How to Explain Corporate Investment Heterogeneity in China’s New Normal: Structural Models with State-owned Property Rights ☆

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Abstract

This paper studies corporate investment and its structural change by the view of state-owned property right. By constructing dynamic investment decision-making model, we find corporate investment heterogeneity in China due to their different dynamic shifts of objective functions, demonstrated by our simulations. Empirical tests imply that the expansion of investment improves financial performance, but does not play a positive role on solving social employment. POEs expanded investment much more than SOEs did, even in the transitional period, but both of them reduced their investment significantly in New Normal. Mechanisms are explored by 3-stage structural models for non-matched control group and nearest neighbor PSM matched control group. Although investment inefficiency of SOEs are concerned, executive stock ownership and equity finance could be exotic methods to stimulate efficient investment. Investment efficiency of POEs has been recovered in New Normal but POEs have shifted away from ‘profit-driving’ they used to be in the old normal.

JEL classification: G15, G21,G32.

Keywords: State-owned Property Rights; Financial Crisis; Investment.

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1. Introduction

China’s slowdown and its structural transformation have been attracting global attention since the end of 2015.\(^1\) Over-debt and over-investment are regarded as the main causes. In normal economic times, Diego (2013) established that physical investment is the key to China’s growth miracle which is exploited by the structural transformation during the period 1952-2006. Knight (2014) also considered high investment as the crucial factor of China’s Developmental State,\(^2\) which generated a virtuous circle of rapid growth - high confidence, high investment, high growth, high confidence- and kept it going. In order to exploit the key to China’s sustainable growth, we examine the structural change of micro corporate investment behavior in this paper, focusing on the state-owned property rights as a resource of its heterogeneity for Chinese firms.

This current paper exploits China’s corporate investment behavior by two dimensions, vertical and horizontal, respectively. In the vertical dimension, the structural changes are tested on the evolution over time. The question is whether there is structural transformation of the effects on firm’s investment and its micro mechanism. If the answer is yes, what’s the difference between China’s old normal and new normal. On the other hand, the horizontal dimension is state-owned property right which is a special feature of China’s companies. Song et al. (2011) examined the difference on productivity and access to financial markets between SOEs (State-Owned Enterprises) and POEs (Private-Owned Enterprises). What is the difference of corporate investment behavior between them in the current China’s slowdown background?

Several articles examined the effect from the financial crisis in 2008, which found a reduction in investment for US companies and European companies. Campello et al. (2010), Campello et al. (2011), Kahle and Stulz (2013) examined capital expenditures fall from credit constraints. There is no signs of investment reduction in China during financial crisis, because there was no bank lending supply shock as US and EU. On the contrary, Chinese state-owned enterprises was funded by a great amount of bank loans from China’s economic stimulus package. Liu et al. (forthcoming) found that bank lending became less responsive to firm profitablity, the stimulus package and the associate increase in bank loan supply resulted in more resources being allocated to SOEs. Therefore, the credit constraint as US and EU companies faced hasn’t appear for Chinese SOEs, but it may still exist for POEs. But SOEs have to take on social responsibilities and their managers may have more concerns on the impact of high risk investment on their job promotion. Our analysis is based on a dynamic model of corporate investment strategy considering different state-owned property rights. The reason why there is heterogeneity in China’s corporate investment is that optimization

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\(^1\)The very first concern on China’s slowdown was revealed by Yellen’s speech on the last declining to raise interest rate of FOMC (Federal Open Market Committee) in September, 2015.

\(^2\)“Enterprises that were owned or controlled by government has access to a ready supply of bank loans at low rates of interest, the non-state enterprises that were not linked to government were sufficiently profitable to be able to rely on their own retained profits.” After analyzing the origins, evolution, incentives and successes of China’s developmental state, he questioned on whether the developmental state itself can be maintained and revealed the adverse shock that threatening the solvency of the banking system and the demand for and supply of funds for investment might result in the consequent slowdown in economic growth. Research group on China’s economic growth (2014) documented that China’s structural slowdown resulted from the triple shocks on investment, employment and learning-by-doing.
objective function shifts differently between SOEs and POEs. POE’s financial distress boundary coming from credit constraints shifts left after the recent global financial crisis. Some POEs abandon their original objectives of value maximization which results in investment expansion even if they are facing financial constraints and economic downturn. Other POEs reduced their investment due to the concerns on increasing risk. Their investment declines as the same trend as European and American companies did after the great recession. For SOEs, some of them reduced investment even if the central government has pushed them to expand investment over and over, including providing large amounts of fundings. Our theoretical model explains that although SOEs have to take on the social responsibility, their investment strategy also shifts since there are severe agency problem due to the decentralized information and incentive problems as Milton and Raviv (1996) suggested.

Using corporate panel data from 2004 to 2015, this current paper has the following three findings. First, we examine the structural change of corporate investment in China’s New Normal. Three-stage Difference-in-Difference analysis based on different time windows implies that the structural transformation is significant. Two shocks are considered, including financial crisis and turn points of transformation. The empirical results imply that the year, 2013, is the starting point of China’s New Normal, while 2011-2012 is the interim period. This provides evidence of the structural transformation of China, especially in micro corporate investment behavior. 3

Second, the real effects of investment expansion considering structural transformation are further examined in this paper. In order to know whether investment expansion promoted sustainable economic growth, I also examined the social performance in addition to financial performance. The empirical tests imply that expansion of investment is able to improve financial performance which is about 3% on average, but no significant evidence on improving social performance. Deeply separating the wheat from the chaff, although SOEs are better at social performance than POEs are, there is no evidence that investment expansion improves employment problem in either SOEs or POEs. IMF (2016) recently highlighted global downside risks from 7 perspectives, the second of which is right the international ramifications of the economic transition in China. This paper shows the real structural transformation and its effect in China by considering China’s special feature, state-owned property rights.

Third, the reason why there are heterogeneity of investment behavior not only in SOEs but also in POEs is that their profit vs. risk trade-off shifts differently. In transitional period, 43.3% of SOEs expanded their investment while the percentage is 51.1% for POEs. The ratio declined to 33.3% and 39.5% for SOEs and POEs in new normal economy, respectively. Using propensity score matching method, the heterogeneity from the impact from agency problem, external financing, and profit vs. risk trade-off implies that POEs have transformed from profit-incentive in old normal

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3Stern and Green (2015) regarded growth rate as the measure of China’s New Normal. They defined new normal between 2012 and 2014 since China’s growth rate is slowing to 7-8% over 2012-2014 while average is 10.5% over the old normal between 2000 and 2010. WorldBank (2015) also addressed that in China, structural reforms, a gradual withdrawal of fiscal stimulus, and continued prudential measures to slow credit expansion will result in slowing growth to 6.9 percent by 2017 from 7.4 percent in 2014.
economy as Knight (2014) described into risk-averse in the new normal economy. Since the investment expansion is unsustainable and has no significant benefits to employment, China’s formal developmental state policy, i.e., virtuous circle of high confidence, high investment and high growth, as Knight (2014) put forward, is going to be broken. Investment expansion, as the main effective factor of China’s sustainable economic growth, is unsustainable in the new normal economy, thus China do have some concerns on economic sustainable growth.

In the current paper, we attempt to contribute to the literature on Coase’s theory of firm. Grossman and Hart (1986) and Hart and Moore (1990) examined this topic using incomplete contracts. But it is hard to make progress because of the difficulty of formalizing haggling costs as Hart (2008) referred to. This topic is facing an emerging improvement currently, one of the important exploring on China’s market. Huang et al. (2017) added to the general literature of local information and firm decentralization. Chen and Wen (2017) interpreted China’s housing boom as a rational bubble which can crowd out productive capital investment, and capital returns of private firms have larger and more significant predictive power on excess housing returns than do capital returns of SOE. This current paper firstly describes the dynamic process of firm’s production and documents the objective for firms in different state ownership, attempting to examine this topic by analyzing its dynamic shift facing shocks of great recession. The difference from state ownership is described by objective functions and credit constraints. Although China’s government set off economic stimulus plan, we still find investment decline not only in POEs but also in SOEs. The firms reducing investment are more than those expanding investment which is implied not only by our theoretical simulation but also by our empirical regressions. Our current paper is helpful to provide evidence that the corporate investment heterogeneity does exist in China and give us a clearer view on the structural change for the research in the future.

