Centralization or Decentralization?

The Evolution of State-Ownership in China

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Abstract

In this paper, we anatomize the state sector and its role in Chinese economy. We propose a measure of Chinese SOEs (and partial SOEs) based on the firm-to-firm equity investment relationships. We are the first to identify all SOEs among over 40 millions of all Chinese registered firms. Our measure captures a significant larger number of SOEs than the existing measure. The aggregated capital of all (partial) SOEs has climbed up to 85%, and the total state capital in all SOEs has increased to 31%, both over total capital in the economy by 2017. The state ownership shows parallel trends of decentralization (authoritarian hierarchy) and indirect control (ownership hierarchy) over time. In addition, we find mixed ownership is associated with higher firm growth and performance; while hierarchical distance to governments is associated with better firm performance but lower growth. Drawing a stark distinction between SOEs and privately-owned enterprises (POEs) could lead to misperceptions of the role of state ownership in Chinese economy.

Keywords: state-owned enterprises; state capital; ownership network; hierarchical distance

JEL codes: G30; P16

"The triumph of the shareholder-oriented model of the corporation over its principal competitors is now assured, even if it was problematic as recently as twenty-five year ago."

<div align="right">

--Hansmann and Kraakman (2001)

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1. Introduction

SOEs constitute the most important pillar of the Chinese economy. China has become the largest economy in the world in Purchasing Power Parity (PPP) terms. China's success in economic growth has been attributed to the success of state capitalism, to a large extent. As of 2019, China has 129 business groups (including 10 Taiwanese companies) in Fortune's Global 500, reaching parity with the US, and 80 percent of the Chinese firms in the list are state-owned enterprises (SOEs),[1] and are so-called China's "national champions" (Lin and Milhaupt, 2013). On the other hand, abundant empirical evidence has also shown that SOEs are less productive and have lower investment efficiency than non-SOEs (e.g. Dollar and Wei, 2007; Zhu, 2012). This seems at odds with the general view that fast economic growth would be impossible when the economy is dominated by less productive SOEs which compete for resources with more productive privately owned enterprises (POEs) (Hsieh and Klenow, 2009; Li, Liu and Wang, 2015).

In the paper, we examine the state sector in China. We propose a measure of Chinese SOEs compared to the existing measure, which comes from the Annual Industry Survey (AIS) by the National Bureau of Statistics (NBS), and reinvestigate the real effects of state ownership using the new measure. In general, SOEs, by virtue of their privileged position vis-à-vis the state, are widely believed to enjoy privileged access to markets and resources, to pursue both economic and uneconomic objectives. POEs, by contrast, largely operate in the free market, and are often idealized as "sanctuary from government authorities". Using the equity ownership networks of all

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[1] A complete list of Fortune Global 500 is provided here: https://fortune.com/global500/

40 million Chinese firms by 2017, we trace shareholders and subsidiaries of each firm in the networks layer by layer and construct ownership trees. By utilizing the list of SOEs provided by the governments of different levels as starting points, we re-identify all the SOEs (and partial SOEs) in Chinese economy through setting multiple thresholds of state ownership. We find that drawing a stark distinction between Chinese SOEs and POEs misperceives the reality of the state capitalism as well as its role in the economy. Functionally, Chinese SOEs and POEs, share some similarities in terms of access to resources and receipt of government subsidies (e.g. Harrison et al., 2019). By tracing the state capital in all Chinese firms, we give a complete account of the state capitalism in China and how it contributes to the economy. The Chinese party-state plays dual roles, both the (controlling) shareholder, and the regulators of SOEs. Chinese experience shows the success of state-oriented corporate model, as an alternative to shareholder-oriented model in Hansmann and Kraakman (2001).

The existing definition of ownership types of Chinese firms in most literature comes from the AIS published by China's National Bureau of Statistics (NBS).[2] AIS covers industrial firms with annual sales over RMB 5 million (about US$800K) before 2010 and over RMB 20 million after 2010 as well as all SOEs across industries based on its own definition. We find *systematic* and *large-scale* misreporting issue based on firm registration type or state control status, the two identifiers AIS employed by existing studies to define SOEs. The misreporting issue mainly comes from two potential reasons. First, some former SOEs do not change their registration ownership type after restructuring; Second, the absolute/relative state control from AIS is also self-reported

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[2] The other existing measure of SOEs, which in principle should cover the SOEs among all registered firms in China, comes from SAIC's firm registration and ownership database. More specifically, SAIC provides firm's ownership by registration type. By comparing SAIC's database and AIS dataset, we find the ownership types are largely consistent, by registration types from these two sources. However, because of the data availability, few existing studies utilize SAIC's measure of SOEs.

by surveyed firms. Dollar and Wei (2007) and Hsieh and Song (2015) also document the misreporting issue and provide examples.

Our measure of SOEs builds on equity ownership networks of all 40 million Chinese firms. We construct the ownership networks using a big dataset on dynamic firm-to-firm equity investments back to 1990 for all the registered firms in China.[3] This dataset records all the individual and corporate/institutional shareholders (including those not registered in China) and their corresponding equity ownership in China.[4] By the end of 2017, the ownership network covers 35 million out-of-network firms and 5.6 million in-network firms (Allen et al., 2020). Based on the ownership networks, we build ownership trees by starting from the list of SOEs provided by SASACs (State-owned Assets Supervision and Administration Commissions) and the Ministry of Finance (central, provincial and city level) as the roots and tracing down their subsidiaries. In this way, we are able to calculate the state capital for the subsidiaries and thus to identify SOEs by thresholding state ownership.

We have four sets of main findings in this paper. First of all, our measure of SOEs and (partial SOEs) identifies a significant larger number of SOEs than the existing measure, by capturing direct/indirect ownership by various (central, provincial and city) level of governments. When we set the ownership threshold to be 100%, our measure covers 37,991 Central SOEs, 36,056 Provincial SOEs, and 299,665 City SOEs; when we set the threshold to be 50%, our measure covers 84,904 Central SOEs, 80,099 Provincial SOEs, and 417,764 City SOEs. In contrast, the existing definition of SOEs by registration type in SAIC only identifies 391，490 SOEs in total. When we set the ownership threshold to be large than 0%, meaning that as long as there is state

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[3] From the original firm registration database, we obtained the firm-to-firm ownership networks back to early 1950s. We construct the ownership networks from 1990 to 2017. For more details on the equity ownership networks of all Chinese firms, please see Allen et al. (2020).

[4] For the purpose of identifying SOEs in this paper, we drop individual shareholders for our analysis.

ownership in firms, they are identified as partial SOEs, our measure covers 1,364,601 SOEs in total.

The aggregated capital of all (partial) SOEs has climbed up from 61% in 1999 to 85% in 2017. Among all SOEs, the total state capital has increased from 21% to 31% from 1999 to 2017. If setting the threshold being 30% or higher than 30%, the total capital of all firms owned by Chinese governments (SOEs) has been declining, while if setting the threshold being 10% or 0%, the total capital of all firms owned by Chinese governments (both SOEs and partial SOEs) has been increasing, from 1999 through 2017.

Second, the state ownership shows combinations of decentralization (authoritarian hierarchy) and indirect control (ownership hierarchy) over time. The hierarchical structure of the ownership structure of Chinese firms ranges from the vertical integration of firms along the ownership trees to the top-down characteristics of policy formulation and enforcement in an authoritarian political regime (from central to local governments). Consistently with Huang et al. (2017), we also find evidence of decentralization of ownership from central to local governments: the state capital from the central government has declined, while that from provincial and city governments has increased over years. Meanwhile, we propose a measure of hierarchical distance in the ownership networks. By constructing the hierarchical distance to governments, we find that the governments tend to inject capital into firms in a more indirect method over time. More specifically, we find that the average hierarchical distance to governments along ownership trees of all SOEs has increased.

