Title
Three essays in corporate investment decisions

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Publication Date
2018

Peer reviewed|Thesis/dissertation

University of California
Santa Barbara

Three essays in corporate investment decisions

A dissertation submitted in partial satisfaction
of the requirements for the degree

Doctor of Philosophy
in
Economics

by

Zheng Wang

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June 2018

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June 2018

Three essays in corporate investment decisions

by

Zheng Wang

This dissertation is dedicated to

my parents: Zhijing Wang and Chunsheng Wang,

for their endless love, support and encouragement

and their 30^{th} Wedding Anniversary;

Leyi Zhang,

the most beautiful girl in the world,
my great companion and soul mate.

Acknowledgements

First and foremost, I want to thank my parents for their love and support throughout my life. Thanks for their sacrifices that made this dissertation possible. My grandparents and relatives deserve my wholehearted thanks as well.

I am greatly indebted to my advisor, Prof. Birchenall, for his invaluable guidance and support through my PhD study, and especially for his confidence in me. I would also like to thank Prof. Frech and Prof. Qin for serving as my committee members, who give me many wise advices and I learn a lot from their insights. I know that I could not have this dissertation without their great help.

Chapter 2 is co-authored with Dr. Haoyu Gao, a brilliant young scholar. I am in charge of conducting data analysis, writing sections of empirical findings and introduction, and he contributes to sections of literature review and institutional background. I enjoy working with him and am very grateful for his constructive suggestions.

In addition, I want to thank all my friends, thank you for your understanding and encouragement in many moments of crisis. I cannot list all the names here, but you are always on my mind.

Finally, I want to sincerely thank Leyi Zhang for her companion and encouragement during my special moments.

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Abstract

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In this dissertation, I use data from publicly listed companies to explore factors that affect corporate investment decisions. In Chapter 1, I investigate the sensitive of investment to cash flow. I argue that the sensitivity is partly driven by agency-conflict within stockholders, namely, controlling shareholders extracting firms' resources at the expenses of minority shareholders. To test this finding, I use the mandatory Split-Share Structure Reform in China, which exogenously converted all non-tradable shares to tradable, and reduced the incentives of controlling shareholders' expropriation by better aligning the interests of all shareholders. By employing a theoretical model and conducting empirical analysis, I find a significant reduction in the sensitivity for firms with higher levels of pre-reform expropriation, and the effect is more pronounced for private firms. Moreover, I find that manager's over-investment, financial constraints, and measurement errors in investment opportunities do not drive the reduction in sensitivity. Overall, my findings support the view that controlling shareholders' expropriation leads to investment-cash flow sensitivity. Given that controlling shareholders' expropriation is widely prevalent, my findings have broad relevance for explaining investment and financing decisions.

Chapter 2 examines whether investment-cash flow sensitivity is a good measure of financial constraints in emerging markets. We exploit a staggered industrial regulation in China as a natural experiment to identify the impact of increasing financial constraints on the sensitivity. We find that the investment-cash flow sensitivity becomes significantly

larger by 7.6% after the enactment of regulation policy in treated industries using a difference-in-differences methodology. Consistent with political favoritism explanations, we show that such a positive association is stronger for state-owned enterprises and more bank-dependent firms, but is smaller under credit easing. The findings empirically suggest that investment-cash flow sensitivity indeed measures financial constraint.

In Chapter 3, I investigate the causality between government intervention and investment efficiency. I use the staggered industrial regulation in Chapter 2 as a policy instrument to changes in government intervention. With a difference-in-differences methodology, I find that investment efficiency becomes significantly larger after the enactment in treated industries. Moreover, I show that the association between higher investment efficiency, measured as increasing investment-Tobin's Q sensitivity, and decreasing government intervention is stronger for state-owned enterprises. In addition, I argue that for private firms, such association is significantly stronger for those with political connections. My findings empirically suggest that government intervention distorts the efficiency of corporate investment.

Contents

Chapter 1

Controlling Shareholders' Expropriation and the Sensitivity of Investment to Cash Flow

1.1 Introduction

The relation between investment and financing decisions is one of the most essential and widely explored issues in corporate finance. In a perfect capital market, investment would rely on a firm's investment opportunities alone rather than on its financing structure (Modigliani and Miller, 1958). However, empirical findings from the literature exhibit a significant and positive correlation between investment and cash flow even after controlling for investment opportunities.[1] Two capital market imperfections have been proposed to explain investment-cash flow (ICF) sensitivity, namely, financial constraints and manager's over-investment. On one hand, investment relies more on cash flow because external finance is not always available if firms are financially constrained, thereby leading to ICF sensitivity.[2] On the other hand, as Jensen (1986) notes, the agency costs

[1]For instance, Lewellen and Lewellen, 2016 study U.S. firms from 1971-2009 and find that an additional dollar of cash flow in the current year leads to nearly $0.35 of investment in fixed assets after correcting for measurement errors in investment opportunities.

[2]Fazzari et al. (1988) first note that ICF sensitivity reflects financial constraints. However, Kaplan and Zingales (1997) find that less constrained firms exhibit a higher ICF sensitivity. Whether ICF sensitivity serves as a good indicator for financial constraints remains a controversial subject.

of free cash flow mainly affect the sensitivity through the canonical principle-agent problem, that is, managers favor growth over profitability because they can obtain private benefits from control, which causes overspending and results in greater ICF sensitivity.

This paper proposes a simple theoretical model and tests a new type of agency-conflict that yields ICF sensitivity without appealing to manager's over-investment. I argue that controlling shareholders (i.e., parent companies) expropriate minority shareholders, which leads to ICF sensitivity. Theoretically, I extend the framework of Kaplan and Zingales (1997) by considering costly financing and agency-conflict with shareholders. I predict that ICF sensitivity increases as the controlling shareholders divert more resources from the firm and decreases as the shareholder protection is strengthened. Expropriation diminishes investment returns, thereby increasing the cost of external finance relative to cash flow. Thus, firms have to rely more on the low-cost cash flow for investment due to a comparatively larger cost-wedge between external and internal funds.

I test the theory using an exogenous variation in the incentives of controlling shareholders' expropriation. I exploit a natural experiment in China, the Split-Share Structure Reform (SSSR), as my identification strategy. Before 2005, almost all publicly listed companies in China included both tradable shares (TS) and non-tradable shares (NTS). On average, the NTS, which consist of 2/3 of total shares, were not tradable in the stock market. Under the split-share scheme, the wealth of NTS (TS) holders was determined by the book value (market value). The agency-conflict within shareholders was acute because the controlling shareholders (i.e., holders of NTS) would divert more resources from firms without being punished by declines in market value. The mandatory reform in 2005 converted all NTS to TS and exogenously reduced controlling shareholders' expropriation because the SSSR removed significant market frictions and better aligned the interests of all stockholders (Chen et al., 2012; Liao et al., 2014).

I use an unbalanced panel of 1,314 listed firms in both the Shanghai and Shenzhen

Stock Exchange Markets from 1998 to 2014. With financial data from China Stock Market & Accounting Research (CSMAR), I analyze the changes in ICF sensitivity after the SSSR announcement. I find that ICF sensitivity has decreased significantly after the reform. Furthermore, I use two common proxies for expropriation to measure the impact of the SSSR on ICF sensitivity, namely, the divergence of controlling shareholders' ownership and control rights (excess control) and the amount of related party transactions (RPTs) between the parent company and the listed company. Higher excess control and more RPTs indicate more severe controlling shareholders' expropriation. By applying a difference-in-differences approach, I find economically and statistically significant declines in ICF sensitivity for firms classified as high expropriation during the pre-reform period. The findings are robust to the controls for operating and financing determinants of investment as well as to the controls for unobserved firm, year and (one-digit) industry by year fixed effects. My findings validate the key predictions from my model and suggest a causal link between controlling shareholders' expropriation and ICF sensitivity.

I also examine whether the changes in ICF sensitivity differ between state-owned enterprises (SOEs) and private firms because state ownership is an important characteristic in China. The corporate insiders' ability of expropriation is more constrained in SOEs than in private firms because the controlling shareholder of SOEs is a government agency, which is an organization with internal control systems (Chen et al., 2012). In addition, SOEs have non-profit considerations, such as meeting certain political and social welfare purposes (Shleifer, 1998). Thus, the incentive and opportunity for the controlling shareholder of SOEs to divert resources for private benefits are less prevalent.[3] By contrast, expropriation is stronger in private firms than in SOEs because the largest shareholder is usually a person or a family, that pursues maximization of returns, including private re-

[3] Although the majority of shares are tradable after the SSSR, the SOEs did not sell a large proportion of state-owned shares, suggesting that the state still remains dominant in these firms.

turns by expropriating other minority shareholders. Moreover, the fact that management in private firms is usually under the controlling shareholder can facilitate expropriation (La Porta et al., 1999; Johnson et al., 2000). Consistent with this view, I find that private firms mainly drive the declines in ICF sensitivity even though they only account for 30% of the total observations. Furthermore, previous studies restrict their sample to manufacturing firms only. I do so to be consistent with previous studies and find more pronounced sensitivity reduction, especially in private firms.

I conduct a battery of ancillary tests to verify the robustness of my findings and rule out alternative explanations. My empirical approach assumes that the SSSR is an exogenous shock to controlling shareholders' expropriation rather than to cash flow or investment opportunities that are uncorrelated with agency-conflict yet affect ICF sensitivity. In the robustness check, I validate these assumptions by showing that my findings are not subject to endogenous control problems. Furthermore, my findings are robust to different sample time selections and to an alternative measure of expropriation, the monitoring intensity from other large (non-controlling) shareholders. More importantly, I thoroughly investigate alternative explanations that may contribute to the significant declines in ICF sensitivity for high expropriation firms, such as, mitigating managers' over-investment, easing financial constraints, and reducing measurement errors in investment opportunities. Although the SSSR may affect all three channels, the effects remain similar in magnitude and the difference is statistically insignificant for firms with high or low controlling shareholders' expropriation.

This paper adds to research on agency costs and ICF sensitivity. Jensen (1986) illustrates agency-induced ICF sensitivity and Stulz (1990) provides a theoretical model for this mechanism. Thereafter, many empirical studies have examined the free cash flow hypothesis and its implication on ICF sensitivity (see e.g., Lang et al., 1991; Lamont, 1997; Richardson, 2006; Lewellen and Lewellen, 2016). However, only few studies have focused on ICF sensitivity and agency costs within stockholders, even though controlling shareholders' expropriation is one of the most important issues in corporate governance. One exception is Lins et al. (2005), who argue that the cost of external financing can be much higher for firms with more severe expropriation. Given that outside investors expect their wealth to be expropriated by the controlling shareholders and thus request for a higher risk premium, the firm increases their dependence on cash flow for investment. Moreover, my work extends the theoretical model in Kaplan and Zingales (1997) to exploit the connection among expropriation, corporate governance, and ICF sensitivity.

My paper also exploits the SSSR as an identification strategy in the context of ICF sensitivity. A standard critique for the ICF sensitivity arises from the measurement errors in investment opportunities, such that cash flow is simply correlated with investment opportunities (e.g., Erickson and Whited, 2000; Alti, 2003). Empirical studies have addressed this concern by examining exogenous shocks as an identification strategy or correcting measurement errors.[4] My results address endogeneity by using the SSSR as an identification strategy. In addition, this reform has exogenous effects because its implementation is almost universal in the world's largest transitional economy.

In addition to these advantages in identification, my research design can increase the power of my tests. First, controlling shareholders' expropriation is widely prevalent, especially in countries where firms are primarily controlled by a single dominant shareholder, for instance, Western European countries, East Asian countries and Latin American countries (Shleifer and Vishny, 1997; La Porta et al., 1999; Lin et al., 2013). U.S. firms exhibit relatively little ownership concentration and modest expropriation (Claessens et al., 2002). Thus, studying non-U.S. firms can provide evidence to analyze

[4]Some studies exploit shocks to cash flow without changing growth opportunities and argue that cash flow matters for investment (e.g., Lamont, 1997; Rauh, 2006). Recent studies also find the ICF sensitivity remains robust after correcting for measurement errors in investment opportunities (Lewellen and Lewellen, 2016; Ağca and Mozumdar, 2017).

the impact of controlling shareholders' expropriation on ICF sensitivity. In particular, the weak shareholder protection and restrictions on the tradability of majority shares in China highlight the importance of detecting the exogenous variation in controlling shareholders' expropriation. Second, in Chinese listed firms, pre-reform ownership structures are exogenously determined during the IPO process, and the trading restrictions on the majority shares have limited the controlling shareholders' endogenous choice on ownership and control rights (Chen et al., 2012). Third, China has relatively immature capital markets, especially in bond and equity finance; thus, the investment relies more on internally generated funds. Overall, these advantages allow the SSSR to be a unique setting for studying the effects of controlling shareholders' expropriation on ICF sensitivity.

My results are in line with the studies that investigate ownership structures and corporate value. The literature suggests that expropriation by corporate insiders engenders corporate value discount (e.g., Shleifer and Vishny, 1997; Bae et al., 2012). According to the entrenchment effects, firm value decreases when shareholders have large excess control rights (e.g., Claessens et al., 2002; Lemmon and Lins, 2003).[5] My paper supports this view by showing that expropriation distorts the efficient allocation of investment for firms with excess control, thereby leading to a decrease in firm value. When investment relies more on the availability of internal funds after controlling for investment opportunities, companies tend to forgo profitable projects. My work also complements Porta et al. (2002), who document low valuations for firms in countries with weak shareholder protection.

[5]Controlling shareholders' expropriation is exacerbated when firm owners exercise control through complex mechanisms, e.g. dual-class shares, pyramidal ownership structure, and cross-holdings, thereby leading to the divergence of controlling shareholder's cash flow and control rights (e.g., La Porta et al., 1999; Claessens et al., 2000; Laeven and Levine, 2009; Lin et al., 2013). In such cases, the risk of the ultimate controller diverting corporate resources for private benefits is high, because they can control firm's operations and conduct self-dealing transactions with very limited direct financial costs (Lin et al., 2011).

My findings also shed light on how regulatory policy improving corporate governance can affect investment and financing efficiency. Such policies are common in developed countries, such as the Sarbanes-Oxley Act and the antitakeover laws in the U.S. This reform reveals the benefits of removing market frictions because resources are misallocated due to internal working problems under the split-share structure. Although my paper focuses on China, my findings have important implications for understanding how the agency relationship, investment allocation, and transparency can shape firms' financing patterns. One essential implication from my study is that the liquidity of majority shares can alleviate the agency-conflict within stockholders in private firms. My paper also provides guidance to policymakers who are engaged in design of corporate governance and legal institutions in emerging markets.

The paper proceeds as follows. Section 2 introduces background information on the Split-Share Structure Reform. Section 3 presents a simple theoretical framework. Section 4 describes data and provides summary statistics. Section 5 presents the main empirical findings. Section 6 discusses alternative explanations, and Section 7 concludes the paper with some remarks about the current SOE reform.
introduction

1.2 Institutional Background of the Split-Share Structure Reform

Before 2005, a unique context in Chinese stock market was that almost all listed companies included both TS and NTS. The Chinese government created this two-tier structure scheme under the context of the "planned economy" when the stock market was first established in 1990. This is because they wanted to avoid particular problems, such as the privatization of SOEs and the loss of state control (Yang et al., 2015). In addition, the government had concerns about the pressure under full circulation. With TS only accounting for a small portion, it would be cost-efficient for the government to retreat if the experiment of establishing stock market failed. Under this scheme, around 70% of the NTS are state-owned shares (state shares and state-owned legal person shares) and the rest of the NTS are other legal person shares in private firms, mainly promoter domestic legal person shares. The fraction of NTS differs for each firm, and on average, NTS holders (usually the controlling shareholders) had roughly a two-thirds of the majority shares.[6] NTS holders can only sell their shares through a negotiated price (based on net asset value per share) with government-approved auction under special circumstances (Liao et al., 2014). Individual investors hold the TS, and the transaction happens in the stock market. Thus, the tradable shareholder, usually the non-controller, has little power to influence the decisions made by the controlling shareholder who owns the NTS. Although both types of shares have the same cash flow rights and voting rights, the market frictions resulting from the inability of NTS transactions in the secondary market have made the stock market less efficient (Liao et al., 2014).

One of the most detrimental aspects of this two-tier structure is the market frictions. The book value measures the value of the NTS, while the market value measures the TS, thereby making it difficult to align the interests of all shareholders. To improve this situation, on Jan. 31, 2004, the State Council issued *"Some Opinions of the State Council on Promoting the Reform, Opening and Steady Growth of Capital Market"* as a blueprint to resolve the split-share structure.[7] In addition, this document also lists guidelines to

[6]The appreciation of NTS does not depend on stock price but on a contract transfer price, which refers to the net asset value per share, equal to the sum of par value of stocks, retained earnings, earning surplus and capital surplus over the total number of outstanding shares. The contract transfer price is also lower than the stock price.

[7]In Section 3, the State Council mentioned that "... standardize the transfer of non-floating shares of listed companies, thus preventing loss of state-owned assets"; "... steadily solve the distribution of non-tradable shares of listed company at present..." (StateCouncil, 2005)

provide better shareholder protection and enhance the supervision of the capital market. In April, 2005, the Chinese government officially enacted this mandatory reform with the purpose of eliminating the two-tier structure for both SOEs and non-SOEs. This required the full conversion of NTS into TS, subject to the agreement of NTS shareholders to compensate TS shareholders.

The time for each firm to finish converting its shares depends on its bargaining process. The agreement NTS holders give compensation to TS holers, in terms of cash or stock shares, had to be approved by two-thirds of all shareholders and two-thirds of the tradable shareholders who voted. Most firms finished converting their NTS within a 18-month pre-specified window from the middle of 2005 to the end of 2006.[8]

1.3 A Simple Model

I consider a two-stage model that includes a controlling shareholder and a manager. The timing of model is that the controlling shareholder, in this case the non-tradable shareholder, first chooses the fraction of expropriation (α) from the firm. The manager observes α before choosing investment to maximize the remaining profits. The controlling shareholder usually takes the form of RPTs to divert resources. In most countries, the diversion is legal but usually requires costly transaction, such as setting up intermediary institutions or legal risk (Johnson et al., 2000). Following Porta et al. (2002), the cost-of-theft function is expressed as $c(k, \alpha)$, where k denotes the quality of shareholder protection. The better protection of tradable (minority) shareholders increases the cost of expropriation. Formally, I maintain the following assumptions in Porta et al. (2002):

[8]After the completion of the reform, NTS holders experience a "lock-up" period during which they cannot sell or transfer their shares on the stock market over the following 12 months and sell or transfer no more than 10% of their shares cumulatively over the following 24 months (Yang et al., 2015).

$c(k, \alpha)$ is increasing in k and α, strictly convex in α, and $c_{k\alpha} > 0$. The last inequality is crucial for the sign of comparative static analysis and it implies that the marginal cost of stealing is higher when tradable shareholders are better protected. The total return to investment I is given by a strictly concave production function $F(I)$. In this simple model, the scale of investment return does not matter, as can be seen in equation (1) below.

If the dividends are not considered, the controlling shareholder chooses α to maximize his/her private benefits:

$$\max_{\alpha} \quad \{\alpha F(I) - c(k, \alpha)F(I)\} \tag{1.1}$$

where the first term is the controlling shareholder's private benefits from expropriating investment return and the second term is the cost to do so.

Next, I assume that the manager observes the controlling shareholder's decision on expropriation (α), and then chooses the investment level to maximize the remaining profits. This part of the model is a generalization of Kaplan and Zingales (1997) with costly financing and agency problems within shareholders.[9] The manager has limited control over controlling shareholders' expropriation because the weak board of shareholders in China allows the controlling shareholder to influence the appointment of management.[10] Conforming to the notations employed in Kaplan and Zingales (1997), I consider the case where a manager chooses the profit maximizing level of investment. Investment can be financed either with cash flow W or with external funds E ($E > 0$). The opportunity cost of cash flow is the cost of capital, for simplicity, I set equal to 1. Given that the

[9] Here, I assume that shareholders have an effective monitoring on manager and that the compensation is based on firm's profits. Therefore, the manager has no incentive or opportunity to over-invest.

[10] Ideally, the board of shareholders and the board of directors are in charge of the appointment of managers. However, given that corporate governance was not well-established and the boards were weak before 2005, the controlling shareholder usually had excess power when appointing managers.

capital market is imperfect, firms face additional costs of external funds $C(E)$, which is increasing and strictly convex in E.

Thus the manager faces the following optimization problem:

$$\begin{aligned} &\max_I \quad \{F(I) - C(E) - I - \alpha F(I)\} \\ =&\max_I \quad \{(1-\alpha)F(I) - C(I-W) - I\} \qquad s.t.\ I = W + E \end{aligned} \tag{1.2}$$

where the first term is investment return after expropriation, the second term is cost of external capital, and last term is the opportunity cost of investment.

I solve the model with backward induction. Since the manager observes the controlling shareholder's expropriation α before choosing I, in principle the manager could condition his choice of I on the observed level of α. Therefore, the manager's strategy is to choose for each α, the level of I that solves equation (2). The manager's optimal reaction function is thereby denoted as $I^*(\alpha, W)$. The controlling shareholder's strategy is to maximize his/her private benefits given $I^*(\alpha, W)$, so that the controlling shareholder's optimal expropriation level $\alpha^*(k, I)$ is the solution to $\max_\alpha \ \{\alpha F(I^*(\alpha, W)) - c(k,\alpha)F(I^*(\alpha, W))\}$. The following propositions summarize the predictions in this two-stage model. The proofs are presented in Part A of the Appendix.

Proposition 1 *Assume that $c_{\alpha\alpha} > 0$ and $c_{k\alpha} > 0$, then the expropriation of minority shareholders is less with better protection of shareholders, that is,*

$$\frac{d\alpha^*(k,I)}{dk} < 0$$

Proposition 2 *Assume that $C''(E) > 0$ and $F''(I) < 0$, then the investment is sensitive* *to cash flow, that is,*

$$\frac{dI^*(\alpha, W)}{dW} > 0.$$

The following proposition assumes a set of sufficient conditions, namely, a) $F(I)$ and $C(E)$ are both quadratic functions, or b) $F(I)$ is a quadratic function and $C'''(E) < 0$, c) $F'''(I) < 0$ and $C(E)$ is a quadratic function, or d) $F'''(I) < 0$ and $C'''(E) < 0$.

Proposition 3 *Investment to cash flow sensitivity increases with a higher proportion of expropriation (α), that is,*

$$\frac{d}{d\alpha}\left(\frac{dI^*(\alpha, W)}{dW}\right) > 0.$$

When the assumptions for Prop (1), (2), and (3) hold, I have:

Proposition 4 *Investment to cash flow sensitivity decreases with better shareholder protection (k), that is,*

$$\frac{d}{dk}\left(\frac{dI^*(\alpha^*, W)}{dW}\right) < 0.$$

Proposition 1 is similar to the results in Porta et al. (2002). If the marginal cost of expropriation increases as more is diverted ($c_{\alpha\alpha} > 0$) and if the marginal cost of expropriation is higher when tradable shareholders have better legal protection ($c_{k\alpha} > 0$), then the expropriation is lower with a better shareholder protection scheme.

The policy announcement in 2004 was designed to improve the protection of minority shareholders. When controlling shareholders' wealth is evaluated by market value, marginal cost of expropriation rises sharply due to the possible punishment from the stock price. More importantly, previous studies have mostly documented that controlling shareholders expropriate mainly through related-party transactions, and the China Securities Regulatory Commission requires listed companies to disclose the amount and nature of each RPT. Therefore, the announcement of RPTs with tunneling intention can lead to negative market reactions, thereby allowing us to reasonably expect expropriation to become less prevalent after the reform. The evidence from the literature is consistent with this notion.[11] Overall, Proposition 1 is consistent with the existing literature.

Proposition 2 requires strict convexity for the cost of external finance and strict concavity of the production function, which is consistent with findings in Kaplan and Zingales (1997). These requirements suggest that investment and cash flow are positively correlated. A convex function for external finance implies an imperfect capital market. If the capital market was frictionless, i.e., $C(E) = 0$, and $C''(.) = 0$, then internal and external finance would be perfectly substitutable and investment expenditures would not respond to cash flow ($\frac{dI^*}{dW} = 0$). Figure 1 further provides a graphic explanation of Proposition 2, where the x-axis represents investment and cash flow, while the y-axis represents the marginal cost of external finance C', and marginal return to investment F'. $(1-\alpha)F'$ is the marginal return to investment after expropriation. Given a small cash flow fluctuation (ΔW), investment increases by ΔI, which reflects ICF sensitivity.

Proposition 3 argues that the ICF sensitivity increases with a higher fraction of expropriation from the controlling shareholder. Intuitively, a higher fraction of stealing will generate lower investment returns $(1-\alpha)F'$, whereas external finance is relatively more costly to obtain even though the absolute cost may not change. Thus, firms have to rely heavily on low-cost internal funds to invest due to the comparatively larger cost-wedge between internal and external finance. In addition, Proposition 3 further requires

[11] For instance, Liu and Tian (2012) support this view by showing a declining amount of inter-corporate loans and positive market-adjusted cumulative abnormal returns around the announcement of RPTs for private firms. Additionally, other articles record a declining fraction of firms conducting RPTs and the incentives for tunneling after the SSSR (e.g., Liao et al., 2014).

the satisfaction of either set of the four sufficient conditions. Condition (a) requires quadratic functional forms for both $C(E)$ and $F(I)$, while condition (b) requires $F(I)$ to be quadratic and the third derivate of $C(E)$ is negative (as is the case with a simple convex function like E^ρ, where $1 < \rho < 2$). Condition (c) requires that $C(E)$ is quadratic and the third derivate of $F(I)$ is negative. Condition (d) requires that the third derivative of both $C(E)$ and $F(I)$ will be negative.[12] However, this proposition would break down if the controlling shareholder extracts his/her proportion of net profits from the firm, i.e., the expropriation is equal to $\alpha[F(I)-C(I-W)-I]$. Therefore, ICF sensitivity does not depend on α, i.e. $\frac{d}{d\alpha}[\frac{dI^*}{dW}] = 0$.

Figure 2 illustrates the findings in Proposition 3 with the sufficient condition (c) as an example; that is, $C(E)$ is quadratic and $F'''(I) < 0$, where α_L or α_H represents a relatively lower or higher level of expropriation. $C'(E)$ is linear because I assume $C(E)$ is a quadratic function. $F'(I)$ is strictly concave because $F'''(I) < 0$.[13] I consider two firms facing the same marginal cost of external finance, but different levels of expropriation. Given the same amount of cash flow increasing (ΔW), investment is more responsive to W at α_H than α_L ($\Delta I_{\alpha_H} > \Delta I_{\alpha_L}$). This suggests that investment demand is more sensitive to α as W rises.