The remainder of the paper is organized as follows: Section 2 describes the background and provides an overview of the relevant literatures; Section 3 provides theoretical analysis on dynamic shift of the optimization objectives; Section 4 analyzes the structural changes based on DiD models; Section 5 examines the effect of expanding investment; and in section 6 we discuss the mechanism of China’s investment heterogeneity through three perspectives and their structural changes. A short conclusion is given in section 7.

2. Background and literature

2.1. China’s stimulus policy and New Normal

After the global financial crisis of 2008, China’s central and local government have implemented at least four turns of policies to stimulate and stabilize China’s economic growth. First round, the 4 trillion new bank loans from 2008 to 2009 bring the signs of economic recovery at the end of 2009 when China becomes the second largest economy in the world. In the second round, China’s National Development and Reform Commission (NDRC) sped up the approval of the project to simulate the economy in 2010. As a result, the economic rebound has lasted for 18 months and
domestic A-share stock market rises 33% from the bottom to the periodic peak. Third round, in order to ease the pressure of economic downturn in 2012, Chinese central bank lowered the deposit-reserve ratio, and NDRC kept speeding up the approval of the project. But the economic rebound has only lasted for 12 months and market rose 23%. Economy slowed down again in the second quarter of 2013. The fourth new round of economic stimulus was injected in a dose in July, 2013, adding open market operation by central bank. But the economic rebound has lasted for only 6 months and Chinese A-share stock market rose 12%. During this period, the ratio of investment to GDP has risen from 48% in 2010 to over 50% in 2013. It is easy to find that these economic stimulus plans were carried out around the investment but its effective period was getting shorter and shorter. Consequently, skepticism on the Sustainability of China’s investment and financing shows up, which is also considered as the key factor influencing the stable growth in China economy. 4

People’s Daily of August 2014, the Chinese official newspaper representing the voice of the Central Communist Party, spent three consecutive days interpreting President Xi Jinping’s speech on China’s New Normal on the front page. New Normal was defined as the current economy as a superposition of transition of growth, economic adjustment and digestion of economic stimulus (Zhang (2015)). Lin (2012) thought the China’s New Normal wouldn’t be immutable. "Infrastructure investing will be a win-win strategy for the developed and developing countries, both now and in the future.” Recently, macro economists are emerging to discuss whether China’s future GDP growth will be of L-shape or U-shape (Higginsa et al. (2016) ), which also implies that the China economy is facing a turn point. This paper firstly aims to test whether there is any structural change of corporate investment behavior and when it is. Two shocks are considered, including financial crisis and points of transition.

Financial crisis is the first shock we aim to investigate, which results in credit constraints (Campello et al. (2010)). Literatures on US and European companies concluded that companies declined their investment because of liquidity scarce (Campello et al. (2011), Tong and Wei (2011)) and demand shrinkage (Kahle and Stulz (2013)). Bianchi and Melosi (2017) highlighted the macroeconomic effects of fiscal shocks before, at and after the onset of Great Recession. Financial crisis or great recession is regarded as the turn point of New Normal (Greenstone et al. (2015)) which found that lending shocks led to economically small declines in both small firm and overall employment. But China shows a special trend that the growth rate of the total investment in fixed assets was more that 15% from 2008 to 2011, even reached a peak of 30% in 2009 (Xu et al. (2013), Higginsa et al. (2016)). Investment expansion is an important part of the economic stimulus plan in China and is the key of steady economic growth. Considering there are many views on the beginning of the New Normal, this paper will test the different time window one by one in Section 4.

Idiosyncratic risk is the second effect on corporate investment during financial crisis. Bachmann et al. (2013) constructed empirical proxies for time-varying business-level uncertainty. Idiosyncratic

4 Global Monitoring Report of World Bank in 2014 implied that China’s economic slowdown would drag down the growth of developed countries about 0.15%. 4
risk rises, firm investment falls, and more so when managers own a larger fraction of the firm (Panousi and Papanikolaou (2012)). Gulen and Ion (2016) found a strong negative relationship between firm-level capital investment and the aggregate level of uncertainty. Policy uncertainty can depress corporate investment by inducing precautionary delays due to investment irreversibility. They found a roughly one-third of the 32% fall in capital investments between 2007 and 2009. Although we found roughly 20% fall in our SOE and POE subsamples in 2009, which is still higher than the fall of US companies in Gulen and Ion (2016). Bloom (2009) offered a structural framework to analyze the impact of these uncertainty shocks, which found that stock-markets levels generate a much more gradual drop and rebound in activity lasting 2 to 3 years. Therefore, we use the risk from stock market to specify each firm’s risk instead of policy uncertainty.

2.2. State-owned property rights

Figure 1 shows the growth of investment. HZZ line in blue is calculated by Higginsa et al. (2016) based on CEIC’s China Premium Database, which compiles Chinese official macroeconomic time series. In order to examine the effects of the state ownership, we compares the growth of investment in two groups: a group that should be directly affected by state ownership, which is the treated group, and a group that should not be directly affected by state ownership, which is control group. The treated group is from the SOEs in our sample, the control group is from the POEs in the sample. We match each SOE with the firm in POE subsample, using the nearest neighbor propensity score matching method based on secondary industry, province, firm size and age. The red line in Figure 1 is the median of treated group’s investment growth, which is much lower than the green line of control group. For POEs, the growth of investment is positive in 2010 and 2011, and stayed negative in 2013 ~ 2015, while we find a negative growth of investment for SOEs in majority of the period.

State-owned property rights is a special feature of Chinese companies, which is important to their investment (Liu and Siu (2012)). The motivations for investment are concluded by Hart et al. (1996) as reducing cost and improving quality. The managers in SOEs are lack of enthusiasm in both of these two objectives (Shleifer (1998)). Agency costs, low investment efficiency and soft budget constraints lead to under-investment in SOEs (Knyazeva et al. (2013)). Nonperformance loan (NPL) is also a concrete form of investment inefficiency for Chinese SOEs. The domestic academic research reveals the duality of investment in SOEs. On the one hand, the first class of principal-agent problems between shareholder and manager generally exists in SOEs. In fact, state-owned listed companies have been in the absence of the owner for a long time. What the manager pursue is job promotion, job consumption and gray income (Lu et al. (2013)). There is a positive correlation between the increase of operating income and the manager’s promotion in central SOE (Yang et al. (2013)). Investment of SOEs depends on the return on their assets (Li

\footnote{They estimated the Chinese listed companies’ investment discount rate in 2001-2005, finding that non-state-owned enterprises’ discount rate was 10% higher than state-owned enterprises’. Meanwhile, non-state-owned enterprises and enterprises with better corporate governance relatively invest less.}

\footnote{NPL accounted for 162% of China’s GDP (Siqueira et al. (2009)).}
Fig. 1. Investment Growth with Different Ownership. HZZ investment growth is calculated by Higginsa et al. (2016) based on CEIC’s China Premium Database, which compiles Chinese official macroeconomic time series. SOE and POE are plotted by the median of our sample winsorized at the 1st and 99th percentiles by year.

Therefore, a lot of managers in SOEs do nothing and expect promotion safely. On the other hand, SOEs have to take on the social responsibility to solve the issues in employment, social stability and pension (Lin et al. (2004)), and get more government subsidies than POEs (Kong et al. (2013) even found that the firms in loss tend to obtain more subsidies), which result in the long term existence of soft constraints of budget. SOEs obtained a large number of bank loans through economic stimulus plans after the current financial crisis. They have to take on the responsibility to expand investment and to absorb employment. Overall, there are two kinds of behavior presented by SOEs after the financial crisis, the reduction of investment caused by principal-agent problem and the expansion of investment caused by the political burden.

POEs have an advantage over the SOEs in the aspects of the mechanism of governance (Hu et al. (2005)). Empirical results implied that investment of POEs are more sensitive to the cash flow than SOEs are (Luo (2007)). The behavior of POEs may be consistent with the conclusion of the international literature because of the increasing financing constraints which will reduce their investment because their investment is positively sensitive to their cash flow which went down after the financial crisis. In addition, some of the entrepreneurs in POEs are always seeking stability after having become prosperous. These POEs should have shown a similar trend to the conclusions as Lins et al. (2013). On the contrary, POEs always face the second kind of principal-agent problem between the major shareholders and small shareholders. Entrenchment effect is widespread in SOEs through the cash holdings (Luo (2007)), especially in listed companies. Cash dividends are used as a means to tunnel rather than a means to curtail the agency problem (Huang et al. (2011)). The M&A of POEs and the bond financing market developed rapidly. A large number

7From the Wind Report in 2013, there were 2136 corporate bonds of unlisted companies, with face value of 2.9

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of internet corporation acquire plenty of cash flow and expand investment through equity finance abroad. Thus, principal-agent problem in POEs lead to the expansion of investment. In summary, there also exists two investment behavior of POEs, the reduction of investment caused by financing constraints and the expansion of investment caused by principal-agent problem.

