64)***	(3.20)***	(4.10)***	(3.34)***
Age	-0.0567	-0.0634	0.0230	-0.0684	-0.0691	-0.0161	-0.0444	-0.0364	0.1105	-0.0883	-0.0525	-0.0658
	(-2.55)**	(-3.27)***	(0.51)	(-5.45)***	(-4.25)***	(-0.31)	(-1.68)	(-0.94)	(0.57)	(-0.99)	(-0.72)	(-0.23)
Years	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control
N	6213	4526	1687	6213	4526	1687	6213	4526	1687	6213	4526	1687
F	72.25	59.30	19.87	98.66	83.25	27.36	32.85	33.27	7.48	41.29	42.26	9.04
R^2	0.2531	0.2625	0.2443	0.3163	0.3332	0.3081	0.1335	0.1665	0.1085	0.1622	0.2024	0.1283

Table 12

Robust Test-Overinvestment and Underinvestment Samples

ROA, the dependent variable, the net income divided by the average assets. **I** is the capital investment, **RESI** is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment**;** I_1 is the increase of long term fixed assets standardized by the beginning assets; I_2 is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **CHAIN** is the number of layers from listed company to the ultimate shareholder; **STATE× CHAIN** is the product of STATE and CHAIN, and **STATE** is a dummy variable, 1 indicate SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	Overinvestment samples		Underinvestment samples	
	I_1	I_2	I_1	I_2
I	**0.3204**	**0.1915**	**0.5907**	**0.2615**
	(3.58)* **	**(3.87)*** **	**(6.38)*** **	**(9.40)*** **
RESI	**-0.3115**	**-0.1691**	**-0.3974**	**-0.1800**
	(-3.39)* **	**(-3.34)*** **	**(-6.36)*** **	**(-2.92)*** **
CHAIN	**-0.3151**	**-0.8653**	**-0.8928**	**-0.4340**
	**(-1.65)* **	**(-5.12)*** **	**(-6.12)*** **	**(-2.12)*** **
STATE× CHAIN	**0.4146**	**1.0059**	**1.1749**	**0.5526**
	**(1.91)* **	**(4.89)*** **	**(6.30)*** **	**(2.30)** **
STATE	-1.4168	-2.6316	-3.1759	-1.4572
	(-2.94)***	(-5.64)***	(-3.86)***	(-2.28)**
V	3.9283	3.7583	4.8716	3.7107
	(13.68)***	(16.75)***	(34.39)***	(4.75)***
CV	0.3144	0.0533	0.1583	0.0281
	(1.79)*	(0.25)	(0.37)	(0.06)
Lev	-1.0074	-0.9597	-0.8715	-4.8856
	(-0.89)	(-0.74)	(-0.89)	(-5.35)***
Size	0.3819	0.7689	0.1387	0.5868
	(4.25)***	(3.81)***	(1.86)*	(4.02)***
Q	2.0169	2.5210	1.9084	1.7391
	(11.32)***	(5.55)***	(1.77)*	(2.04)**
Sale	1.5797	1.9633	2.5159	2.6537
	(5.25)***	(8.61)***	(9.48)***	(6.62)***
PROA	0.1069	0.0635	0.1289	0.2440
	(2.26)**	(2.36)**	(4.19)***	(6.22)***
Age	0.1240	-0.0869	0.1940	-0.0174

	(3.03)***	(-7.07)***	(2.40)**	(-0.59)
Years	Control	Control	Control	Control
Inds	Control	Control	Control	Control
N	2071	2071	2071	2071
F	26.64	27.73	33.10	24.73
R^2	0.2841	0.2827	0.3066	0.2600

Table 13

Non-linear relationship

ROA, the dependent variable, the net income divided by the average assets. **I** is the capital investment, **RESI** is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment**;** $\mathbf{I_1}$ is the increase of long term fixed assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **CHAIN** is the number of layers from listed company to the ultimate shareholder; CHAINSQ is the square form of CHAIN; **STATE× CHAIN** is the product of STATE and CHAIN, STATE× CHAINSQ is the product of STATE and CHAINAQ, and **State** is a dummy variable, 1 indicate SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, , 11dummy variables for 12 industries. In the parentheses are the Newey**-**West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	Non-linear for CHAIN		Non-linear for STATECHAIN		Non-linear for both	
	I_1	I_2	I_1	I_2	I_1	I_2
I	**0.5082**	**0.2602**	**0.5093**	**0.2608**	**0.5075**	**0.2600**
	(7.86)* **	**(6.85)*** **	**(7.80)*** **	**(6.82)*** **	**(7.91)*** **	**(6.91)*** **
RESI	**-0.4279**	**-0.1825**	**-0.4290**	**-0.1831**	**-0.4274**	**-0.1825**
	(-6.46)* **	**(-3.93)*** **	**(-6.41)*** **	**(-3.93)*** **	**(-6.49)*** **	**(-3.96)*** **
CHAIN	-0.4644	-0.6864	**-0.7093**	**-0.7545**	-0.8008	-0.9963
	(-1.17)	(-1.52)	**(-5.72)*** **	**(-6.64)*** **	(-1.61)	(-1.60)
CHAINSQ	-0.0410	-0.0092			0.0184	0.0454
	(-0.74)	(-0.13)			(0.23)	(0.43)
STATE× CHAIN	**0.9188**	**0.9251**	**1.4041**	**1.2532**	**1.4958**	**1.4971**
	(13.90)* **	**(14.07)*** **	**(6.61)*** **	**(5.96)*** **	**(4.31)*** **	**(3.07)*** **
STATE× CHAINSQ			-0.0870	-0.0584	-0.1057	-0.1049
			(-1.59)	(-1.41)	(-1.63)	(-1.22)
STATE	-2.4757	-2.3894	-3.0786	-2.8058	-3.1602	-3.0663
	(-8.51)***	(-10.83)***	(-6.56)***	(-7.17)***	(-7.58)***	(-5.82)***