The interpretation of Proposition 4 is the combined effects from Proposition 1 and 3. Given that $\frac{d}{dk}[\frac{dI^*}{dW}] = \frac{d}{d\alpha}[\frac{dI^*}{dW}] * \frac{d\alpha}{dk}$, when expropriation decreases along with better protection of tradable (minority) shareholders and ICF sensitivity decreases with a lower level of expropriation, ICF sensitivity decreases along with a better shareholder protection. Since one of the targets of the SSSR is to curb the controlling shareholder's abuse

[12]Under conditions (a) and (b), $F(I)$ is a quadratic, concave production function, thereby implying that the solution is a local optimal condition. For instance, $F(I)$ may take the form of $AI - BI^2$ if $0 < I < \frac{A}{2B}$. Conditions (c) and (d) are the assumptions for global optimal.

[13]The intuition of $F'''(I) < 0$ implies that over a range, the marginal return to investment (investment demand) is likely to be high and decrease slowly (so that $F''(I)$ is small). At some point, $F'(I)$ changes from declining slowly to declining rapidly, which corresponds to $F'''(I) < 0$.

of power and provide legal protection for minority shareholders, the establishment of legal mechanisms can improve corporate governance in China. Thus, k increases while α decreases, such that ICF sensitivity decreases after the reform.

1.4 Data

1.4.1 Description of Sample and Dataset

The data used in this paper are drawn from the China Stock Market and Accounting Research (CSMAR) Database. The sample consists of all firms listed on the main board of the Shanghai and Shenzhen stock exchanges from 1998 to 2014, excluding those firms in the financial sectors (i.e., finance and insurance as well as real estate). I drop these sectors because they are highly regulated and their operating and investing activities are distinct from those of other sectors. I also drop firms that has been listed for less than a year as well as those firms under special treatment (ST).[14] I winsorize the observations at 1% and 99% for the main regression variables to minimize the influence of outliers. Table C1 in the Appendix provides the variable definitions, and Table 1 tabulates the summary statistics for the main variables.

The unbalanced panel consists of 15,482 firm-year observations and 1,314 unique firms. Among these firms, 1,134 have completed the conversion of NTS, while the rest of firms did not complete this process. The latter firms have been classified into two groups, namely, (a) firms delisted before the reform, and (b) firms issued after the reform (not having NTS). Including these firms helps increase the precision of my estimates of

[14]Stocks in danger of being delisted are under special treatment (ST) in China, such as firms with negative net profits for two consecutive years. The main results also hold if I include these firms in my sample.

normal ICF sensitivity. I do not impose restriction that firms must be listed continuously across the whole sample period.

1.4.2 Variables and Summary Statistics

Panel A of Table 1 reports the summary statistics on investment expenditure, cash flow, and other control variables. *Interest rate* refers to the financial expenses over interest-carrying liabilities and measures the cost of debt.[15] Total capital expenditures is the measure of total investment (Inv) and cash flow (CF) is the earnings before interest, tax, depreciation, and amortization. All variables are scaled by the net fixed capital of the previous year, except Tobin's Q and interest rate. Table C1 in the Appendix provides the definitions for all variables. In terms of means, cash flow shows an increasing pattern and total investment shows a decreasing pattern, thereby suggesting the possible reduction of ICF sensitivity after the reform. For comparison, one can examine the rates in Chinese firms with those in the U.S. firms. Despite differences in the institutional environments of these two countries, some of the investment and cash flow variables are comparable in magnitude. In Hovakimian (2009), the average investment-capital ratio for U.S. manufacturing firms during 1985-2004 is 0.273, while the cash flow-capital ratio is 0.379. Both of these indices are lower than those for Chinese firms. Panel B reports the pre-reform firm features by the end of 2003. The fraction of NTS consists of around 60% of the total shares. In addition, around 75% of the listed companies in 2003 are SOEs.[16]

[15] Since the CSMAR dataset does not include the amount of interest paid, I use a parsimonious proxy for interest rate, namely, financial expenses over interest-carrying liabilities. Financial expense is the sum of net interest (interest paid - interest earned), exchange gains or loses, and commission charges. The interest-carrying liabilities include short-term borrowing and long-term debt.

[16] I define SOEs and non-SOEs based on their ultimate controlling party in the year prior to the policy announcement. Following previous studies, I define a firm as a SOE if its ultimate controller is the state; non-SOEs include private companies and mixed ownership but without state control (e.g., Liao et al.,

1.5 Empirical Findings

1.5.1 ICF Sensitivity: the Baseline Regression

First, I check whether a correlation exists between investment and cash flow after controlling for investment opportunities in Chinese listed firms. My starting point is the extended Q-model for investment-cash flow sensitivity, which is expressed as follows:

$$\frac{Inv_{i,j,t}}{K_{i,j,t-1}} = \alpha_0 + \beta_1 \frac{CF_{i,j,t}}{K_{i,j,t-1}} + \beta_2 Q_{i,j,t-1} + \beta_3 \frac{Sale_{i,j,t-1}}{K_{i,j,t-1}} + \alpha_i + \alpha_t + \alpha_{j,t} + \epsilon_{i,j,t} \qquad (1.3)$$

where the subscript i, j, and t denote for firm, industry, and year (1998-2014), respectively. The dependent variable Inv is capital expenditures. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. Traditional Q-investment models control for Tobin's Q as a proxy for investment opportunities. I also include $Sale$ as a control variable. Total sales approximate for production, to take into account the accelerator effects. Including this variable is important because production positively influences investment expenditures (Abel and Blanchard, 1986; Fazzari et al., 1988). I use the beginning-of-period values of all regressors (except CF) in order to avoid reverse causality. In all specifications, I include firm fixed effects (α_i) to control for the time-invariant firm characteristics omitted in the regression. I also include industry-by-year fixed effects ($\alpha_{j,t}$), controlling for shocks to a certain industry at a specific year.[17] The coefficient β_2 represents investment-cash flow sensitivity.

2014).

[17]Year fixed effects (α_t) are absorbed by industry-by-year fixed effects, where α_t controls for changing macroeconomic conditions. The industry is based on the one-letter code used by the China Securities Regulatory Commission. See the note in Table C1 for specific industrial classification.

I present the estimates of this equation in columns (1) and (3) of Table 2, and the results are consistent with the view that these firms rely on cash flow to finance their investment after controlling for growth opportunities and production. The coefficient of CF is between 0.209 and 0.268 (significant at the 1% level), which shows that investment is sensitivity to cash flow. This is consistent with the prediction of Proposition 2. Therefore, an additional RMB in cash flow of the current year will lead to 0.21-0.27 RMB in investment spending even after controlling for investment opportunities and production. The adjusted R^2 almost doubles when adding $Sale$ as a control variable. In column (5), the results are robust to the specification of Euler equation model of investment, where I use debt, beginning-of-period total investment, and its squared term to proxy for investment opportunities (Bond and Meghir, 1994). Table 2 also shows that the coefficients on Tobin's Q and Sale are significantly positive as expected, thereby indicating that investment expenditure increases with better investment opportunity and higher production.

1.5.2 ICF Sensitivity: the Interaction Regression

In the next set of regressions, I formally test whether the reform affects ICF sensitivity. Given that the SSSR alleviates agency-conflict, I would observe that ICF sensitivity declines after the reform. To test this hypothesis, I include a regime-shift dummy $Post$ and its interaction term with CF in the equation (4) as follows:

$$\frac{Inv_{i,j,t}}{K_{i,j,t-1}} = \alpha_0 + \beta_1 \frac{CF_{i,j,t}}{K_{i,j,t-1}} + \beta_2 \frac{CF_{i,j,t}}{K_{i,j,t-1}} * Post_t + \beta_3 Q_{i,j,t-1} + \beta_4 \frac{Sale_{i,j,t-1}}{K_{i,j,t-1}} + \alpha_i + \alpha_{j,t} + \epsilon_{i,j,t} \tag{1.4}$$

where $Post$ is the "treatment dummy", that is an indicator variable equal to 1 after the announcement year, and equal to 0 otherwise. The interaction term CF*$Post$

measures the average ICF sensitivity after policy announcement. The rest of the variables, fixed effects, and standard errors are the same as those in equation (3). In 2004, the State Council introduced "Some Opinions of the State Council on Promoting the Reform, Opening and Steady Growth of Capital Market" and explicitly emphasized the importance of actively yet prudently solving the split-share structure problem. I use the announcement time (year 2004) to classify the pre- and post- reform periods for two reasons. First, after its announcement by the State Council, firms perceived the guideline as a strong signal for an upcoming reform. Rather than wait until the end, they preferred to make adjust quickly and accordingly when they had such expectation in order to maintain a favorable position. This preference is particularly true in China because of powerful government interventions. Second, the announcement time is exogenous and can avoid the potential endogenous timing problem in policy completion. By estimating ICF sensitivity before and after the announcement, I could identify the impacts of the announcement for the same set of firms in a time-series framework.

Table 2 presents the results of the interaction regression for each specification, traditional Q-investment model (column (2)), extended Q-investment model (column (4)), and Euler equation model (column (6)). In all specifications, the coefficient on CF is positive and statistically significant, suggesting that, investment relied on cash flow during the pre-announcement period. However, the coefficient on CF that interacts with the $Post$ dummy is negative and statistically significant, thereby implying that ICF sensitivity is lower after the announcement. This observation becomes particularly apparent when the results contrast with the baseline regression. For instance, in column (4), ICF sensitivity drops from 0.273 to 0.193 (= 0.273 - 0.080). However, at this stage, we do not know which factors drive the declines in sensitivity.

1.5.3 Controlling Shareholders' Expropriation and ICF Sensitivity: Ownership Structures

From Proposition 3, if controlling shareholders' expropriation drives ICF sensitivity, I hypothesize that those firms with higher pre-reform expropriation will exhibit a higher ICF sensitivity during the pre-announcement period and experience larger declines in the sensitivity afterward. Given that the announcement is designed to protect minority shareholders and alleviate expropriation by the controlling shareholder, I expect that those firms with a large divergence in ownership structures will respond more to the policy. Therefore, I perform a difference-in-differences (DD) analysis in equation (5) to test this prediction:

$$\frac{Inv_{i,j,t}}{K_{i,j,t-1}} = \alpha_0 + \beta_1 \frac{CF_{i,j,t}}{K_{i,j,t-1}} + \beta_2 \frac{CF_{i,j,t}}{K_{i,j,t-1}} * Post_t + \beta_3 Z_i * \frac{CF_{i,j,t}}{K_{i,j,t-1}} * Post_t + \beta_4 Z_i * Post_{i,t} + \beta_5 Z_i * \frac{CF_{i,j,t}}{K_{i,j,t-1}} + \beta_6 Q_{i,j,t-1} + \beta_7 \frac{Sale_{i,j,t-1}}{K_{i,j,t-1}} + \alpha_i + \alpha_t + \alpha_{j,t} + \epsilon_{i,j,t} \quad (1.5)$$

where I include the same set of fixed effects and control variables as in equation (4). Z_i measures the pre-announcement of the controlling shareholders' expropriation. The coefficient of the triple interaction term (β_3) is the DD estimator that captures the effect of controlling shareholders' expropriation on ICF sensitivity after the SSSR. The coefficient on $Z_i * Post_{i,t}$ (β_4) measures the effect of expropriation on ICF sensitivity during the pre-announcement period. According to Propositions 3 and 4, β_3 must be negative, while β_4 must be positive.

A firm's ownership structure, specifically the disparity in the controlling shareholders' ownership and control (excess control) rights, is a common measure for the controlling shareholder's incentive to expropriate minority shareholders.[18] When the divergence is

[18]Consistent with the standard definition, ownership (cash flow) rights are the sum of the products of the proportion of ownership along the control chains, while the control (voting) rights are the minimum

high, the controlling shareholders can play an essential role in operations with only a relatively small direct stake in cash flow rights, thereby internalizing only part of their financial costs.[19]

I use the following variables to measure pre-reform ownership structures: (1) *Sdummy* (separation dummy) is a dummy equal to 1 if the control rights of the largest shareholder exceed the cash-flow rights, and equal to 0 otherwise. Thus, those firms with excess control rights ($Sdummy = 1$) can be seen as the treatment group, while those firms without excess control rights is the control group. (2) *Excess* (excess control rights) is a continuous variable that measures cash flow rights subtracted from the control rights of the largest shareholder. Having high excess control rights implies controlling shareholders can expropriate minority shareholders with less restraints.

The first three columns of Table 3 present the estimates that link ownership structures and ICF sensitivity for the whole sample. Column (1) reports the baseline regression in equation (5) with *Sdummy*. Column (2) reports a similar specification using *Excess*. Column (3) includes two variables to control for financing determinants of investment. I include cash holdings because cash is an important source of funds to finance investment. I also control for interest rate because a large proportion of external financing in Chinese firms comes from bank loans, and interest rate can be used as a proxy for costs of debt. As noted, interest rate, cash, and cash flow represent the financial condition of a firm in a more comprehensive way compared with cash flow only.

The estimates of all three specifications are consistent with the view that firms with ex-ante high separation of ownership and control rights experience economically and sta-

proportion of ownership along the control chains (Faccio and Lang, 2002).

[19]By way of illustration, if Firm A owns 80% in Firm B and if Firm B owns 70% in Firm C, then control rights of Firm A in Firm C is 70%, while its ownership rights in Firm C is 56%(=70%*80%). A sale of overpriced assets from Firms A to C for a value of $3,000 will result in a net loss of $3,000 for the shareholders in Firm C. However, the ultimate controller (Firm A) will have a net cash flow of $1,320 (=$3,000*(1-56%)).

tistically significant declines in their ICF sensitivities after the SSSR announcement. In column (1), the coefficient on β_1 is 0.217 (significant at the 1% level), thereby indicating that an additional dollar of cash flow in the current year leads to nearly $0.22 of capital expenditures after controlling for investment opportunities and sales in firms without excess control. The coefficient estimate for β_4 is 0.095, significant at the 10% level, suggesting that firms with excess control rights have experienced a 31.2% (=0.217+0.095) ICF sensitivity before 2003. The DD effect (β_3) is -0.146, thereby indicating that the ICF sensitivities in those firms have declined to 16.6%(=0.217+0.095-0.146) after the announcement. Moreover, the coefficients on β_3 and β_4 are comparable in magnitude and the sum of these two coefficients are statistically insignificant from zero (p-value = 0.28). This suggests that the reform has almost closed the gap in ICF sensitivity for firms with or without excess controls.

More importantly, I argue that Proposition 4 explains the declining ICF sensitivity shown in Section 5.2. In particular, ICF sensitivity decreases as the reform provides better legal shareholder protection because controlling shareholders' expropriation leads to ICF sensitivity (thereby verifying Proposition 3), and the SSSR announcement provides better investor protection and alleviates the incentive to expropriation (Proposition 1 is supported by the literature). The validation of those two propositions assures the prediction in Proposition 4.

Under the second specification, since *Excess* is measured in percentage points, a one standard deviation increase in the separation of ownership and control rights induces a 7.7% (=6.982*0.011) decrease in the ICF sensitivity at the 5% significance level. The sample size is smaller in column (3) because *Interest rate* is missing for some firm-year observations. The DD estimator is -0.008, which is significant at the 10% level, thereby suggesting that the financial determinants of investment only partially explain the effect of expropriation on ICF sensitivity. With respect to the coefficients on the control variables, as expected, I find that investment is positively correlated with Tobin's Q, total sales, and cash holdings, but is negatively associated with interest rate.

Moreover, many previous studies limit their samples to manufacturing firms only in the context of ICF sensitivity (e.g., Fazzari et al., 1988; Chen and Chen, 2012). The preceding estimations include all firms from non-financial sectors because the reform has affected almost all listed companies. To be consistent with previous research, I re-estimate the three specifications with manufacturing firms only based on the one-digit industrial codes published by the China Securities Regulatory Commission.

The last three columns of Table 3 present the findings. According to the DD estimators, the effect of ownership structures on ICF sensitivity is more pronounced across all specifications in manufacturing firms. In column (4), the DD effect in manufacturing firms (-0.254, significant at the 5% level) is larger in magnitude than that in the whole sample, suggesting that the ICF sensitivity is 38.0% (0.213+0.167) for manufacturing firms with excess control rights in the pre-announcement period, and such sensitivity declines to 12.6% (0.213+0.167-0.254) after 2004. In addition, the DD estimator in column (5) indicates that a one standard deviation increase in the divergence of ownership and control rights induces a 14.0% decline in the ICF sensitivity of manufacturing firms at the 5% significant level, which is higher than the 7.7% decline of the whole sample. The DD coefficient barely changes when the additional control variables in column (6) are added, which suggests that, the financial determinants do not drive my findings, at least for the manufacturing firms.[20]

Figure 3 shows the event-study graph for testing the parallel trend assumption. Panel A is for the whole sample, which corresponds to column (1), while Panel B is for manufacturing firms only, which corresponds to column (4). The solid black line plots the change

[20] In the untabulated results, I also a find similar effect in non-manufacturing firms. However, the DD coefficients are smaller in magnitude and statistically significant at the 10% level.

of β_3 over time and the dash lines plot the 95% upper and lower bounds of confidence intervals. The omitted year is 2014. According to Panel A, no pre-trend is observed before the announcement. Although it seems noisy, the tendency shows a positive difference in ICF sensitivity between firms with and without divergence of ownership and control rights before 2003. The ICF sensitivity converges to zero after the reform for the two groups of firms. This situation is more noticeable in Panel B. Before 2003, a positive gap is observed in ICF sensitivity with an increasing tendency, suggesting that the effects of expropriation on ICF sensitivity are highly pronounced. However, the difference in ICF sensitivity decreases immediately after the announcement and the coefficients fluctuate around zero afterward, thereby indicating that the SSSR alleviates the effects by reducing the less incentives of expropriation. In addition, the 95% confidence intervals shift downward from a (mostly) positive region to a region (mostly) centered around zero. Overall, the figure ensures that the required assumption in DD is satisfied and shows that the effect of expropriation on ICF sensitivity is more pronounced in manufacturing firms than in other types of firms.

However, one caveat in explaining the findings is that an endogenous missing data problem can underestimate the effects of controlling shareholders' expropriation on ICF sensitivity. The information for the largest shareholder's control and ownership rights are only available beginning from 2003 in CSMAR. After 2004, the China Securities Regulatory Commission required the annual reports of firms to disclose the diagram of the control chain, which is used to calculate ownership and control rights. Missing data are generated because around 29% of the firms in the whole sample did not (voluntarily) release such information in their 2003 annual reports. These firms are more likely to show divergence in their ownership and control rights because they do not want the outside investors to detect such disparity.[21] Otherwise, investors will expect their

[21]The average controlling shareholders' excess control rights are 3.6% in 2003 and 6.2% in 2004-2005.

money to be diverted by the controlling shareholder, thereby requiring a higher risk premium when providing capital for these firms. Therefore, I argue that the actual effects of expropriation on ICF sensitivity could be more noticeable than the findings in Table 3.

1.5.4 SOE and non-SOEs

I further partition the sample into SOEs and non-SOEs. The incentives of expropriation are stronger in non-SOEs because the controlling shareholders pursue maximizing returns, including private returns through diverting firms' resources. Additionally, managers in private firms, particularly those in emerging markets, are usually part of the controlling shareholders, thereby making expropriation easier to conduct. Therefore, I would expect that the DD effects of controlling shareholders' expropriation on ICF sensitivity are more pronounced among private firms.

Table 4 separately reports the estimates for SOE and non-SOEs. The first four columns show the results for the whole sample, while the last four columns show the results for manufacturing firms only. I choose $Excess$ as the measure of ownership structures, and the results are robust when $Sdummy$ is used as the proxy. The first two columns show that the DD effect for SOEs is -0.007, and is statistically insignificant at conventional level, while the DD effect for private firms is -0.020, and is statistically significant at the 5% level. The findings also become larger in magnitude (-0.018) and only significant in private firms (at the 5% level) when controls for the financial determinants of investment are included. As for manufacturing firms, the DD effect becomes even more pronounced in private firms but barely changes in SOEs. For instance, in column (8), a one standard deviation increase in the divergence of ownership structure results in a 23.0% (=0.033*6.982) reduction in ICF sensitivity for private firms in the manufacturing sector, significant at the 1% level. But the corresponding estimation for SOEs in column (7) is -0.008, which is also insignificant. Taken together, although I cannot reject the null hypothesis that the difference in the effect of expropriation on ICF sensitivity is zero for SOE and non-SOEs, private firms mainly drive the decline even though they only account for 1/3 of the observations.[22]

1.5.5 Controlling Shareholders' Expropriation and ICF Sensitivity: RPTs

I use the average amount of pre-announcement RPTs as an additional measure of expropriation (Z_i) because previous studies reveal that controlling shareholders use RPTs to conduct expropriation, especially under the context in China (e.g., Johnson et al., 2000; Jiang et al., 2010; Chen et al., 2012). RPTs are transactions between the parent company (controlling shareholder) and its subsidiary (the listed company) that involve inter-corporate loans, asset sales, equity sales, trading relationships, and cash payments to connected parties (Cheung et al., 2006). A parent company can extract resources from its listed firms through unfair, "self-dealing" transactions. In particular, given the highly concentrated ownership, limited tradability of majority shares, and weak investor protection, expropriation through RPTs become very evident in China.[23] For instance, in the normal course of business of Chinese firms, the parent company can acquire inter-corporate loans from its listed companies with preferential terms, such as, no interest

[22]I note that the mean of $Excess$ for non-SOE (SOE) firms is 6.84 (2.19) percentage points. The differential DD effect may also be driven by the relatively high separation ratio in private firms. However, given that ownership structures are endogenous, the controlling shareholders in non-SOEs could intentionally create such disparity in order to expropriate minority shareholders with less restraints.

[23]Admittedly, RPTs occur for reasons other than expropriation. Firms benefit from transactions with its connected parties as long as they are dealing at arm's length. Therefore, measurement errors occur when using RPTs to approximate for expropriation, working against finding results.

accruals (Jiang et al., 2010). Therefore, by providing RPTs as an additional proxy, I hope that I can show the effect of controlling shareholders' expropriation on ICF sensitivity, and the extent to which this effect remains robust across alternative measures.

I use two proxies to measure the average pre-reform RPTs. The first proxy is a time-invariant dummy variable RPT_{High}, which is equals to 1 if the average amount of RPT scaled by total sales between 1998 and 2003 is above its median, and equal to 0 otherwise. Therefore, the treatment group is $RPT_{High} = 1$ and the control group is $RPT_{High} = 0$. No "perfect" control group exists because even the group with smaller RPT is affected by the reform. The second proxy is the nature log of the average amount of pre-reform RPT ($Ln(1 + RPT)$) without scaling, which explores the effects of expropriation as a continuous variable. Those firms with high RPTs are more likely to suffer from severe controlling shareholders' expropriation. I expect the DD effect (β_3) to be negative and β_4 to be positive.

Table 5 presents the estimates for those specifications in RPTs for the whole sample. Column (1) reports the findings in the baseline specification (equation (5)) using RPT_{High}. Column (2) additionally controls for cash holdings and interest rate. Columns (3)-(4) separately estimate equation (5) for SOEs and private firms. Columns (5)-(6) show the estimates, including additional controls with $Ln(1 + RPT)$, for SOEs and private owned firms, respectively.

The estimates of all specifications are consistent with the view that firms with ex-ante high RPTs respond more to the reform. In column (1), the coefficient on $RPT_{High}*Post_t$ is positive and statistically significant at the 5% level, suggesting that the above median RPT firms experience a 12.5% greater ICF sensitivity than the below median firms before 2004. More importantly, the DD estimator is negative and statistically different from zero at the 5% level, which suggests that those firms also exhibit a 12.9% greater decline in ICF sensitivity after the reform. The DD effect is -14.2% when additional variables for the financial determinants of investment are included.[24]. Moreover, the coefficients on β_3 and β_4 are similar in magnitude and the sum of these two coefficients are statistically insignificant from zero (p-value = 0.91). This suggests that the reform has closed the gap in ICF sensitivity for firms with high and low RPTs.

The last four columns of Table 5 suggest that private firms mainly drive the decline in ICF sensitivity when using RPT as a proxy for controlling shareholders' expropriation. Columns (3)-(4) indicate that the DD effect is greater in magnitude (-0.170) and only significant in non-SOEs. The same pattern also holds true when treating RPT as a continuos variable as reported in columns (5)-(6). In column (6), a 10% increase in the amount of RPT induces a 12% decrease in post-reform ICF sensitivity, which is significant at the 5% level. However, the DD estimators for SOEs are statistically insignificant and smaller in magnitude. I obtain an even more pronounced effect in non-SOEs when including manufacturing firms only. It is not unexpected given that expropriating incentives are stronger for controlling shareholders in private firms than the government agencies in SOEs.

To test the parallel trend assumption, Figure 4 presents an event-study graph of β_3 corresponding to the specification in column (2). First, the coefficients of β_3 are positive and shows no pre-trend before 2003. After the announcement, the difference in ICF sensitivity decreases immediately and the coefficients fluctuate around zero afterward. This observation implies that those firms with above median RPT tend to remain a relatively high pre-reform ICF sensitivity, and experience a contemporaneous reduction in such sensitivity at the time of the announcement. The difference in ICF sensitivity between those two RPT groups converges to zero over time. Overall, although the confidence interval is noisy, Figure 4 ensures that the required assumptions in DD are satisfied.

[24]The results still hold when using median regression, suggesting that the findings are robust to outliers and non-normal errors. In addition, the results are robust when RPT_{High} is defined as scaling RPT by total assets instead of total sales.

1.5.6 Robustness Check

Alternative Measure for Controlling Shareholders' Expropriation

I provide an alternative firm-specific measure of the incentives of controlling shareholders' expropriation, that is the monitoring intensity by large (non-controlling) shareholders. Following Chen et al. (2012), I measure it as the sum of shares collectively held by the second to the fifth largest shareholders (as a percentage of total shares) multiplying a Herfindahl index for the concentration of shares, averaged over the pre-announcement period. Thus, a higher external monitoring intensity implies that large (non-controlling) shareholders hold more shares in a highly concentrated way. Therefore, these shareholders have more direct stake and voting power in the firm. I hypothesize that stronger monitor by large shareholders will limit the opportunities and abilities of the controlling shareholders to expropriate. In other words, I expect that firms with ex-ante lower monitoring will experience a significant and greater reduction in ICF sensitivity.