The influence of state-owned property rights is exploited in this paper. State-owned property right’s impact on the investment of Chinese enterprises has been checked in a large amount of literatures, but the mechanism is complicated. Recently, Jiang and Kim (2015) provides a modern overview of corporate governance in China which surveys the difference between SOEs and non-SOEs. Some articles revealed that POEs and large SOEs invest more positively and more eager to expansion (Luo (2007)). Is this conclusion still holds after the financial crisis or in the China’s New Normal? Or do Chinese SOEs and POEs cut investment as European and American companies did (Campello et al. (2010), Campello et al. (2011) and Lins et al. (2013))?

3. Theoretical analysis

3.1. Dynamic process of firm’s production

Baker and Wurgler (2013) pointed out that a complete explanation of financing and investment patterns requires a correct understanding of the beliefs and preferences of managers and investors. These two sets of agents are supposed to develop unbiased forecasts about future events and use these to make decisions that best serve their own interests. It has been hard to make progress on Coase’s theory of firm because of the difficulty of formalizing haggling costs. Using contracts as reference points to which parties feel entitled is a substitute for the assumptions of incomplete contracts and ex post bargaining over the surplus that drive the results in Grossman and Hart (1986) and Hart and Moore (1990)). Hart (2008) uses reference points more broadly as the underpinning for a theory of the firm. Because we do not observe this sort of bargaining within real firms, the reference point approach may outlive the existing architecture of the property rights theory of the firm.

We construct dynamic process to examine corporate investment decision. Let $K$ and $I$ denote the level of capital stock and gross investment rate, respectively. Following DeMarzo et al. (2012)’s capital accumulation model, the firm’s capital stock $K$ evolves according to

$$dK_t = (I_t - \delta K_t)dt$$  \hspace{1cm} (1)

where $\delta > 0$ is the depreciation rate.

Since Lehman Brothers broke on September 15, 2008, the global financial crisis has had strong trillion RMB, and 1071 corporate bonds of listed companies, with face value of 0.76 trillion RMB. While there were only 210 corporate bonds of unlisted companies (0.34 trillion RMB) and 5 corporate bonds of listed companies (0.011 trillion) by the end of 2007. After the financial crisis, bond financing grew from nothing in China and developed rapidly.
impact on the economy. Introducing the following uncertainty as Albuquerue and Wang (2008)

\[ dK_t = (I_t - I_{old}) dt + \sigma_1 I_t dZ_t \]  

(2)

where \( \sigma_1 > 0 \) is the constant volatility parameter, \( Z_t \) is a Brownian motion, and \( K_0 > 0 \).

Suppose \( I_{old} \) is the gross investment rate without structural change, i.e. in the old normal, and \( \Delta I_t \) is the additional change, which will be either positive meaning expansion caused by government policy or negative implying reduction due to risk aversion. Then capital stock will change after the shock, satisfying

\[ dK_t = (I_{old} + \Delta I_t - I_{old} \Delta K_t) dt + \sigma_2(I_{old} + \Delta I_t) dZ_t \]  

(3)

where volatility parameter \( \sigma_2 \) is different from the risk in the old normal, which is indicated as \( \sigma_1 \). If it is in new normal, it is still exogenous, meaning it is constant. But if it is in transitional period, the equilibrium was broken and the new equilibrium is still not constructed, \( \sigma_2 \) will be endogenous, depending on investment. It is supposed to the increasing function of \( \Delta I_t \).

The firm’s operating profit \( dY_t \) over time increment \( dt \) is the net value of capital revenue and producing cost, satisfying the dynamic function:

\[ dY_t = hK_t + f_t dt - (I_{old} + \Delta I_t) dt - G dt \]  

(4)

where \( h \) denotes capital output ratio, \( f \) denotes external financing, and \( G \) denotes adjusted cost function including the cost of labor \( L \) and the private benefits of controlling shareholders \( C \). The last term \( G \) is the monotonic increasing function of investment. External financing \( f \) is composed of two parts, credit funding \( B \), and other financing \( f - B \) which contains new bond financing and equity financing for listed company, which is denoted as \( D \) and \( S \), respectively.

3.2. Investment decision-making

3.2.1. POE’s optimization

There are two categories of objective function. One is based on profit-driving,

\[ \max I E \left[ \int_0^\infty e^{-rt} dY_t \right] \]  

(P1)

The other category results from agency problem. The objective function is

\[ \max I, g E \left[ \int_0^\infty e^{-rt} u(m_t + w_t, g_t) dt \right] \]  

(P2)

where the manager’s utility function is exponential as Coles et al. (2012) used as follows,

\[ u(m_t + w_t, g_t) = -e^{-\eta(m_t + w_t - g(D_t))} \]  

(5)

where \( m_t \) is the managerial wealth, \( w_t \) is the uncertain wage, which is the executive stock ownership,
supposing it is $\phi dY_t$ where $\phi$ is the incentive parameter in He et al. (2014). $\eta$ is a parameter determining the degree of risk aversion, $0 < \eta < 1$. $g$ is the money equivalent cost of managerial input, which is dependent on $\Delta I_t$. Therefore, the objective function considering agency problems in the new normal can be written as,

$$\max_{\Delta I} E \left[ \int_0^\infty -e^{-rt-\eta(m_t+w_t-g(\Delta I_t))} dt \right]$$

(P2’)

The objective function can be regarded as a single decision-making problem on investment by on the assumption that the adjusted cost function $G$ is the increasing function of investment, i.e.,

$$G(I_{old}+\Delta I_t)dt = dL_t + dC_t = \alpha \cdot (I_{old} + \Delta I_t)dt + \gamma \cdot (I_{old} + \Delta I_t)dt, \alpha > 0, \gamma \geq 0$$

(6)

3.2.2. SOE’s optimization

For SOEs, Zhang (1996) analyzed the principal-agency problem of SOEs implying that the real controller is absent in SOEs. Therefore, SOE’s decision appeared much similar to insider’s optimization, in which the objective function should include social contributions, $SC_t$, such as employment expansion and agent’s promotion correlated to the firm’s profit. Milton and Raviv (1996) explained that the observed budgeting process is a response to decentralized information and incentive problems. These imperfections can result in underinvestment when capital productivity is high and over-investment when it is low. The specific agency problem they considered is that headquarters allocates capital so as to maximize the value of the firm, but the division manager prefers maximizing their personal consumption. This model can describe the investment decision-making process of SOEs by regarding the State-Owned Assets Supervision and Administration Commission (SASAC) or a local SASAC as a headquarter, and regarding Chinese SOE’s manager as division manager in Milton and Raviv (1996). Thus, the objective function of SOE is

$$\max_{\Delta I} \left\{ E \int_0^\infty e^{-rt} [u(m_t+w_t, g_t) + U(SC_t)] dt + \text{Prob}(Y_t > 0) \right\}$$

(P3)

where $u$ denotes the utility function of corporate manager, which is defined by equation (5), and $U$ denotes the utility function of SASAC, which is increasing with profit. We suppose $U(SC_t) = -e^{-\zeta dY_t}$, where $\zeta$ is the parameter of social contribution over operating profit, $0 < \zeta < 1$. The last term in P3 indicates the manager’s expectation of safe promotion or doing nothing. This also explains why entrepreneur in SOE prefer quiet life (Bertrand and Mullainathan (2013), Stein (2003)) rather than empire building.

3.2.3. Credit constraint

State-owned property rights bring the impact on investment from corporate financing in China. For POEs, the decision-making process is not unlimited. Since the banks are also state owned, the SOEs have no difficulties on borrowing from banks. Economic stimulus plan brought them a great
amount to new bank loans after the financial crisis. Therefore, on the contrary to the firms in U.S. and EU Campello et al. (2010) and Duchin et al. (2010), there is no credit constraint in China’s SOEs.