Third, mixed ownership structure is associated with higher firm growth and performance. Using our definition of state ownership and SOEs, we re-examine the real effects of state ownership as well as the hierarchical distance to the governments. Mixed ownership of central

/provincial state ownership and private ownership benefits firm growth and efficiency (profitability and productivity). On average, city government ownership tends to have less positive and significant real effects. State ownership is also associated with lower costs of borrowing from banks. However, we do not find a monotonic negative relationship between state ownership and loan spreads. This confirms our argument that while state ownership brings privileged access to resources in the economy, drawing a distinction between SOEs and POEs using the existing definition misperceive the role of state ownership. Our definition of SOEs provides a better understanding of SOEs and state ownership.

Fourth, the hierarchical distance to the governments is associated with better firm performance, but lower growth of total assets. In other words, firms closer to central/provincial governments in ownership hierarchy tend to have higher growth rate, while firms remotely owned by governments tend to have higher profitability and efficiency. This is consistent with the slogan of overall SOE reform, that is, "*Grasp the Large and Let Go of the Small*" (Hsieh and Song, 2015). The high-level (central and provincial) governments tend to focus on key SOEs — many large SOEs merged to form industrial conglomerates with their control rights consolidated more directly to the central government. Meanwhile, small SOEs were partially privatized and government agencies turn over their control rights to other controlling shareholders. However, we do not find a significant effect of such hierarchical distance on access to loans after taking into consideration the state ownership.

Our paper contributes to the existing literature on government ownership, especially extant literature on SOEs in China. The success of Chinese economy makes China a unique setting to study state ownership. Abundant literature investigates state ownership, privatization and several rounds of SOE reforms in China. For example, Chen et al. (2019) examine the within-group capital transfers in 321 Chinese business groups over 2004 to 2013 and find private business groups

allocate more capital to units with better investment opportunities, while state-owned groups do the opposite. Li et al. (2011) study whether the removal of market frictions improves efficiency using the share privatization process in China. Huang et al. (2017) examine the relationship between the geographic distance to governments and the likelihood of being decentralized for Chinese SOEs. Lin et al. (2019) document during the economic stimulus state-owned banks favor disproportionately SOEs in granting loans. A good understanding the role of state ownership in the real economy builds on an accurate measure of it. Though a few existing studies (e.g. Dollar and Wei, 2007) pointed out the misreporting issue of Chinese SOEs in AIS dataset, no one has addressed the problem. As far as we know, we are the first to propose a measure of all SOEs, among all registered firms (over 40 millions) in Chinese economy. By tracing state ownership using ownership trees and reidentifying all SOEs, we provide a complete account of the state capitalism in China and revisit the important research question that how state ownership affects firm growth in Chinese economy. In addition, by mapping out the ownership hierarchy of all Chinese firms, we show that the hierarchical distance to governments also plays a role in firms' real growth.

The remainder of the paper is organized as follows. Section 2 discusses the role of government ownership as well as SOEs in China from existing literature. Section 3 describes the existing definition of state ownership and its misreporting issue in the AIS dataset. Section 4 describes the data and sample construction. Section 5 lays out the methodology of reidentifying SOEs in China as well the results. Section 6 revisits the real effects of state ownership. Section 7 concludes.

2. Chinese Model of State Ownership

2.1 Government Ownership in Firms

The role of government ownership in the economy has been puzzling. While the worldwide

state privatization has also proven to be successful from the early 1980s through the first years of 2000s, the 2008's global financial crisis resulted in the resurgence of state ownership, mainly caused by market failures and government bailouts. Many governments around the world have re-discovered SOEs as useful instruments to achieve specific policy goals during economic downturn. China's emergence as a global economic power is the important factor undergirding the rise of "state-capitalist" model in the recent decades, among others (Megginson, 2017).

A large number of studies consider privatization an effective way to improve SOE performance (e.g. Megginson, Nash, and Randenborgh, 1994; Megginson and Netter, 2001), as private investors have better incentives to maximize firm value than the government does. Meanwhile, other studies also find evidence that state ownership can be value-enhancing. For example, Boubakri et al. (2015) use a sample of firms from nine East Asian countries, and find government-controlled firms exhibit higher market valuations than non-government-controlled firms. Borisova et al. (2015) find the influence of government ownership is complex, as government imposes non-profit-maximizing social and political objectives yet also offer implicit guarantees against default. Using evidence from 43 countries over 1991-2010, they find government ownership is associated with a higher cost of debt during normal periods (consistent with state-induced investment distortions), while is associated with a lower cost of debt during crises (consistent with the role of government implicit guarantees).

2.2 SOEs in China

SOEs are a distinctive type of business organization because the state is the corporate "owner". Though the state may run an SOEs in the hope of earning profits, it typically also has non-financial objectives such as providing public goods, reducing unemployment, etc. In China, the social responsibility of SOEs might be more important. Bearing the costs of maintaining social stability

diminishes SOEs' ability to generate profits, which harms minority shareholders (Jiang and Kim, 2020). Consequently, vast literature documents the notoriously poor performance of Chinese SOEs (e.g., Bai, Lu and Tao, 2006).

Lin and Milhaupt (2013) and Jiang and Kim (2020) give a brief review on the history of Chinese SOEs and several waves of privatization and nationalization in the recent decades. The national SOEs were carved out of ministries of the central government in the process of "corporatization", transforming government organs into joint stock companies. Crucially and in major contrast to SOEs of prior eras, corporatization has permitted the shares of SOEs to be listed on stock exchanges. As of July 2020, among all the listed firms in China, by the existing definition of SOEs, of which government is the ultimate controlling shareholder, this group of firms accounted for 28.7% in firm number and 44.4% in total assets.[5] Obviously, many listed SOEs, with the government as the "owner", are more accurately thought of as mixed ownership enterprises.

Many SOEs are structured as business groups under a parent holding company (organized as a special form of limited liability company), whose only shareholder is SASAC, which was originally established in 2003.[6] To date, the largest controlling shareholder of SOEs in China is SASAC. In 2008, the *Law of the PRC on State-Owned Assets of Enterprises* (*SOE Asset Law*, henceforth), was enacted to "give full paly to the leading role of the State-owned economy in the national economy". Meanwhile, the *SOE Asset Law* formally recognizes SASAC as an investor-a shareholder in the national SOEs, with both rights (control rights in both management and state assets; cash flow rights) and duties of a shareholder. Lin and Milhaupt (2013) document that the

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[5] The definition of SOEs here is given by WIND financial database, which is widely used for academic research on Chinse listed firms. As of July 2020, there are 1131 SOEs (out of 3937 all listed firms) in China, including both Central SOEs and local (provincial and city) SOEs.

[6] SASAC is a ministerial level agency, and so are the most important SOEs under its supervision (Lin and Milhaupt, 2012).

Law the actually grants SASAC powers greater than those available to it as a shareholder under China's *Company Law*.[7] Some legal scholars discuss about a unique political feature of Chinese SOEs that has been rarely seen in other economies is the monitoring of SOEs by the Party-state which comingles the Chinese Communist Party (CCP) and the CCP-controlled government (e.g. Wang, 2014).[8]

Because of the close ties to the governments, Chinese SOEs enjoy a large amount of cheaper loans from state-owned banks (Lin and Tan, 1999). This phenomenon is particularly significant after 2008's global financial crisis when government launched the massive stimulus plan to boost the economy (Cong et al., 2019). Connections to the government can also bring subsidies, favorable tax treatment, industrial license approvals, all of which are called government's "helping hands" in Shleifer and Vishny (1998). Prior studies have provided strong evidence that after privatization of listed SOEs, stock prices decline as investors fear the loss of government's helping hands (Calomiris, Fisman and Wang, 2010)[9]. Harrison et al. (2019) find that even SOEs have been partially privatized, compared to those purely private firms with no government ownership, they are still favored by cheaper bank loans and government subsidies. In addition to these preferential conditions in financing and operations, national SOEs under SASAC supervision are exempt from enforcement of Anti-trust Law, which regulates the alliances/merger and acquisitions between business groups (Lin and Milhaupt, 2013).

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[7] For example, apart from control rights and cash flow rights, SASAC also has personnel power over SOEs. There are two parallel personnel systems in Chinese SOEs, the regular corporate system and the party system. The top executives in Chinese major SOEs are appointed and evaluated by the Party and SASAC. In addition, SASAC also rotates senior corporate and party leaders among business groups.