Table 6 reports the split sample estimation based on monitoring intensity. Columns (3) and (4) control for the financing determinants of investment, namely, $Cash$ and $Cost\ of\ debt$. The results indicate that for those firms with below median level of monitoring, a statistically significant 14.3% reduction in ICF sensitivity is observed as shown in column (2). Meanwhile, an 11.3% reduction in ICF sensitivity (significant at the 10% level) is observed if additional controls for financial condition are included. However, the corresponding estimated changes are not statistically significant for those firms with an above median monitoring level. These estimates suggest that those firms with lower monitoring by large shareholders mainly drive the declines in ICF sensitivity, which is consistent with the notion that expropriation leads to ICF sensitivity. Therefore, I verify the causal link between controlling shareholders' expropriation and ICF sensitivity as well as the extent to which this effect is robust across three different measures, namely, excess control rights, RPTs, and large shareholder monitoring.

Endogenous Control

My research design assumes the SSSR as an exogenous shock the incentives of controlling shareholders' expropriation, with no effects on the variables that are uncorrelated with such incentive but also affect ICF sensitivity. In particular, if the SSSR affects the cash flow or investment opportunities differently for firms with high or low expropriation, my findings would be subject to endogenous control problems. In this case, for example, a negative DD coefficient my be attributed to an increasing (decreasing) cash flow for firms with more (less) controlling shareholders' expropriation.

I explicitly test the endogenous control problem by regressing each control variables, including cash flow, Tobin's Q, interest rate, cash holdings, and total sales on *Post*Sdummy*, with the rest of the controls (other than the dependent variable itself). Thus, the coefficients of the interaction terms capture the heterogenous effects for firms with or without separation of ownership and control rights.

Table 6 presents the coefficients on *Post*Sdummy*, and the results from all specifications suggest that the DD effects does not seem to be biased by endogenous controls. In column (1), the dependent variable is cash flow and the control variables include Tobin's Q, sale, cash, and interest rate. The coefficient of interest is small in magnitude (0.001) and statistically insignificant, thereby implying no heterogenous effects on cash flow for firms with or without excess control rights. The effects on Tobin's Q, interest rate, and cash holdings are also negligible as shown in columns (2)-(4). No endogenous control problems are also observed in *Sale*. The coefficients on *Post*Sdummy* are statistically insignificant and small in magnitude when using $Post^{*}Excess$ and $Post^{*}Ln(1 + RPT)$ to measure the level of expropriation (results are not tabulated).

Alternative Sample Time Selection

The third set of robustness check comes from an alternative sample time selection. The sample period in the main results is from 1998 to 2014. I reestimate the regressions from Table 2 to Table 5 with observations from 2000 to 2007 because the alternative sample time eliminates the potential impacts from the post-2007 financial crisis. In addition, the sample is symmetric around the time of announcement in 2004. I obtain quantitatively similar results using this alternative time selection (results are untabulated), thereby ensuring that the data construction procedure is not an important determinant of my results.

1.6 Potential Concerns

1.6.1 Manager's Over-investment

The reform could also mitigate the canonical principle-agent problem between managers and shareholders, and reduce manager's over-investment. This is because holders of NTS (usually the controlling shareholder) paid less attention to a firm's operating performance under the two-tier structure. Due to the lack of monitoring intensity, managers in firms with available free cash flow tended to engage in wasteful expenditure. But when NTS are associated with market price, the benefits of monitoring increase for controlling shareholders. They tend to form stronger monitoring intensity on managers, and develop better incentive compensations based on the manager's performance, which results in the establishment of professional manager markets. Therefore, if those firms suffering from high expropriation were also the ones experiencing more severe pre-reform over-investment, attributing the declines in ICF sensitivity to expropriation could be problematic.

This subsection tests this alternative explanation by examining the subsample effects of expropriation on ICF sensitivity in firms with different likelihood of over-investment and by explicitly estimating the sensitivity of over-investment to free cash flow. If the mitigation of manager's over-investment could explain the findings, I would expect to see significant declines in over-investment and free cash flow sensitivity for firms with high expropriation, and/or the DD effect (β_3) is more prominent in firms with high likelihood of over-investment. Admittedly, neither of these two approaches could perfectly measure agency-conflict between managers and shareholders. My hope is that, by using two different methodologies, I can increase the power and accuracy of my test when rule out this alternative explanation.

Within-Sample Comparison: The Likelihood of Over-Investment

I partition the firms based on the likelihood of manager's over-investment. If those firms with higher expropriation are suffering from severe agency costs of free cash flow, then the effects of controlling shareholders' expropriation on ICF sensitivity will be significant and larger in firms with a high likelihood of over-investment. First, I use cash balance as a partitioning variable based on the argument that firms with large cash holdings are more likely to face managers' overspending (e.g., Jensen, 1986; Opler et al., 1999; Biddle et al., 2009).[25] I also use leverage ratio as another proxy for the likelihood of over-investment because debt mitigates overspending by reducing the cash flow available for expenditures at the discretion of managers Jensen, 1986. Moreover, high leverage firms tend to experience under-investment due to a potential debt overhang problem, thereby leading to a lower likelihood of over-investment (e.g., Myers, 1977). Thus, firms with high cash holdings and low leverage will potentially suffer more from manager's over-investment.

Table 9 presents the subsample estimation of equation (5) based on the likelihood of over-investment with a full set of control variables. Cash holding is computed as cash and cash equivalents divided by total assets, while leverage is the ratio of total debt to total assets. Columns (1)-(2) report the results for firms with high versus low values of pre-announcement cash holdings, while columns (3)-(4) report the results for firms with high versus low values of leverage. The coefficient estimate for the triple interaction term is larger in magnitude for firms with below median cash holdings (-0.013) and above median leverage (-0.013), and is statistically insignificant and small in magnitude with above median cash holdings (-0.005) and below median leverage (-0.002). These findings suggest that the effects of controlling shareholders' expropriation on ICF sensitivity is not highly pronounced in firms with a high probability of over-investment.[26] Taken together, these results are not consistent with the alternative explanation that the declines in ICF sensitivity for firms with higher expropriation is due to the mitigation of manager's over-investment.

[25] Admittedly, firms can save cash in anticipation of financial constraints. Nonetheless, empirical evidence suggests that firms with high cash holdings are more likely to face managers' agency considerations, such as empire building and perquisite consumption, thereby causing over-investment (e.g., Blanchard et al., 1994; Opler et al., 1999; Biddle et al., 2009).

[26] I obtain qualitatively similar results (untabulated) when I replace *Excess* with *Sdummy* in the regression and when I partition cash holdings and leverage on the subsamples of SOEs and private firms.

The Sensitivity of Over-Investment to Free Cash Flow

I directly measure over-investment relative to the "optimal" investment following the accounting-based framework (Richardson, 2006) as a different approach. Table C3 reports the summary statistics for over- (under-) investment and free cash flow estimated. All variables are scaled by the average total assets. The positive (negative) residuals between actual investment and "optimal" investment are over- (under-) investment. I include detailed information for calculating over- (under-) investment and free cash flow in Part B of the Appendix.

If the manager's tendency of over-investment has been restricted by a stronger monitoring and a proper compensation scheme after the announcement, then I expect the over-investment to be less responsive to free cash flow and also expect this finding to be strongest for those firms with the highest reduction in sensitivity. For example, compared with private firms, the main agency issue in SOEs is the agency-conflict between shareholders and managers, given that SOEs have different objectives and principal-agent framework (Liu and Tian, 2007). In addition, the management is usually part of the controlling family in private firms in emerging markets, thereby leading to more efficient monitoring on managers. Therefore, I predict that SOEs respond more to the announcement in terms of reducing over-investment of free cash flow.

To test this hypothesis, I estimate equation (6) on the whole sample and the subsamples based on state ownership as follows:

$$\frac{I^{over}_{i,j,t}}{aveSize_{i,j,t}} = \alpha_0 + \beta_1 \frac{FCF_{i,j,t}}{aveSize_{i,j,t}} + \beta_2 \frac{FCF_{i,j,t}}{aveSize_{i,j,t}} * Post_t + \alpha_i + \alpha_{j,t} + \epsilon_{i,j,t} \tag{1.6}$$

The dependent variable is Over-investment. Free cash flow (FCF) is computed as cash flow from operations minus investment for maintenance and "optimal" investment. The variables are scaled by the average total assets. *Post* is the regime-shift variable that is equal to 1 after announcement, and equal to 0 otherwise. The coefficient of interest, β_2, checks if the average free cash flow and over-investment sensitivity has changed after the announcement. I also control for firm fixed effects (α_i), year fixed effects and industry-by-year fixed effects($\alpha_{j,t}$).

Panel A of Table 8 reports the estimation for equation (6). Columns (1)-(3) report the regression analysis based on the coefficients in column (1) Table C2. The last column shows regression estimation based on the coefficients in Richardson (2006) (column (2) of Table C2) without industry-by-year fixed effects.

Panel A shows that the SSSR alleviates the agency-conflict between managers and shareholders and reduces the manager's over-investment. The coefficient on FCF is economically and statistically significant in the whole sample and SOEs, suggesting that managers indeed conduct over-investment when free cash flow is available in SOEs. The outcomes in the first column indicate that the decline of over-investment and free cash flow sensitivity is economically and statistically significant. Columns (3) shows a 6.4% decline in sensitivity for SOEs, significant at the 5% level, and shows almost no change for non-SOEs. These estimates suggest that the declines in ICF sensitivity are mainly driven by SOEs, which is consistent with the view that these firms suffer more from manager's over-investment compared with non-SOEs. The main results still hold in column (4), thereby suggesting that, even if those firms were located in the U.S., they would still face reductions in over-investment of free cash flow during the post-announcement period. These results provide strong evidence to support that the canonical principle-agent problem is largely alleviated after the reform.

Panel B of Table 8 shows within-sample regression based on three measurements of pre-reform expropriation by controlling shareholders. The reduction in sensitivity is insignificant and similar in magnitude for firms with or without excess control rights. Meanwhile, the declines in sensitivity are marginally significance for firms with no excess control rights, and the significant level is higher for firms with a greater monitoring intensity. The outcomes are inconsistent with the hypothesis that firms suffering more from expropriation are also the ones experiencing larger manager's over-investment.

1.6.2 Financial Constraints

As another possible concern, the reduction of ICF sensitivity in firms with high controlling shareholders' expropriation can be explained by the easing financial constraints in those companies after the SSSR. The cost wedge between internal funds as well as external funds and the availability of internal funds are two essential aspects affecting financial conditions. In Section 5.6, I show that cash flow does not change differently for firms with disparate levels of expropriation. However, those firms that are suffering greatly from expropriation can access less expensive external finance after the reform. In particular, costs of equity are usually high in firms where controlling shareholders can divert resources with few restraints, because outside investors could expect their money to be expropriated, thereby requesting for a higher risk premium when providing funds (Lins et al., 2005). Consequently, those companies can benefit from the cheaper costs of financing due to less expropriation after the reform, thereby leading to lower dependence of investment on cash flow. Stated differently, if firms with high expropriation were also financially constrained before the announcement, then the negative DD effect (β_3) can be due to the lower costs of external financing after the SSSR.

I examine the changes in financial status for firms with high or low expropriation by employing direct and indirect measures of financial constraints. Direct measures include costs and volume of external financing. A more relaxing condition of external financing for firms with high expropriation would implicate that these firms face relatively relaxing financial conditions. I also apply three indirect measures of financial constraints, namely, cash holdings, cash-cash flow sensitivity, and underinvestment to free cash flow sensitivity. Given that ICF sensitivity is a controversial measure of financial constraints, if firms with high expropriation have experienced relatively easing financial conditions after the reform, then I expect to see negative DD effects in those indirect measures of financial constraints.

Direct Measures of Financial Constraints

A. Costs of External Financing

Costs of equity and costs of debt are the two main aspects of external financing costs in China. In Section 5, I have shown that the DD effect still holds when the interest rate is included as an additional control variable, and costs of debt do not seem to suffer from the endogenous control problem. Thus, I only need to examine costs of equity. One way to estimate the change of cost of equity due to policy announcement is to obtain the market-adjusted cumulative abnormal return (CAR) using CAPM. Specifically, the policy announcement by the State Council on January 31 2004 may result in a positive stock price reaction, which in turn will lead to lower costs of equity. According to the efficient market assumption, the CAR shock around the event date will persist in the long term if no further shocks are observed.

Table 10 reports the market-adjusted CAR for 3 days, 5 days, and 11 days around the policy announcement date for SOEs and non-SOEs with different RPTs and excess control. The composite index for all A-shares is used as a proxy for market returns. All CARs are positively significantly at the 1% level, thereby indicating that the announcement was unexpected and indeed lowered the cost of equity for those companies. In addition, the CAR is higher for private firms than for SOEs, thereby suggesting that the announcement leads to a relatively lower cost of equity finance for non-SOEs. However, the Difference_{1-0} for firms with or without excess controls, or for firms with high and low RPT is not positively significant between SOEs and non-SOEs in those periods. These findings are consistent with the notion that the policy announcement has lowered the cost of equity, but the decreasing cost is statistically insignificant for firms with high or low controlling shareholders' expropriation.

B. Volume of External Financing

However, under credit rationing, firms are still constrained financially if they cannot borrow or issue new equity even when the apparent costs of external finance are low (Chen and Chen, 2012). Given that the NTS accounts for 2/3 of total shares on average, companies have been imposed restrictions for equity issuance during the pre-reform years. To address this concern, Figure 4 plots the change in new debt issuance, measured as the aggregate change in total debt scaled by total assets; the new equity issuance, measured as the aggregate change in total equity (the sum of common stock and capital surplus) scaled by total assets. In 1998, new debt issuances account for 6% of total assets. In 2014, this fraction has declined to 4%. Such decreasing trend of new debt issuance is statistically significant. The new equity issuances account for 6% of total assets in 1998 and 2% in 2014. This implies that although a majority shares cannot be exchanged before the reform, controlling shareholders can still issue new equity through allotment of shares. Overall, the trends of new issue activities for debt and equity decline significantly over time. These data do not support the view that reduction in credit rationing has occurred after the reform.

Indirect Measures of Financial Constraints

A. Cash Holdings

Firms usually hold cash as a precaution against future financial constraints, and accessibility to capital market explains cash holdings to a great extent (Opler et al., 1999; Erel et al., 2015). If the reform eases the financial constraints for firms with high expropriation, then the precautionary demand for holding cash (i.e., firms' cash holding) declines in those companies during the post-reform period. I estimate the following specification to predict the change in the amount of cash for firms with disparate ownership structures normalized by their total assets:

$$Cash_{i,j,t}/Size_{i,j,t} = \alpha_0 + \beta_1 Post_t + \beta_2 Post_t * Excess_i + \gamma Controls_{i,j,t} + \alpha_i + \alpha_{j,t} + \epsilon_{i,j,t}$$

where the coefficient $Post_t*Excess_i$ captures the cash holdings for firms with different ownership structures after the announcement. I include firm fixed effects and (one-digit) industry-by-year fixed effects (year fixed effects are absorbed). Following Erel et al. (2015), I include a different set of control variables, including log of firm size and its squared term, leverage, and sales growth (see Table C1 for the variable definitions).

The estimates of cash holdings are presented in the first three columns of Table 11. The coefficient estimate for $Post_t*Excess_i$ is negligible and statistically insignificant, and the finding holds for the whole sample, SOEs, and non-SOEs. These results suggest that the precautionary demand for cash holdings does not change for firms with different ownership structures.

B. Cash-Cash Flow Sensitivity

The propensity of a firm to save cash from incremental cash flow presents another approach for estimating financial constraints (Almeida et al., 2004).[27] A positive sensitivity of cash to cash flow can be seen as evidence of future constraints (e.g., Hadlock and Pierce, 2010; Erel et al., 2015). If the reform relaxes the financial constraints in firms with more expropriation, then I expect to see significant reductions in cash-cash flow sensitivity for these companies. I use the following specification to estimate the changes in the cash to cash flow sensitivity of firms with disparate ownership structures at the time of the SSSR:

$$\Delta\frac{Cash_{i,j,t}}{Size_{i,j,t}} = \alpha_0 + \beta_1\frac{CF_{i,j,t}}{Size_{i,j,t}} + \beta_2\frac{CF_{i,j,t}}{Size_{i,j,t}} * Post_t + \beta_3 Excess * \frac{CF_{i,j,t}}{Size_{i,j,t}} * Post_t + \beta_4 Excess * \frac{CF_{i,j,t}}{Size_{i,j,t}} + \beta_5 Excess * Post_{i,t} + \gamma Controls + \alpha_i + \alpha_{j,t} + \epsilon_{i,j,t}$$

where fixed effects and other control variables are the same as those in the the cash holding equation, and the coefficient of interest is the triple interaction term.

The estimates for changes in cash to cash flow sensitivity are presented in the last three columns of Table 11. The coefficient estimate of $Excess * \frac{CF_{i,j,t}}{Size_{i,j,t}} * Post_t$ is negligible and statistically insignificant, and this finding is consistent among the whole sample, SOEs, and non-SOEs. These findings imply that the propensity to save cash from incremental cash flow for future investment does not change for firms with disparate ownership structures.

C. Under-Investment and Free Cash Flow

When firms face financial constraints, they may forgo profitable projects because they have to use their internal cash flow to fund their investment; thus, a negative cash flow

[27] Almeida et al. (2004) argue that an increase in cash flow would not affect the investment in unconstrained firms because they would invest at the first-best level. However, when firms face financial constraints, they have to prioritize investment and would allocate additional cash flow to expand their investment. Consequently, cash holdings for future investment may increase along with cash flow in financially constrained firms.

shock can cause under-investment. A high under-investment to free cash flow sensitivity can be used as evidence of financial constraints (Guariglia and Yang, 2016). Therefore, a declining under-investment to free cash flow sensitivity will implicate easing financial conditions. The model specification is similar to equation (6) with only one change, that is, I use *under-investment* as the dependent variable.

Table C4 reports the findings on under-investment to free cash flow sensitivity for the subsamples based on the measures of expropriation. The coefficients on free cash flow are significant across all columns. However, the interaction term is statistically insignificant for either SOEs or non-SOEs, and for firms with or without excess control, high or low RPTs, and monitoring intensity. This evidence implies that although firms have been constrained before, they do not face a significantly easing financial condition after the announcement. Taken together, I argue that those firms with severe controlling shareholders' expropriation do not experience relatively easing financial constraints after the reform, and these findings are consistent with the alternative indirect measures of financial condition.

To summarize, I examine financial constraint both through its explicit measures, namely, cost of debt, cost of equity, cash flow, and growth of external financing, and three indirect measures. Empirical evidence suggests that even though the reform may relax financial constraints through lower costs of equity, the effects are similar for firms with different ownership structures. Stated differently, the declines in ICF sensitivity for firms suffering greatly from controlling shareholders' expropriation are caused by their relatively easing financial conditions.

1.6.3 Measurement Errors in Investment Opportunities

In principle, investment opportunities can explain a large proportion of the cash flow effects if Tobin's Q is a noisy proxy. For example, if Tobin's Q performs worse for financially constrained firms, then these firms may obtain a higher ICF sensitivity because cash flow reflects more information in investment opportunities (Alti, 2003). The SSSR may affect the measurement errors in Tobin's Q. This is because before the announcement, the majority shares were non-tradable, thereby creating measurement errors in estimating the market value and leading to poor performance of Tobin's Q. However, this situation is improved after the reform completion because all shares have become tradable, thereby providing a relatively proper calculation of market value and Tobin's Q. Therefore, another alternative explanation for my results can be: if Tobin's Q is a noisier proxy for firms with higher expropriation before the announcement and the reform has alleviated the measurement errors in these firms, then the reform can also lead to declines in ICF sensitivity.

While I do not know any particular channels of how the SSSR can mitigate measurement errors more profoundly in firms with higher expropriation, and even though my research design focuses on the difference of coefficients thereby canceling out potential bias, I want to ensure that this possible argument is not an essential determinant of my results. I address this concern by applying a standard instrument variable approach. Following Lewellen and Lewellen (2016), I use the beginning-of-period stock returns as an instrument for investment opportunities based on the assumption that fundamental value drives stock prices. In addition, I consider the beginning-of-period growth rate of sales as another instrument in the Chinese context. The first-stage is an over-identification case where I regress Q_{t-1} on the beginning-of-period stock returns, beginning-of-period growth rate of sales, and other control variables. Then, I obtain a fitted value $Q*_{t-1}$. In the second-stage, I replace Q_{t-1} with $Q*_{t-1}$ for the main regressions in Tables 2, 3, and 4. The idea is that the coefficient of $Q*_{t-1}$ in the second-stage reflects the fraction of cash flow that is uncorrelated with investment opportunities.

The results of the error-corrected model are presented in Table 12. The specifications follow column (4) of Table 2, column (1) of Table 3, and column (1) of Table 4.The first two are over-identification, while the last one is exact-identification. Related tests show that my models pass the weak instrument test and cannot reject the null in the Hansen J test, thereby implying that the over-identifying restrictions are valid. The estimates are similar in magnitude and are significant with the findings in Tables 2-4 because my research design focuses on the differences in ICF sensitivity, thereby canceling out potential biases to a great extent. Furthermore, I find my findings are robust to other proxy variables for investment opportunities, namely, beginning-of-period market-to-book ratio, beginning-of-period growth of employment, and the Euler equation specification in column (6) of Table 2. The evidence supports the view that the measurement errors in investment opportunities do not seem to cause the declines in ICF sensitivity.

1.7 Conclusions

This paper tests the extent to which the agency-conflict within shareholders drives ICF sensitivity through controlling shareholders' expropriation. I exploit a unique policy reform in China, the SSSR, which aligned the interests of shareholders and exogenously alleviated the incentives of expropriation from controlling shareholders by converting all NTS to TS. Chinese listed companies usually have highly concentrated ownership structure with weak investor protection, thereby facilitating the detection of the impacts of expropriation on ICF sensitivity. With a generalization of the model in Kaplan and

Zingales (1997), I illustrate that controlling shareholders' expropriation diminishes investment returns, thereby leading to a relatively high cost-wedge between external and internal finance. Therefore, firms have to rely more on the low-cost cash flow to invest. Empirically, I argue that firms with high levels of pre-reform expropriation show significant declines in ICF sensitivity, and this finding is more pronounced among private firms. Furthermore, the findings are robust to alternative measures of expropriation. I also make considerable efforts to show that alternative explanations, including the managers' over-investment, financial constraints, and measurement errors in investment opportunities, do not seem to drive my findings.

My findings also expand potential research directions. Agency problems lead to ICF sensitivity through both controlling shareholders' expropriation and manager's over-investment. Further work should try to disentangle the two effects to realize the relative importance of these channels and should also empirically test the mechanism through which expropriation leads to ICF sensitivity. Doing so would greatly contribute to our understanding of how investment depends on cash flow under the agency relationship.

One of the most essential implications from the SSSR is the liquidity of the majority shares can resolve the agency-conflict in private firms to a great extent. However, given the difference in state ownership between SOE and non-SOEs, policy makers should continue searching for the solution to address the different types of agency-conflict in SOEs. This partially explains why Chinese government pledges to further deepen the reform of SOEs.

1.8 Tables & Figures

Table 1: Summary Statistics (1998-2014)

Panel A: Main Regression Variables

	Mean	SD	5%	25%	50%	75%	95%
Before (1998-2003)							
$\text{Investment}_t/K_{t-1}$	0.334	0.507	0.009	0.064	0.175	0.396	1.148
$\text{Cash flow}_t/K_{t-1}$	0.431	0.746	-0.229	0.181	0.313	0.526	1.378
$\text{Sale}_{t-1}/K_{t-1}$	3.093	5.442	0.433	0.977	1.696	3.052	9.139
Tobin's Q_{t-1}	2.447	1.513	0.822	1.400	2.066	3.078	5.377
$\text{Debt}_{t-1}/K_{t-1}$	2.554	4.099	0.447	0.970	1.549	2.640	7.270
Cash_t/K_{t-1}	1.007	1.811	0.053	0.223	0.477	1.025	3.585
Interest Rate_t	0.038	0.119	-0.034	0.026	0.046	0.064	0.116
After (2004-2014)							
$\text{lnvestment}_t/K_{t-1}$	0.318	0.475	0.018	0.082	0.186	0.359	1.006
$\text{Cash flow}_t/K_{t-1}$	0.517	0.895	-0.076	0.185	0.301	0.552	1.699
$\text{Sale}_{t-1}/K_{t-1}$	4.495	7.217	0.485	1.192	2.250	4.549	15.511
Tobin's Q_{t-1}	1.437	1.275	0.325	0.646	1.067	1.779	3.774
$\text{Debt}_{t-1}/K_{t-1}$	3.197	5.959	0.451	1.026	1.632	2.961	9.775
Cash_t/K_{t-1}	1.178	2.165	0.063	0.225	0.518	1.191	4.131
Interest Rate_t	0.051	0.146	-0.047	0.036	0.057	0.080	0.174

Panel B: Pre-Announcement Firm Characteristics (by the end of 2003)

	Mean	SD	5%	25%	50%	75%	95%
RPT/Sales	0.163	0.296	0.000	0.000	0.031	0.186	0.784
Ln(1+RPT)	13.084	7.965	0.000	0.000	17.026	18.618	20.764
Sdummy	0.250	0.433	0.000	0.000	0.000	1.000	1.000
Excess (p.p.)	3.352	6.982	0.000	0.000	0.000	0.008	20.938
NTS	0.592	0.126	0.362	0.526	0.614	0.679	0.750
SOE	0.751	0.432	0.000	1.000	1.000	1.000	1.000

The sample consists of 15,482 firm-year observations and 1,314 unique firms from 1998 to 2014. Panel A shows the summary statistics for the main regression variables during the pre- and post- announcement periods, respectively. The main variables are winsorized at 1% and 99% to minimize the influence of outliers. Investment expenditure and cash flow variables are deflated by the beginning-of-period net fixed capital. Panel B reports the (average) pre-announcement firm features by the end of 2003, where *Excess* (p.p.) is measured in terms of percentage points. Variable definitions are provided in the Appendix Table C1.