V	3.5464	3.5541	3.5271	3.5359	3.5302	3.5397
	(13.50)***	(12.64)***	(13.28)***	(12.25)***	(13.15)***	(12.12)***
CV	0.1297	0.0538	0.0998	0.0392	0.0831	0.0092
	(0.45)	(0.17)	(0.33)	(0.11)	(0.29)	(0.03)
Lev	-1.5352	-2.0411	-1.5222	-2.0315	-1.5333	-2.0356
	(-2.11)**	(-2.31)**	(-2.11)**	(-2.31)**	(-2.12)**	(-2.32)**
Size	0.3382	0.7108	0.3329	0.7071	0.3367	0.7087
	(4.94)***	(5.93)***	(4.89)***	(5.84)***	(4.85)***	(5.89)***
Q	1.7405	2.0773	1.7355	2.0738	1.7381	2.0732
	(2.80)***	(2.79)***	(2.80)***	(2.79)***	(2.81)***	(2.80)***
Sale	2.3673	2.4103	2.3669	2.4118	2.3573	2.3990
	(8.16)***	(9.25)***	(8.19)***	(9.29)***	(8.06)***	(9.05)***
PROA	0.0636	0.0793	0.0635	0.0792	0.0637	0.0794
	(2.30)**	(2.90)***	(2.30)**	(2.90)***	(2.31)**	(2.92)***
Age	0.1782	-0.0553	0.1787	-0.0560	0.1789	-0.0539
	(4.43)***	(-2.39)**	(4.49)***	(-2.52)**	(4.46)***	(-2.35)**
Years	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control
N	6213	6213	6213	6213	6213	6213
F	81.44	69.83	81.50	69.87	78.89	67.67
R^2	0.2786	0.2531	0.2787	0.2532	0.2788	0.2534

Table 14

Model Selection

ROA, the dependent variable, the net income divided by the average assets. **I** is the capital investment, **RESI** is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment**;** $\mathbf{I_1}$ is the increase of long term fixed assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **CHAIN** is the number of layers from listed company to the ultimate shareholder; **STATE× CHAIN** is the product of STATE and CHAIN, and **STATE** is a dummy variable, 1 indicate SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, 11 dummy variables for 12 industries. For the OLS regression, in the parentheses are the White–adjusted t statistics considering the heteroscedasticity; For Fama-Macbeth columns in the parentheses are Fama-Macbeth standard errors adjusted statistics, for CL-2 are the two-way cluster robust standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	OLS		Fama-Macbeth		CL-2	
	I_1	I_2	I_1	I_2	I_1	I_2
I	**0.5178**	**0.2653**	**0.5094**	**0.2607**	**0.5178**	**0.2653**
	(19.92)* **	**(16.09)*** **	**(8.49)*** **	**(7.83)*** **	**(17.27)*** **	**(14.94)*** **
RESI	**-0.4357**	**-0.1861**	**-0.4291**	**-0.1830**	**-0.4357**	**-0.1861**
	(-16.45)* **	**(-10.40)*** **	**(-7.23)*** **	**(-4.54)*** **	**(-14.50)*** **	**(-10.13)*** **
CHAIN	**-0.8184**	**-0.8541**	**-0.7010**	**-0.7487**	**-0.8184**	**-0.8541**
	(-4.92)* **	**(-5.04)*** **	**(-4.56)*** **	**(-4.56)*** **	**(-4.02)*** **	**(-4.13)*** **
STATE× CHAIN	**1.0849**	**1.0482**	**0.9409**	**0.9430**	**1.0849**	**1.0482**
	(5.54)* **	**(5.26)*** **	**(6.82)*** **	**(6.52)*** **	**(4.81)*** **	**(4.58)*** **
STATE	-2.8688	-2.6598	-2.5326	-2.4413	-2.8688	-2.6598
	(-5.74)***	(-5.23)***	(-7.01)***	(-6.68)***	(-5.30)***	(-4.86)***
V	3.6889	3.7986	3.5542	3.5513	3.6889	3.7986
	(7.61)***	(7.70)***	(10.71)***	(10.97)***	(7.82)***	(7.94)***
CV	0.3293	0.2435	0.1441	0.0714	0.3293	0.2435