[8] The latest round of SOE reform in 2016-17 has stipulated that party leadership should be incorporated in SOEs' corporate bylaws. For more details: http://www.sasac.gov.cn/n2588030/n2588919/c4615614/content.html (in Chinese).

[9] In addition to the existing state ownership, Calomiris, Fisman and Wang (2010) also find that companies managed by former government officials have positive abnormal stock returns, suggesting personal political connections can substitute for state ownership.

3. Ownership and Its Misreporting

3.1 Existing Definition of Ownership

The definition of ownership of Chinese firms in most of the existing studies comes from the Annual Industry Survey (AIS) published by China's National Bureau of Statistics (NBS). AIS covers industrial firms with annual sales over RMB 5 million (about US$800K) before 2010 and over RMB 20 million after 2010 as well as all SOEs across industries based on its own definition. In AIS, either firm registration type or state control (absolute/relative state control) can be used to identify SOEs. However, both ways reveal inconsistencies. First of all, some former SOEs do not change their registered ownership type after ownership restructuring. This has also been documented by Dollar and Wei (2007), that the ownership defined by registration type is not reliable as there are serious mismatches between firms' actual and notional (registered) ownership due to the rapid changes in the economy.[10] In their own sample of firms (a total of 12400 firms), 169 firms (out of a total of 1122) registered as SOEs and 208 firms (out of a total of 869) registered as collectives are already wholly domestic private firms by the time of their survey. Hsieh and Song (2015) find that a large number of firms directly or indirectly controlled by SASAC are legally registered as private firms; in the meanwhile, some privately owned firms may use SASAC to mask their ownership stake for certain reasons, therefore these firms appear to be SOEs based on their registration type. One example they provided is a company named Chongqing International trust, a firm legally owned by the local government of Chongqing according to its registration type, whereas in fact it was privately owned by a crony of the Party Secretary of

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[10] In order to address the concerns of ownership definition, Dollar and Wei (2007) conduct their own survey for ownership type, with two different questions: first, the ownership type according to the current firm registration form; second, breaking down ownership shares by owners' types (state, collective, legal person, private individual, and foreign investors).

Chongqing at that time.

Second, the absolute/relative state control from AIS is also self-reported by reporting firms. Doctrine 81 by SASAC of the State Council in 1994 stipulates that there are two types of state controlling (as controlling shareholder): absolute controlling if the state owns above 50% of equity; relative controlling if the state owns above 30% but below 50% of equity.[11] In both cases, state must be the largest shareholder. Consistently, AIS provides such information, i.e. whether a firm is absolute/relative state control, though it is self-reported by reporting firms. Some existing studies use this definition. For example, Huang et al. (2017) define SOEs by relative state control with the state ownership exceeding 30% from AIS.

3.2 Misreporting Issues in Annual Industrial Survey

In addition to registration type and state-control type, AIS also provides sub-categories of paid-in capital, including state capital.[12] We then use the information of state capital to examine the definition of state ownership by registration type. We find significant misreporting issues.

To illustrate, we focus on a subsample of firms reported as wholly SOEs in at least one year over the sample period of AIS from 1999 to 2013.[13] By definition, wholly SOEs are firms fully owned by central or local governments, and hence, in principle all the paid-in capital should come from the governments. However, we find significant misalignment between these two items. Table 1 reports the confusion matrix of the reported wholly SOEs and the contribution of state capital. Panel A presents the matrix of reported wholly SOEs and zero-state-capital contribution. We find that some firms are reported as wholly SOEs, but the contribution of state capital is zero percentage,

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[11] In Doctrine 81 by SASAC of the State Council in 1994, it also states that when calculating state ownership, we should not aggregate the ownership by different entities, but only consider ownership by each entity separately. The full document (in Chinese) can be found here: http://www.sasac.gov.cn/n2588025/n2588119/c2689970/content.html

[12] The subcategories of paid-in capital include state capital, collective capital, legal person capital, individual capital, HMT capital, and foreign capital.

[13] In AIS, wholly SOEs (*Guo You Du Zi*) by registration type is numbered 151 in subcategories.

which contradicts the definition of wholly SOEs. Specifically, out of 19,872 firm-year observations of wholly SOEs, 6,067 observations (30.5 percent) have zero percentage of state capital. Panel B presents matrix of reported wholly SOEs and full-state-capital contribution, where we find significant inconsistency to a similar extent. Out of 17.450 firm-year observations with 100% contribution of state capital, 6,286 observations (36.0 percent) are not reported as wholly SOEs.

[TABLE 1]

By checking firms' registration type over the years in AIS sample period, we also find a large number of firms change their registered ownership types while there is no change in shareholders as well as their equity holding. To illustrate, a firm named *Jiangsu Nanjing Tianfang Clothing Ltd. Co*., located in Jiangsu Province, changed its registered ownership type from other limited companies to wholly SOE in 2008 and 2009, and then changed back to other limited companies again in 2010, and then again to wholly SOE in 2011. Over the survey period, this firm is solely invested by a wholly provincial SOE (named *Jiangsu Fangyuan Holding Co.*) owned by Jiangsu provincial government.

4. Data and Sample Construction

4.1 Data Description

Our data comes from multiple sources. The first is the Firm Registration and Ownership Database, originated from China's State Administration for Industry and Commerce (SAIC). This database contains two parts of information. One is firm basic information, such as firm name and code, registration date, registration capital, firm status (e.g. existing, bankrupt), ownership type, industry and location. Firms in this database can be traced back to as early as 1950. The number of all the registered firms is up to 90 million as of 2017, including individual businesses (self-employed businesses). Meanwhile, SAIC also provides detailed information of shareholders,

including the names of shareholders and their holding back from 1950. Each update of shareholders records the time of update, names of shareholders and the change of holdings (the investment amount and share percentage) before and after the updates.

In order to compare firms' ownership types, we also retrieve related information from the Annual Industry Survey (AIS) published by China's National Bureau of Statistics (NBS), and then match with SAIC registration and ownership database. AIS covers industrial firms with annual sales over RMB 5 million (about US$800K) before 2010 and over RMB 20 million after 2010, as well as all SOEs in China. Matching these two datasets allows us to have a panel dataset of industrial firms and SOEs with financial information from 1999-2013, for our regression analysis.

4.2 Variables

4.2.1 Registered Capital and Paid-in Capital in China

According to Chinese *Company Law* (1994; 2005), registered capital, is the capital that all shareholders commit to invest when the firm is registered at SAIC; while paid-in capital is the capital that all shareholders actually invest in firms. Before 2014, firm registration in China is based on the "paid-in" system, meaning that registered capital has to be fully paid in within the first two years after the firm is registered at SAIC. The *Company Law* (2014) further changed the old "paid-in" system to the "subscription" system, meaning that registered capital might be different from the actual paid-in capital within certain period, but at the end registered capital still needs to be realized.

In addition to registered capital, shareholders and their ownership are also required to be recorded at SAIC. For limited liability companies (LLCs), all the shareholders and their holding changes need to be recorded; for incorporated companies, all the original shareholders and their holdings need to be recorded, while there is no mandatory requirement that changes of holdings

afterwards have to be reported. However, shareholders are motivated to be registered at SAIC to get government endorsement. By checking the sample of AIS firms, for which we have access to both registered and paid-in capital, we do not observe significant differences between these two. The actual paid-in capital by each shareholder, represents cash flow rights and voting rights of shareholders.

4.2.2 State Ownership

SOEs/POEs can be identified in two ways in AIS. One is through registration type, which gives the details of the ownership type upon registration at SAIC: whether the firm is wholly state-owned enterprises (wholly SOEs), SOEs, collectively-owned enterprises, privately-owned enterprises (POE), etc. The other is through an item "absolute/relative state control", which gives in principle gives the identification of SOEs if the state ownership is above 30 percent (relative state control) or 50 percent (absolute state control). Meanwhile, AIS also provides the proportion of state capital in paid-in capital for each firm, which could be used to calculate the state ownership as well. However, as we document in Section 3, we find significant inconsistency of SOEs using these ways.