Table 2: Investment-Cash Flow (ICF) Sensitivity and the Reform

Dependent Variable: $\text{Investment}_t/\text{K}_{t-1}$	(1)	(2)	(3)	(4)	(5)	(6)
$\text{CF}_t/\text{K}_{t-1}$	0.268***	0.330***	0.209***	0.273***	0.190***	0.260***
	(0.016)	(0.037)	(0.017)	(0.032)	(0.019)	(0.036)
Post_t * $(\text{CF}_t/\text{K}_{t-1})$		-0.079*		-0.080**		-0.084**
		(0.043)		(0.038)		(0.040)
Tobin's Q_{t-1}	0.031***	0.029***	0.036***	0.034***		
	(0.006)	(0.006)	(0.006)	(0.006)		
$\text{Sale}_{t-1}/\text{K}_{t-1}$			0.020***	0.020***	0.012***	0.012***
			(0.003)	(0.003)	(0.003)	(0.003)
$\text{Debt}_{t-1}/\text{K}_{t-1}$					0.007**	0.008**
					(0.003)	(0.003)
$\text{Itotal}_{t-1}/\text{K}_{t-2}$					0.379***	0.380***
					(0.031)	(0.030)
$(\text{Itotal}_{t-1}/K_{t-2})^2$					-0.048***	-0.049***
					(0.014)	(0.014)
Adjusted R^2	0.208	0.211	0.235	0.238	0.285	0.288
N	15,482	15,482	15,476	15,476	14,010	14,010

This table presents the estimates of ICF sensitivity during the sample period in columns (1), (3), and (5), and the effects of the SSSR on ICF sensitivity in columns (2), (4), and (6). All regressions include year, firm, and (one-digit) industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. I also include its interaction with cash flow (CF) to examine the changes in sensitivities subsequent to the announcement. Columns (5)-(6) present the findings for the Euler equation model, including the sum of short-term and long-term debts, beginning-of-period value of investment, and its squared term. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 3: Controlling Shareholders' Expropriation and ICF Sensitivity: Ownership Structures

Dependent Variable:	Whole Sample			Manufacturing Firms Only		
$Investment_t/K_{t-1}$	(1)	(2)	(3)	(4)	(5)	(6)
CF_t/K_{t-1}	0.217***	0.223***	0.167***	0.213***	0.212***	0.152***
	(0.038)	(0.036)	(0.035)	(0.052)	(0.050)	(0.047)
$Post_t$*(CF_t/K_{t-1})	-0.012	-0.017	0.002	-0.003	-0.013	0.004
	(0.042)	(0.039)	(0.038)	(0.062)	(0.058)	(0.054)
$\boldsymbol{Triple_1}$	-0.146**			-0.254**		
	(0.069)			(0.110)		
S_{dummy}*(CF_t/K_{t-1})	0.095*			0.167**		
	(0.057)			(0.084)		
S_{dummy}*$Post_t$	0.016			0.086*		
	(0.036)			(0.047)		
$\boldsymbol{Triple_2}$		-0.011**	-0.008*		-0.020**	-0.020**
		(0.005)	(0.005)		(0.008)	(0.008)
*Excess**(CF_t/K_{t-1})		0.006	0.005		0.014**	0.014*
		(0.004)	(0.004)		(0.007)	(0.007)
$Post_t$*$Excess$		0.004	0.003		0.009**	0.009**
		(0.003)	(0.003)		(0.004)	(0.004)
Controls:						
Tobin's Q_{t-1}	0.038***	0.038***	0.043***	0.037***	0.037***	0.043***
	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.009)
$Sale_{t-1}/K_{t-1}$	0.021***	0.021***	0.010***	0.029***	0.030***	0.013**
	(0.004)	(0.004)	(0.003)	(0.007)	(0.007)	(0.007)
$Cash_t/K_{t-1}$			0.061***			0.079***
			(0.010)			(0.014)
Interest $Rate_t$			-0.145***			-0.084
			(0.052)			(0.059)
Adjusted R^2	0.242	0.243	0.284	0.219	0.219	0.271
N	10,454	10,454	9,773	6,312	6,312	5,925

This table presents the effects of controlling shareholders' expropriation (measured with ownership structures) on ICF sensitivity for the whole sample (columns (1)-(3)) and for manufacturing firms only (columns (4)-(6)). All regressions include year, firm, and (one-digit) industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Triple_1$ stands for $\mathbf{Post_t}$*$\boldsymbol{S_{dummy}}$*$\mathbf{(CF_t/K_{t-1})}$ and $Triple_2$ stands for $\mathbf{Post_t}$*$\boldsymbol{Excess}$*$\mathbf{(CF_t/K_{t-1})}$. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 4: Controlling Shareholders' Expropriation and ICF Sensitivity: SOEs and non-SOEs

Dependent Variable:	Whole Sample				Manufacturing Firms Only			
$Investment_t/K_{t-1}$	SOE (1)	non-SOE (2)	SOE (3)	non-SOE (4)	SOE (5)	non-SOE (6)	SOE (7)	non-SOE (8)
CF_t/K_{t-1}	0.245***	0.168***	0.200***	0.100	0.236***	0.190***	0.171***	0.122**
	(0.045)	(0.060)	(0.044)	(0.066)	(0.069)	(0.055)	(0.065)	(0.059)
$Post_t$ * (CF_t/K_{t-1})	-0.031	0.029	-0.019	0.059	-0.009	0.006	0.004	0.037
	(0.048)	(0.068)	(0.046)	(0.074)	(0.077)	(0.072)	(0.070)	(0.073)
$\boldsymbol{Triple_2}$	-0.007	-0.020**	-0.004	-0.018**	-0.009	-0.031**	-0.008	-0.033***
	(0.005)	(0.009)	(0.004)	(0.009)	(0.008)	(0.013)	(0.007)	(0.012)
$Excess$*(CF_t/K_{t-1})	0.003	0.013**	0.002	0.011*	0.007	0.019**	0.006	0.020*
	(0.005)	(0.006)	(0.004)	(0.006)	(0.007)	(0.009)	(0.008)	(0.010)
$Excess$*$Post_t$	0.006**	0.001	0.003	0.002	0.010***	0.003	0.009**	0.005
	(0.003)	(0.006)	(0.002)	(0.006)	(0.004)	(0.007)	(0.004)	(0.007)
Controls:								
Tobin's Q_{t-1}	0.037***	0.042***	0.043***	0.046***	0.025**	0.053***	0.037***	0.053***
	(0.008)	(0.012)	(0.009)	(0.012)	(0.011)	(0.016)	(0.011)	(0.014)
$Sale_{t-1}/K_{t-1}$	0.018***	0.031***	0.009**	0.013**	0.025**	0.039***	0.010	0.020**
	(0.004)	(0.007)	(0.004)	(0.006)	(0.010)	(0.009)	(0.009)	(0.010)
$Cash_t/K_{t-1}$			0.052***	0.072***			0.079***	0.078***
			(0.012)	(0.020)			(0.018)	(0.024)
Interest $Rate_t$			-0.175***	-0.083			-0.072	-0.091
			(0.062)	(0.082)			(0.073)	(0.073)
Adjusted R^2	0.249	0.263	0.289	0.298	0.224	0.240	0.278	0.280
N	7,799	2,655	7,279	2,494	4,597	1,715	4,314	1,611

This table separately presents the estimates of controlling shareholders' expropriation (measured with ownership structures) on ICF sensitivity for SOEs non-SOEs in the whole sample (columns (1)-(4)) and in manufacturing firms only (columns (5)-(8)). The classification of SOEs is based on firm's ultimate controlling party by the end of 2003, one year prior to the announcement. All regressions include year, firm, and (one-digit) industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Triple_2$ stands for $\mathbf{Post_t}$******$\boldsymbol{Excess}$******$\mathbf{(CF_t/K_{t-1})}$. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 5: Controlling Shareholders' Expropriation and ICF Sensitivity: RPTs

Dependent Variable: Investment$_t$/K$_{t-1}$	Whole Sample (1)	Whole Sample (2)	SOE (3)	Non-SOE (4)	SOE (5)	Non-SOE (6)
$\frac{CF_t}{K_{t-1}}$	0.194***	0.131***	0.214***	0.156***	0.161**	0.088
	(0.037)	(0.036)	(0.047)	(0.055)	(0.063)	(0.066)
Post$_t$*$\frac{CF_t}{K_{t-1}}$	-0.003	0.025	-0.015	0.020	-0.013	0.122
	(0.040)	(0.040)	(0.050)	(0.063)	(0.072)	(0.083)
$\boldsymbol{Triple_3}$	-0.129**	-0.142**	-0.119	-0.170**		
	(0.064)	(0.065)	(0.085)	(0.083)		
RPT_{High}*$\frac{CF_t}{K_{t-1}}$	0.125**	0.126**	0.137*	0.123*		
	(0.055)	(0.055)	(0.074)	(0.064)		
RPT_{High}*Post$_t$	-0.003	0.012	-0.001	-0.007		
	(0.027)	(0.028)	(0.033)	(0.055)		
$\boldsymbol{Triple_4}$					-0.005	-0.012**
					(0.005)	(0.006)
$Ln(1+RPT)$*$\frac{CF_t}{K_{t-1}}$					0.006	0.005
					(0.004)	(0.004)
$Ln(1+RPT)$*Post$_t$					0.002	0.001
					(0.002)	(0.004)
Controls:						
Tobin's Q$_{t-1}$	0.036***	0.040***	0.031***	0.041***	0.036***	0.042***
	(0.006)	(0.006)	(0.007)	(0.011)	(0.008)	(0.010)
Sale$_{t-1}$/K$_{t-1}$	0.020***	0.011***	0.017***	0.025***	0.009***	0.013**
	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.006)
Cash$_t$/K$_{t-1}$		0.062***			0.054***	0.076***
		(0.009)			(0.011)	(0.014)
Interest Rate$_t$		-0.133***			-0.157***	-0.075
		(0.043)			(0.052)	(0.076)
Adjusted R^2	0.243	0.280	0.252	0.245	0.279	0.305
N	14,756	13,781	10,963	3,793	10,185	3,596

This table presents the estimates of controlling shareholders' expropriation (measured with RPTs) on ICF sensitivity for the whole sample in columns (1)-(2), for SOEs in columns (3) and (5), and for non-SOEs in columns (4) and (6). The classification of SOEs is based on firm's ultimate controlling party in 2003, one year priori to the announcement. All regressions include year, firm, and (one-digit) industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Triple_3$ stands for $\mathbf{Post_t*}\boldsymbol{RPT_{High}}\mathbf{*(CF_t/K_{t-1})}$, and $Triple_4$ stands for $\mathbf{Post_t*}\boldsymbol{Ln}\mathbf{(1+}\boldsymbol{RPT}\mathbf{)*(CF_t/K_{t-1})}$. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 6: Controlling Shareholders' Expropriation and ICF Sensitivity: Monitoring Intensity

Dependent Variable: $Investment_t/K_{t-1}$	High Monitoring (1)	Low Monitoring (2)	High Monitoring (3)	Low Monitoring (4)
CF_t/K_{t-1}	0.234***	0.327***	0.187***	0.243***
	(0.034)	(0.047)	(0.033)	(0.053)
$Post_t$ * (CF_t/K_{t-1})	-0.048	-0.143**	-0.031	-0.113*
	(0.037)	(0.056)	(0.035)	(0.063)
Controls:				
Tobin's Q_{t-1}	0.031***	0.039***	0.036***	0.040***
	(0.008)	(0.009)	(0.008)	(0.010)
$Sale_{t-1}/K_{t-1}$	0.022***	0.017***	0.013***	0.009**
	(0.004)	(0.004)	(0.004)	(0.003)
$Cash_t/K_{t-1}$			0.056***	0.058***
			(0.012)	(0.013)
Interest $Rate_t$			-0.075	-0.216***
			(0.065)	(0.055)
Adjusted R^2	0.280	0.255	0.316	0.292
N	7,257	7,283	6,843	6,732

This table presents the estimates of controlling shareholders' expropriation (measured with monitoring intensity by large shareholders) on ICF sensitivity. I divide the sample based on the median level of average pre-announcement monitoring. Columns (1) and (3) report results for the high monitoring (above median) group, while columns (2) and (4) report the results for the low monitoring (below median) group. All regressions are estimated with firm, year, (one-digit) industry-by-year, and region-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 7: Endogenous Control

Dependent Variable:	CF_t/K_{t-1}	Q_t	Interest $Rate_t$	$Cash_t/K_{t-1}$
	(1)	(2)	(3)	(4)
$Post_t$*$Excess$	0.001	0.001	0.000	-0.003
	(0.003)	(0.006)	(0.001)	(0.007)
Control variables	X	X	X	X
Adjusted R^2	0.466	0.394	0.034	0.521
N	9,786	9,786	9,786	9,786

This table checks for the endogenous control problem in which the dependent variables are cash flow in column (1), Tobin's Q in column (2), interest rate in column (3), and cash holdings in column (4). All regressions are estimated with firm, year, and (one-digit) industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. I include its interaction with $Excess$ to examine different changes in the dependent variable for firms with high or low excess control rights subsequent to the announcement. Control variables are the rest of controls in the main regression (other than the depend variable itself). I omit the coefficients of these control variables to save space. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 8: Over-Investment and Free Cash Flow

Panel A: Manager's Over-Investment of Free Cash Flow

Dependent Variable:	Whole Sample	State Ownership		Whole Sample
$Over\text{-}Investment_t$/aveSize$_t$		SOE	non-SOE	OverInv$^{U.S.}$
	(1)	(2)	(3)	(4)
FCF_t/aveSize$_t$	0.084***	0.093***	0.043	
	(0.019)	(0.022)	(0.050)	
Post$_t$ * (FCF$_t$/aveSize$_t$)	-0.048**	-0.064***	0.008	
	(0.021)	(0.024)	(0.053)	
$FCF_t^{U.S.}$/aveSize$_t$				0.403***
				(0.050)
Post$_t$ * ($FCF_t^{U.S.}$/aveSize$_t$)				-0.250***
				(0.052)
Adjusted R^2	0.342	0.335	0.380	0.233
N	7,367	5,448	1,919	2,083

Panel B: Within-Sample Comparison

Dependent Variable:	Separation		RPT		Monitoring	
$Over\text{-}Investment_t$/aveSize$_t$	Yes	No	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
FCF_t/aveSize$_t$	0.131***	0.083***	0.071**	0.094***	0.101***	0.079***
	(0.038)	(0.026)	(0.031)	(0.025)	(0.027)	(0.025)
Post$_t$ * (FCF_t/aveSize$_t$)	-0.066	-0.055*	-0.048	-0.044	-0.064**	-0.049*
	(0.044)	(0.028)	(0.033)	(0.029)	(0.031)	(0.028)
Adjusted R^2	0.505	0.292		0.351	0.349 0.355	0.350
N	1,447	4,354	3,381	3,627	3,360	3,535

Over-investment$_t$ and FCF_t are estimated from column (1) of Table C3 with post-announcement data. *Over-investment$_t^{U.S.}$* and $FCF_t^{U.S.}$ are calculated with the U.S. coefficients in column (2) of Table C3. All regressions include firm, year, and industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 9: Controlling Shareholders' Expropriation and ICF Sensitivity: Likelihood of Over-Investment

Dependent Variable: $Investment_t/K_{t-1}$	High Cash Holdings (1)	Low Cash Holdings (2)	High Leverage (3)	Low Leverage (4)
CF_t/K_{t-1}	0.161***	0.171***	0.084**	0.328***
	(0.055)	(0.044)	(0.039)	(0.071)
$Post_t$ * (CF_t/K_{t-1})	0.030	-0.022	0.067	-0.121*
	(0.053)	(0.048)	(0.044)	(0.073)
$Post_t$*$\boldsymbol{Excess}$*(CF_t/K_{t-1})	-0.005	-0.013	-0.013**	-0.002
	(0.005)	(0.008)	(0.006)	(0.007)
$Excess$*(CF_t/K_{t-1})	0.004	0.006	0.007*	0.003
	(0.005)	(0.005)	(0.004)	(0.006)
$Post_t$*$Excess$	0.001	0.004	0.007**	-0.004
	(0.003)	(0.004)	(0.003)	(0.004)
Controls:				
Tobin's Q_{t-1}	0.038***	0.048***	0.051***	0.025**
	(0.011)	(0.010)	(0.011)	(0.010)
$Sale_{t-1}/K_{t-1}$	0.008	0.012***	0.012***	0.004
	(0.005)	(0.004)	(0.004)	(0.006)
$Cash_{t-1}/K_{t-1}$	0.063***	0.064***	0.053***	0.066***
	(0.014)	(0.016)	(0.013)	(0.015)
Interest $Rate_t$	-0.134**	-0.163**	-0.203**	-0.114*
	(0.068)	(0.082)	(0.088)	(0.061)
Adjusted R^2	0.304	0.273	0.285	0.309
N	4,686	5,076	5,039	4,723

This table presents the estimates of controlling shareholders' expropriation (measured with excess control) on ICF sensitivity for firms with different likelihoods of over-investment. I divide the sample based on the median level of the average pre-announcement cash holdings and leverage ratio. Cash holding is cash and cash equivalents divided by total assets, and leverage is the ratio of total debt to total assets. Columns (1) and (4) report outcomes for firms with higher probability of over-investment (above median cash holdings and below median leverage ratio), while columns (2) and (3) report outcomes for firms less likely to over-investing. All regressions include firm, year, and industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 10: Cumulative Abnormal Return Around Policy Announcement

	(1) CAR[-1,+1]		(2) CAR[-2,+2]		(3) CAR[-5,+5]	
	SOE	Non-SOE	SOE	Non-SOE	SOE	Non-SOE
$Sdummy = 1$	0.016***	0.020***	0.029***	0.031***	0.040***	0.055***
	(0.006)	(0.004)	(0.008)	(0.005)	(0.010)	(0.008)
$Sdummy = 0$	0.012***	0.019***	0.014***	0.029***	0.021***	0.056***
	(0.002)	(0.005)	(0.003)	(0.006)	(0.003)	(0.008)
Difference_{1-0}	0.004	0.001	0.015	0.002	0.019	-0.001
N	538	194	538	194	538	194
$RPT_{High} = 1$	0.010***	0.022***	0.013***	0.036***	0.018***	0.060***
	(0.002)	(0.005)	(0.003)	(0.006)	(0.004)	(0.007)
$RPT_{High} = 0$	0.015***	0.019***	0.023***	0.028***	0.035***	0.051***
	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.006)
Difference_{1-0}	-0.005	0.003	-0.010	0.008	-0.017*	0.009
N	747	250	747	250	747	250

This table presents a univariate test of cumulative abnormal returns (CARs) around the policy announcement date for SOEs and private firms based on pre-reform controlling shareholders' excess control and RPTs. $Sdummy = 1$ represents the firms with excess control, while $Sdummy = 0$ represents the firms without excess control. $RPT_{High} = 1$ represents the firms with above median pre-announcement RPT, while $RPT_{High} = 0$ represents the firms with below median. Robust standard errors are reported in parentheses. Difference$1-0$ reports the T-test results for the difference in means. The SSSR announcement was on 1/31/2004 (Saturday), and the event-date was the following Monday (2/2/2004). I use the composite index for all A-shares as the proxy for market returns. The number of observations in SOEs (non-SOEs) with $Sdummy = 1$ is 84 (118) and $Sdummy = 0$ is 454 (76). The number of observations in SOEs (non-SOEs) with $RPT_{High} = 1$ is 392 (122) and $RPT_{High} = 1$ is 355 (158). *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 11: Indirect Measurement of Financial Constraints: Cash Holdings and Cash-Cash Flow Sensitivity

Dependent Variable:	$\text{Cash}_t/\text{Size}_t$			$\Delta(\text{Cash}_t/\text{Size}_t)$		
	Whole Sample	SOE	non-SOE	Whole Sample	SOE	non-SOE
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{CF}_t/\text{Size}_t$	0.181***	0.158***	0.232***	0.167***	0.132***	0.237***
	(0.022)	(0.025)	(0.043)	(0.028)	(0.032)	(0.057)
Post_t	0.024	-0.091	0.041			
	(0.070)	(0.132)	(0.172)			
Post_t*$\text{CF}_t/\text{Size}_t$				-0.026	-0.019	-0.011
				(0.031)	(0.035)	(0.065)
Post_t*$\boldsymbol{Excess}$*($\text{CF}_t/\text{Size}_t$)				0.003	0.004	-0.002
				(0.004)	(0.005)	(0.006)
*Excess**($\text{CF}_t/\text{Size}_t$)				0.000	-0.000	-0.001
				(0.004)	(0.006)	(0.005)
Post_t*$\boldsymbol{Excess}$	-0.000	0.000	-0.001	-0.001*	-0.001*	0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Controls:						
Leverage_t	-0.072***	-0.071***	-0.073***	-0.080***	-0.087***	-0.077***
	(0.007)	(0.008)	(0.013)	(0.006)	(0.008)	(0.010)
LnSize_t	-0.029	-0.027	-0.120	-0.120***	-0.100***	-0.158***
	(0.054)	(0.067)	(0.107)	(0.026)	(0.031)	(0.058)
Ln(Size)_t^2	0.001	0.000	0.003	0.002***	0.002***	0.003**
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Sales Growth_t	0.005***	0.007***	0.003	0.002	0.005**	-0.001
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Adjusted R^2	0.103	0.095	0.131	0.104	0.095	0.134
N	10,529	7,852	2,677	10,529	7,852	2,677

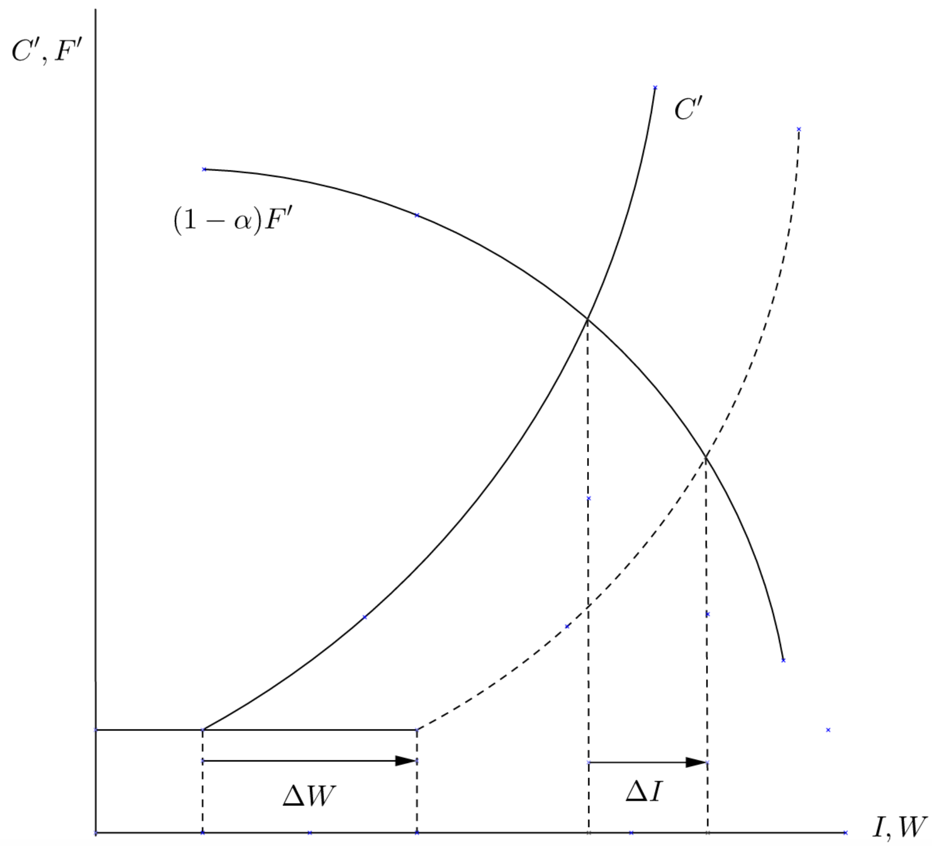
This table presents the estimates of equations in which the dependent variables are the firms' cash holdings to total assets in columns (1)-(3) and the changes in the ratio of the firms' cash holdings to total assets in columns (4)-(6). Columns (1) and (4) report outcomes for the whole sample, columns (2) and (5) report for SOEs, and columns (3) and (6) reports for non-SOEs. The classification of SOEs is based on firm's ultimate controlling party in 2003, one year prior to the announcement. All regressions include year, firm, and (one-digit) industry-by-year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. *Leverage* is the ratio of total debt to total assets; *LnSize* is the log of total assets; and *Sales Growth* is the growth rate of real sales. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 12: Correction for Measurement Errors in Investment Opportunities

Dependent Variable: $Investment_t/K_{t-1}$	(1) IVs: Stock $Return_{t-1}$ Sales $Growth_{t-1}$	(2) IV: Stock $Return_{t-1}$	(3) IVs: Stock $Return_{t-1}$ Sales $Growth_{t-1}$
Q^*_{t-1}	0.040***	0.034**	0.043***
	(0.012)	(0.016)	(0.012)
CF_t/K_{t-1}	0.270***	0.224***	0.192***
	(0.032)	(0.037)	(0.037)
$Post_t$ * (CF_t/K_{t-1})	-0.078**	-0.016	-0.002
	(0.038)	(0.038)	(0.040)
$Post_t$*Sdummy*(CF_t/K_{t-1})		-0.011**	
		(0.005)	
*Excess**(CF_t/K_{t-1})		0.006	
		(0.004)	
*Excess**$Post_t$		0.003	
		(0.003)	
$Post_t$*RPT_{High}*(CF_t/K_{t-1})			-0.128**
			(0.063)
RPT_{High}*(CF_t/K_{t-1})			0.124**
			(0.054)
RPT_{High}*$Post_t$			-0.005
			(0.027)
$Sale_{t-1}/K_{t-1}$	0.020***	0.021***	0.020***
	(0.003)	(0.004)	(0.003)
Hansen J test (p-value)	0.126		0.164
Adjusted R^2	0.166	0.179	0.176
N	15,413	10,424	14,721

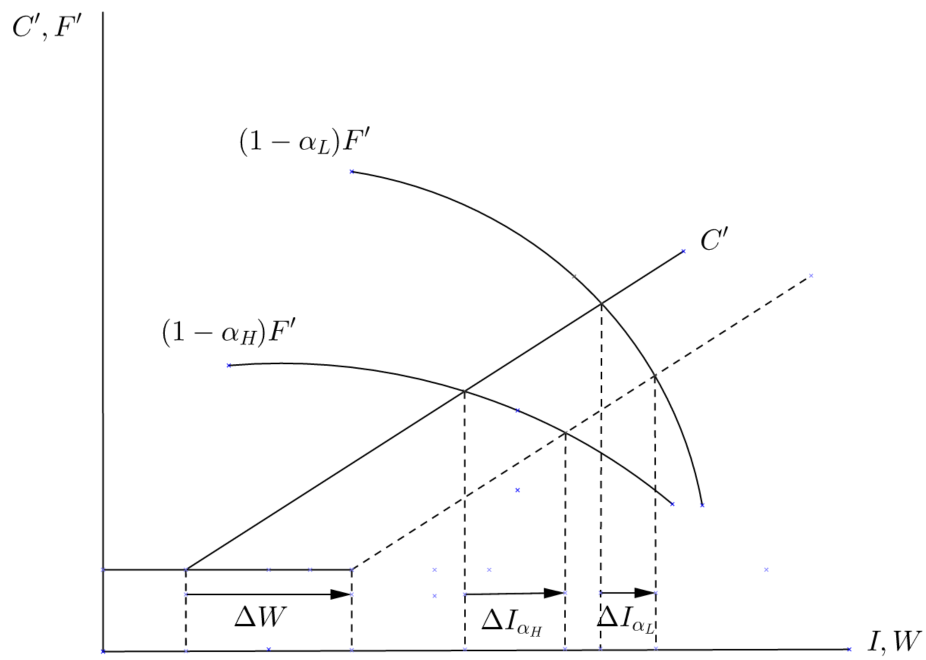
This table presents the estimates of the equation in which I address the measurement errors in Tobin's Q with instrument variable approach. The instruments are the beginning-of-period sales growth and stock return in columns (1) and (3) and the beginning-of-period stock return in column (2). The regression specifications follow column (4) in Table 2, column (2) in Table 3, and column (1) in Table 5. All regressions are estimated with firm, year, and industry-by-year fixed effects. Standard errors (in parentheses) are clustered at the firm level. Q^*_{t-1} represents investment opportunities after correcting measurement errors. $Post_t$ is an indicator variable that is equal to 1 after the announcement year in 2004, and equal to 0 otherwise. The results of Hansen J tests for over-identification are also included. Definitions and sources of the other variables are provided in the Appendix Table C1. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Figure 1: Graphic Explanation for Proposition 2



This figure provides a graphical explanation for Proposition 2, where the x-axis represents investment and cash flow, while the y-axis represents the marginal cost of external finance C', and marginal return to investment F'.