	(0.95)	(0.69)	(0.28)	(0.13)	(0.88)	(0.64)
Lev	-1.8867	-2.4197	-1.5116	-2.0185	-1.8867	-2.4197
	(-5.34)***	(-6.81)***	(-2.04)**	(-2.39)**	(-3.48)***	(-4.36)***
Size	0.2917	0.6798	0.3347	0.7093	0.2917	0.6798
	(2.73)***	(6.54)***	(2.44)**	(4.18)***	(2.54)**	(6.04)***
Q	2.2131	2.2981	1.7361	2.0754	2.2131	1.2716
	(13.40)***	(13.68)***	(3.12)***	(3.23)***	(11.64)***	(4.57)***
Sale	0.9973	1.2716	2.3691	2.4118	0.9974	2.2981
	(5.66)***	(7.15)***	(9.12)***	(9.91)***	(3.73)**	(12.25)***
PROA	0.0373	0.0518	0.0636	0.0794	0.0373	0.0518
	(6.71)***	(9.29)***	(2.13)**	(2.57)**	(2.41)**	(3.11)***
Age	0.1893	-0.0453	0.1786	-0.0567	0.1893	-0.0453
	(5.58)***	(-1.54)	(4.06)***	(-1.82)*	(5.63)***	(-1.65)*
Years	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control
N	6213	6213	6213	6213	6213	6213
F	84.26	72.25	84.26	72.25	84.26	72.25
R^2	0.2787	0.2531	0.2787	0.2531	0.2785	0.2531

Table 15

Long-term Performances

AROA, the dependent variable, the average ROA during the sample period; A**I** is the average I, A**RESI** is the average **RESI**; $\mathbf{I_1}$ is the increase of long term fixed assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **ACHAIN** is the average CHAIN; A**STATE**× **CHAIN** is the product of STATE and ACHAIN, and **STATE** is a dummy variable, 1 indicates SOEs and 0 otherwise. A**V** is the average V; A**CV** is the average CV; A**LEV** is the average Lev; A**Size** is the average Size. A**Q** is average Q; A**Sale** is the average Sale; AP**ROA** is the average PROA; A**Age** is the average Age; In the parentheses are the white statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	All		Listed all the time	
	I_1	I_2	I_1	I_2
AI	**0.9416**	**0.3865**	**0.9514**	**0.2958**
	(7.65)***	**(6.09)*****	**(8.11)*****	**(4.54)*****
ARESI	**-0.8953**	**-0.3258**	**-0.9493**	**-0.2735**
	(-6.55)***	**(-3.89)*****	**(-7.53)*****	**(-3.28)*****
ACHAIN	**-0.5278**	**-0.7487**	**-0.4717**	**-0.5076**
	(-1.85)*	**(-2.55)****	**(-1.91)***	**(-2.02)****
ASTATE× CHAIN	**0.6401**	**0.8706**	**0.6489**	**0.5562**
	(1.97)**	**(2.53)****	**(2.27)****	**(1.90)***
STATE	-1.5865	-2.0781	-2.0138	-1.6681
	(-2.02)**	(-2.53)**	(-2.88)***	(-2.33)**
AV	2.5995	2.7133	2.3952	2.4652
	(3.76)***	(3.64)***	(3.95)***	(3.74)***
ACV	-0.0808	-0.0025	0.3948	0.2806
	(-0.15)	(-0.00)	(0.75)	(0.51)
ALev	-3.0906	-4.4518	2.0971	-0.1443
	(-3.13)***	(-4.32)***	(1.94)*	(-0.13)
ASize	0.0284	0.8136	-0.4504	0.3918
	(0.15)	(4.66)***	(-2.37)**	(2.24)**
AQ	0.4477	1.1059	0.5770	1.4687
	(0.79)	(2.08)**	(1.37)	(3.10)***
ASale	2.4975	2.6875	1.5526	1.5929
	(7.88)***	(7.87)***	(4.90)***	(4.90)***
APROA	0.0224	0.0483	0.2986	0.3544
	(0.35)	(0.64)	(4.56)***	(5.42)***
AAge	0.5605	0.0216	0.5676	0.0588
	(5.16)***	(0.37)	(6.78)***	(1.26)
Inds	Control	Control	Control	Control
N	1199	1199	823	823
F	60.83	49.45	79.28	70.27
R^2	0.5577	0.5027	0.7076	0.6788