This ownership discrimination leads to POEs obtain far less finance support from the existing banking system than SOEs do. For POEs, their financial constraint mainly appears as credit constraints (Miao and Wang (2012)), which means the loan can’t be less than the market value of its collateral. The stopping time of financial distress, $\tau$, is when the market value of the firm’s net assets, $M(\delta K)$, declines below the overall loans. Therefore, the credit constraint is

$$B_t \leq \beta E_t [M_{\tau}(\delta K_{\tau})]$$

(7)

The above objective functions from P1 to P3 are for the financially healthy firm, therefore, their decision-making process is infinite. The credit constraint Equation (7) let the objective functions for POEs be finite scope optimization with the upper bond is $\tau$ instead of infinity in section 3.2.1. Recently, Herranz et al. (2015) examined the dynamic model of small firms with a borrowing constraint. Our model and empirical results also support their findings.

3.3. Dynamic shift

3.3.1. Structural change on objective functions

The dash lines in Figure 2 plot the value functions in old normal, where capital stock $K$ subject to equation (2). The solid lines represent the objective functions after the structural change. Figure 2(a) implies that for those POEs with $\Delta f < 0$, $\delta$ increases (Kahle and Stulz (2013)), the drift ratio of equation (3) decreases, and the uncertainty depends on investment and risk $\sigma_2$. If the credit constraints of POE tightens, the financial distress boundary will move left, resulting in some of the enterprises with original objective function of P1 shifts to P2. Therefore, such companies expand investment. On the other side, according to equation (4) and equation (6), POEs of P1 will choose lower $\sigma_2$, shifting from profit-driving to risk-averse, thus, such kind of companies will reduce their investment.

Since SOE is able to obtain the credit support from the government, their objective function does not need to satisfy the credit constraint as Equation (7). Thus, the optimization problem of SOE is unlimited. Figure 2(b) represents the shift of SOE’s investment. The first term of objective function P3 comes from the agency problem which equals to Equation P2 plus the cumulative social contribution, which is denoted as $P2'$. Investment must be expanded in order to reach the same objective function. The last term of Equation (P3) is to ensure no loss instead of value maximization, therefore $\Delta I < 0$. Whether to expand investment or to reduce it depends on the objective function is tending to $P2'$ or P3. In fact, SOE obtains a large number of bank loans due to the economic stimulus plans, i.e., $\Delta f > 0$ which leads to the increase of $dY_t$, and $\text{Prob}(Y_t > 0)$ goes up according to equation (4). That’s why some of the SOEs shift from $P2'$ to P3, thus the number of SOEs reducing investment increases.
Overall, Figure 2 implies that China’s investment expansion comes from the dynamic shift of objective functions, due to agency problem for POEs and SOEs. On the other hand, investment decline also exists both in POEs and SOEs.

![Figure 2: Value Functions with Different Ownership](image)

(a) POE with credit constraints  
(b) SOE without credit constraints

3.3.2. Simulations on heterogeneity

Figure 3 shows the impact of heterogeneity other than profit-driving objective function, in which the simulations are based on the objective function P2 for POE, and P3 for SOE, respectively. We do see the investment reduction from all of simulation results. We suppose the manager’s uncertain wage is increasing with the profit, i.e., \( w_t = \phi dY_t \), following He et al. (2014). In the simulation, we followed Miao and Wang (2012) to specify the credit constraint as increasing with \( K_t \), i.e.,

\[
E_t[M_t(\delta K_t)] = \psi K_t.
\]

The first two figure shows the impact on investment from executive ownership by relieving the agency problem. We see a closer gap between old normal and new normal at the left of Figure 3(a) than in Figure 3(b), and the investment is almost flat for SOEs in the new normal. Figure 3(c) and Figure 3(d) shows that External finance the investment declines lower for POE than for SOE. The empirical result in section 6 give us a further explain on dividing the external finance by debt and stock financing. The last two figures shows the profit vs. risk trade-off. Figure 3(e) shows the profit decrease harder if investment rate increases. Figure 3(f) shows investment of POE is much sensitive to risk than that of SOE.

Gilchrist et al. (2014) recently examined firm’s financing investment, analyzing within a quantitative general equilibrium model which also considering financial frictions. Our model considering the impact from state-owned property rights, explaining that firm’s optimal function is different with state-owned property rights which results in different shifts. This heterogeneity is consistent with the empirical evidence in later sections.
Fig. 3. **Simulations on heterogeneity.** Parameters are $r = 4.6\%$, $\delta = 12.5\%$, $\sigma_1 = 26\%$ (these three parameters are set following DeMarzo et al. (2012)), $\sigma_2 = 40\%$, $\eta = 0.05$, $\phi = 0.05$ (He et al. (2014)), $\psi = 30\%$ (Miao and Wang (2012)), $\alpha = 0.1$, $\gamma = 0.1$, $\zeta = 0.1$ (set following the parameters in Bolton et al. (2013)). Suppose capital output ratios are different for POEs and SOEs, $h$ is 1.2 for POE, and 0.8 for SOE, respectively.
4. Structural transformations of corporate investment

4.1. Data

The sample is collected from Chinese manufacturing companies listed on Shanghai and Shenzhen Stock Exchanges which are still listed on the A-shares stock market until August 1, 2014. Since China’s interest rate liberalization began in 2004, the unbalanced panel data is from 2004 to 2015. The data contains 1670 listed companies and 12516 observations. The data is collected from the annual report from 2004 to 2015, provided by Wind financial database. Lehman Brothers’s bankruptcy in September 2008 is regarded as the symbol of the outbreak of the recent financial crisis, therefore, 2008 is regarded as the shock of financial crisis. In order to minimize the influence from outliers, all non-binary variables are winsorized at the 1st and 99th percentiles (Lins et al. (2013), Hadlock and Pierce (2010)).

The factors that affect corporate investment have been systematically sorted out and defined in Hovakimian (2009), including Market-to-Book ratio, real sales growth, firm size, age, leverage, asset tangibility, dummy for bond rating, dividend payout, and financial slack. My benchmark model adds two variables, age and size, on the basis of Hadlock and Pierce (2010). We do not use dummy for bond rating because there is no public index reflecting the rank of corporate debt in China. We also consider two external finance, new debt and new equities, instrumented with lagged values, in a dynamic model of investment to control the endogeneity (Brown and Petersen (2009)). Since SOEs have social responsibility, we also examine the social performance in addition to the financial performance. The social performance is defined as the log of total number of employees. Table B represent these variables and its description.

4.2. Structural change from property rights

In order to test whether there is a significant difference of corporate decisions on financing and investment before and after the crisis, Difference-in-Difference analysis is following Lins et al. (2013):

\[ \text{Decision}_{it} = 1'\lambda_{it} + b\text{SOE}_i \times \text{Crisis}_t + \gamma'X_{it} + \varepsilon_{it} \]  (8)

The vector \( \lambda_{it} \) comprises a set of firm-, year- and industry-fixed effects to control for the impact of business cycle fluctuations, and industry belongings, respectively. \( \text{Decision}_{i,t} \) is a financing decision or an investment decision for company \( i \) in year \( t \). SOE is a dummy which equals 1 if the firm is a SOE, or equals 0 if it is a POE. Crisis\(_t\) is an indicator that takes the value of 1 for the years between 2008 and 2015 and is 0 otherwise. \( X_{it} \) refers to a set of firm-specific control variables which include firm size, leverage and market-to-book ratio \(^8\). The parameter of interest is \( b \), which captures the change in either financing activity or investment activity during the crisis for SOEs or POEs. Standard errors are clustered at the province level in Table 1.

\(^8\)Control variables in Lins et al. (2013) also include profitability, which is not included in my regression because profit vs. risk are considered in my later regressions.
Lins et al. (2013) implied that family-controlled firms reduce their investment by 0.52 percent points relative to other firms during the 2008-2009 financial crisis using a sample of more than 8,500 firms from 35 countries, but there is no significant difference in finance decision. We find that the median of investment rate before crisis is 0.2109, and the median of investment rate after crisis is 0.293. Overall sample shows a trend of investment expansion of Chinese enterprises, which is different from Lins et al. (2013) and other international literatures. An interesting finding is this investment expansion is heterogenous in SOEs and POEs. For POEs, the median of investment rate is 0.2709 before crisis and 0.401 after crisis, which is increasing. On the contrary, for SOEs, the median of investment rate is 0.175 before crisis and 0.167 after crisis, reducing 0.8 percent.