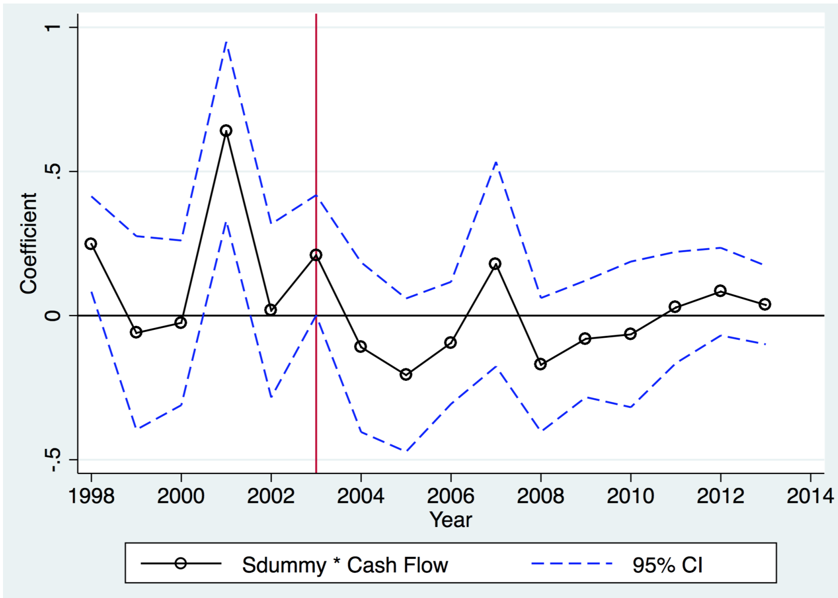
Figure 2: Graphic Explanation for Proposition 3 (Condition c)



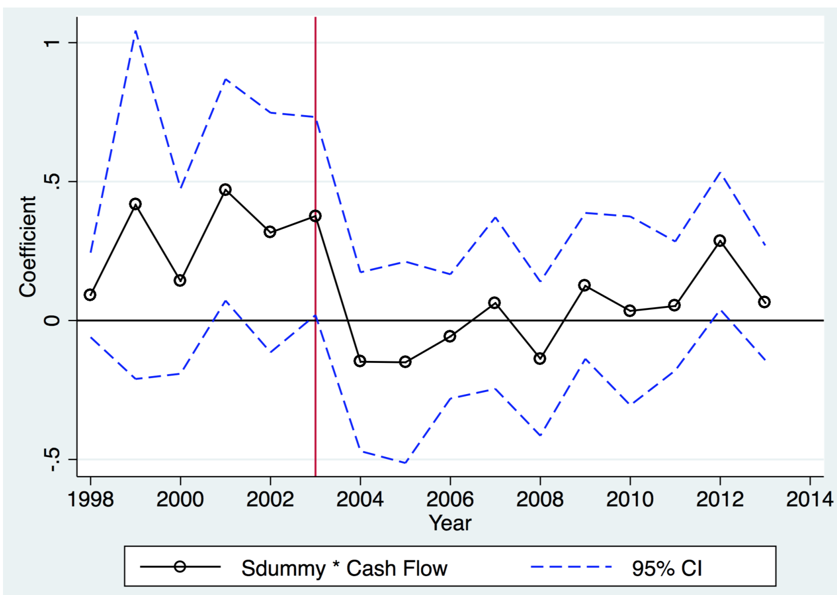
This figure provides a graphical explanation for Proposition 3 under the third set of sufficient condition ($C(E)$ is quadratic and $F'''(.)$ <)0), where the x-axis represents investment and cash flow, while the y-axis represents the marginal cost of external finance C', and marginal return to investment F'.

Figure 3: Parallel Trend (Excess Control)

(a) Whole Sample

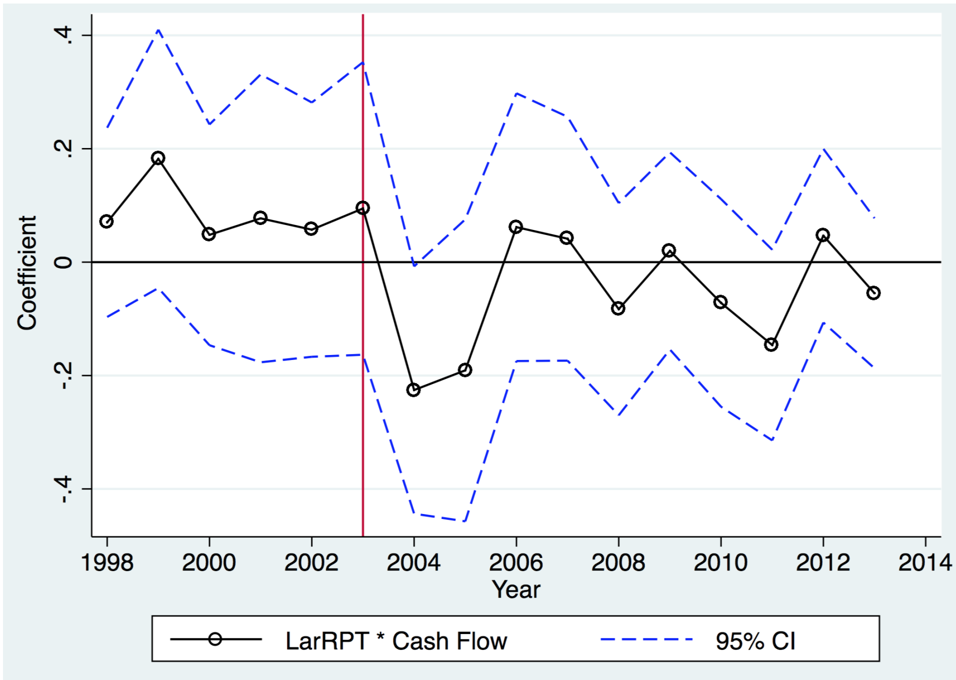


(b) Manufacturing Firms Only



The figures plot the coefficients and 95% confidence intervals from an event-study regression that compares ICF sensitivity in each year for firms with and without excess control. Figure 3(a) is for the whole sample and Figure 3(b) is for manufacturing firms only. The omitted year is 2014, and the vertical lines represent the announcement of the SSSR.

Figure 4: Parallel Trend (RPTs)



This figure plots the coefficients and 95% confidence intervals from an event-study regression that compares ICF sensitivity in each year for firms with high and low related-party transactions. The omitted year is 2014, and the vertical line represents the announcement of the SSSR.

Figure 5: New External Financing

This figure plots new issue activity. New debt refers to the aggregate change in total debt, scaled by total assets. New equity is the aggregate change in total equity (the sum of common stock and capital surplus), scaled by total assets. New debt and New equity are constructed from the CSMAR dataset using all non-financial firms between 1998 and 2014. The vertical line represents the announcement of the SSSR.

1.9 Appendix

A. Proof of Propositions

Proof for Proposition 1

For notational ease, I denote the optimal choice of the controlling shareholder (manager) as α^* (I^*). The first order condition from Equation (1) shows:

$$c_\alpha(k, \alpha^*) = 1 \tag{A1}$$

Differentiating the first order condition with respect to k, I get:

$$\frac{d\alpha^*}{dk} = -\frac{c_{k\alpha}(k, \alpha)}{c_{\alpha\alpha}(k, \alpha)} < 0 \tag{A2}$$

Proof for Proposition 2

According to Equation (2), the first-order optimality condition shows that the optimal investment level I^* must satisfy:

$$(1 - \alpha)F'(I^*) = 1 + C'(I^* - W) \tag{A3}$$

Implicit differentiation with respect to W yields:

$$(1 - \alpha)F''(I^*)\frac{dI^*}{dW} = C''(I^* - W)[\frac{dI^*}{dW} - 1] \Leftrightarrow \frac{dI^*}{dW} = \frac{C''(I^* - W)}{C''(I^* - W) - (1 - \alpha)F''(I^*)} \tag{A4}$$

Therefore, $\frac{dI^*}{dW} > 0$ given $C'' > 0$ and $F'' < 0$. Q.E.D.

Proof for Proposition 3

For Equation (A3), implicit differentiation with respect to α yields:

$$-F'(I^*) + (1-\alpha)F''(I^*)\frac{dI^*}{d\alpha} = C''(I^*-W)\frac{dI^*}{d\alpha} \Leftrightarrow \frac{dI^*}{d\alpha} = \frac{-F'(I^*)}{C''(I^*-W)-(1-\alpha)F''(I^*)} \tag{A5}$$

From (A4) and (A5), I get that:

$$\begin{aligned}
\frac{d}{d\alpha}[\frac{dI^*}{dW}] &= \frac{-C''(I^*-W)F''(I^*)}{(C''(I^*-W)-(1-\alpha)F''(I^*))^2} \\
&- \frac{C'''(I^*-W)}{C''(I^*-W)-(1-\alpha)F''(I^*)}(\frac{F'(I^*)}{C''(I^*-W)-(1-\alpha)F''(I^*)}) \\
&+ \frac{C''(I^*-W)(C'''(I^*-W)-(1-\alpha)F'''(I^*))}{(C''(I^*-W)-(1-\alpha)F''(I^*))^2}(\frac{F'(I^*)}{C''(I^*-W)-(1-\alpha)F''(I^*)}) \\
&\propto -C''(I^*-W)F''(I^*) - F'(I^*)C'''(I^*-W) \\
&+ \frac{C''(I^*-W)F'(I^*)(C'''(I^*-W))-(1-\alpha)F'''(I^*))}{C''(I^*-W)-(1-\alpha)F''(I^*)} \\
&= -C''(I^*-W)F''(I^*) + \frac{(1-\alpha)F'(I^*)[C'''(I^*-W)F''(I^*)-C''(I^*-W)F'''(I^*)]}{C''(I^*-W)-(1-\alpha)F''(I^*)}
\end{aligned}$$

Therefore, $\frac{d}{d\alpha}[\frac{dI^*}{dW}] > 0$, if $C''(I^*-W)F'''(I^*) \leq C'''(I^*-W)F''(I^*)$, or equivalently if $\frac{C'''(I^*-W)}{C''(I^*-W)} \leq \frac{F'''(I^*)}{F''(I^*)}$. This is true when either set of the sufficient conditions is satisfied, namely, $F(I)$ and $C(E)$ are quadratic functions, $F'''(I) < 0$ and $C(E)$ is a quadratic function, $F(I)$ is a quadratic function and $C'''(E) < 0$, or $F'''(I) < 0$ and $C'''(E) < 0$.

Proof for Proposition 4

$$\frac{d}{dk}[\frac{dI^*}{dW}] = \frac{d}{d\alpha}[\frac{dI^*}{dW}] * \frac{d\alpha}{dk} \tag{A6}$$

B. Measurement of Over-Investment

I decompose total investment (I_{total}) into three parts: expected or optimal investment, unexpected investment, and investment for maintenance. First, investment expenditures on new projects (I_{new}) are computed as the total investment (I_{total}) minus investment for maintenance (I_{main}). Second, to adjust dynamic panel bias, I apply a system-GMM approach to estimate the fitted value of the following equation as the optimal investment (I^e_{new}), namely, the investment in projects with positive net present value:

$$\begin{aligned} I_{new_{i,j,t}} &= \alpha_0 + \beta_1 I_{new_{i,j,t-1}} + \beta_2 Cash_{i,j,t-1} + \beta_3 Q_{i,j,t-1} + \beta_4 Size_{i,j,t-1} + \beta_5 Age_{i,j,t} \\ &+ \beta_6 ROA_{i,j,t-1} + \beta_7 Debt_{i,j,t-1} + \beta_8 StockReturns_{i,j,t-1} + \alpha_i + \alpha_{j,t} + \epsilon_{i,j,t} \end{aligned}$$

where i, t, and j denote firm, year, and industry, respectively. All variables, except for Q, ROA, and Stock Return, are scaled by average total assets. The unexpected investment (I^u_{new}) is the residual component ($I_{new} - I^e_{new}$). A positive (negative) residual component represents over-investment (under-investment). Table C2 in the Appendix reports the estimation of this equation using system-GMM (Blundell and Bond, 1998). In column (1), I estimate the coefficients only based on post-announcement data to obtain a relatively accurate measurement of the "optimal" investment.[28] In column (2), I show the coefficients in the U.S. between 1988 and 2002 from the findings in Richardson

[28] I drop pre-reform observations because they involve more severe agency costs and would largely bias the estimation. Admittedly, the reform might not be able to eliminate all agency problems. But using the post-reform data when the major agency-conflict is alleviated can generate less bias.

(2006).[29] These coefficients may suffer from less bias for calculating the "optimal" investment because the U.S. is a more developed market than China with better shareholder protection and a more mature professional market for managers.

In addition, free cash flow (FCF) is obtained by subtracting optimal investment (I^e_{new}) and investment for maintenance (I_{main}) from net cash flow from operating activities (CFO).

C. Tables

[29]Firms in a less developed market may make investment decisions based on return on assets (ROA) instead of stock returns (Guariglia and Yang, 2016). In addition, Richardson (2006) constructs V/P, which represents the book value of the firm divided by the market value of equity, as a measurement for the growth opportunity of U.S. firms. However, the parameters for calculating V/P may not be applicable to Chinese firms. Thus, I use ROA and Tobin's Q instead in my specification.

Table C1: Variable Definition

Variable	Definitions
Age	Number of years since listing
$Cash$	Cash and cash equivalents
CF	Cash flow, i.e., earnings before interest, tax, depreciation and amortization (EBITDA)
$Debt$	Sum of short-term and long-term debt
$Excess$	Cash flow rights subtracted from control rights of the controlling shareholders
$Interest\ Rate$	Financial expenses over interest carrying liabilities
$Investment$	Capital expenditures, i.e. cash paid to acquire and construct fixed assets, intangible assets and other long-term assets
K	Net fixed capital
$Ln(1 + RPT)$	Logarithm of average pre-reform amount of related-party transactions between listed company and the parent company
$LnSize$	Natural logarithm of average total assets
$Leverage$	The ratio of total debt to total assets
$Monitoring$	Sum of shares held by the second to the fifth largest shareholders (as a percentage of total shares), multiplying a Herfindahl index for the concentration of shares, averaging over pre-reform period
NTS	Fraction of non-tradable share
ROA	Return on asset, i.e. ratio of net income to total assets
RPT_{High}	A dummy variable equal to 1 if the average pre-reform related-party transactions scaled by total sales is above its median
$Sale$	Main operating income
$Sales\ Growth$	Growth rate of real main operating income
$Sdummy$	A dummy equal to 1 if the control rights of the largest shareholder exceed the cash-flow rights
SOE	State-owned enterprises, a dummy variable equal to 1 if the firm's ultimate controller is the state
$Tobin'sQ$	Ratio of market value to book value of assets, where market value of assets is market value of equity plus book value of total liabilities

Industry classification: Farming, forestry, animal husbandry & fishing; Mining; Manufacturing; Utilities; Construction; Transportation & warehouse; Information technology; Wholesale & Retailing; Real estate; Social services; Communications & Cultural; Conglomerates; Finance and insurance. Following previous studies, I exclude Finance and insurance, and Real estate sectors.

Table C2: Estimation of Optimal Investment

Dependent Variable: $I_{new_{i,t}}$	(1) Post-Announcement	(2) U.S. Coefficients
$I_{new_{i,t-1}}$	0.405***	0.386***
	(0.037)	
$\text{Cash}_{i,t-1}$	0.017	0.104***
	(0.038)	
$\log \text{Size}_{i,t-1}$	-0.003	0.003***
	(0.005)	
$\text{Age}_{i,t}$	-0.001	-0.006***
	(0.003)	
$\text{Leverage}_{i,t-1}$	-0.038	-0.049***
	(0.031)	
Tobin's $\text{Q}_{i,t-1}$	0.002	
	(0.003)	
$\text{ROA}_{i,t-1}$	0.152**	
	(0.068)	
Stock $\text{Return}_{i,t-1}$		0.010***
Growth $\text{opportunity}_{i,t-1}$		-0.013***
Hansen J test (p-value)	0.162	
m3 test (p-value)	0.344	
N	9,840	58,053

In column (1), this table presents the estimates of the optimal investment coefficients using post-announcement data. Column (2) presents the coefficients in Richardson (2006). Test statistics and standard errors (in parentheses) of all variables in the regressions are asymptotically robust to heteroscedasticity. Standard errors are clustered at the firm level. The dependent variable is $\text{I}_{new_{i,t}}$, the new investment expenditure. All variables except Tobin's $\text{Q}_{i,t-1}$, $\text{Size}_{i,t-1}$ and $\text{Age}_{i,t}$ are scaled by average total assets. For the system-GMM regression, m3 is a test for third-order autocorrelation of the differenced residuals, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. The Hansen J test of over-identifying restrictions is distributed as Chi-square under the null of instrument validity. I treat the beginning-of-period new investment, cash, Tobin's Q, Size, ROA and leverage as potentially endogenous variables; levels of these variables dated t-3 and further are used as instruments in the first-differenced equations and first-differences of these same variables lagged twice are used as additional instruments in the level equations. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table C3: Summary Statistics: Abnormal Investment and Free Cash Flow

	Mean	SD	5%	25%	50%	75%	95%
Before (1998-2003)							
$\text{Investment}_t/\text{aveSize}_t$	0.058	0.061	0.000	0.015	0.040	0.081	0.188
New $\text{investment}_t/\text{aveSize}_t$	0.032	0.058	-0.030	-0.005	0.016	0.052	0.160
Optimal $\text{investment}_t/\text{aveSize}_t$	0.008	0.106	-0.134	-0.043	0.005	0.056	0.162
Unexpected $\text{investment}_t/\text{aveSize}_t$	0.024	0.114	-0.148	-0.031	0.025	0.082	0.191
Free cash $\text{flow}_t/\text{aveSize}_t$	0.020	0.126	-0.173	-0.044	0.026	0.089	0.203
After (2004-2014)							
$\text{Investment}_t/\text{aveSize}_t$	0.058	0.060	0.001	0.016	0.040	0.081	0.181
New $\text{investment}_t/\text{aveSize}_t$	0.032	0.058	-0.032	-0.003	0.017	0.053	0.148
Optimal $\text{investment}_t/\text{aveSize}_t$	0.007	0.065	-0.098	-0.032	0.009	0.049	0.108
Unexpected $\text{investment}_t/\text{aveSize}_t$	0.025	0.075	-0.082	-0.024	0.018	0.066	0.155
Free cash $\text{flow}_t/\text{aveSize}_t$	0.024	0.094	-0.126	-0.034	0.020	0.079	0.183

All variables are estimated with coefficients from column (1) of Table C2. Summary statistics show separately for before and after reform period. Investment and cash flow variables are deflated by average total assets. Investment is total capital expenditures. New investment is (total) investment less investment for maintenance. Optimal investment is investment expenditure in projects generating positive net present value. Unexpected investment is abnormal investment expenditure, which is new investment minus optimal investment. Free cash flow is subtracting investment for maintenance and optimal investment from net cash flow from operating. Those variables are winsorized at 1% and 99% to minimize the influence of outliers.

Table C4: Indirect Measurement of Financial Constraints: Under-Investment and Free Cash Flow

Dependent Variable:	State Ownership		Separation		RPT		Monitoring	
Under-Investment$_t$/aveSize$_t$	SOE	non-SOE	Yes	No	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FCF$_t$/aveSize$_t$	0.085***	0.092**	0.043	0.092***	0.082***	0.083***	0.063***	0.090***
	(0.024)	(0.038)	(0.034)	(0.029)	(0.029)	(0.031)	(0.027)	(0.032)
Post$_t$ * (FCF$_t$/aveSize$_t$)	-0.036	-0.009	0.035	-0.049	-0.015	-0.033	0.004	-0.043
	(0.025)	(0.039)	(0.039)	(0.030)	(0.032)	(0.031)	(0.027)	(0.035)
Adjusted R^2	0.651	0.746	0.661	0.642	0.612	0.738	0.758	0.539
N	3,554	1,092	986	2,668	2,205	2,262	2,194	2,225

This table presents with-sample comparisons for the sensitivity of under-investment to free cash flow. The dependent variable is $under-investment$ scaled by average total assets. $Under-investment_t$ and FCF_t are estimated from Table C3 column (1), using post-announcement data. The table reports outcomes as follows: state-owned enterprises (SOEs) in column (1) and private firms in column (2); firms with excess control rights in column (3) and without excess control in column (4); firms with above median RPTs in column (5) and below in column (6); firms with above median monitoring in column (7) and below in column (8). All regressions include firm, year, and industry-by-year fixed effects. The only exception is column (4) in panel A, which includes firm and year fixed effects. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. $Post_t$ is an indicator variable equal to 1 after the announcement year in 2004, and 0 otherwise. I include its interaction with free cash flows (FCF) to examine changes in the under-investment and free cash flow sensitivity subsequent to the announcement. Definitions and sources of the other variables are provided in the Appendix Tables C1 and C3. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Chapter 2

Does Investment-cash Flow Sensitivity Measure Financial Constraints? Evidence from Industrial Regulation in China

2.1 Introduction

In perfect capital markets, investment should only depend on a firm's investment opportunities and not on its financing structure (Modigliani and Miller, 1958). However, empirical findings indicate a significant and positive correlation between investment and cash flow, after controlling for growth opportunities. Fazzari et al. (1988) (hereafter, FHP, 1988) initially argue that this can be explained by financial constraints because of the increased costs of acquiring external finance that drive firms to complete investments based on their internal cash flow.[1] However, the literature raises considerable debate on the relationship between investment-cash flow sensitivity (ICFS) measure and financial constraints. The non-consensus on the interpretation originates from the proxy used for

[1] They discuss the sensitivity of firms' investment to fluctuations in internal funds for U.S. manufacturing firms. The main idea is to introduce a measure of financial constraints because their empirical results confirm that more constrained firms have investments that are more sensitive to cash flows than less constrained firms.

financial constraints, such as that in Kaplan and Zingales (1997) (hereafter, KZ, 1997).[2] Many scholars have also challenged the financial constraints view. Thus, whether ICFS is a good indicator for financial constraints remains controversial.

By building on a staggered industrial regulation for 23 industries with backward production capacity and over-capacity in China, we extend the study on ICFS in the context of emerging markets and find evidence supporting FHP's view. The policy restricts the accessibility to bank loans for firms that operate in regulated industries, thereby serving as an exogenous shock of increasing external finance costs. Using a difference-in-differences approach, we examine the change of ICFS by exploiting this variation in financing costs and find that firms in treated industries show a 7.6% increase in the sensitivity. Our results robustly confirm the view that ICFS effectively indicates financial constraints.

Previous studies have shown that state ownership is an essential force in scare resource allocation and note that state-owned enterprise (SOEs) often enjoy preferential treatment ("soft-budget constraints") from the government regardless of their performance, such as lower cost of credit and land endowment (e.g., Gugler, 2003). By removing the previous "helping hand" of the government, we predict that the regulated SOEs would suffer more from tightening financial constraints. Consistent with our expectation, we find that SOEs exhibit significantly higher ICFS than private companies. Moreover, we empirically support the political favoritism argument by showing that SOEs experience economically and statistically significant losses in loans. Our further analyses on the effect of prior credit dependence provide analogous evidences that ICFS increments after industrial regulation are larger for firms with higher levels of credit dependence than their

[2] They question the financial constraints proxy and disagree with the interpretation of the sensitivity measure. They criticize that a firm's dividend ratio is an endogenous firm-level choice and an imperfect sorting mechanism; instead, they collect the quantitative and qualitative information from the annual reports to classify financial conditions.

counterparts.[3] Relative to the rich variations in macroeconomic conditions in China, the impact of industrial regulation on ICFS can be exacerbated during the world financial crisis and moderated during the credit expansion in China.

We also conduct a battery of ancillary tests to verify the robustness of our findings. First, although the results are consistent with the view that ICFS measures financial constraints, the regulation might also affect cash flow and/or investment opportunities. In such cases, changes in control variables could also increase ICFS. We test this finding by checking for the endogenous control problem of cash flow and Tobin's Q. Second, we employ a propensity score matching method to further address the concern of endogenous selection in the treatment group. We create a paired-sample by matching main financial variables based on one-year prior to the regulation in treatment and control groups. Third, we use an alternative classification standard to define regulated firms. Finally, we conduct a set of placebo tests by changing treatment time, randomly varying the treatment group, and replacing the dependent variable with another irrelevant variable. Overall, the robustness check and placebo tests can rule out alternative explanations and support the notion that increases in ICFS are driven by the exogenous loss of loans.