Table 16

Endogenous Problem

ROA, the dependent variable, the net income divided by the average assets. **I** is the capital investment, **RESI** is the residual derived from Richardson (2006) expected investment model, proxy for the scale of inefficient investment**;** $\mathbf{I_1}$ is the increase of long term fixed assets standardized by the beginning assets; $\mathbf{I_2}$ is the cash purchase in long-term equity investment, debt investment, fixed assets, intangible assets and other assets, then minus the cash flow from selling of fixed assets, intangible assets and other assets, standardized by the beginning assets. **CHAIN** is the number of layers from listed company to the ultimate shareholder; **STATE×CHAIN** is the product of STATE and CHAIN, and **STATE** is a dummy variable, 1 indicates SOEs and 0 otherwise. Control variables include: **V**, the total voting right of ultimate shareholder in the listed companies; **CV** is the deviation of cash flow right from voting right, equals to cash flow right divided by voting right; **LEV**, the debt ratio at the beginning of year; **Size** is the nature log of beginning assets. **Q** is Tobin's Q, which is calculated as the market value of assets divided by book value; **Sale** is the prior year's sales revenue divided by beginning assets; P**ROA** is the accounting performance for the prior year; **Age** is the time span from IPO year; **Years**, 5 dummy variables for six year; **Inds**, 11 dummy variables for 12 industries. In the parentheses are the Newey-West modified for Fama-Macbeth standard errors adjusted statistics. ***, **, and * denote significant at the 0.01, 0.05, and 0.10 level, respectively.

	Prechain		NoChange		Change	
	I_1	I_2	I_1	I_2	I_1	I_2
I	**0.5873**	**0.2956**	**0.4987**	**0.2412**	**0.4284**	**0.2896**
	(8.13)* **	**(6.45)*** **	**(8.06)*** **	**(7.25)*** **	**(4.63)*** **	**(3.08)*** **
RESI	**-0.4896**	**-0.2236**	**-0.4249**	**-0.1684**	**-0.3351**	-0.1454
	(-7.74)* **	**(-4.01)*** **	**(-6.48)*** **	**(-4.30)*** **	**(-3.72)*** **	(-1.28)
CHAIN	**-0.6162**	**-0.6201**	**-0.4026**	**-0.4531**	**-1.4378**	**-1.0854**
	(-5.26)* **	**(-5.53)*** **	**(-4.22)*** **	**(-5.46)*** **	**(-3.74)*** **	**(-2.46)** **
STATE×CHAIN	**0.8503**	**0.8559**	**0.7286**	**0.7616**	**1.2846**	0.6026
	(9.13)* **	**(10.58)*** **	**(6.07)*** **	**(8.74)*** **	**(2.75)*** **	(1.26)
STATE	-2.4384	-2.2629	-2.5250	-2.5307	-1.7185	0.0013
	(-6.19)***	(-5.96)***	(-3.93)***	(-4.90)***	(-1.08)	(0.00)
V	3.4250	3.3147	3.1222	3.2066	3.6873	3.4878
	(11.95)***	(10.62)***	(7.88)***	(8.10)***	(9.65)***	(7.44)***
CV	0.6133	0.5947	0.7099	0.6422	-1.5037	-1.0732
	(2.44)**	(2.24)**	(2.47)**	(1.74)*	(-1.61)	(-0.98)
Lev	-0.9435	-2.0106	-1.6995	-2.2418	0.2325	0.3803
	(-2.06)**	(-3.74)***	(-2.36)**	(-2.68)***	(0.15)	(0.21)
Size	0.1314	0.6605	0.3073	0.6867	0.3669	0.5084
	(1.88)*	(8.36)***	(4.75)***	(8.00)***	(1.00)	(1.09)
Q	1.9879	2.2223	1.5826	1.9617	2.0142	2.3767
	(3.10)***	(3.08)***	(2.56)**	(2.68)***	(2.88)***	(3.18)***
Sale	2.1469	2.2054	2.2660	2.2841	4.1812	4.2272
	(7.23)***	(9.61)***	(9.51)***	(10.81)***	(4.94)***	(4.99)***
PROA	7.6743	9.5442	0.0913	0.1102	0.0657	0.0818
	(2.71)***	(3.52)***	(5.68)***	(6.93)***	(0.76)	(0.87)
Age	0.2265	-0.0157	0.1961	-0.0451	-0.0941	-0.2273

	(9.14)***	(-1.54)	(4.28)***	(-1.70)*	(-1.24)	(-2.53)**
Years	Control	Control	Control	Control	Control	Control
Inds	Control	Control	Control	Control	Control	Control
N	4997	4997	5471	5471	742	742
F	74.64	62.44	80.55	69.45	8.69	7.69
R^2	0.2961	0.2603	0.2960	0.2701	0.2578	0.2384