An accurate measure of state ownership should be able to capture the total state capital in firms. We propose a measure of state ownership, which we calculate from the ownership trees constructed based on the firm-to-firm equity ownership networks of all registered firms in China. The measure of state ownership can capture the direct/indirect ownership by various level of governments. Using the state ownership we are able to identify SOEs (or partial SOEs) by setting different thresholds of ownership when tracing SOEs along the ownership trees.

4.2.3 Other Firm Characteristics

Other firm characteristics are available from AIS dataset. We mainly consider firm

performance including firm growth, profitability, productivity when examining the effects of state ownership. *Firm growth*, is defined as growth rate of firms' total assets. To measure profitability, we use *rate of profits* in main businesses or returns on assets (ROA). Firm productivity is measured by *total factor productivity (TFP)*. To calculate TFP, we estimate the logarithm linear production function at the 2-digit Chinese Industry Classification (CIC)

$$y_{it} = \beta_0 + \beta_m m_{it} + \beta_l l_{it} + \beta_k k_{it} + \mu_{it}$$

where l_{it}, m_{it}, k_{it} represent the natural logarithm of labor, intermediate input and capital, respectively. We run the regressions with year ×2-digit CIC (industry) fixed effects. The TFP of firms i at year t is estimated as $\hat{\mu}_{it}$.

We also consider an assortment of firm financials and other features in the analysis, *Firm size* is the natural logarithm of the book value of total assets; *Firm age* is the natural logarithm of the years that the firm has operated since its establishment; *Leverage* is the ratio of total liabilities to total assets; *Reg cap* is firm's registered capital at SAIC. The construction of the measures of state ownership and SOEs is described in Section 5. Table A.1 in the Appendix provides a detailed list of variable definitions.

5. Reidentify SOEs in China: Using China's Equity Ownership Network
5.1 Methodology: Building Ownership Trees and Searching Algorithm

Network analysis aims to describe the network structure using graph theory. Network structure shows how each actor is connected to others, based on its relationship with his neighbors. Our firm-to-firm equity ownership networks are constructed using the firm-to-firm equity investments. Therefore, nodes denote firms and edges reflect the directional equity investments between firms. To construct the ownership networks, we keep only firms who historically invested in other firms/institutions or were invested by other firms/institutions. We end up with 5.6 million in-

network firms up till 2017.[14]

Based on the firm-to-firm equity ownership networks, we then build ownership trees, in order to reidentify all SOEs in Chinese economy. We use the searching algorithm as following:

i)   Locate firms directly controlled by central government in the whole networks over years, use them as the roots of the ownership trees, and build the trees based on the firm-to-firm connections from the ownership networks. We then trace firms owned by roots by setting different thresholds of ownership (100%, 50%, 30%, 10%, 0%). We use a consistent threshold throughout the searching process. At the central government level, we consider firms directly controlled by the SASAC of the State Council, by the Ministry of Finance ("*Cai Zheng Bu*") and other related government departments. We hand collect the list of firms (127 firms in total) from the websites of various departments of the central government.

ii)   Locate firms 100% directly owned by provincial governments in the networks, and then use them as the roots to grow the trees. We then trace firms owned by provincial governments by setting the same thresholds of ownership (100%, 50%, 30%, 10%, 0%). At the provincial government level, we consider firms 100% directly owned by the SASAC of the provincial governments, the Department of Finance ("*Cai Zheng Ting*") and other related provincial government departments. We hand collect the list of 850 provincial-government-owned firms from websites of provincial governments (and their departments), and use them as root firms.

iii)   In a similar manner as step ii), locate firms 100% directly owned by city governments in the networks (247,736 firms in total), use them as the roots to grow the trees. Given

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[14] For more details about the ownership networks are constructed, please see Allen et al. (2020).

there are a large number of firms owned by city governments, instead of starting from a list collected from government websites, we use keywords of SASAC of city governments, and related city government departments to search in the SAIC database to identify the root firms. Then, we trace firms owned by city governments by setting the same thresholds (100%, 50%, 30%, 10%, 0%).

When using 100% as the threshold of ownership to trace SOEs along the trees, the firms we identify are apparently wholly state-owned enterprises (whole SOEs). We define the firms we identify as state-owned enterprises (SOEs) when using 100%, 50% or 30% as the threshold of ownership, given the definition of absolute/relative state control by SASAC. We define the firms we identify as partially state-owned enterprise (partial SOEs) when using 10% or 0% as the threshold, to differentiate them from SOEs.

5.2 Reidentify SOEs

Using the search algorithm above, we trace all SOEs in Chinese economy. Table 2 reports the SOEs that we identify using ownership trees layer by layer. In Panel A, we set the threshold to be 100%: in other words, from the roots of the ownership trees, we trace firms that are 100% owned by the last layer of firms in the trees to be SOEs. We identify 37,991 SOEs wholly owned by the central government (i.e. Central SOEs), 36,056 SOEs wholly owned by provincial governments (i.e. Provincial SOEs), and 299,665 SOEs wholly owned by city/county level governments (i.e., City SOEs). At the central and provincial government level, we find the most SOEs in the 3-4th layers; while at the city/county government level, we find the most SOEs in the 1st and 2nd layers. Central SOEs and Provincial SOEs tend to have larger average registered capital when they are closer to the roots of the ownership trees (and also closer to the governments in the ownership networks); while City SOEs have relatively similar registered capital in different layers of the ownership trees.

Panel B reports the SOEs that we identify when setting the threshold to be 50%. We find 84,904 Central SOEs, 80,099 Provincial SOEs, and 417,764 City SOEs. Consistently, we find Central SOEs and Provincial SOEs tend to have larger firm size (in terms of average registered capital) when they are closer to the governments. Panel C reports the SOEs when using 30% as the threshold; Panel D and E report the partial SOEs when using 10% or 0% as the threshold. When we impose lower thresholds, the difference of firm size among different layers shrinks. This suggests that firms with higher percentage of state capital tend to have larger firm size.

[TABLE 2]

Table 3 reports the summary statistics of the SOEs that we identify using ownership trees. In Panel A, we the threshold to be 100%. For Central SOEs, the mean value of registered capital is 81.1 billion RMB, and the median value registered capital of Central SOEs is 524 million RMB. For Provincial SOEs, the mean registered capital is 25.2 billion RMB, and the median registered capital is 580.5 million RMB. For City SOEs, the mean registered capital is 5.3 billion RMB, and the median is 87 million RMB. However, the average firm age shows a different pattern. The average firm age of Central SOEs is 15.4 years; that of Provincial SOEs is 15.4 years; and that of City SOEs is 18.9 years. Overall, Central SOEs have the largest firm size, followed by Provincial SOEs and City SOEs; while they all have fairly similar average firm age. In Panel B, C, D, and E, we set the threshold to be 50%, 30%, 10%, 0% respectively, and we find consistent results.

[TABLE 3]

Panel A of Table 4 compares the proposed and existing definitions of SOEs. Panel A compared the number of SOEs identified using ownership trees and using registration type in SAIC. In SAIC, by registration type there are in total 391,490 SOEs, while by our definition, if setting threshold above 50% (either 100% or 50%), there are in total 539,238 SOEs. Undoubtedly, these are SOEs

absolutely controlled by the governments. By the threshold of 30%, which according to the rules by SASAC, is the definition of "relative state control", we identify in total 628,554 SOEs. If we define SOEs as long as there is state capital in it, we identify in total 866,757 million SOEs, among which 238,203 (=866,757-628,554) are partial SOEs (with proportion of state capital above 0% and below 30%). In short, we find significant difference between the two definitions.

Panel B of Table 4 reports the discrepancy of SOEs by the measure if setting ownership threshold to be 30% and the exiting measure by registration type from SAIC. Our proposed measure identifies 628,544 SOEs, while the existing measure of SOEs from SAIC identifies 391,490 SOEs in total. Only 167,544 firms are SOEs under both definitions, which are 26.7% of all SOEs by the measure and 42.8% of all SOEs by the SAIC measure.