Table 1 Panel A represents the characteristics of the finance and investment decisions with different property right. After the crisis, external financing and investment rate are significantly lower in SOEs than those in POEs, but the cash holdings of SOEs is significantly higher than those of POEs. The investment of SOE is lower than that of POE by 11.7% according to the result of DiD analysis by clustering standard error at provincial level.

4.3. New Normal or no New Normal

In order to test whether there is New Normal of China’s corporate investment, we investigated the periodical difference based on alternative event windows. Table 1 Panel B adds dummy variable \textit{NewNormal} to exploit the structural changes adjusting Table 11 in Lins et al. (2013). Variable \textit{NewNormal} equals 1 in column (1) if the year is 2008~2015, in column (2) if the year is 2009~2015, and so on. The last column does not include \textit{NewNormal} implying that there is no New Normal. The parameter of \textit{SOE} $\times$ \textit{Crisis} is not significant from the first column to the third column, implying that the impact of the financial crisis does not show up immediately when taking the difference of property rights into account. The empirical test for alternative event windows unveil the periodical transformation should be divided into three periods, 2004~2010, 2011~2012, and 2013~2015, respectively. The transitional period is from 2011 to 2012, because the investment behavior in this period is significantly different with either of the other periods. The year, 2013, is the set-off point of China’s New Normal.

The median of investment rate in old normal (2004~2010), transitional period (2011~2012) and New Normal (2013~2015) are 0.252, 0.372, and 0.244, respectively, which shows an obvious inverted-U curve of Chinese corporate investment. For POEs, the median of investment rate in the three periods is 0.341, 0.525 and 0.344, respectively. For SOEs it’s 0.178, 0.202 and 0.131, respectively. In the transitional period, the expansion of investment is 28.4% in POEs which is much higher while it is only 2.4% in SOEs. In the New Normal, POEs increase their investment compared to themselves in old normal by 0.3 percentage, while SOEs reduce their investment by 4.6 percent. Gulen and Ion (2016) found that policy uncertainty can affect investment up to eight quarters. We also find China’s transitional period is 2 years, too.
Table 1: DiD analysis

Panel A. Property rights and corporate decisions

| Variables                  | (1)     | (2)     | (3)     | (4)     | (5)     | (6)     |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Cash Dividend              | 0.658***| 0.004   | 0.273   | -0.274***| -0.178***| -0.117***|
| Leverage                   | 0.064   | 0.005   | 1.319   | 0.091   | 0.028   | 0.039   |
| Debt                       | 0.273   | 0.004   | 0.273   | -0.274***| -0.178***| -0.117***|
| Equity                     | 0.091   | 0.028   | 0.091   | 1.319   | 0.064   | 0.039   |
| Investment                 | -0.274***| -0.178***| -0.117***| -0.117***| -0.117***| -0.117***|

Control variables: Yes Yes Yes Yes Yes Yes
Year fixed effect: Yes Yes Yes Yes Yes Yes
Firm fixed effect: Yes Yes Yes Yes Yes Yes
Secondary industries: controlled controlled controlled controlled controlled controlled
Province: clustered clustered clustered clustered clustered clustered
Observation: 12516 12516 12516 12516 12516 12516
R²: 0.042 0.013 0.032 0.075 0.078 0.030
F-statistic: 31.56 16.60 21.89 54.45 33.59 15.05
p-statistic: 0.000 0.000 0.000 0.000 0.000 0.000

Panel B. Periodical differences of investment for alternative event windows

| Variables                  | (1)     | (2)     | (3)     | (4)     | (5)     | (6)     | (7)     | (8)     |
|----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| 2008                       | -0.015  | -0.026  | -0.052  | -0.069**| -0.090***| -0.104***| -0.120***| -0.117***|
| 2009                       | (0.033) | (0.025) | (0.026) | (0.027) | (0.029) | (0.032) | (0.033) | (0.039) |
| 2010                       | -0.124***| -0.135***| -0.124**| -0.121**| -0.097* | -0.073  | 0.030   |         |
| 2011                       | (0.045) | (0.041) | (0.051) | (0.049) | (0.049) | (0.064) | (0.120) |         |
| 2012                       |         |         |         |         |         |         |         |         |
| 2013                       |         |         |         |         |         |         |         |         |
| 2014                       |         |         |         |         |         |         |         |         |
| No New Normal              |         |         |         |         |         |         |         |         |

Control variables: Yes Yes Yes Yes Yes Yes Yes Yes
Year fixed effect: Yes Yes Yes Yes Yes Yes Yes Yes
Firm fixed effect: Yes Yes Yes Yes Yes Yes Yes Yes
Secondary industries: controlled controlled controlled controlled controlled controlled controlled controlled
Province: clustered clustered clustered clustered clustered clustered clustered clustered
Observation: 12516 12516 12516 12516 12516 12516 12516 12516
R²: 0.030 0.031 0.031 0.031 0.031 0.031 0.030 0.030
F-statistic: 16.13 13.18 12.85 13.49 12.64 13.87 13.73 15.05
p-statistic: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

Notes: Standard errors are clustered at provincial level and reported in parentheses. SOE=1 if it is SOE in this paper while family control equals 1 if it is family firm in Lins et al. (2013). The control variables of the first column regression do not include Profit and of the third column regression does not include Leverage.

*: significant at 0.1 level.
**: significant at 0.05 level.
***: significant at 0.01 level.
5. Consequence of expanding investment

5.1. Definition of expanding investment

Different with the international academic literatures that enterprises reduce investment during this financial crisis in other countries, SOEs and POEs in China have an impulse to expanding their investment because of SOE’s political burden and POE’s agency problem. This section is to investigate the consequence of expanding investment in which corporate performance is considered from two perspectives, financial performance \( (ROE) \) and social performance \( (SocialPer) \). The model is

\[
Performance_i = \alpha + \eta' SOE_i + \varphi' Invup_i + f(\text{control variable}) + \varepsilon_i \tag{9}
\]

which is also clustered standard error at provincial level. The \( Performance \) is periodical average of \( ROE \) and \( SocialPer \), respectively. The control variable in this model is the secondary classification of manufacturing industry according to the standard of CSRC. \( Invup \) is a dummy variable representing investment expansion, which equals 1 if the amount of investment increases and 0 otherwise. The index of investment expansion is as follows:

\[
\Delta I_{k,i} = \frac{AvgI_{i,k} - AvgI_{i,basis}}{AvgI_{i,basis}}, k = 1, 2, 3 \tag{10}
\]

where \( \Delta I_{1,i} \) represents the ratio between the average investment after crisis and the average investment before crisis of enterprise \( i \), \( \Delta I_{2,i} \) represents the ratio between the average investment in 2011~2012 and the average investment in 2004~2010, and \( \Delta I_{3,i} \) indicates the ratio between the average investment in 2013~2015 and the average investment in 2004~2010. Table 2 supports the analysis on the dynamic shift of the optimization objective for SOEs and POEs in section 3.

5.2. Vertical and horizontal difference

For POEs, there are 492 companies increasing their investment in transitional period, which is 51.1% of the total POEs). Tightening on credit constraint drives SOEs from P1 to P2. In New Normal, with the credit financing constraint’s relaxing and the booming of debt and equity financing market, some POEs return to P1 from P2 and become risk-averse from profit-motivated by choosing low-risk investments. Table 2 shows there are 380 enterprises whose investment in New Normal stage is higher than that in the old normal, which is 39.5% of the total POEs. For SOEs, there are 237 companies increasing investment in transitional period, and 183 companies

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9The reason for investigating social performance is that employment is the most important index to judge whether the economy has recovered from the financial crisis. It is also a key difference between SOEs and POEs by solving employment problem and ensuring social stability, which China’s special data can provide evidence on the impact from state-owned property rights (Shleifer (1998), Huang et al. (2010), Jiang and Kim (2015)).

10In order to reduce collinearity and endogeneity, control variable only includes secondary industries because \( Invup \) has reflected the impact of investment.