This paper adds to the continued discussion on the association between financial constraints and ICFS. Starting from the debate between FHP (1988) and KZ (1997), many scholars have examined the interpretation of ICFS.[4] Empirically, many later studies have

[3]The results are robust when using the fraction of loans in total external finance, and when using interest rates to approximate credit-dependence.

[4]For example, some studies are concerned with measurement errors in investment opportunities, in which the positive ICFS is merely attributed to cash flow containing information of investment opportunities (see e.g. Erickson and Whited, 2000; Erickson and Whited, 2012; Alti, 2003). Gomes (2001)'s model predicts that cash flow sensitivities can be derived even without any settings on financial constraints and Moyen (2004) builds an unconstrained model and a constrained model to rationalize the empirical dispute between FHP (1988) and KZ (1997). While Hadlock and Pierce (2010) find that ICFS is not monotonically increasing in a firm's level of financial constraints based on their own measure, which is in line with the conclusions in KZ (1997). Chen and Chen (2012) study ICFS and find that it cannot effectively measure financial constraints because the number declines over time and is almost zero during the recent credit crunch.

used the estimated ICFS as their main measure of financial constraints, such as Erel et al. (2015). These studies have mainly focused on well-developed financial markets, whereas few studies have included emerging markets in which the financing condition is different (e.g., the restricted availability of external finance).[5] In such cases, implications from the developed markets might not always hold in these emerging countries. Our work is among the first to test whether ICFS measures financial constraints in the context of emerging markets.

We also contribute to the understanding of the causal effect of financial constricts on ICFS with a natural experiment during which firms experience an unexpected, exogenous, and substantial increase in cost of external financing. The literature using identification strategies to test the validity of measures for financial constraints is increasing because indicators of financial constraints are usually an endogenous choices, such as cash holdings and dividend ratios.[6] Moreover, our empirical results can tackle endogeneity because the identification design focuses on the difference of coefficients, thereby cancelling the potential bias that arises from measurement errors in investment opportunities, which is a standard critique in the context of ICFS (see e.g. Erickson and Whited, 2000; Alti, 2003).

Finally, our results provide a novel perspective to examine the economic consequences of government intervention on corporate activities. Previous studies have mainly argued

[5] An emerging market, like China, which is a typically bank-dependent financing economy, has been criticized for underdeveloped capital markets with higher costs of information production and dissemination. For instance, referring to the total social financing statistics released by the People's Bank of China, by the end of 2016, CNY loans from the banking system accounts for 67.4%, whereas the corporate bond market only reaches 11.5% of total social financing.

[6] Andrén and Jankensgård (2015) use a positive oil price shock as an exogenous decline of financing costs for companies in the U.S. oil and gas industry. Chowdhury et al. (2016) consider two exogenous shocks to firms' information asymmetry as indicators of the changing cost of external finance. Both of them conclude that ICFS is an effective indicator of financial constraints. More broadly, Farre-Mensa and Ljungqvist (2016) use 43 staggered increases in corporate income taxes as an exogenous increase in cost of financing and argue that constrained firms do not behave like they were constrained.

that government intervention may distort efficient resources allocation.[7] Our study analyzes the effects of the industrial regulation itself and also sheds light on the heterogeneous effects between SOE and non-SOEs. Futhermore, over-capacity and outdated capacity represent important global issues that affects not only China's economy, but also that of other countries via exports and outward foreign direct investments. However, related literature has remained lacking when evaluating the performance of the regulation using micro-level data. By contrast, many studies have focused on aggregated data, descriptive analysis, or capacity measurement (Shen and Chen, 2017).

The paper proceeds as follows. Section 2 introduces the institutional background of the industrial regulation and develops hypotheses. Section 3 describes the data, variables, and summary statistics. Section 4 presents the main findings with the difference-in-differences approach. Section 5 discusses heterogeneity via within-sample comparison. Section 6 shows robustness analysis, and finally, Section 7 concludes the paper.
Introduction

2.2 Institutional Background and Hypotheses Development

2.2.1 Institutional Background

Over-capacity and outdated (backward production) capacity are important phenomena that emerged in certain industries during China's recent economic development. Several recent rounds of economic stimulus plans are enacted by central and local govern-

[7]For instance, Li et al. (2008) provide evidence on the beneficial impact of political connections to the performance of private entrepreneurs and reveal the underlying mechanism that private entrepreneurs with political capital can easily obtain loans from banks or other state institutions, and afford them more confidence in the legal system. By contrast, Chen et al. (2011) find that government intervention in SOEs distorts investment behavior and harms investment efficiency in China.

ments, providing a strongly irrational incentive for "hot money" flows into government-targeted sectors. Given these large-scale investments in prior years, the production capacity of many industries remains a rapid growth process. As a response to the central call, China equipped companies that operate in the favored industries with grants, low-interest loans, cheap energy and other raw materials, and even free land resources. In particular, over-capacity industries mainly include ironmaking and steel making, solar panel manufacturing, coal, shipbuilding, aluminum and concrete, whereas outdated capacity industries include not only these over-capacity ones, but also other sectors, such as heavy chemical industry and etc. Under such intervention, these sectors grow rapidly and significantly expanded in production capacity despite their inefficient production technologies. For example, as reported by the *China Steel Year Book*, the total production of crude steel in 2004 amounted to 340.1 million tons, which increased to 610.3 million tons in 2007, thereby suggesting that the total production nearly doubled within 3 years. The average annual growth rate is roughly 21.5%. Compared with the number released in *World-steel's Steel Statistical Yearbook*, in 2004, China's crude steel production amount contributed to 25.7% of the global production, and in 2007, the percentage increased to 36.3%. This number exceeded 50% in recent years continuously, which indicates that over half of the total production of crude steel in the world is provided by China. Meanwhile, the total investment of fixed assets in the iron and steel industries increased dramatically from 145.3 billion CNY in 2003 to 509.9 billion CNY in 2013, with an average annual growth rate of 13.4%.

Furthermore, local governments aim to promote economic development growth and maintain regional social stability, and hope to elicit key investment and stabilize job positions via these industries, whereas their products may have a high degree of homogenization. Over-capacity is not limited to traditional industries. Emerging sectors such as the photovoltaic and wind turbine manufacturing industries have also faced with excess capacity issues because these strategic emerging industries did enjoy excess preferential policies from local governments.

Given the slowdown of China's economic growth and the sluggish demand abroad for exports, the prices of products and services went down, the profit margin of industrial enterprises above fell significantly, the number of loss-making enterprises gradually increased, and the scope and severity of over- and outdated capacity further expanded. Moreover, the low-efficiency enterprises that previously enjoyed preferential policies and regional protection from the government are reluctant to withdraw from the market-ordinated competition, thereby significantly crowding out the top-quality enterprises.[8] Within a short period, these enterprises that operated in over-capacity and outdated industries can smoothen and internalize the potential operating risk. However, such practice can only mask these socio-economic risks for a short time, but the operational risks of enterprises continue to accumulate.

To avoid the risk of a "hard landing" for China's economy, the State Council issued *"Instructions on Tackling the Problem of Excess Over-capacity and Eliminations of Outdated Industries"*. The Ministry of Industry and Information Technology (MIIT) made staggered efforts to gradually strict control over the added capacity in order to avoid a new round of gluts and included more industries to the list of sectors, which is aim to curb production. The regulators are targeting the following energy-intensive and highly pollution industries to curb over-capacity and outdated capacity (based on four-digit industrial codes): coking, calcium carbide, ferroalloy, cement manufacturing, paper making, plate glass, ironmaking and steelmaking, electrolytic aluminum, coal, monosodium glutamate, citric acid, dyeing and textile, tanning, chemical fiber, copper, lead and zinc

[8]According to a document released in government's websites, in Shanxi province, China's top coal-producing region, the government told financial institutions to maintain coal sector lending at least on last year's levels, increase awareness of the industry's "pillar and strategic status" and not recall loans to seven local government-owned coal groups (an average liability-to-asset ratio of roughly 83%).

smelting, electricity, lead storage battery, and shipbuilding. Table 1 lists the specific timetables for the regulated industries. All industries in Table 1 have backward production capacity and the six bolded ones are over-capacity industries. The regulators drafted and released the name lists of affected industries and enforced the guidelines of clearing out the over-capacity and outdated industries.

In accordance to a guiding statement on how to resolve China's over-capacity in a number of outdated industries, central ministries and offices must instruct their provincial and local-level offices to conduct policies accordingly. If enterprises do not comply with the local restrictions, then local banks and financial institutions must deny the enterprises' access to new loans, lines of credit, and other financial assistance. China's banks have been ordered to slash lending to loss-making and delinquent corporate borrowers. Similarly, local offices of the Ministry of Land and Resources may not approve additional requests for new land permits from noncompliant enterprises. In extreme cases, local regulators must cut companies' power supplies. Furthermore, the government should call off unfair preferential policies in whatever regions and industries so as to promote fair competition through which good enterprises stand out, whereas those that lack in competitiveness are sifted out. Moreover, substantial efforts should be enforced to improve and implement the policy issued by leaders to "digest, transfer, integrate, and obsolete a batch of excess capacities".

Therefore, these industry policy adjustments provide an ideal setting for staggered regulation shock in specific industries, especially in terms of the accessibility of government-favored resources such as credit. Intuitively, we believe that firms operating in these treated industries will face severe financial constraints.

2.2.2 Hypotheses Development

Prior studies (i.e., FHP, 1988) on ICFS have interpreted the positive coefficient estimated from regressing investment on cash flow after controlling for the investment opportunities of Tobin's Q as financial constraints. They posit that the sensitivity of investment to internal funds should increase with the wedge between the costs of internal and external funds. However, the followed research has raises a debate on this interpretation with their models and empirical evidence (i.e., KZ, 1997; Gomes, 2001; Chen and Chen, 2012).

In this section, we develop our testable hypotheses, which further concern the empirically interprets ICFS by exploring the recent industry policy adjustment in China. As reviewed in the last section, the Chinese government promoted a significant regulation campaign to eliminate over-capacity and outdated capacity in specific industries. These staggered regulations provided a relatively exogenous shock on the loss of government favored resources, which intuitively ensures that firms in these treated industries will face severe financial constraints after the regulation shock.

The rationale behind the positive association between the reform of affected industries and the firm-level financial constraint can be understood from the following aspects. First, given the cooling down of the over-heated sector, the financial condition of firms that operate in these declining industries worsens as the profit margin of products and services above a designated size significantly fell. Second, digesting the production gluts of previously "favored" sectors is difficult for the government, which is caused by rapid expansion with little regard for real market demand. These regulated firms' sudden loss of the "helping hand" from central and local governments corrected prior misallocations of scarce resources (such as banking credit). The cost wedge between internal and external financing enlarges. Third, apart from the preceding misallocation of resources, firms in over-capacity and outdated industries are also often criticized for lower operating efficiency and lower productivity of factors as these industries likely belong to the state-dominant upstream sectors. Without further access to government preferential policy, worsening financial difficulties build barriers to investment. Thus we expect a significant increase in ICFS if the FHP's interpretation is rightly recognized. This situation leads to our first hypothesis.

Hypothesis 1: Firms in treated industries have greater investment-cash flow sensitivity given the exogenous constraint caused by regulating over-capacity and outdated industries.

Hypothesis 1 notably links the strict regulations in some industries to the exogenous deterioration in financial constraints. To differentiate the industry regulation effect, we further examine whether and how the exogenous shock on firms' financial constraint varies across different firms.

Given that state ownership is an important institutional feature in China, previous literature has recognized that SOEs constantly enjoy significant support through low credit cost, land endowment, and some specific benefits from protected markets. Under typical conditions, the preferential treatment to SOEs is a classic type of resource misallocation (i.e., credit accessibility in Khwaja and Mian (2005) and Ai et al. (2017); corporate bailouts in Faccio et al., 2006).

Treated (i.e. regulation policy-affected) firms will experience a sudden loss of the "helping hand" from central and local governments and efficiency-based allocation of scarce resource scheme emerges with the regulations enforced in specific industries. Thus, compared with prior-regulation periods, SOEs lose more preferential treatment after the industry policy adjustment than non-SOEs because non-SOEs have limited access to these preferential privileges. Moreover, prior research has indicated that SOEs are always criticized for worse performance and weak balance sheets. That is, without access to the past government favor, we can intuitively posit that these SOEs suffer more from financial constraints and their cost wedges between internal and external financing will be relatively larger. This situation leads to our second hypothesis:

Hypothesis 2: State-owned firms in treated industries have greater investment-cash flow sensitivity than private firms given the exogenous constraint caused by regulating over-capacity and outdated industries.

The following hypothesis further explores the impact of firms' bank-dependency. Owning to the sluggish development of the direct financing market in developing countries, especially in China, much attention has been devoted to the effect of accessibility of this scarce resource. Credit rationing is a conventional market intervention tool for the central government because of the supply shortage, and this tool fulfills their macroeconomic objectives such as industrial policy. As required by the industry regulation policy, for firms that operate in the over-capacity and outdated capacity industries, local banks and financial institutions must deny the enterprises' access to new loans, credit lines, and other financial assistance.

Moreover, compared with firms that do not depend on banks, bank-dependent firms are less incentivized to pursue other alternative financing sources prior to the regulation shock. Under a similar level of shock, the wedge between internal cash and external financing sources will become even larger for those bank-dependent firms. Thus, given the guideline of industry policy adjustment over these out-of-favor firms, if the affected firms have prior higher bank dependency, then the dramatic drop in the total amount of borrowing from banks will significantly increase firms' financial constraints. We expect that bank-dependent firms will experience severely worsening financial constraints after the government removes prior preferential treatment. We then have our third hypothesis:

Hypothesis 3: Firms in treated industries have greater investment-cash flow sensitivity *for bank- or credit-dependent firms given the exogenous constraint cased by regulating over-capacity and outdated industries.*

Lastly, as comprehensively discussed in the literature, the macroeconomic liquidity, that is, the availability of cash in the economy, is one of the key factors that determines the cost of external financing. Hypothesis 4 examines whether and how the exogenous shock in financial constraints is related to macroeconomic variables. In November of 2008, the Chinese government introduced an economic stimulus plan to mitigate the effects of the global financial crisis. Two main components are proposed to increase the liquidity of the entire market. The first component is the increase in government spending by launching 4 trillion CNY stimulus packages on infrastructure projects and social welfare enhancement activities. The second is the decrease of bank reserve requirements and benchmark lending rates. Given this grand plan, the larger wedge between internal cash and external financing triggered by the loss of political favoritism after the regulation shock will be reduced during the stimulus period. Thus, we have our fourth hypothesis:
Hypothesis 4: Firms in treated industries increase less in investment-cash flow sensitivity during the credit expansion period from 2009 to 2010 given the exogenous constraint caused by regulating over-capacity and outdated industries.

2.3 Data

2.3.1 Description of Sample and Dataset

Our sample includes all non-financial firms listed on the main board of Shanghai and Shenzhen stock exchanges from 2006 to 2015. We drop financial firms because they are highly regulated, and their operating and investing activities are distinct from those of other sectors. We start from 2006 to avoid the effects of the Split-share Structure Reform on ICFS, which was initiated in 2005. We further exclude firms whose time of listing is less than a year, as well as firms under special treatment (ST).[9] Our entire sample consists of 1,362 unique firms and 11,274 firm-year observations, of which 104 firms are in the over- and outdated capacity lists and are affected by the industrial regulation. We retrieve all variables from the China Stock Market and Accounting Research (CSMAR) and WIND database. We winsorize observations at 1% and 99% for the main regression variables to minimize the influence of outliers.

2.3.2 Variables and Summary Statistics

Table A1 in the appendix provides variable definitions. $Investment_{i,t}$ is calculated as firm i's amount of capital expenditures in year t scaled by i's beginning-of-period net property, plant, and equipment. $CF_{i,t}$ represents cash flow, namely, earnings before interest, tax, depreciation, and amortization for firm i in year t, deflated by beginning-of-period net property, plant, and equipment. In addition, other main variables are also scaled by beginning-of-period net property, plant, and equipment, for example, cash holdings (*Cash*), revenues from main operating activities (*Sale*), bank loans (*Loan*), and the amount of total external finance (the sum of loan, equity and bond) (*External Finance*). We use Tobin's Q to approximate for investment opportunities, and admittedly, the approach suffers from measurement errors. However, in untabulated results, our findings are robust to use alternative proxies for investment opportunities, namely, market-to-book ratio and employment growth, and to use stock returns and growth rate

[9]Stocks in danger of being delisted are under ST in China, such as firms with negative net profits for two consecutive years. The main results also hold if we include these firms in the sample.

of sales as instruments. Table 2 tabulates summary statistics for the main variables used in the analysis. The mean (median) pooled sample ratio of investment-capital ratio is 35.2% (17.7%). As a useful comparison, one can examine the rates in Chinese firms with those of U.S. firms, despite the differences in the institutional environments of the two countries. In Chen and Chen (2012), the average investment-capital ratio for manufacturing firms in the U.S. during 2002-2006 is 21.5%. In Hovakimian (2009), the ratio for manufacturing firms during 1985-2004 is 27.3%. Both findings indicate that investment-capital ratio in U.S. is lower than that in Chinese firms.

2.4 Empirical Findings

2.4.1 Baseline Results

Given that firms were regulated at different calendar times, we can apply a difference-in-differences (DID) methodology to identify the effect of restriction to external finance on ICFS, based on the enactment of the listed industries in Table 1. The treatment group includes firms being regulated, whereas the control group includes firms never being regulated. The treatment time differes in those regulated industries, thereby providing additional variations across time. We first estimate the following equation to test Hypothesis 1 (H1):

$$\begin{aligned} Investment_{i,j,w,t} &= \alpha_0 + \beta_1 CF_{i,j,w,t} + \beta_2 Regulated_{i,j,t} + \beta_3 CF_{i,j,w,t} * Regulated_{i,j,t} \\ &+ \beta_4 Q_{i,j,w,t-1} + \beta_5 Sale_{i,j,w,t-1} + \beta_6 Cash_{i,j,w,t} + \alpha_i + \alpha_{j,t} + \alpha_{w,t} + \epsilon_{i,j,w,t} \end{aligned} \tag{1}$$

where the subscript i, j, t, and w denote for firm, industry, year (2006-2015), and province, respectively. The dependent variable is investment over beginning-of-period net fixed capital. $Regulated_{i,t}$ is the treatment dummy; that is, a dummy variable that equals one if the company is in an industry that has been regulated in year t. The interaction term $CF_{i,j,w,t}$ * $Regulated_{i,t}$ (β_3) measures the difference in ICFS after being regulated between treatment and control groups. In all specifications, I include firm fixed effects (α_i) to control for time-invariant firm characteristics omitted in regressions, industry-by-year fixed effects ($\alpha_{j,t}$) for shocks to a certain industry at a specific year, and province-by-year fixed effects ($\alpha_{w,t}$) for region-specific shocks at a given year.[10] Standard errors are adjusted for heteroscedasticity and clustered at the firm level. We omit subscripts in the reminder of this paper for notational ease.

Based on prior research (e.g., Chen and Chen, 2012; FHP 1988), we also include other control variables. Tobin's Q (Q) is a proxy for investment opportunities, estimated as market value over book value. Total sales ($Sale$) approximate for production, to consider the accelerator effects. Including this variable is important because production positively influences investment (Abel and Blanchard, 1986). We also include $Cash$ because cash holdings and cash flow represent financial determinants of investment in a more comprehensive way compared with only including cash flow. In addition, we use the beginning-of-period values of Q and $Sale$ to avoid reverse causality. β_3 is the DID estimator that measures the causal effects of the industrial regulation on ICFS, and H1 predicts that this result would be positive and significant.

Table 3 tabulates the estimation results in Equation (1). Column (1) shows the findings based on the treatment group. Thus, β_3 captures the pre- and post-average ICFS after the firm has been regulated. The DID estimator is 0.079 and is significant at 1% level. Thus, as firms are restricted with access to loans, they rely on internal funds to finance investment expenditures after controlling for investment opportunities and op-

[10] Year fixed effects (α_t) are absorbed by industry-by-year fixed effects, where α_t controls for changing macroeconomic conditions. The industry is based on the one-digit code in China Securities Regulatory Commission. The note in Table A1 shows specific industrial classification.

erational and financial determinants of investment. This finding is consistent with the prediction that ICFS is an effective indicator for financial constraints, at least in developing countries.

In column (2), we expand observations to the main sample by including firms in the treatment group, and those in the control group which are not in the same two-digit industry as the treatment group.[11] By way of illustration, firms in electrolytic aluminium (four-digit industrial code: 3316) are under regulation, and they belong to a broader category: non-ferrous metal smelting and rolling processing industry (two-digit industrial code: 33). In the control group, we also exclude firms in non-ferrous metal smelting and rolling processing industry even if they are unregulated. This is because firms in the same two-digit industry that may experience overlaps in primary business, and these firms (code in 33 but not in 3316) may also be affected by the regulation. We exclude these observations because they would confound the control group.[12] The coefficient on CF is 0.061 and significant at the 1% level, which implies that firm's investment relies on cash flow before being restricted by the industrial policy. However, β_2 is -0.008, which is small in magnitude and statistically insignificant, suggesting that regulated firms do not reduce their investment expenditures after policy implementation. More importantly, the DID estimator is similar in magnitude (7.6%) with column (1) and positively significant at the 1% level. In untabulated results, we obtain more prominent effects for most of the specifications when only including firms in the over-capacity industries.

In column (3), we further expand observations to the entire sample, including the treatment group and all unregulated firms as the control group. The results are robust to the alternative definition of the control group. Therefore, our findings are consistent with H1, where firms in treated industries experience greater ICFS after the exogenous

[11]Unless otherwise noted, all estimations used in this paper are based on the main sample.

[12]The main results are robust and qualitatively similar when considering all the unregulated firms as the control group.

constraint. Although it is not the main focus of our paper, columns (2)-(3) also show that coefficients on Q, $Sale$ and $Cash$ are positively significant, thereby indicating that investment expenditures increase with better investment opportunities, higher production, and increased cash holdings.

2.4.2 SOE and non-SOE firms

In the next set of regressions, we formally check the validation of Hypothesis 2 (H2). The restriction of accessibility to loans makes the treated SOEs experience sudden losses of the "helping hand" from central and local governments. Therefore, we would observe a greater increase in ICFS for SOEs than non-SOEs. We test this hypothesis by separately estimating Equation (1) for SOEs and non-SOE firms.[13]

Columns (1)-(2) of Table 4 show the regression analysis for H2.[14] Both SOEs and non-SOEs experience positively significant ICFS before the regulation and statistically insignificant investment reduction afterwards. However, the DID effect is 0.189, significant at 1% level for SOEs, whereas the coefficient is 0.036 for non-SOEs and is significant at 5% level. More importantly, we could reject the null hypothesis that the DID effects between these two types of firms are the same at 1% level. This result is consistent with our prediction from H2.

Given that all regressions in Table 4 include calendar-year fixed effects (absorbed by industry-by-year fixed effects), the coefficient on $Regulated*CF$ can be interpreted as the average effect of the industrial policy on ICFS. To investigate the dynamics of ICFS and the effect of the regulation over time, we replace the $Regulated$ dummy with a set of

[13]Following early literature, e.g., Liao et al. (2014), we define a firm as an SOE if its ultimate controller is the state. Thus, non-SOE firms include private companies and mixed ownership structure but without state controlled.

[14]We exclude firms changing state ownership during the sample period, i.e., from SOE to non-SOE or from non-SOE to SOE. The results are quantitatively similar in maintaining these firms.

six dummy variables that indicate the two years prior to the treatment (*Regulated*(−2), *Regulated*(−1)); the year of the treatment (*Regulated*(0)); the first and second year after the treatment (*Regulated*(1), *Regulated*(2), respectively); and three or more years after the treatment (*Regulated*(3+)).[15]

As shown in columns (3)-(4), the coefficients of all pretreatment dummies that interacted with cash flow are insignificant for SOEs and non-SOEs. This finding reassures that no preexisting trend exists in the data. As shown by the positive and statistically significant coefficient of *Regulated*(0)*CF, the effect becomes prominent and significant for both types of firms during the treatment year. Specifically, the ICFS of SOEs (non-SOEs) increases by 50.2% (12.1%), significant at the 1% (5%) level. In addition, the coefficients of *Regulated*(1)*CF, *Regulated*(2)*CF, and *Regulated*(3+)*CF remain large and significant for SOEs, indicating that restricting access to loans has long-lasting effects on ICFS for SOEs. However, for private companies, the effect is only marginally significant one year after the treatment and remains insignificant for a longer period. This is also in line with H2 because SOEs lost more preferential treatment after the regulation than non-SOEs, as non-SOEs already have limited access to these preferential privileges before.

2.4.3 Further Tests on the Mechanism

Thus far, we contribute the increasing ICFS to the restricted accessibility to loans after the policy. This seems plausible given the evidence of the industrial regulation. However, potential issues could still arise, such as whether banks can strictly implement the regulation on those restricted firms or whether local governments excessively intervene, such that regulation implementation could be distorted. We conduct a formal test

[15]Earlier literature, (see e.g., Bertrand and Mullaianathan, 2003; Flammer and Kacperczyk, 2016) use a similar specification to analyze the dynamics of the treatment effect under the DID methodology.

to explicitly evaluate the mechanism by estimating the following equation:

$$Loan_{i,w,t} = \alpha_0 + \beta_1 Regulated_{i,t} + \gamma X_{i,t} + \alpha_i + \alpha_t + \alpha_{w,t} + \epsilon_{i,w,t} \quad (2)$$

The dependent variable is loan, namely, cash obtained from bank loan deflated by net property, plant, and equipment. X includes the following control variables, such as $Debt$, $Cash$, and ROA (ratio of operating income to total assets). We also control for firm (α_i), year (α_t), and province-by-year fixed effects ($\alpha_{w,t}$). Standard errors are adjusted for heteroscedasticity and clustered at the firm level.

In Panel A of Table 5, column (1) reports findings in Equation (2) using the main sample. After controlling for other covariates that may affect loans, findings in column (1) predict a statistically significant (at 5% level) decline in loans for regulated firms. This is consistent with the notion that industrial regulation reduced the accessibility to loans for firms in the treatment group.