[TABLE 4]

5.3 State Capital in Aggregation

Then we examine the total capital of all SOEs as well as the total state capital in Chinese economy. Panel A plots the proportion of the aggregated capital of all SOEs identified using our algorithms over total capital of all registered firms (over 40 millions) in Chinese economy from 1999 to 2017, using different ownership thresholds.

The figure shows the aggregated capital of all SOEs (and partial SOEs using larger than 0% as the threshold), has increased from 60.6% in 1999 to 85.3% in 2017; while that of wholly SOEs has reduced from 41.0% in 1999 to 25.4% in 2017. Overall, if setting 30% or higher than 30% as the threshold, the total capital of all SOEs has been declining, while if setting 10% or 0% as the threshold, the total capital of all SOEs has been increasing, from 1999-2017. We further calculate the state capital in all SOEs based on the proportions of state ownership: it has increased on 21.0% in 1999 to 30.8% in 2017.

Panel B plots the total capital of all SOEs (and partial SOEs) owned by central, provincial and

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city governments over total capital of all registered firms when using the threshold of 0%. The figure shows that that proportion of central government capital has been declining from 37% in 1999 to 31% in 2017, while that of local governments has been increasing continuously (especially that of provincial government, increasing from 9% in 1999 to 35% in 2017).

[FIGURE 1]

Figure 2 plots the aggregate state assets owned by central, provincial and city governments, using the group of firms in the AIS dataset, over the years from 1999 to 2017. In order to obtain this, we calculate the assets owned by governments according their equity holding in the firms that they have invested. The figure shows that the proportion of state assets over total assets of the AIS firms has been rising for all levels of governments. Figure 1 and 2 together suggest that governments are investing in large number of firms while the average holding in firms is declining; meanwhile, central government is investing in firms with larger scale of asset in recent years.

[FIGURE 2]

Figure 3 plots the state capital in firms directly invested by central, provincial and city governments, over the years from 1999 to 2017. In another word, we only consider firms in the next layer to governments along the ownership trees. The left-y axis stands for the proportion of state capital in firms directly invested by central and provincial governments; the right-y axis stands for that by city governments. The figure shows that all levels of governments' capital has been declining in the last two decades. Taken Figure 1 and 3 together, it suggests that while keeping the stake in firms, central government is changing from direct investment to remote investment.

[FIGURE 3]

6. The Role of State Ownership: Revisited

6.1 Empirical Identification

In this section, we reexamine an important question in prior literature, the effect of state ownership in firm performance, by employing our proposed definition of SOEs. Specifically, we divide firms into five groups–100% (SOEs), 50-100% (SOEs), 30-50% (SOEs), 10-30% (partial SOEs) and 0-10% (partial SOEs)- based on the state ownership that we have calculated along the ownership trees. We employ the following model:

$$
\begin{aligned}
Firm\ growth/performance_{i,t} \\
= \alpha_i + \alpha_{ct} + \alpha_{ind,t} + \beta_0 + \beta_{00}\ I_{0-10} + \beta_{10}\ I_{10-30} + \beta_{30}I_{30-50} + \beta_{50}I_{50-100} \\
+ \beta_{100}I_{100} +\ X_{i,t-1} +\ \epsilon_{it}
\end{aligned}
$$

$$(1)$$

where firm growth or performance is the dependent variable; α_i is firm fixed effect, and α_{ct}, $\alpha_{ind,t}$ are city-year, industry-year fixed effects respectively. The key explanatory variables are state ownership dummies $I_{0-10}, I_{10-30}, I_{30-50}, I_{50-100}, I_{100}$ as identifier for the groups of firms. The benchmark is firms who do not have any state capital (purely privately-owned enterprises). We also incorporate an assortment of firm financial characteristics as control variables (X_{it}), including Firm size, Firm age, Leverage, ROA. We incorporate firm fixed effects, as well as industry-year and city-year two-dimensional fixed effects into all regressions to account for firm heterogeneities and time-varying industry and city heterogeneities.

6.2 Summary Statistics of Firm Characteristics

Table 5 reports the summary statistics for the sample matched with AIS firms that we use for regression analysis. Leverage ranges from 0.004 to 1.000, with the sample mean of 0.564. Firm growth ranges from -1.545 to 2.052, with the sample mean of 0.133, suggesting the average growth rate (of total assets) is 13.3%. ROA ranges from -0.231 to 1.543. Profit rates range from -0.245 to 0.868 with the sample mean of 0.146. TFP ranges from -6.631 to 2.391, with the sample mean of 0.013. Over the sample period (1999-2013), firms' average distance to central government is 3.851;

firms' average distance to provincial governments is 3.589; firms' average distance to city governments is 1.443, lower than that of central and provincial governments.

6.3 The Real Effect of State Ownership

We first examine the effects of state ownership on firm growth, measured by the growth of firm total assets, with the results reported in Table 6. In column (1)-(3) we run the regressions using subsamples of firms owned by central, provincial and city government respectively. We find that in column (1) the coefficients of I_{0-10} , I_{10-30} , I_{30-50}, I_{50-100} are positive and significant, while I_{100} are negative but insignificant, suggesting that other than firms fully controlled by central government, other Central SOEs with less amount of central government ownership grows faster in terms of total assets than private firms. Wholly central SOEs have similar growth rate with private firms. Column (2) shows that similar results also hold for provincial SOEs: other than firms 100% owned by provincial governments, other Provincial SOEs have higher growth rate than private firms. In column (3), only I_{0-10} enters with positive and significant signs, while other ownership dummies all enter with negative and significant signs, suggesting that firms owned by city local governments at 0-10% level have higher growth rate than private firms, while other City SOEs with state ownership higher than 10% all have lower growth rate than private firms. Other than the state ownership dummies, the negative coefficients of *Firm size* and *Firm age* suggest that larger firms or firms with longer history tend to have lower growth rate.

[TABLE 5]

Then we examine the effects of state ownership on firm profitability and productivity. In Panel A of Table 7, we use profit rates as the dependent variable. We find that the coefficients of I_{0-10} are significantly positive in column (1)-(3), and those of I_{100} are significantly negative in column

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(1), suggesting that compared to private firms, firms with 0-10% state ownership have significantly higher profit rates, while firms with 100% central government ownership have significantly lower profit rates, all else equal. In Panel B, we use ROA as the dependent variable. We find firms with more than 50% state ownership at central, provincial or city government level, their ROAs are lower. In addition, firms with city government ownership, tend to have lower ROAs on average. Table 8 reports the results using TFP as the dependent variable. We find that state ownership less than 50% is associated with higher productivity on average (the most significant for firms with 0-10% state ownership).

[TABLE 7]

[TABLE 8]

Then we compare the effects of central, provincial and city government ownership, in Table 9. We use firm growth, ROA, profit rates and TFP as dependent variable respectively. The results in column (1) show that for firm growth, central government ownership has positive effect on average. The effect of provincial government ownership does not differ from central government ownership significantly, while the growth effect of city government ownership is lower than central government ownership. In column (2), we find that on average central government ownership has negative (though not significant) effect on firm growth. However, the effect of city government ownership on ROA is significantly lower than that of central government ownership. Column (3) shows that while central government has significant and negative effect on profit rates, provincial government ownership tends to have more positive effects compared to central government ownership. This is also consistent with what we find in Table 7. The results in column (4) suggest that central government ownership has significant and positive effect on productivity, while city government ownership does not.

[TABLE 9]

Overall, we find state ownership tend to have positive effect on firm growth (growth of total assets) and productivity, and negative effect on profitability, on average. The difference between central and provincial government ownership in affecting firm growth and performance is not significant, while on average the real effect of city government ownership is lower than central and provincial government.

6.3 Hierarchical Distance to Governments

The organizational structure of state capitalism practiced in China is a network hierarchy, which can be described as vertically integrated corporate groups organized under SASAC, enmeshed in a helix-like personnel appointment process of rotations managed jointly by SASAC and the Communist Party (Lin and Milhaupt, 2013). Therefore, the hierarchical network can help facilitate information flow from the bottom up as well as from the top down. Huang et al. (2017) finds geographic distance to central government implies the amount of information and hence the strength of oversight by the state. However, we propose the oversight is more practiced through the ownership hierarchy, which foster relational exchange and collaboration on production and policy implementation processes. Therefore, we then examine whether the hierarchical structure of state ownership, i.e. remote ownership versus direct ownership affects firm performance.