11This paper use the method of Lins et al. (2013) to measure the change of investment in order to avoid the problem to define excessive investment. Jiang et al. (2009) investigate the impact of background and internal control to excessive investment by using the method of Richardson (2006).
Table 2: Investment behavior and performance in SOEs and POEs

| No. Enterprises | $\Delta I_{t,i}$ | ROE | No. Employees |
|-----------------|-----------------|-----|---------------|
| **Panel A. Difference before and after the financial crisis** 2008–2015 vs 2004–2007 |     |     |               |
| SOEs $\Delta I > 0$ | 225 | 1.050 | 6.851 | 2978 |
| SOEs $\Delta I < 0$ | 295 | -0.624 | 3.215 | 2992 |
| Total | 520 | -0.209 | 5.043 | 2934 |
| POEs $\Delta I > 0$ | 235 | 1.222 | 14.357 | 1086 |
| POEs $\Delta I < 0$ | 295 | -0.582 | 8.497 | 1643 |
| Total | 530 | -0.122 | 12.507 | 1235 |
| **Panel B. Difference of transitional period to the old normal** 2011–2012 vs 2004–2010 |     |     |               |
| SOEs $\Delta I > 0$ | 237 | 0.962 | 7.512 | 3197 |
| SOEs $\Delta I < 0$ | 311 | -0.648 | 5.686 | 3078 |
| Total | 547 | -0.155 | 6.631 | 3103 |
| POEs $\Delta I > 0$ | 492 | 1.278 | 8.693 | 1216 |
| POEs $\Delta I < 0$ | 471 | -0.552 | 8.632 | 1330 |
| Total | 963 | 0.029 | 8.671 | 1266 |
| **Panel C. Difference between New Normal and old normal** 2013–2015 vs 2004–2007 |     |     |               |
| SOEs $\Delta I > 0$ | 183 | 1.625 | 4.696 | 3528 |
| SOEs $\Delta I < 0$ | 365 | -0.759 | 2.664 | 3280 |
| Total | 548 | -0.449 | 3.500 | 3670 |
| POEs $\Delta I > 0$ | 380 | 1.309 | 8.085 | 1463 |
| POEs $\Delta I < 0$ | 584 | -0.647 | 5.640 | 1650 |
| Total | 963 | -0.268 | 6.622 | 1599 |

Increasing investment in the New Normal which is 43.3% and 33.3% of total SOEs, respectively, either of which is less than 50%.

Compare to the old normal basis period, the median of $\Delta I$ in transitional period and in the New Normal is -0.155 and -0.499 in SOEs, respectively, which implies that SOEs’ investment is decline. Overall, China is suffering decrease on investment, only POEs increased their investment in transitional period (the median of $\Delta I_{t,i}$ is 0.029). Therefore, I also got the same conclusion that both SOEs and POEs have decreased investment compared to the old normal, which is consistent with the existing international literature.

5.3. Impact of investment expansion on corporate performance

Table 3 implies that state-owned property rights and investment expansion do matter to corporate performance. The impact from state-owned property rights works through the whole process and it is consistent in each period. SOEs perform worse than POEs do, but the social performance of SOEs is higher than that of POEs, since parameters of $SOE$ in Table 3 are all significantly negative in Panel A, and positive in Panel B. The first part of Panel A in Table 3 shows that the financial performance increases 5% by expanding investment if the event window is simply cut by year 2008. The second and third parts divide the period into three parts, the old normal
Table 3: The impact of investment expansion on corporate performance

Panel A. Financial Performance

|                  | (1) $ΔI_1$ 2008~2015 vs 2004~2007 | (2) $ΔI_2$ 2011~2012 vs 2004~2010 | (3) $ΔI_3$ 2013~2015 vs 2004~2007 |
|------------------|------------------------------------|------------------------------------|------------------------------------|
| SOE              | -6.401*** (-0.560)                | -5.771*** (0.431)                 | -3.437*** (0.605)                 |
| SOE              | -3.294*** (0.569)                 |                                    | -5.189*** (0.750)                 |
| SOE              | -3.999*** (0.638)                 |                                    |                                    |
| Invup            | 5.957*** (0.571)                  | 5.136*** (0.581)                  | 0.802 (0.484)                     |
| Invup            | 0.643 (0.486)                     | 3.514*** (0.607)                  | 2.750*** (0.606)                  |
| Industries       | no                                 | yes                                | no                                 |
| Observation      | 1512                               | 1512                               | 1512                               |
| Adjusted $R^2$   | 0.203                              | 0.272                              | 0.036                              |

Panel B. Social Performance

|                  | (1) $ΔI_1$ 2008~2015 vs 2004~2007 | (2) $ΔI_2$ 2011~2012 vs 2004~2010 | (3) $ΔI_3$ 2013~2015 vs 2004~2007 |
|------------------|------------------------------------|------------------------------------|------------------------------------|
| SOE              | 0.893*** (0.094)                  | 0.862*** (0.088)                  | 0.961*** (0.085)                  |
| SOE              | 0.909*** (0.080)                  |                                    | 0.847*** (0.092)                  |
| SOE              | 0.804*** (0.091)                  |                                    |                                    |
| Invup            | -0.228*** (0.075)                 | -0.153*** (0.072)                 | -0.083 (0.078)                    |
| Invup            | -0.049 (0.068)                    | -0.106* (0.054)                   | -0.108** (0.043)                  |
| Industries       | no                                 | yes                                | no                                 |
| Observation      | 1512                               | 1512                               | 1512                               |
| Adjusted $R^2$   | 0.178                              | 0.266                              | 0.164                              |

(2004~2010), transitional period (2011~2012) and the New Normal (2013~2015), as the data of the second and third parts of Panel A of Table 3 has showed. Three periodical regression shows that there is no difference in financial performance between transitional period and the old normal, but a significant change (about 3%) in financial performance between the New Normal and the old normal.

Improving employment is a key indicator of sustainable growth of developing countries, according to development economics. Thus, this paper also tests the impact of the expansion of investment on employment rate to investigate the social performance. Panel B in Table 3 implies that the social performance of SOE is significantly higher than that of POE. SOEs do have a positive effect on solving the employment problem. But the effect from investment expansion is not efficient to improve sustainable growth, and the effect in transitional period leads to a increase in employment rate by 2.5% (parameters are 0.961 and 0.909 respectively). The parameter of $Invup$ is not significant in transitional period (part 2), even reduces 1.1% averagely in the New Normal (part 3).

6. Mechanism analysis

6.1. Benchmark model and structural changes

Our benchmark model is as follows:

$$I_{i,t} = \beta_0 + \beta_1(CF/K)_{i,t} + \beta_2I_{i,t-1} + f(\text{control variables}) + \epsilon_{i,t}$$  \hspace{1cm} (11)
where control variables following Hovakimian (2009) include market-to-book ratio, sales growth, asset tangibility, leverage, financial slack, dividend, age and firm size. Following Brown and Petersen (2009), lagged variable $I_{i,t-1}$ is used to reduce endogeneity and lagged effects (Michael and Whited (2012)). Standard errors in Table 4 are clustered at provincial level. In order to consider structural change in the investment behavior, column (4) to column (6) add two dummy variables to divide the period into three periods. $Shock$ equals 1 if the time is after 2011. $NewNormal$ equals 1 if the time is after 2013. Otherwise both of them equal 0.

In order to examine the effects of the state-owned property right, we divide the total sample, 1670 manufacturing companies, into treated group (548 SOEs) and control group (964 POEs, non matched). To construct a sample of firms similar, we also match each SOE with the firm in POE subsample. Using the nearest neighbor propensity score matching method based on secondary industry, province, firm size and age, the matched control group is finally consisted of 305 POEs, with $ATT = -0.235$, standard error=0.103 and $t$-statistics=-3.174, implying that the investment of treated group (SOEs) is significantly lower than that of the control group (POEs).

Table 4 shows that the parameters of $CF/K$ in column 1 and 3 are not significant in the benchmark model while it is significant in column 2 implying that POEs present positive investment-cash flow sensitivity overall, but SOEs and similar POEs matched sample aren’t sensitive.

We also investigate the structural changes of the three period in column 4 ~ 6. Column 4 shows that investment of SOEs are significantly positive sensitive to cash flow before the financial crisis. Parameters of $CF/K \times Shock$ and $CF/K \times NewNormal$ aren’t significant . This implies that SOEs are positively sensitive only in the old normal, neither in the transitional period nor in New Normal. Column 5 and column 6 show that SOEs aren’t sensitive in the transitional period while they are positively significant both in old normal and New Normal. The regressions of three-period structure change model reveal that although the investment efficiency reduced during transitional period POEs has recovered in the New Normal. The empirical tests enlightened the concerns on SOEs’ investment inefficiency in transitional period and in New Normal.