Moreover, to the extent that SOEs and non-SOEs respond differently in ICFS, we expect to see that loans are significantly reduced for SOEs following the enactment of the industrial regulation compared with non-SOEs. Thus, we add a variable capturing the interaction between *Regulated* and SOE, where SOE is a dummy variable that equals one if the ultimate controller of a firm is the state or a government agency.[16] The estimated coefficient on this interaction term is the differential loan responses on these two types of firms.

We present this estimation in column (1) of Panel B. The coefficient of *Regulated* is 0.509, statistically insignificant at the conventional level, whereas the coefficient of *Regulated**SOE is -1.189, significant at 5% level. The economic magnitude is also significant because the mean of the dependent variable is 4.05. These results indicate that

[16]Again, we exclude firms that change state ownership status during the sample period. The results are also robust if those observations are not dropped.

loans to SOEs are significantly reduced after the regulation, while the effect is positive but statistically insignificant for private companies. This difference on how the regulation affects loan amount is not unexpected given that SOEs were treated with preferential terms before the regulation. The findings also support the view that it is the reduced accessibility to loans that triggers the increase in ICFS, especially for SOEs.

However, a natural concern is whether the regulation affects other variables that are uncorrelated with the accessibility to loan but also affects ICSF. If this is the case, an increasing sensitivity could suffer from endogenous control. For example, if the policy also affects cash flow and/or investment opportunities, then the increase of ICFS would be explained by changes in the main control variables, instead of the restriction on loans. Columns (2)-(3) of Panel A report estimation of Equation (2) with CF and Q as the dependent variables, respectively. The finding shows a reduction of cash flow and investment opportunity after being regulated. However, the declines are not statistically significant at the conventional level. Furthermore, we examine the endogenous control of cash flow and Tobin's Q for SOEs and non-SOE firms in columns (2)-(3) of Panel B. The finding is reassuring because the coefficients of $Regulated*SOE$ are statistically insignificant, suggesting that the responses in ICFS for SOEs and non-SOEs are not explained by differential changes in control variables.

Finally, we check the direct effect of regulation on investment expenditures because the policy originally aims to restrict investment in those over-capacity and outdated capacity sectors. However, based on column (4) of both Panels A and Panel B, investment in those regulated industries does not seem to decrease after the policy, and almost no difference occurs between SOEs and non-SOE firms. However, identifying the types of investment that those firms make after the regulation is difficult without further detailed data. These regulated firms could invest in developing new techniques and adapting advanced equipment to raise productivity. Conversely, in a worse scenario, although the accessibility to loan was restricted, the firms maintain similar investment levels by relying more on internal funds.

2.5 Within-sample Comparison

2.5.1 Cross-sectional Heterogeneity

The estimates presented thus far suggest that ICFS increases as the ability to acquire loans is restricted, and the effects are more profound for SOEs. These findings suggest that ICFS is an effective indicator for financial constraints in China. If a reduction in the availability of loan was indeed the reason for high ICFS, then we would expect that it would be strongest for firms with the highest reliance on loans.

We evaluate Hypothesis 3 (H3) in this section. We use two proxies to measure the dependence on loans, namely, (1) the fraction of loan to total external finance (*Loan ratio*) and (2) cost of loan (*Interest rate*). For the first indicator, external finance is consisted of loan, bond, and equity finance. A higher loan ratio reflects a firm's greater dependence on bank credits. For the second indicator, a lower interest rate implies less expensive costs of loan, leading to higher dependence on bank credits. By using different proxies, we aim to estimate whether credit-dependent firms experience a greater increase in ICFS, as well as the extent to which the effect is robust across alternative measures.

Table 6 presents split-sample estimations for equation (1) based on indicators of credit-dependence. We initially calculate the median level of the two variables for each year, and firm i belongs to the high (low) group in year t if the value is above (below) the median at t. Columns (1)-(2) report outcomes for high and low loan ratios. For firms whose loan amounts consist of a high fraction of external finance, the lCFS increases by

10.8% after the policy, significant at 1% level. However, the effect is economically small and statistically insignificant for firms with below median loan. In addition, the results are robust when loan ratio is calculated as loan amounts scaled by net fixed capital. The next two columns show results for firms with above/below median interest rates. As expected, the effects are only significant for firms with lower interest rates (7.8%, at the 1% significant level), while the high interest rate group appears unaffected by the regulation. Overall, the results are in line with our H3, suggesting that firms in treated industries have higher increases in the ICFS for bank- or credit-dependent companies.

2.5.2 Effects Across Different Macro-economic Conditions

This part explores the potential heterogeneity across time series. If ICFS is a valid measure of financial constraints, the effects of the industrial regulation should be amplified during the global financial crisis (2006-2008), because the crisis could lead to credit crunch and exacerbate the difficulty of acquiring loans for regulated firms. Moreover, according to Hypothesis 4 (H4), we also expect that the effect would be moderated during the period of 4-trillion CNY economic stimulation plan by the Chinese government (2009-2010), given that this stimulation plan is accompanied with credit boom, significant growth of loan issuance, and substantial liquidity injections to the market. To examine this issue, we run regression for equation (1) based on different macro-economic conditions.

Table 7 reports outcomes based on time series. Column (1) shows the effect of the regulation during the financial crisis. As expected, when firms were restricted to obtain loans between 2006 and 2008, the interaction term is greater in magnitude (25.5% compared with 7.6% in column (2) of Table 3) and significant at 1% level. This implies that effects on ICFS are stronger when financial constraints are tighter in the general economic condition. Column (2) reports the effect during 2009 and 2010. The DID estimator is small in magnitude and statistically insignificant, suggesting that, firms in regulated industries also benefit from the credit expansion during the stimulation plan. We observe the pattern that capital flows back to less efficient sectors during this time period.[17] Finally, column (3) shows estimation analysis after 2011, when the influences of crisis and stimulation have faded away. The DID coefficient is 0.061 and significant at the 10% level, which reflects the effects of regulation without other compounding events.

In addition to the interaction term, the change of coefficients on CF is also consistent with macro-economic conditions. During the credit crunch, the coefficient in column (1) is 13.5% and significant at 1% level. As the investment plan expands credits, the coefficient becomes statistically insignificant, thereby implying relaxed financial constraints. When these effects fade away, the coefficient on CF remains positive and significant at 1% level (5.2%) in column (3). However, the magnitude is less than the case during the financial crisis. Overall, the finding is consistent with H4.

2.6 Robustness Analysis

2.6.1 Propensity Score Matching

When we document changes in ICFS for regulated firms, we cannot know whether the sensitivity would have increased even if these firms were not regulated. Thus, the increasing sensitivity for the treatment group may suffer from selection bias because reg-

[17] Media reports also mention that part of the investment plan flows into those regulated industries, such as iron and steel making. One of the disadvantages of the plan is to exacerbate the over-capacity due to excessive government intervention.

ulated firms are not randomly chosen. In the main results, we use the DID methodology to address this concern and estimate the dynamics of ICFS. In the first robustness check, we utilize the alternative method, propensity score matching, to confirm our findings. Estimating equation (1) with the treatment group and its matched sample will correct selection bias by accounting for the covariates that predict receiving the treatment.

To construct a sample of firms similar to the regulated firms, we match one-on-one pairs for a treated firm with a firm that was never treated based on key financial variables one year prior to the regulation. These variables include the previous main variables ($Investment$, $Cash$, CF, $Sale$, SOE, and Q), as well as the log of book value of assets ($lnSize$) and the sum of short-term and long-term debt over book value ($Debt\ ratio$).[18] We can find matched firms for 81 of the regulated firms and obtain 162 paired-sample for the propensity score matching analysis.

Table A2 in the Appendix shows the matching results for the main variables. The t-statistics for all normalized differences are not significant at the conventional level, which suggests that, covariates are balanced across the treatment and control groups within strata of the propensity score. Table 8 reports estimation results for propensity score matching using caliper matching (0.01). Column (1) indicates only one year after regulation of the paired-sample. Column (2) shows the outcomes for the rest of years after regulation. Column (3) is similar to column (2) and additionally controls for unobserved firm fixed effects. The coefficient of treatment effect on ICFS ($Regulated*CF$) are positive and significantly at the 1% level in all three cases. This finding is reassuring because it implies that the main findings are robust in the paired-sample when key financial variables are balanced across the treatment and control groups.

[18] By way of illustration, if firm A was regulated in 2008, then we use A's key variables in 2007 (one year prior to the regulation) and match them with key variables in 2007 from firms in the control group (never regulated).

2.6.2 Alternative Definition of the Treatment Group

Thus far, in the main results, the treatment group is defined based on the four-digit industrial code of the firm's primary business. If that industry was in the regulation list, then the firm within the same industry would be considered as treated. Here, we provide an alternative definition for the treatment group. A firm could conduct business belonging to different types of (four-digit) industries, and WIND database provides detailed descriptions of all types of business in which each firm is involved. We then count the number of times that a firm's business belongs to regulated industries. We create a dummy variable (*Sdummy*) that equals 1 if at least one of these industries is regulated, and 0 otherwise.[19] Column (1) of Table 9 reports the estimation results in equation (1), and the only change is replacing $Regulated_{i,t}$ with *Sdummy*. The coefficient of *Sdummy*CF* is 5.9%, significant at 1% level, thereby implying that the findings are robust to this alternative definition of the treatment group.

2.6.3 Placebo Tests

Finally, we conduct three sets of placebo tests. The first one varies the regulation time for the treatment group. We reestimate the regression in Table 3 with a pseudo treatment time and results are reported in columns (2) of Table 9. We create modified treatment times by allowing two years prior to the actual regulation time ($Regulated_{pre2}$). For example, the regulation time for coal (electricity) industry was in 2009 (2010), and we change it to 2007 (2008). As expected, the findings in column (2) show that the treatment effect is small in magnitude and statistically insignificant for the pseudo timing. We explore the second test using the random assignment of treatment firms ($Regulated_{random}$).

[19] For instance, if a firm?s primary business is involved in making tires, nitrogenous fertilizer, and plate glass, then it counts as $Sdummy = 1$ because plate glass is in that list.

We randomly select firm-year observation to the treated and maintain the same number of total regulated observations. We present the results for in column (3). The effects are small in magnitude and insignificant at the conventional level. The third test replaces the dependent variable ($Investment$) with another variable that is unlikely to be affected by the regulation. For example, the dependent variable we choose is the receivable ratio, namely, the total amount of account receivables over book value of assets. We expect to see no effect when reestimating equation (1) with receivable ratio as the dependent variable. Column (4) presents the outcomes. The results are in sharp contrast to those in Table 3, and the estimates predict negligible effects. Overall, treatment effects do not appear to persist based on the results of all three placebo tests.

2.7 Conclusions

This paper tests the extent to which ICFS measures financial constraints, which is a controversial finding since 1997. We exploit the staggered industrial regulation in China, which exogenously restricted the accessibility to loans for over- and backward production capacity industries in the manufacturing sector. Using the DID methodology, we find that a 7.6% significant increase in ICFS for treated industries after policy implementation, and the effects are more prominent in SOEs and more credit-dependent firms, and smaller under credit expansion. We also reassure that the regulation affects the accessibility to loan without confounding to other variables that are uncorrelated with financial constraints but also affect ICFS. Finally, we provide robustness analysis by employing propensity score matching, alternative definition of treatment industries, and a series of placebo tests.

The staggered regulation tightened financial constraints for firms in those treated industries, but did not reduce the amount of investment expenditures in outdated- and overcapacity sectors. Further research should focus on providing a rationalized explanation, in particular, the types of investment that these firms make. This effect is not trivial because this is not only a domestic issue in China, but also affects other economic entities via exports and outward foreign direct investments. Moreover, future study should examine whether and how ICFS measures financial constraints differently in emerging and developed markets. Doing so would greatly add to our understanding of the interaction between investment and financing decisions across countries.

2.8 Tables

Table 1: Time of Listing for Regulated Industries

Four-digit Code (2002 version)	Industry	Date of Listing	Article
2520	Coking	10/2008	a
3199	Calcium carbide	10/2008	a
3240	Ferroalloy	10/2008	a
3111-3121	**Cement manufacturing**	10/2008	b
2210-2223	Paper making	12/2008	c
3141	**Plate glass**	12/2008	c
3210-3230	**Ironmaking and steelmaking**	12/2008	c
3316	**Electrolytic aluminium**	12/2008	c
0610-0690	**Coal**	09/2009	d
4419	Wind turbines[1]	09/2009	d
N/A	Polysilicon[2]	09/2009	d
1461	Monosodium Glutamate(MSG)	11/2009	e
1469	Citric acid	11/2009	e
1510	Ethyl alcohol	11/2009	e
1711-1761	Dyeing and textile	04/2010	f
1910	Tanning	04/2010	f
2811-2829	Chemical fiber	04/2010	f
3311-3312	Copper, Lead, and Zinc smelting	04/2010	f
4411	Electricity	08/2010	g
3940	Lead storage battery	12/2011	h
3751-3752	**Shipbuilding**	07/2013	i

[1], [2]: Polysilicon and Wind Turbines were removed from this list in 2015.

We collect information based on official announcements from the MIIT, and only record the first time when each industry was listed. All industries have outdated capacity, and in particular, the six ones in bold are over-capacity industries.

Article (a) *Eliminating Outdated Production Capacity in Calcium Carbide, Ferroalloy, and Coking Industries (Lists of Enterprises)*
Article (b) *Eliminating Outdated Production Capacity in Cement Industry (Lists of Enterprises)*
Article (c) *Eliminating 1.065 million tons of Outdated Production Capacity in Paper-making Industry*
Article (d) *Several Opinions on Suppressing over-capacity in Some Industries (Forwarded from the State Council)*
Article (e) *Notice on the Decomposition of Eliminating Outdated Production Capacity*
Article (f) *Notice on Further Strengthening the Work of Removing Outdated Capacity (Forwarded from the State Council)*
Article (g) *Report on Task Accomplishments for the National Elimination of Outdated Production Capacity*
Article (h) *Issuing Objectives and Tasks for 19 Industrial Sectors on the Elimination of Outdated Production Capacity*
Article (i) *Interpretation of Standard Conditions for the Shipping Industry*

Table 2: Summary statistics, 2006-2015

	Mean	SD	5%	25%	50%	75%	95%
Investment	0.352	0.651	0.017	0.076	0.177	0.361	1.136
Cash flow (CF)	1.169	3.306	-0.046	0.197	0.349	0.750	4.253
Loan	4.054	13.145	0.000	0.346	0.861	2.001	15.683
External finance	4.667	15.173	0.000	0.407	0.982	2.291	17.473
Q	1.565	1.420	0.309	0.641	1.127	1.958	4.427
Sale	7.301	16.284	0.516	1.330	2.702	5.931	25.684
Cash	2.537	7.590	0.070	0.242	0.597	1.562	9.633
SOE	0.678	0.467	0.000	0.000	1.000	1.000	1.000
Debt ratio	0.519	0.190	0.187	0.384	0.531	0.662	0.815
ROA	0.042	0.053	-0.044	0.023	0.041	0.066	0.125
lnSize	22.188	1.338	20.272	21.283	22.030	22.960	24.622
Regulated	0.084	0.278	0	0	0	0	1

This table presents summary statistics for main regression variables. The sample consists of 11,274 firm-year observations and 1,362 unique firms from 2006 to 2015. Main variables are winsorized at 1% and 99% to minimize the influence of outliers. Investment expenditure, cash flow, loan, external finance, sale, and cash are deflated by the beginning-of-period net fixed capital. Variable definitions are provided in the Appendix Table A1.

Table 3: Effects of the Industrial Regulation

Dependent variable: *Investment*	Treatment Group	Main Sample	Whole Sample
CF	0.078	0.061***	0.062***
	(0.047)	(0.012)	(0.012)
Regulated	0.106*	-0.008	-0.017
	(0.059)	(0.029)	(0.028)
*Regulated**CF	0.079***	0.076***	0.077***
	(0.014)	(0.027)	(0.027)
Q	0.060**	0.060***	0.060***
	(0.025)	(0.010)	(0.009)
Sale	0.016	0.005**	0.005**
	(0.010)	(0.002)	(0.002)
Cash	-0.005	0.010***	0.009**
	(0.008)	(0.004)	(0.004)
Firm FE	X	X	X
Year FE	X	X	X
Industry-year FE	X	X	X
Region-year FE		X	X
adjusted R^2	0.476	0.178	0.173
No. of cases	1,021	10,107	11,274

The dependent variable is *Investment* and CF is cash flow. The rest of results are estimated with the main sample, unless specified otherwise. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 4: SOEs and non-SOEs

Dependent Variable *Investment*	SOE	non-SOE	SOE	non-SOE
CF	0.050***	0.041**	0.050***	0.042**
	(0.014)	(0.019)	(0.014)	(0.019)
Regulated	-0.037	-0.049		
	(0.034)	(0.068)		
*Regulated**CF	0.189***	0.036**		
	(0.042)	(0.018)		
Regulated(-2)			0.043	-0.166*
			(0.059)	(0.097)
Regulated(-1)			0.029	-0.202*
			(0.060)	(0.117)
Regulated(0)			-0.114*	-0.147
			(0.065)	(0.125)
Regulated(1)			0.009	-0.203
			(0.051)	(0.127)
Regulated(2)			0.020	-0.189**
			(0.060)	(0.084)
Regulated$(3+)$			0.019	-0.151
			(0.060)	(0.098)
Regulated(-2)*CF			0.127	-0.010
			(0.107)	(0.016)
Regulated(-1)*CF			0.138	-0.007
			(0.107)	(0.022)
Regulated(0)*CF			0.502***	0.121**
			(0.053)	(0.047)
Regulated(1)*CF			0.220***	0.042*
			(0.028)	(0.021)
Regulated(2)*CF			0.113***	0.032
			(0.025)	(0.020)
Regulated$(3+)$*CF			0.206*	0.022
			(0.108)	(0.030)
Control variables	X	X	X	X
Firm FE	X	X	X	X
Year FE	X	X	X	X
Regional-year FE	X	X	X	X
Industry-year FE	X	X	X	X
adjusted R^2	0.158	0.156	0.164	0.152
No. of cases	6,222	2,751	6,172	2,723

Control variables include Q, $Sale$, and $Cash$. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 5: Tests on the Mechanism

Panel A: Main Sample

Dependent variable:	*Loan*	*Cash flow*	*Q*	*Investment*
	(1)	(2)	(3)	(4)
Regulated	-0.588**	-0.048	-0.069	0.032
	(0.288)	(0.057)	(0.134)	(0.028)
Control variables	X	X	X	X
Firm FE	X	X	X	X
Year FE	X	X	X	X
Region-year FE	X	X	X	X
adjusted R^2	0.263	0.543	0.159	0.187
No. of cases	10,007	10,062	10,040	10,058

Panel B: SOEs and non-SOEs

Dependent variable:	*Loan*	*Cash flow*	*Q*	*Investment*
	(1)	(2)	(3)	(4)
Regulated	0.509	-0.442	-0.380	0.023
	(0.529)	(0.323)	(0.256)	(0.048)
*Regulated**SOE*	-1.189**	0.333	0.351	-0.001
	(0.564)	(0.326)	(0.263)	(0.057)
Control variables	X	X	X	X
Firm FE	X	X	X	X
Year FE	X	X	X	X
Region-year FE	X	X	X	X
adjusted R^2	0.364	0.167	0.119	0.125
No. of cases	8,960	9,006	8,954	9,006

Control variables include *Cash*, *CF*, *Sale*, *Debt*, *Q*, and *ROA* (except the dependent variable in each regression). Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 6: Within-sample Comparison (Credit-dependence)

Dependent variable: *Investment*	High *Loan ratio*	Low *Loan ratio*	High *Interest rate*	Low *Interest rate*
CF	0.058***	0.082***	0.067***	0.053***
	(0.017)	(0.017)	(0.021)	(0.014)
Regulated	-0.030	-0.003	-0.031	-0.007
	(0.029)	(0.068)	(0.026)	(0.054)
*Regulated**CF*	0.117***	0.022	0.033	0.077**
	(0.030)	(0.022)	(0.043)	(0.030)
Control variables	X	X	X	X
Firm FE	X	X	X	X
Year FE	X	X	X	X
Region-year FE	X	X	X	X
adjusted R^2	0.187	0.238	0.177	0.195
No. of cases	5,993	4,143	5,311	4,825

Classifications of high and low are based on the median level in each year. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 7: Heterogenous Effects Across Different Macro-economic Conditions

	Sample Period		
Dependent variable: *Investment*	Financial Crisis 2006-2008	four-trillion RMB Stimulus 2009-2010	After 2011 2011-2015
CF	0.135***	0.067	0.052***
	(0.028)	(0.046)	(0.017)
Regulated	-0.048	0.049	0.036
	(0.047)	(0.103)	(0.089)
*Regulated * CF*	0.255***	-0.052	0.061*
	(0.044)	(0.080)	(0.033)
Control variables	X	X	X
Firm FE	X	X	X
Year FE	X	X	X
Region-year FE	X	X	X
Industry-year FE	X	X	X
adjusted R^2	0.240	0.101	0.202
No. of cases	2,822	1,957	5,328

Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 8: Propensity Score Matching

Dependent Variable: *Investment*	One-year after matching	All years after matching	All years after matching
CF	0.047	-0.052**	-0.007
	(0.122)	(0.023)	(0.023)
Regulated	-0.203***	-0.110***	0.004
	(0.052)	(0.038)	(0.075)
*Regulated*CF*	0.610***	0.226***	0.131***
	(0.190)	(0.018)	(0.030)
Control variables	X	X	X
Firm FE			X
Year FE	X	X	X
adjusted R^2	0.549	0.544	0.316
No. of cases	160	1024	1024

The one-on-one paired match is between a treated and a never treated firm based on their key financial variables one-year prior to the being regulated.*, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 9: Placebo Tests

Dependent variable:	*Investment*	*Investment*	*Investment*	*Receivable ratio*
	(1)	(2)	(3)	(4)
CF	0.043***	0.062***	0.064***	0.000
	(0.013)	(0.012)	(0.012)	(0.000)
$SDummy$*CF	0.059***			
	(0.019)			
$Regulated_{pre2}$		-0.000		
		(0.032)		
$Regulated_{pre2}$*CF		0.051		
		(0.033)		
$Regulated_{random}$			0.016	
			(0.029)	
$Regulated_{random}$*CF			-0.012	
			(0.013)	
$Regulated$				0.001
				(0.004)
$Regulated * CF$				0.001
				(0.002)
Control Variables	X	X	X	X
Firm FE	X	X	X	X
Year FE	X	X	X	X
Region-year FE	X	X	X	X
Industry-year FE	X	X	X	X
adjusted R^2	0.178	0.176	0.171	0.083
No. of cases	10,205	10,136	10,256	11,307

$Regulated_{pre2}$ is a pseudo regulation time, namely, two years prior to the actual regulation time. $Regulated_{random}$ represents that firms receive random assignment of treatment. The dependent variable in column (4), receivable ratio, is the total amount of account receivables over book value of assets. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

2.9 Appendix

Table A1: Variable Definitions

Variable	Definition
Cash	Cash and cash equivalents scaled by the beginning-of-period net fixed capital
CF	Earnings before interest, tax, depreciation and amortization scaled by the beginning-of-period net fixed capital
Investment	Capital expenditures scaled by the beginning-of-period net fixed capital
Sale	Main operating income scaled by previous year's net fixed capital
Q	Tobin's Q, the ratio of market value to book value of assets
Regulated	A dummy variable that equals one after firms being regulated in treated industries
SOE	A dummy variable that equals one if the state is the ultimate controller of a company
Exteral finance	Sum of cash obtained from bank loans, and issue of bond and equity
Loan	Cash obtained from bank loans
lnSize	Natural logarithm of total assets
Debt ratio	Sum of short-term and long-term debt over book value of assets
ROA	Return on assets, i.e. ratio of net income to total assets
Loan ratio	The fraction of loan and total amount of external finance
Interest rate	Financial expenses over interest-carrying liabilities
Receivable ratio	Total amount of account receivables over book value of assets

(One-digit) Industry classification: Farming, forestry, animal husbandry & fishing; Mining; Manufacturing; Utilities; Construction; Transportation & warehouse; Information technology; Wholesale & Retailing; Real estate; Social services; Communications & Cultural; Conglomerates; Finance and insurance. Firms in the Finance and Insurance sector are excluded.

Table A2: Comparing Covariates for Matched Samples

	Control_{mean}	Treatment_{mean}	Norm Difference	t-statistic
Investment	0.319	0.276	-0.088	(-0.560)
CF	0.852	0.691	-0.055	(-0.350)
Q	1.937	1.718	-0.142	(-0.904)
Sale	3.301	6.245	0.121	(0.768)
Cash	2.592	1.454	-0.126	(-0.802)
lnSize	22.267	22.328	0.045	(0.286)
Debt ratio	0.508	0.533	0.160	(1.016)
SOE	0.790	0.765	-0.059	(-0.376)
No. of observation	81	81		

*, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Chapter 3

Government Intervention and Investment Efficiency: Evidence from China's Industrial Regulation

3.1 Introduction

Investment efficiency is one of the most important topics in corporate finance. In perfect capital markets, investment would only depend on a firm's investment opportunities measured by Tobin's Q (Modigliani and Miller, 1958; Tobin, 1969). However, empirical findings indicate that firms often deviate from the optimal investment strategy due to frictions and cause inefficient investment. Literature has mainly discussed two sources of these frictions in developed markets: agency problems and information asymmetry. The former would create conflict between managers and shareholders, resulting in over-investment; while the latter would increase the costs of external finance and result in under-investment due to financial constraints (see e.g., Stein, 2003). However, following Chen et al. (2011), this paper investigates the source of frictions through government intervention and further explores its causal impacts on investment efficiency, which is prevelant in emerging markets.

Although government intervention in corporate activities is common across the world, I explore the effect in China and use an industrial policy, "the elimination of over-capacity and outdated capacity production", as the exogenous shock to the reduction of government intervention. This regulation makes staggered efforts to include various manufacturing sectors into the list at different time and gradually restrict control over the added capacity. This is because prior to the reform, these companies received favorable policies due to political considerations and they would hardly survive without it. I find the Chinese setting is particularly interesting for two reasons. First, this industrial regulation provides exogenous variation across both time and industries by removing previously favored government interventions. This serves as an unique identification strategy and largely mitigates the endogeneity concern. Second, it is easier to detect the effects of government intervention in China because both local and central governments play an essential role in corporate activities through state ownership, especially in state-owned enterprises (SOEs). Besides ownership structure, the Chinese government also expands its control by establishing political connections, e.g., appointing top executives, many of whom are current or previous government officials (Pan and Tian, 2017). Thus, firms with state ownership and/or political connections provide an opportunity to explore whether and how government intervention affects firms' investment behavior.