In addition to the state ownership dummies, we further incorporate *Distance from the root* into the regressions. *Distance from the root* is defined by the number of layers (1-10 layers) from where the firm is located to the root node (government ministries or local governments), and then we classify the number of layers to be 5 groups, where 1-2 layers to have the distance as 1, 3-4 layers to have the distance as 2, 5-6 layers to have the distance as 3, and so forth. While the state ownership dummies capture the total ownership by governments (both remote and direct), *Distance from the root* captures the other dimension of government control, that is, how far the

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firm is away from the governments along the ownership trees that we have constructed. Figure 4 plots the average hierarchical distance to governments of firms owned by governments from 1999 to 2013. We can see that the average distance has been increasing over years, meaning that governments tend to own firms more remotely in the hierarchical structure.

In the regressions, we also include the ownership fixed effects, i.e. whether the firm is an SOE or private firm, as well as Year*City fixed effects and YEAR*CIC2 fixed effects. Panel A of Table 10 reports the results for firms owned by central governments. Column (1)-(4) use Firm growth, Profit rates, ROA, and TFP as the dependent variable respectively. *Distance from the root* enter with a negative and significant sign in column (1), and with a positive and significant sign in column (2) to (4). This suggests that after taking into account the geographic location, industry as well as other firm characteristics, higher distance to the root nodes (central government) is associated with lower firm growth, but higher firm profitability and productivity.

Panel B of Table 10 reports the results for firms owned by provincial governments. We find that Distance from the root enters with negative sign in column (1) and positive signs in column (2)- (4), suggesting that distance from the root nodes (provincial governments) is associated with lower firm growth but higher firm profitability and productivity. This finding is consistent with that using firm owned by central government in Panel A. Panel C reports the results for firms owned by city governments, and we find the distance does not matter for firm growth, while higher distance to city governments is associated with profitability and productivity.

[TABLE 10]

6.4 State Ownership and Access to Finance

Finally, we investigate how state ownership and hierarchical distance to governments affect access to finance. We have access to information of transactional-level loans by a state-owned bank in China. Some firms might have multiple loans from this bank in a given year. We calculate

the weighted average yield spreads and maturity, as well as the total loan amount at the firm-year level, and match it with our firm-year sample. We end up with a smaller sample of 10,410 firm-year observations. We use *Weighted loan spreads* as the dependent variable and also incorporate *Log maturity* and *Log loan amt* as control variables.

Table 11 reports the results. In Panel A, we find that compared to private firms, firms with state ownership tend to have lower borrowing costs on average, all else equal, and the effect is stronger and more significant for central/provincial government ownership. However, we do not have a monotonic negative relationship between weighted loan spreads and state ownership, suggesting that firms with mixed ownership (both state and private ownership) enjoy lower favorable terms from state-owned banks in a similar manner as wholly state-owned enterprises. The effect on loan spreads is less pronounced for city government ownership. Panel B reports the results of the tests examining the effect of hierarchical distance to governments. In column (1)-(3), we run tests using subsamples of firms owned by central, provincial and city governments respectively. The benchmark group is the firms with 0-10% state ownership. We do not find strong evidence that lower distance to governments can reduce borrowing costs from banks, after taking into account the impact of state ownership. Overall, the results confirm our argument that drawing a stark distinction between SOEs and POEs using the existing definitions from AIS might misperceives the reality that state ownership can bring privileged access to resources and markets.

7. Conclusion

In this paper, we revisit the state sector and its role in Chinese economy. We propose a measure of Chinese SOEs (and partial SOEs) based on equity ownership networks of all registered firms in China (over 40 millions). By capturing direct/indirect ownership by various (central, provincial and city) levels of governments, our measure identifies a significant larger number of SOEs than

the existing measure: if taking 30% as ownership threshold to be SOEs, the criteria of relative state control by SASAC, our measure covers 89 percent more SOEs; if taking 50% as the ownership threshold to be SOEs, the criteria of absolute state control by SASAC, our measure covers 5 percent more SOE. Using the measure, we find mixed ownership of state and private, is associated with higher firm growth and performance. Based on our ownership networks and SOE ownership trees, we also propose a measure of hierarchical distance to governments, and find that distance to governments is associated with better firm performance but lower growth. Our results suggest that drawing a stark distinction between SOEs and POEs can misperceive the role of state ownership.

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Aggregated capital of all SOEs in Chinese Economy

Legend: 100%, 50%, 30%, 10%, 0%
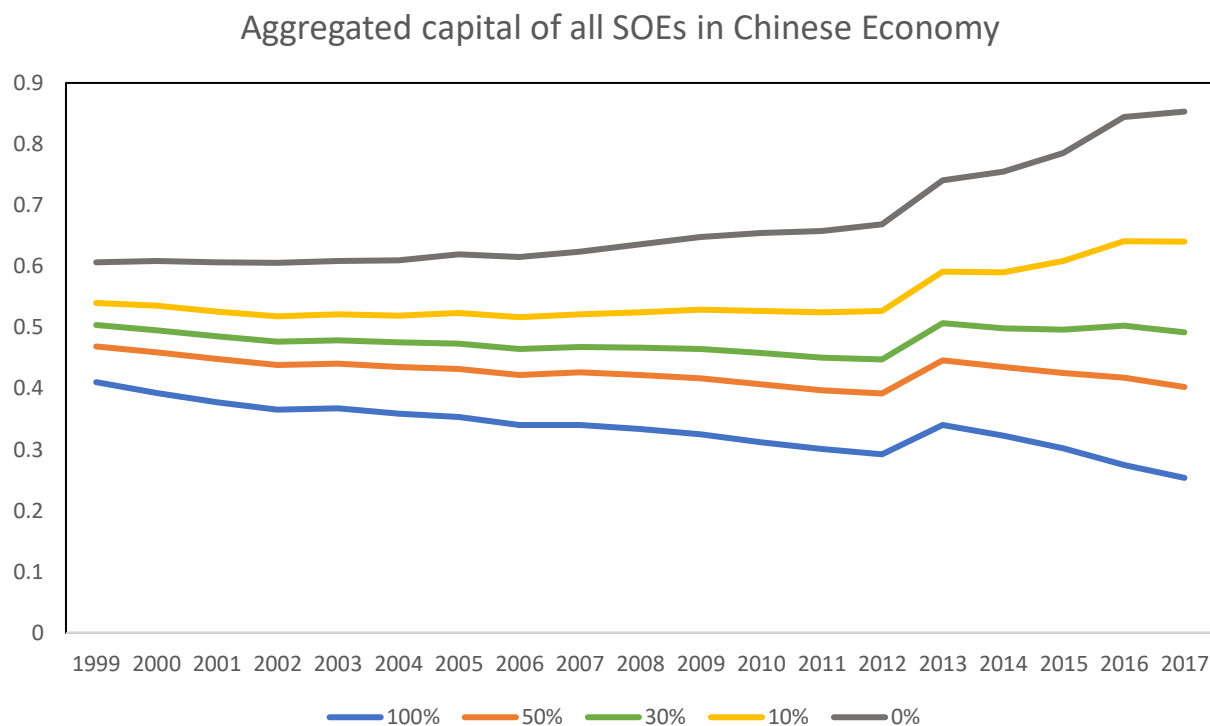
Figure 1: Total Capital of SOEs and Total State Capital in Chinese Economy

Panel A: Total Capital of All SOEs: Different Ownership Thresholds

This figure plots the proportion of the aggregated capital of all SOEs (and partial SOEs) over total capital in Chinese economy from 1999 to 2017. We first trace all firms (SOEs) *in the whole economy* directly or indirectly invested by various level of governments along the ownership trees, by setting multiple ownership thresholds to be 0%, 10%, 30%, 50% and 100%, and then calculate the proportion of total registered capital of all SOEs over total registered capital of all registered firms (over 40 millions) in China. The figure shows that if setting the threshold being 30% or higher than 30%, the total capital of all SOEs has been declining, while if setting the threshold being 10% or 0%, the total capital of all SOEs has been increasing, from 1999-2017.