6.2. Heterogeneity

6.2.1. Agency problem

Managers are self-interested. The agency problem will reduce if the manager holds shares. The reason why this paper chose managerial ownership instead of the ratio of state-owned shares is that state-owned shares count only in un-tradable shares, which is a small part of the corporate equities now. This ratio hasn’t been revealed in the tradable shares since China set off reforms on split-structure of equities. In addition, the ratio of managerial ownership can be used to examine the agency problem not only in SOEs but also in POEs.

Column 1-3 of Table 5 reveal the impact from executive stock ownership on investment and its structural changes. In old normal, executive stock ownership has positive impact on investment both in SOEs and in POEs. In transitional period, the parameter of $Agent \times Normal$ is significantly negative, which reveals a severe agency problem both for SOEs and POEs. In the New Normal,
### Table 4: Benchmark model and structural change of investment behavior

|                      | (1) Benchmark model |                     | (2) Benchmark model |                     | (3) Benchmark model |                     | (4) Structural change model |                     | (5) Structural change model |                     | (6) Structural change model |
|----------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-----------------------------|---------------------|-----------------------------|---------------------|-----------------------------|
|                      | Treated group       | Control group       | Treated group       | Control group       | Treated group       | Control group       | (Matched)                  | (Matched)                  | (Matched)                  | (Matched)                  | (Matched)                  |
| $CF/K$               | 0.167               | 0.318**             | 0.151               | 0.229**             | 0.190**             | 0.172*              |
|                      | (0.159)             | (0.061)             | (0.111)             | (0.022)             | (0.072)             | (0.085)             |
| $CF/K \times \text{Shock}$ | -0.148                  | -0.154              | -0.261              | (0.122)             | (0.095)             | (0.176)             |
| $CF/K \times \text{NewNormal}$ | 0.057                  | 0.571***            | 0.393*              | (0.354)             | (0.118)             | (0.206)             |
| $I_{i,t-1}$          | 0.077**             | 0.024               | 0.035               | 0.078**             | 0.022               | 0.041               |
|                      | (0.032)             | (0.037)             | (0.061)             | (0.030)             | (0.040)             | (0.061)             |
| $M/B$                | 0.423***            | 0.449***            | 0.535****           | 0.426***            | 0.359***            | 0.503***            |
|                      | (0.098)             | (0.089)             | (0.170)             | (0.066)             | (0.085)             | (0.149)             |
| Salegrowth           | 0.001               | 0.002***            | 0.004***            | 0.001               | 0.002***            | 0.004***            |
|                      | (0.001)             | (0.004)             | (0.002)             | (0.001)             | (0.001)             | (0.002)             |
| Tangibility          | -0.019**            | -0.013***           | -0.019*             | -0.010**            | -0.012***           | -0.018**            |
|                      | (0.005)             | (0.004)             | (0.009)             | (0.005)             | (0.004)             | (0.008)             |
| Leverage             | -0.008              | -0.001              | -0.011              | -0.008              | -0.008              | -0.010              |
|                      | (0.006)             | (0.005)             | (0.008)             | (0.006)             | (0.005)             | (0.007)             |
| Finslack             | 0.338***            | 0.199***            | 0.220***            | 0.338***            | 0.195***            | 0.218***            |
|                      | (0.053)             | (0.023)             | (0.055)             | (0.053)             | (0.020)             | (0.052)             |
| Div                  | -0.468**            | -0.246              | -0.068              | -0.417**            | -0.015              | -0.140              |
|                      | (0.221)             | (0.416)             | (0.611)             | (0.169)             | (0.347)             | (0.565)             |
| Age                  | -0.039***           | -0.051***           | -0.057***           | -0.037***           | -0.058***           | -0.059***           |
|                      | (0.008)             | (0.011)             | (0.013)             | (0.006)             | (0.012)             | (0.014)             |
| Size                 | 0.217***            | 0.495***            | 0.511***            | 0.229***            | 0.448***            | 0.510***            |
|                      | (0.058)             | (0.085)             | (0.092)             | (0.061)             | (0.087)             | (0.090)             |
| Industry             | yes                 | yes                 | yes                 | yes                 | yes                 | yes                 |
| Cluster              | province            | province            | province            | province            | province            | province            |
| F                    | 33.44***            | 41.49***            | 9.28***             | 42.26***            | 38.97***            | 7.72***             |
| Adj.$R^2$            | 0.300               | 0.275               | 0.302               | 0.302               | 0.308               | 0.318               |
| Observation          | 6032                | 6474                | 2390                | 6032                | 6474                | 2390                |
heterogeneity shows up since agency problem behave differently in SOEs or POEs. The parameter of $Agent \times Normal$ is significantly positive in SOEs while it is insignificant in POEs. The empirical tests imply that the relieving effect from managerial ownership works again for SOEs in the New Normal, but it worked no longer for POEs in the New Normal.

6.2.2. External financing

Column 4-6 of Table 5 investigate the investment heterogeneity from external financing and structural changes. According to the two aspects considered in Brown and Petersen (2009), this paper study and analyze the impact of external financing. The two aspects are new debt financing ($debt$) and new equity finance ($stock$), respectively. And we consider the transformation change based on it.

The parameters of $debt$ are all significantly positive indicating that there is a positive sensitivity between investment and new debt finance both in SOEs and POEs. The parameters of $debt \times Shock$ and $debt \times Normal$ are not significant in column 4 implying that although the new 4 trillion RMB loans were mainly injected into SOEs according to China’s economic stimulus plan, a large amount of the loans has not been converted into the direct investment of SOEs.

But these two parameters in matched control group, similar POEs, are both significantly, representing a expanding investment by the new debt financing in transitional period and reducing investment in the New Normal for the concerns on the financial distress caused by the new debt financing. Overall, debt financing driving investment works only in the old normal. It doesn’t work in the New Normal for both SOEs and POEs, even worse that more new debt financing results in investment shrinkage. New debt financing can’t support investment expansion any more, which also shows a feature of China’s New Normal.

6.2.3. Profit vs. risk trade-off

The model of dynamic proxy show that investment decrease with idiosyncratic risk and incentive compatibility constraints in DeMarzo et al. (2012), He et al. (2014) suggest that it is possible to study the problem of over-investment through two perspectives, the uncertainty of profit and risk.

Column (7)-(9) of Table 5 represent the impact from profit-risk trade-off on investment and its structural changes. The results of regression show that in the old normal the corporate investment is not sensitive to profit for SOEs while it is significantly positive for POEs. This provides evidence of Knight (2014) that investment of POEs depends on their own corporate profit. However, this relationship has suffered structural changes since the recent financial crisis. The parameter of $profit \times Shock$ of POEs in non-matching group is significantly negative, implying that POEs are no longer driven by profit (as Knight (2014) analyzed in the old normal), neither in transitional period nor in the New Normal. Because expansion of investment in transitional period is caused by the second kinds of agency problem rather than profit (profit decreases in this period).

For SOEs, Li et al. (2011) pointed out that the managers of SOEs tend to choose investment projects with lower risk in order to maintain their own positions. Our results of regression imply
that Li et al. (2011)’s conclusion still holds in the New Normal since the parameter of $risk \times Normal$ of SOEs is significantly positive. The median of risk for SOEs are 45.959% and 41.44% in the old normal and the New Normal, respectively. The regression test of SOEs supports Li et al. (2011)’s conclusion.
Table 5: Corporate investment heterogeneity in China