I hypothesize that government intervention would decrease investment efficiency, and specifically, the effect is more prominent for SOEs. Previous studies have shown that state ownership is an essential force in scare resource allocation and note that SOEs often enjoy preferential treatment ("soft-budget constraints") from the government regardless of their performance, such as lower cost of credit and land endowment (e.g., Gugler, 2003). This is because an important target of SOEs is to accomplish social and political goals such as employment and regional economic growth. Thereby, the favored government policy would lead to distortion of investment efficiency and result in misallocation of resources (see e.g., Fan et al., 2007; Chen et al., 2011). I test the hypothesis by examining whether investment efficiency (measured as the sensitivity of investment to Tobin's Q) would increase for treated firms after the regulation since this policy exogenously reduced (or even reversed) government interventions. I further posit that the increase in the investment-to-Tobin's Q sensitivity is significant both economically and statistically in SOEs because private companies tend to suffer less from the deprivation of government intervention. Because non-SOEs did not usually have the "helping hand" from the government priori to the reform. Using a difference-in-differences approach, I examine the change of investment efficiency and find that empirical results are consistent with my prediction.

I further measure government intervention by whether a firm has politically connections. Following Fan et al. (2007) and Chen et al. (2011), I classify a firm as politically connected if its chairman or CEO is a current or former government officer. I predict that for private firms, investment efficiency will be higher for politically connected companies than non-politically connected ones in the treated industry given the exogenous shock of government intervention. This is because non-SOEs with political connections are usually the ones with more resources (e.g., access to profitable investment opportunities), and this connection remains effective even after the regulation, thereby, leading to higher investment efficiency. However, it is not the case for SOEs because political connection does not provide additional benefits for investment efficiency given that SOEs are already connected with the government through ownership. The empirical findings are also consistent with my predictions.

This paper adds to the extant literature on the association of corporate investment and government intervention. Many scholars have examined the interpretation of investment efficiency through agency problems and information asymmetry, which mainly focusing on well-developed financial markets. However, since market structure is different across countries, implications from the developed countries might not always hold in emerging markets. Therefore, this paper is among the first to explore the causal impacts between government intervention on investment under the context of developing countries. Given that government intervention is prevalent, this paper enriches our understanding of the efficiency of corporate investment. Furthermore, it also investigates the link between political connections and corporate investment behavior, which provides additional measurement of government intervention.

Moreover, the results also provide a novel perspective to examine the economic consequences of an important industrial policy, the elimination of over-capacity and outdated capacity in manufacturing sectors. This paper analyzes the direct effects on firms' investment and also sheds light on the heterogeneous effects between SOE and non-SOEs, and between firms with and without political connections. Furthermore, studying this regulation would allow us to learn more about international trade related to China since excessive production could lead to important global issues that affects other countries via exports and outward foreign direct investments (Gao and Wang, 2017). However, many studies so far have mainly focused on aggregated data, descriptive analysis, or capacity measurement (see e.g., Shen and Chen, 2017). By contrast, it is among the first papers that examines the industrial regulation with firm-level data.

The paper proceeds as follows. Section 2 introduces the institutional background of the regulation and develops hypotheses. Section 3 describes the data, variables, identification strategy and econometric model. Section 4 presents the main findings with a difference-in-differences approach.

3.2 Institutional Background and Hypotheses Development

3.2.1 Institutional Background

Over-capacity and outdated capacity are important phenomena that emerged in certain manufacturing sectors in China. Over-capacity implies low capacity utilization. For example, the production capacity of raw steel in 2012 was 72% in China and 78% in the world. But, there were still on-going investments aiming to expand capacity of steel making. Outdated capacity implies either inefficient production technology or production causing pollution and high energy consumption.[1]

This is caused by economic stimulus plans enacted by the government of China, providing a strongly irrational incentive for "hot money" flowing into those government-targeted sectors.[2] Therefore, the government intervention creates many "zombie firms", namely, firms that would go bankrupt due to poor performance but survive with external support from governments or financial sector (Kane, 1987). Local governments support these companies because they can support local economic growth, fiscal income, social stability, and employment targets, which are essential performance indicators for government officers' promotion. Under such intervention, these sectors grow rapidly despite the phenomena of over-capacity and outdated capacity.

Furthermore, over-capacity and outdated capacity are exacerbated by the support from local banks. Regardless of the performance, banks still prefer to provide loans to firms which are important to regional economy because they are "stable", namely, these

[1] In particular, over-capacity industries mainly include ironmaking and steel making, coal, shipbuilding, aluminum, concrete, and emerging sectors such as the photovoltaic and wind turbine, whereas outdated capacity industries include not only these ones, but also other sectors, such as heavy chemical industry and etc.

[2] For example, companies operating in the favored industries were equipped with grants, low-interest loans, cheap energy and other raw materials, and even free land resources (Gao and Wang, 2017).

firms are more likely to pay back debts due to the support from local governments. In addition, the scope and severity of over- and outdated capacity further expanded given the macroeconomic conditions, such as the slowdown of China's economic growth and the decreasing demand for exports. As a consequence, government interventions allow low-efficiency manufacturing enterprises to enjoy preferential policies and regional protection, thereby causing inefficient resource allocation and crowding out the top-quality enterprises.

Eliminating zombie firms is the main approach to reduce over-capacity and backward production capacity. Therefore, zombie firms need to be deprived of those privileged policies. Beginning from 2008, in order to curb excessive production capacity, the State Council issued *"Instructions on Tackling the Problem of Excess Over-capacity and Eliminations of Outdated Industries"*. The Ministry of Industry and Information Technology gradually restricted controls over the added capacity and included more industries to the list of sectors based on four-digit industrial codes.[3] Once an industry is being listed, the regulators would restrain firms in that industry from obtaining previous preferential policies.

In order to make sure the successful implementation, the central government instructed local governments to conduct policies accordingly. If companies do not comply, e.g., still investing on projects that adding over-capacity and backward production capacity, local banks and financial institutions must deny the enterprises' access to new loans, lines of credit, and other financial assistance (Gao and Wang, 2017). Meanwhile, local officers cannot approve additional requests for new land permits from noncompliant enterprises (Shen and Chen, 2017). Furthermore, the government promotes market competition and improves the exit mechanism for zombie firms. Therefore, the industrial

[3] See Table 1 in Gao and Wang (2017) for detailed information about the listing time and listing industries.

regulations provide an ideal setting for staggered shocks in government interventions. In particular, the staggered industrial regulation provides a relatively exogenous shock on the loss of favored government intervention, e.g., firms change from enjoying favored policies to suffering from strict regulations.

3.2.2 Hypotheses Development

The Chinese economy is a hybrid of central planning and market-based activities, where the government controls the key resources that are essential for companies (Pan and Tian, 2017). In this sense, government intervention can shape the incentives and operations of economic entities to a great extend. According to firms' operating activities, the efficiency of corporate investment is a fundamental concern in corporate finance. Empirically, a firm's investment should be only determined by its investment opportunity (Tobin, 1969). Nonetheless, researchers have identified a variety of frictions that could distort investment efficiency. In particular, information asymmetry and agency problems are two important distortional forces that have received most attention in the literature (Stein, 2003; Chen et al., 2011).

In this section, I argue that government intervention is another source of friction causing suboptimal investment. In particular, I develop testable hypotheses, concerning the causality of government intervention on investment efficiency by exploring the recent Chinese industry regulation. As reviewed in the institutional background, China promoted a regulatory campaign to eliminate over-capacity and outdated capacity in specific industries. After the reform, treated firms would have to rectify the distorted investment efficiency in order to survive, leading to improved investment efficiency. Therefore, I construct my first hypothesis:

Hypothesis 1: After regulating over-capacity and outdated capacity industries, investment becomes more efficient for firms in treated industries given the exogenous shock of government intervention.

The rationale behind the association between the reform of affected industries and investment efficiency can be different between SOEs and non-SOEs. For SOEs, before the regulation, government intervention would change the objective of SOEs to the preference of the government (such as employment and fiscal income), thereby leading to misallocation and investment inefficiency. For example, given the soft budget constraint, SOEs do not have incentives to improve the quality of investment as it may not be the priority of the government. However, with the implementation of the regulation, the treated SOEs suddenly lost the "helping hand" from governments. Thus, they have to pursue for more efficient investment through improving production technology in order to survive in the fierce market competition. However, for regulated non-SOEs, although being negatively affected by the policy as well, they would not suffer as much loss as the SOEs, because private companies had limited access to the preferential government interventions during the pre-regulation period. Thus, I expect that the industrial regulation will remove the valuable preferential treatment from SOEs, but not necessarily from non-SOEs. I therefore construct the following hypothesis:

Hypothesis 2: After regulating over-capacity and outdated capacity industries, compared with private firms, investment becomes more efficient for state-owned firms in treated industries given the exogenous shock of government intervention.

State ownership is not the only measure of government intervention because SOEs in

China are not static and the establishment of state-owned holding companies and partially privatized SOEs made government intervention more costly to realize. Therefore, I further measure the degree of government intervention by whether their top executives are politically connected. Following Fan et al. (2007), I classify a firm as politically connected if its chairman, CEO, president, or vice president is a current or former government official.

According to Wu et al. (2012), I posit that the impact of political connection is different for SOEs and non-SOEs. In particular, SOEs are already connected with the government through government ownership. In this case, no matter whether a SOE is politically connected or not, it does not provide additional benefits for investment opportunity (Pan and Tian, 2017). On the other hand, private firms with political connections are usually the ones with more profitable investment opportunities. A common impression is that maintaining political connections is more important than operational profitability in emerging markets, which is particularly important in China (Chen et al., 2011). Because valuable investment projects are still controlled by the Chinese government. Therefore, although all treated non-SOEs are affected by the industrial regulation, the ones with political connections would be able to recover more easily and obtain more profitable investment projects. This situation leads to our second hypothesis:

Hypothesis 3: After regulating over-capacity and outdated capacity industries, compared with state-owned enterprises, investment becomes more efficient for politically connected private firms relative to non-politically connected private firms in treated industries, given the exogenous shock of government intervention.

3.3 Identification, Sample and Methodology

3.3.1 Identification of the influence of government intervention

The endogeneity issue of government intervention is the main concern for empirical study. Ideally, I would apply a natural experiment that allows me to avoid the omitted variable bias. Specifically, I collect a sample of regulated listed corporations, because the timing of this staggered policy announcement is exogenous to these firms. I compare investment efficiency for event firms before and after the policy of eliminating over-capacity production. Furthermore, different four-digit manufacturing sectors are regulated at different times, which allows me to explore the time-variation as well.

3.3.2 Sample and data

My sample includes all non-financial firms listed on the main board of Shanghai and Shenzhen stock exchanges from 2006 to 2015. Following Gao and Wang (2017), I manually collect information about the time and which four-digit industry is regulated through the official website of the Ministry of Industry and Information Technology. I determine the nature of firm ownership by the ultimate controller from the annual report.[4] Information about political connection is collected from China Stock Market and Accounting Research (CSMAR) database. I classify a firm as politically connected if one of the top executives (i.e., the president, CEO, or vice president), is a current or a previous government official. For case with ambiguous disclosure, I search Google and WIND dataset as a cross-check. Other firm-specific financial variables are drawn from the CSMAR database.

[4]A firms is classified as an SOE if its ultimate controller is the government, while a firm is considered as a non-SOE when the ultimate controller is an individual or a non-state entity.

Following common practice, I drop financial firms because their operating and investing activities are distinct from other sectors. I also exclude firms whose time of listing is less than a year. Furthermore, I winsorize observations at 1% and 99% for the main regression variables to minimize the influence of outliers. My entire sample consists of 1,362 unique firms and 11,274 firm-year observations, of which 104 firms are in the over- and outdated capacity lists and are affected by the regulation. Table 1 provides detailed variable definitions.

Around two thirds of my sample firms are state-owned enterprises, and one third of the firms are private companies. 15.2% of all listed firms are politically connected, 11.56% for SOEs, and 15.96% for non-SOEs. I use Tobin's Q to approximate for investment opportunities. Admittedly, the approach suffers from measurement errors. In untabulated results, my findings are robust to use alternative proxies for investment opportunities, namely, market-to-book ratio and employment growth. Table 2 tabulates summary statistics for the main variables used in the analysis. The mean (median) pooled sample ratio of investment-to-asset ratio is 4.8% (3.3%).

3.3.3 Methodology

Given that firms are regulated at different times, I apply a difference-in-differences (DID) methodology to identify the effect of government intervention on investment efficiency based on the enactment of the listed industries (see Table 1 of Gao and Wang, 2017 for detailed information). The treatment group is considered as firms in regulated industries, whereas the control group includes firms never being regulated. To study the multivariate analysis of corporate investment efficiency, I follow the majority of investment literature by employing the sensitivity of investment expenditure to investment opportunities (Tobin's Q) (e.g., Lang et al., 1996; Stein, 2003; Gertner et al., 2002; Hung et al., 2007; Chen et al., 2011). Thus, I first estimate the following equation to test Hypothesis 1 (H1):

$$Investment_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 Regulated_{i,t} + \beta_3 Q_{i,t-1} * Regulated_{i,t} + \beta_4 CFO_{i,t-1} \quad (1)$$

$$+ \beta_5 Lev_{i,t-1} + \beta_6 logSize_{i,t-1} + \beta_7 SEO_{i,t-1} + \alpha_i + \alpha_{i,t} + \epsilon_{i,t}$$

where the subscript i and t denote for firm and year respectively. The dependent variable is *Investment*, which is capital expenditures scaled by the beginning-of-period total asset. *Regulated* is the treatment dummy; that is, a dummy variable that equals one if a firm is in an industry that has been regulated in year t. Q represents investment opportunities, measured as the market value over book value of total assets. The interaction term Q * *Regulated* (β_3) is the DID estimator, measuring the difference in investment efficiency after regulation between treatment and control groups. H1 predicts that this coefficient would be positively significant. In all specifications, I also include firm fixed effects (α_i) to control for time-invariant firm characteristics omitted in regressions and (one-digit) industry-by-year fixed effects for shocks to a industry-specific shock at a given year (year fixed effects are therefore absorbed). Standard errors are adjusted for heteroscedasticity and clustered at the firm level.

Based on prior research (e.g., Richardson, 2006; Chen et al., 2011), I also include other control variables. *CFO* is a firm's cash flows from operating activities. I expect a positive coefficient for this variable because higher cash flow provides more internal finance for investment. A firm with high leverage ratio (*Lev*) indicates a high debt finance burden. Thus, I expect this coefficient to be negative. *SEO* represents cash proceeds from seasoned equity offerings, controlling for another main source of external finance.

All of the three variables are scaled by the beginning-of-period total assets. Moreover, I also include the logarithm of total assets as an approximation for size, which could also affect the level of investment. More importantly, I use the beginning-of-period values for these variables to avoid reverse causality.

To test Hypothesis 2 (H2), I further explore the heterogeneous effects by regressing on SOEs and non-SOEs respectively. Moreover, to examine the impact of government interventions on firms with and without political connections, I use a modified version of Equation (1) and introduce a triple-interaction term to test Hypothesis 3 (H3):

$$Investment_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 Regulated_{i,t} + \beta_3 PC_{i,t} + \beta_4 Regulated_{i,t} * PC_{i,t} * Q_{i,t-1} \tag{2}$$

$$+ \beta_5 Q_{i,t-1} * Regulated_{i,t} + \beta_6 PC_{i,t} * Q_{i,t-1} + \beta_7 PC_{i,t} * Regulated_{i,t} + \beta_8 CFO_{i,t-1}$$

$$+ \beta_9 Lev_{i,t-1} + \beta_{10} logSize_{i,t-1} + \beta_{11} SEO_{i,t-1} + \alpha_i + Industry * Year + \epsilon_{i,t}$$

PC is a dummy variable that equals one if a firm has political connections and zero otherwise. β_4 is the triple DID estimator, measuring the difference between investment efficiency for treated firms with and without political connections after the regulation. According to H3, β_4 is expected to be positively significant in non-SOEs, while the sign is uncertain for SOEs.

3.4 Empirical Findings

3.4.1 Baseline Results

Table 3 presents the test results of H1, predicting that treated firms will exhibit higher investment efficiency after being regulated. Column (1) shows the findings based on the whole sample, including all firms in both manufacturing and non-manufacturing sectors. The coefficient on *Regulated*Q* captures the average investment efficiency after the firm has been regulated, indicating a significantly higher investment efficiency. This DID estimator is 0.007 and is significant at 1% level. Thus, as firms are restricted with favored government interventions, they have to increase investment efficiency to survive in the market competition. The coefficient on *Regulated* is negatively significant, suggesting that total investment declines after the regulation. Meanwhile, the coefficient on Tobin's Q is positively significant, which is consistent with the investment theory. With respect to other control variables, the amount of investment expenditures is significantly smaller when a firm has higher debt-to-asset ratio; and the amount is significantly larger when a firm has a greater in size and/or using more equity finance. The effects of cash flow from operating on investment is positive but not significant at the conventional level. In column (2), I further include province-by-year fixed effects to control for province-level shocks in a specific year and the coefficients are almost identical as in column (1), suggesting that the effects are not explained by province-specific shocks.

In column (3), I restrict observations to the main sample by including firms in the treatment group, and those in the control group but are not in the same two-digit industry as the treatment group. By way of illustration, firms in the plate glass industry (four-digit code: 3141) are under regulation, and they belong to a broader category: nonmetal mineral products industry (two-digit industrial code: 31). Therefore, in the control group, I also exclude firms in the nonmetal mineral products industry even if they are not directly regulated. This is because firms in the same two-digit industry may experience overlaps in primary business, and firms with code in 31 but not in 3141 may be indirectly affected. I exclude them in case they would confound the control group. However, the main results are still robust and qualitatively similar if considering all unregulated firms as the control group. Unless otherwise noted, all regressions are based on the main sample. In this case, the DID estimator of the interaction term is 0.006, still positively significant at the 5% level, which implies that the results are not sensitive to different control groups. Therefore, my findings are consistent with H1, where firms in treated industries experience significantly higher investment efficiency after the reform.

3.4.2 SOE and non-SOE firms

I formally check the validation of H2 in this section. Before the regulation, SOEs have more privileged benefits from government intervention and are more likely to operate with less efficiency under the “soft budget constraints”. However, the restricted regulation makes the treated SOEs experience sudden losses of the “helping hand” from central and local governments. Therefore, I expect to observe a greater increase in investment efficiency for SOEs than non-SOEs because they have incentives to correct resource misallocation and pursue higher efficiency investment. However, since non-SOEs did not enjoy much of these previous preferential treatments, their responses to the regulation may not be as significant as SOEs.

I test this hypothesis by separately estimating Equation (1) for SOEs and non-SOE firms and Table 4 shows regression analysis of H2. Because the state ownership status changes across time, to avoid endogeneity, I exclude the ones that have changed ownership status during the sample period, i.e., from SOE to non-SOE or from non-SOE to

SOE.[5] From the number of observations, we can infer that SOEs consist of two thirds of the sample. In column (1), investment efficiency increases significantly for SOEs and the DID estimator is 0.01 at the 5% significant level. However, for non-SOEs, investment efficiency is higher (0.005) after the regulation but is not significant at the conventional level. In addition, I cannot reject the null hypothesis that the DID estimator is quantitatively the same between SOEs and non-SOEs. In summary, the results in Table 4 are consistent with my prediction in H2.

3.4.3 Differential Impacts of Political Connections in SOEs versus non-SOEs

In Table 5, I examine H3, which is how political connections influence investment efficiency for SOEs versus non-SOEs. Because the nature of political connections between these two groups is different, I analyze them separately. PC is the dummy variable to differentiate connected and non-connected firms. In column (1), the coefficient of the triple interaction term is negative but insignificant, suggesting that investment efficiency is not higher for SOEs with political connections after the regulation. This is consistent with my prediction in H3 because whether an SOE is politically connected or not, it does not provide additional benefits for investment efficiency. The interpretation of β_2 is also important because it captures average investment efficiency for SOEs after the regulation, which is consistent with column (1) in Table 4. However, the triple interaction term for non-SOEs is positively significant (0.014) at the 5% significant level, indicating that non-SOEs with political connections experience a higher investment efficiency after the regulation compared to the ones without connections. In addition, β_2 is small in

[5]However, the results are quantitatively similar if I include these firms back.

magnitude and insignificant, suggesting that most of the increasing investment efficiency is driven by firms with political connections. The intuition is that private firms with political connections are usually the ones with access to key investment projects and resources, and the connection is still valuable after the regulation. Therefore, they are more resourceful when cope with the unfavored regulation and increase the investment efficiency during the post-reform period. According to the triple interaction terms in β_3, I argue that the results are consistent with H3.

3.5 Tables

Table 1: Variable Definitions

Variable	Definition
CFO	Earnings before interest, tax, depreciation and amortization scaled by the beginning-of-period total assets
$Investment$	Capital expenditures scaled by the beginning-of-period total assets
$Sale$	Main operating income scaled by previous year's net fixed capital
Q	Tobin's Q, the ratio of market value to book value of assets
$Regulated$	A dummy variable that equals one after firms being regulated in treated industries
PC	A dummy variable that equals one if a firm is politically connected
SOE	A dummy variable that equals one if the state is the ultimate controller of a company
$logSize$	Natural logarithm of total assets
Lev	Sum of short-term and long-term debt over book value of assets

(One-digit) Industry classification: Farming, forestry, animal husbandry & fishing; Mining; Manufacturing; Utilities; Construction; Transportation & warehouse; Information technology; Wholesale & Retailing; Real estate; Social services; Communications & Cultural; Conglomerates; Finance and insurance. Firms in the Finance and Insurance sector are excluded.

Table 2: Summary statistics (2006-2015)

	Mean	SD	5%	25%	50%	75%	95%
Inv_t	0.048	0.049	0.001	0.012	0.033	0.068	0.151
Q_{t-1}	1.720	1.814	0.314	0.658	1.162	2.047	5.088
CFO_{t-1}	0.077	0.072	-0.028	0.046	0.073	0.109	0.191
Lev_{t-1}	0.545	0.246	0.188	0.389	0.541	0.679	0.862
$Size_{t-1}$	22.046	1.434	19.976	21.111	21.930	22.871	24.562
SEO_{t-1}	0.017	0.052	0.000	0.000	0.000	0.003	0.132
SOE	0.664	0.472	0.000	0.000	1.000	1.000	1.000
Reg	0.087	0.282	0.000	0.000	0.000	0.000	1.000
PC	0.152	0.359	0.000	0.000	0.000	0.000	1.000

This table presents summary statistics for main regression variables. The sample consists of 11,274 firm-year observations and 1,362 unique firms from 2006 to 2015. Main variables are winsorized at 1% and 99% to minimize the influence of outliers. Investment expenditure (Inv), cash flow (CFO), the sum of short term and long term debt (Lev), and cash proceeds from seasoned equity offerings (SEO) are deflated by the beginning-of-period total assets. Tobin's Q (Q) is the sum of market value of tradable shares, book value of non-tradable shares and liabilities, divided by book value of total assets. SOE, Reg, and PC are indicator variables for state-owned enterprises, firms in regulated industry, and firms with political connections, respectively. $Size$ is the logarithm ratio of the beginning-of-period total assets. Variable definitions are provided in Table 1.

Table 3: Effects of the Government Regulation on Investment Efficiency

Dependent variable: *Investment*	Whole Sample	Whole Sample	Main Sample
Regulated	-0.015***	-0.015***	-0.013**
	(0.005)	(0.005)	(0.005)
*Regulated*Q*	0.007***	0.007***	0.006**
	(0.003)	(0.003)	(0.003)
Q	0.003***	0.003***	0.004***
	(0.000)	(0.000)	(0.000)
CFO	0.007	0.007	0.008
	(0.008)	(0.008)	(0.008)
Lev	-0.013***	-0.013***	-0.010***
	(0.004)	(0.003)	(0.004)
lnSize	0.009***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)
SEO	0.055***	0.055***	0.061***
	(0.009)	(0.009)	(0.010)
Firm FE	X	X	X
Year FE	X	X	X
Industry-year FE	X	X	X
Region-year FE		X	
adjusted R^2	0.073	0.080	0.075
No. of cases	12,354	12,354	11,026

The dependent variable is *Investment*. Columns (1) and (2) are estimated for the whole sample. Column (3) includes the only the main sample. The rest of results are estimated within the main sample, unless specified otherwise. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 4: Heterogenous Effects on SOEs and non-SOEs

Dependent variable:	SOE	non-SOE
	(1)	(2)
Regulated	-0.018**	-0.013
	(0.007)	(0.010)
*Regulated**Q*	0.010**	0.005
	(0.004)	(0.006)
Q	0.004***	0.004***
	(0.001)	(0.001)
CFO	0.007	-0.011
	(0.015)	(0.012)
Lev	0.003	-0.016***
	(0.008)	(0.005)
lnSize	0.009***	0.006***
	(0.002)	(0.002)
SEO	0.069***	0.040**
	(0.013)	(0.016)
Firm FE	X	X
Year FE	X	X
Industry-year FE	X	X
adjusted R^2	0.093	0.062
No. of cases	6,573	3,144

Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

Table 5: Heterogenous Effects on Political Connections

Dependent variable: *Investment*	SOE	non-SOEs
Regulated	-0.016**	-0.008
	(0.008)	(0.007)
*Regulated*Q*	0.010**	-0.001
	(0.004)	(0.003)
*Regulated*Q*PC*	-0.010	0.014**
	(0.009)	(0.007)
*Q*PC*	-0.002	0.001
	(0.002)	(0.002)
*Regulated*PC*	-0.004	-0.006
	(0.012)	(0.024)
Q	0.004***	0.004***
	(0.001)	(0.001)
PC	0.008*	0.002
	(0.005)	(0.005)
CFO	0.008	-0.013
	(0.015)	(0.013)
Lev	0.004	-0.018***
	(0.008)	(0.005)
lnSize	0.008***	0.006***
	(0.002)	(0.002)
SEO	0.070***	0.040**
	(0.014)	(0.015)
Firm FE	X	X
Year FE	X	X
Industry-year FE	X	X
adjusted R^2	0.094	0.069
No. of cases	6,526	3,077

Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significant level at the 10%, 5%, and 1%, respectively.

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