Fraction of Economy Linked to Governments (threshold = 0)
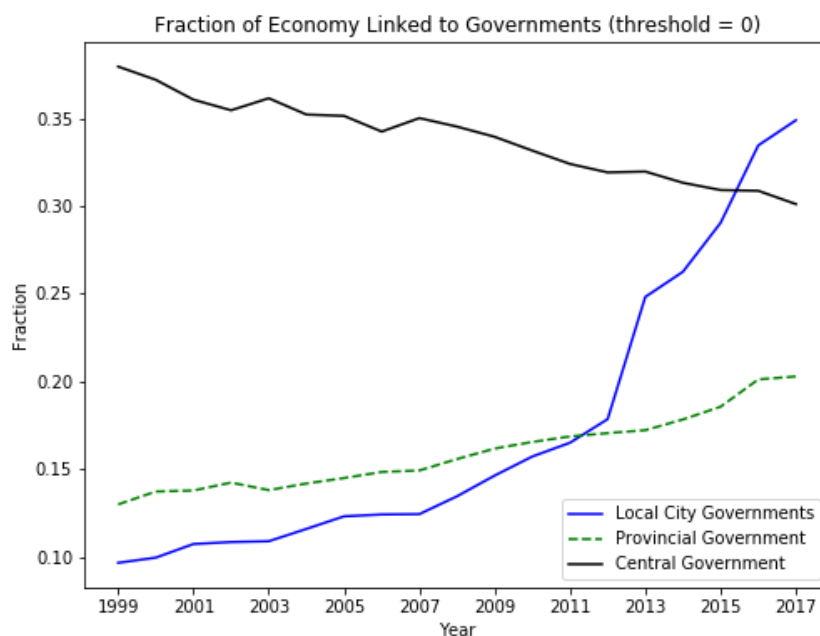
Panel B: Total Capital of All SOEs and Partial SOEs (Ownership Threshold 0%): Central and Local Governments

This figure plots the total capital of all SOEs and partial SOEs owned by various level of governments (central, provincial and city governments), when setting the ownership threshold being 0%. We first trace all firms *in the whole economy* directly or indirectly invested by various level of governments along the ownership trees (by setting the threshold of ownership to be 0%), and then calculate the proportion of total registered capital of all SOEs and partial SOEs over the total registered capital of all registered firms (over 40 millions) in China. The figure shows that the capital of SOEs in the whole economy by local governments has been increasing continuously; while the capital of SOEs by central government has been declining from 1999-2017.
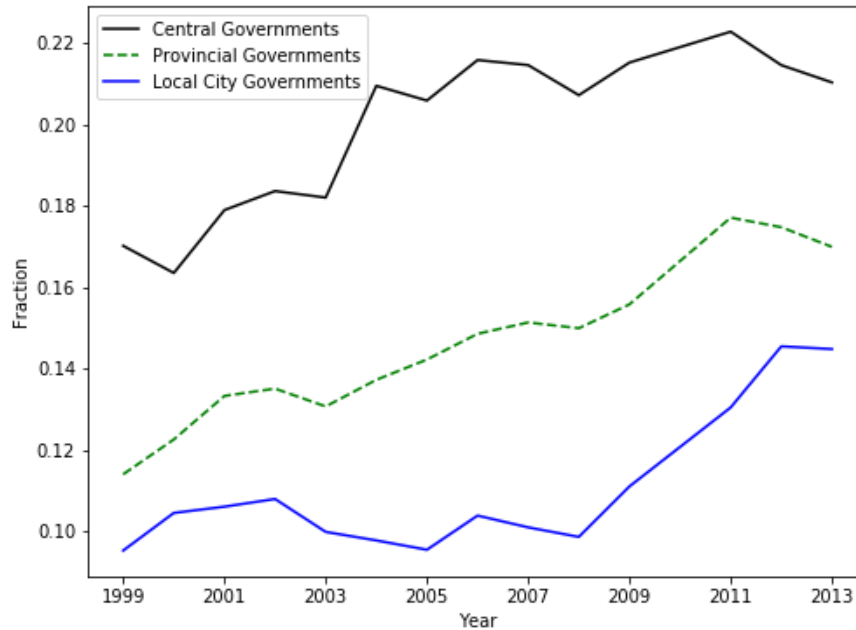
Figure 2: State Assets in Aggregation: Matched with AIS Sample

This figure plots the total assets owned by the governments (central, provincial and city governments), using the sample of firms matched with AIS data. We first trace the firms directly/indirectly invested by governments along the ownership trees, and then calculate the assets owned by governments according to their proportion of equity ownership over the total assets of these firms. The figure shows the state-owned assets have been increasing for central, provincial and city governments from 1999-2013.

Fraction of Real Registered Capital (threshold =0)
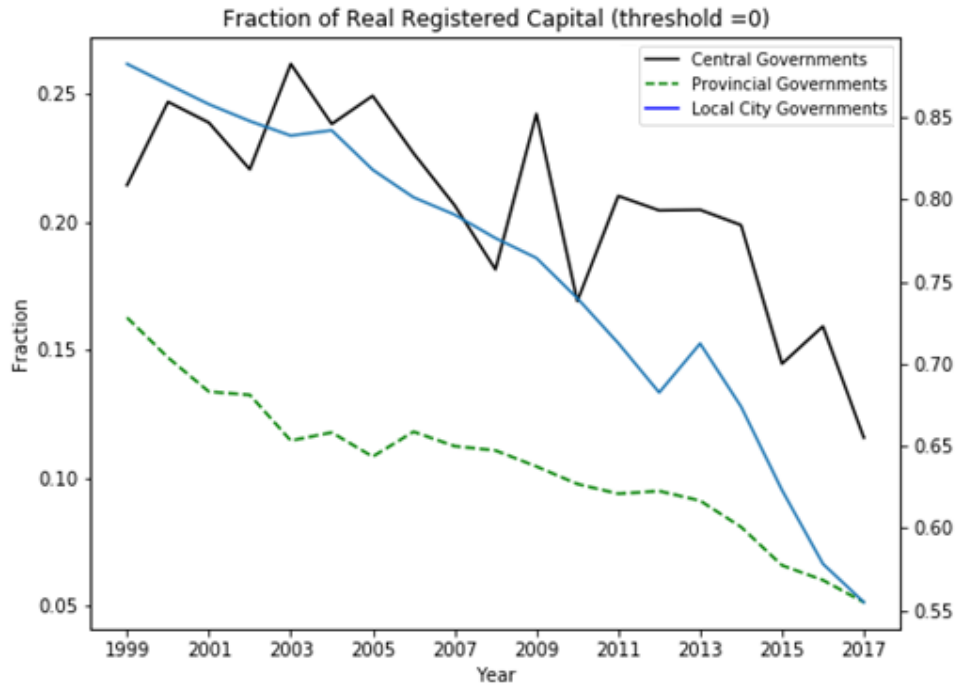
Figure 3: State Capital in Firms Directly Invested by Governments