|                      | (1) Treated group | (2) Control group (Non-matched) | (3) Control group (Matched) | (4) Treated group | (5) Control group (Non-matched) | (6) Control group (Matched) | (7) Treated group | (8) Control group (Non-matched) | (9) Control group (Matched) |
|----------------------|-------------------|-------------------------------|-----------------------------|-------------------|---------------------------|-----------------------------|-------------------|-----------------------------|-----------------------------|
| Agency problem       |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| Agent                | 0.076**           | 0.068***                     | 0.066**                     |                   |                           |                             |                   |                             |                             |
| Agent \times Shock   |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| Agent \times NewNormal | 0.042***         | 0.001                         | 0.002                       |                   |                           |                             |                   |                             |                             |
| debt                 | 0.133***         | 0.123***                     | 0.124***                    |                   |                           |                             |                   |                             |                             |
| debt \times Shock    |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| debt \times NewNormal |               |                               |                             |                   |                           |                             |                   |                             |                             |
| stock                | 0.140             | 0.047                         | 0.154                       |                   |                           |                             |                   |                             |                             |
| stock \times Shock   |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| stock \times NewNormal | 0.389***        | 0.034                         | 0.215*                      |                   |                           |                             |                   |                             |                             |
| profit               | 0.001             | 0.007***                     | 0.006**                     |                   |                           |                             |                   |                             |                             |
| profit \times Shock  |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| profit \times NewNormal |             |                               |                             |                   |                           |                             |                   |                             |                             |
| risk                 | 0.001             | 0.003                         | 0.010*                      |                   |                           |                             |                   |                             |                             |
| risk \times Shock    |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| risk \times NewNormal |               |                               |                             |                   |                           |                             |                   |                             |                             |
| Control variables    |                   |                               |                             |                   |                           |                             |                   |                             |                             |
| Industry             | yes               | yes                           | yes                         | yes               | yes                       | yes                         | yes               | yes                         | yes                         |
| Cluster              | province          | province                      | province                    | province          | province                   | province                    | province          | province                    | province                    |
| F                    | 34.94***          | 55.78***                     | 19.66***                    | 57.87***          | 67.28***                  | 46.29***                    | 33.26***          | 61.69***                   | 29.75***                   |
| Adj.R2               | 0.146             | 0.278                         | 0.304                       | 0.429             | 0.356                     | 0.429                       | 0.396             | 0.295                       | 0.318                       |
| observation          | 6032              | 6472                          | 2393                        | 6031              | 6474                      | 2390                        | 5998              | 6163                        | 2357                        |

Note: The results of regressions without control of secondary industries are consistent with Table 5.
7. Conclusion

This paper investigates the impact of state-owned property rights on Chinese corporate investment behavior which is the key of China’s economic growth. China corporate investment is unlikely to support Lins et al. (2013)’s conclusion, and this heterogeneity behaves differently whether it is state-owned or not. As Ouyang and Peng (2015) pointed out, China’s economic stimulus plans promoted the actual GDP growth of 3.2% but this growth is temporary. This paper studies the impact of state-owned property rights and structural changes of Chinese manufacturing enterprises from 2004 to 2015. DiD analysis with different event windows shows that there is no significant transformation in investment behavior during 2008~2010. The structural difference has emerged since 2011. The empirical tests imply that the structural changes in investment behavior ought to be divided into three periods, the old normal (2004~2010), transitional period (2011~2012) and the New Normal (2013~2015).

Structural changes of investment behavior result from the shift of objective function, which is different with state-property rights. The ratio of expanding investment for SOEs compared to the old normal is 43.3% in transitional period and 33.3% in the New Normal while this ratio for POEs is 51.1% in transitional period and 39.5% in the New Normal. The financial performance of POEs is higher than that of SOEs, but SOEs have more advantage in social performance, especially in transitional period, improving the employment rate by 2.5%. The expansion of investment in the New Normal significantly improves financial performance but has no positive impact on solving the problem of employment, as a result of which, it is not able to drive the sustainable economic growth effectively.

The analysis of investment-cash flow sensitivity based on the three-period structural changes implies the heterogeneity of SOEs and POEs. First, the empirical results reveal the concerns on SOEs since their investment are insensitive to cash flow both in transitional period and in the New Normal. Second, financial constrains are still one of key problem POEs face in the new normal as they were in the old normal, since their investment is positively sensitive to cash flow in these two periods. Three kinds of heterogeneity are considered in the mechanism of corporate investment behavior, agency problem, external financing and profit vs. risk trade-off. I find that the structural change results from executive stock ownership, which still work on relieving agency problem for SOEs while it is no longer an efficient way for POEs in the New Normal. In the second perspective, external financing, debt’s driving investment doesn’t work any more in the New Normal, even results in matched POEs’ shrinking their investment. In the third perspective, profit vs. risk trade-off, POEs are no longer profit-driving as Knight (2014) described, neither in the transitional period nor in the New Normal. SOEs show a risk averse investment shrinkage in these two periods even though they got the majority amount the economic support and under China’s expanding investment policies.

\[^{12}\text{They found that family-controlled firms cut investment more relative to other firms, and these investment cuts are associated with greater underperformance during the financial crisis using a sample from 35 countries.}\]
Appendix A. Variable and Parameters

Table A: Summary of key variables and parameters in theoretical analysis

| Variable                              | Symbol | Parameters                      | Symbol | Old normal | New normal |
|---------------------------------------|--------|---------------------------------|--------|------------|------------|
| Capital stock                         | $K$    | Riskfree rate                   | $r$    | 4.6%       |            |
| Gross investment rate                 | $l$    | Rate of depreciation            | $\delta$ | 12.5%      |            |
| Brownian motion                       | $Z$    | Degree of risk aversion         | $\eta$ | 0.05       |            |
| Total profit                          | $Y$    | Incentive parameter             | $\phi$ | 0.05       |            |
| External financing                    | $f$    | Cost of labor                   | $\alpha$ | 0.1        |            |
| Cost of Labor                         | $L$    | Cost of controlling shareholders| $\gamma$ | 0.1        |            |
| Private benefits of controlling       | $C$    | Social contribution over        | $\zeta$ | 0.1        |            |
| shareholders                           |        | operating profit                |        |            |            |
| Adjusted cost                         | $G$    | Subjective discount factor      | $\beta$ | 99%        |            |
| Credit funding                        | $B$    | Pledging fraction               | $\psi$ | 30%        |            |
| Bond financing                        | $D$    | Capital output ratio            | $h$    | 0.8 (for SOE) |          |
| Equity financing                      | $S$    |                                  |        | 1.2 (for POE) |          |
| Managerial wealth                     | $m$    | Volatility                      | $\sigma$ | 26% 40%    |            |
| Uncertainty wage                      | $w$    |                                  |        |            |            |
| Money equivalent cost of managerial   | $g$    |                                  |        |            |            |
| input                                |        |                                  |        |            |            |
| Social contributions                  | $SC$   |                                  |        |            |            |
| Stopping time of financial distress   | $\tau$ |                                  |        |            |            |
| Variable name          | Definition                                                                 |
|------------------------|-----------------------------------------------------------------------------|
| **Explained variables**|                                                                             |
| Investment rate        | $I =$investment at the end of the year over initial fixed assets.            |
| Performance            | $ROE=$the annual return on net assets (in %)                                 |
| SocialPer              | SocialPer=log(the amount of employees at the end of year)                   |
| **Explanatory variables**|                                                                             |
| Cash flow              | $CF/K$, where $CF$ is the net cash flows from operating activities and $K$ is the fixed assets at the beginning |
| Property rights        | SOE, Dummy variable, equals 1 if it is a SOE, or equals 0 if it is a POE.    |
| Agency problem         | Agent =the manager’s shareholding ratio at the beginning of the year (in %) |
| New debt finance       | Debt=new debt over the initial fixed assets                                  |
| New equity finance     | Stock=new stock over the initial fixed assets                                |
| Profit                 | Profit =the ratio of operating and operating revenue (in %)                 |
| Risk                   | Risk=Equity return volatility at the beginning of the year (in %).           |
| **Control variables**  |                                                                             |
| Market-to-book ratio   | $M/B=$ market value over book value of company                               |
| Growth                 | $Salegrowth=$main business’s increasing rate of income at the end of year (in %) |
| Tangible assets        | $Tangibility=$tangible assets over total assets (in %)                       |
| Asset-liability ratio  | $Leverage=$leverage rate at the beginning of the year (in %)                 |
| Financial slack        | $Finslack=$cash and cash equivalents over the initial fixed assets           |
| Dividend               | $Div=$ the cumulative dividends over the initial fixed assets                |
| Age                    | Age =number of years since establishment                                     |
| Size                   | Size =ln(the total assets)                                                  |
| Industry               | Industry: Dummy variable, classifications of manufacturing industry         |
|                        | according to CSRC code                                                      |

Notes: We calculate the fluctuation ratio in the way of Logarithmic yield method based on the daily data of stock in 6 months up to January 1. In order to reduce the endogeneity, I use the volatility ratio at the beginning of the year. Fortunately, this index is not affected by the stock market crash at the end of 2015.
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