This figure plots the proportion of state capital in firms directly invested by central, provincial and city governments. The left-y axis stands for the proportion of state capital in firms directly invested by central and provincial governments; the right-y axis stands for the proportion of state capital in firms directly invested by city governments. This figure shows that the proportion of state capital in firms directly invested governments has been decreasing from 1999-2017.
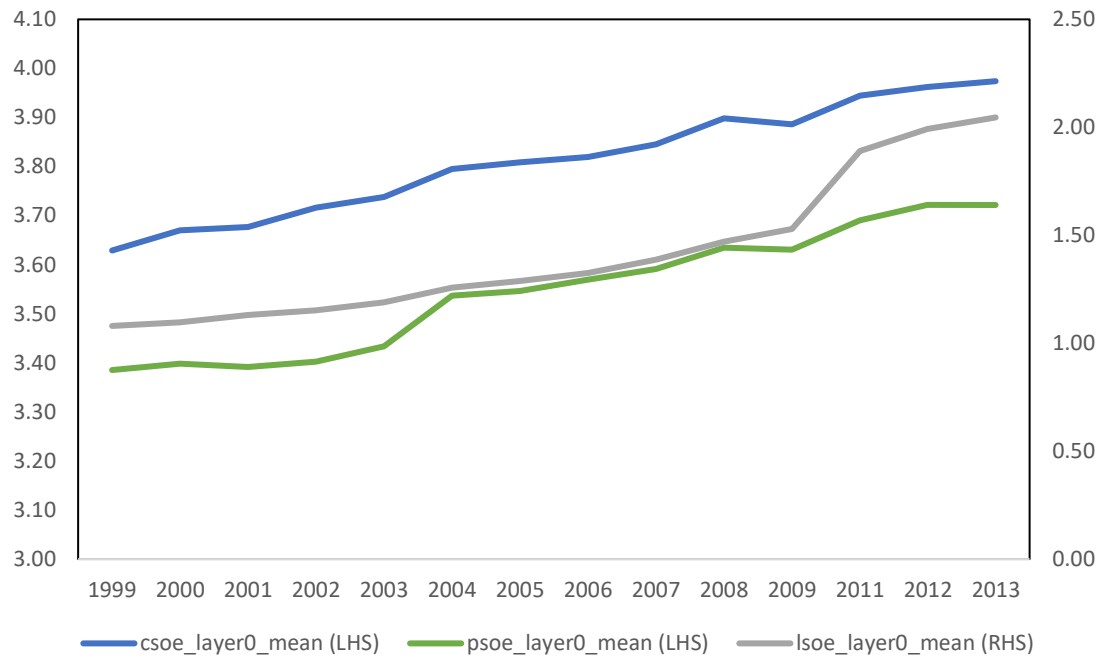
Figure 4 The average distance to governments of AIS firms owned by governments: 1999-2013

This figure plots the average hierarchical distance to governments of firms owned by governments in the AIS dataset from 1999 to 2013.

Table 1: Misreporting: Comparison Between Wholly SOE and State Capital

This table reports the confusion matrix between wholly SOEs and proportion of state capital (either 0% or 100%), to reflect the inconsistency from different items in the AIS data.

Panel A: Confusion Matrix: Reported Wholly SOEs and State Capital (0%)

| Wholly SOE | % of State Capital= 0% | | |
	False	True	Firm-year obs.
False	9,118	6,930	16,048
True	13,805	6,067	19,872
Firm-year obs.	22,923	12,997	35,920

Panel B: Confusion Matrix: Reported Wholly SOEs and State Capital (100%)

| Wholly SOE | % of State Capital= 0% | | |
	False	True	Firm-year obs.
False	9,762	6,286	16,048
True	8,708	11,164	19,872
Firm-year obs.	18,470	17,450	35,920

Table 2: Re-identify State-owned Enterprises (SOEs): Layer by Layer using Ownership Trees by 2017

This table reports the results of the reidentification of the SOEs in Chinese economy using ownership trees. We follow this search algorithm to identify SOEs: in the 1st step, we start from the firms directly controlled by the SASAC of the State Council and by the Ministry of Finance ("*Cai Zheng Bu*"), which are used as roots. We then trace all firms directly or indirectly (we set a consistent threshold throughout the process) controlled by this group of firms; in the 2nd step, we start from the firms 100% directly owned by the provincial SASAC or Department of Finance ("*Cai Zheng Ting*"), and other related departments of provincial governments, and trace all firms directly or indirectly owned by this group of firms; in the 3rd step, we start from firms who are 100% directly controlled by local governments (at city or county level), and trace all firms directly or indirectly owned by this group of firms. We impose various thresholds of ownership (100%, 50%, 30%, 10%, and 0%) to identify (*partial*) SOEs along the ownership trees. In Panel A, we set the threshold to be 100%, meaning that in each step if the firms are owned 100% by the state then they are defined as *SOEs* (i.e. wholly state-owned enterprises); In Panel B, we set the threshold to be 50%, meaning that in each step if the firms are owned 50% by the state, then they are defined as *SOEs*; In Panel C, we set the threshold to be 30% , to define *SOEs*; in Panel D, we set the threshold to be 10%, to define *SOEs*; and in Panel E, we set the threshold to be 0, meaning that as long as the firms have the state capital (larger than 0%), then they are defined as *SOEs*. Note that in order to calculate firm age, firms established prior to 1950 are set to be established in 1950. *Avg_Rep cap* denotes the average registered capital of the SOEs identified in each layer and step. *Avg_Firm age* denotes the average firm age of SOEs identified in each layer and step; *Firm number* denotes the number of SOEs identified in each layer and step. Note that if missing information of share percentage, then we treat as *zero* holding.

Panel A: Summary of SOEs Layer by Layer in Ownership Trees (Threshold = 100%)

Step	Layer	Avg_Reg cap (RMB mn)	Avg_Firm age	Firm number
Total				*37,991*
1st Step	1	63606.06	21.04	127
1st Step	2	4822.69	15.97	4301
1st Step	3	187.38	15.28	13587
1st Step	4	68.26	15.89	11869
1st Step	5	55.28	15.56	5835
1st Step	6	53.26	12.38	1597
1st Step	7	57.85	9.20	450
1st Step	8	55.10	8.86	175
1st Step	9	31.89	14.00	46
1st Step	10+	11.58	13.25	4
Total				*36,056*
2nd Step	1	3838.17	15.19	850
2nd Step	2	449.85	14.33	8658
2nd Step	3	101.81	15.37	14213
2nd Step	4	54.76	15.88	8731
2nd Step	5	32.06	17.12	2600
2nd Step	6	21.76	17.04	655

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2nd Step	7	17.56	11.41	283
2nd Step	8	14.43	8.68	54
2nd Step	9	3.50	1.67	12
2nd Step	10+	-	-	0
Total				*299,665*
3rd Step	1	56.48	19.91	247736
3rd Step	2	42.11	14.64	36875
3rd Step	3	32.63	13.06	11185
3rd Step	4	26.16	11.30	2904
3rd Step	5	34.63	9.31	607
3rd Step	6	35.42	5.96	154
3rd Step	7	65.75	4.44	108
3rd Step	8	12.22	2.72	74
3rd Step	9	10.46	1.00	22
3rd Step	10+	-	-	0

Panel B: Summary of SOEs Layer by Layer in Ownership Trees (Threshold = 50%)

Step	Layer	Avg_Reg cap (RMB mn)	Avg_Firm age	Firm number
Total				*84,904*
1st Step	1	74421.36	20.87	155
1st Step	2	3526.30	13.75	6700
1st Step	3	317.46	13.14	24946
1st Step	4	178.62	13.59	26736
1st Step	5	112.44	12.63	15809
1st Step	6	105.76	10.65	5957
1st Step	7	91.44	8.10	2032
1st Step	8	101.86	5.63	1124
1st Step	9	14.12	4.14	985
1st Step	10+	101.17	5.26	460
Total				*80,099*
2nd Step	1	4196.99	15.81	1014
2nd Step	2	521.47	13.14	13087
2nd Step	3	163.82	13.10	28865
2nd Step	4	123.54	12.90	21792
2nd Step	5	78.38	12.98	8676
2nd Step	6	52.62	10.98	4169
2nd Step	7	88.76	9.01	1739
2nd Step	8	123.61	8.94	322
2nd Step	9	82.01	9.23	114
2nd Step	10+	88.04	6.72	321
Total				*417,764*
3rd Step	1	72.89	18.77	301500
3rd Step	2	65.60	13.06	71002
3rd Step	3	71.00	11.41	29627
3rd Step	4	131.23	10.08	10043
3rd Step	5	81.21	7.50	3509
3rd Step	6	54.92	5.82	906
3rd Step	7	38.41	6.38	439
3rd Step	8	462.10	5.28	308
3rd Step	9	100.22	4.07	262
3rd Step	10+	16.13	2.52	168

Panel C: Summary of SOEs Layer by Layer in Ownership Trees (Threshold = 30%)

Step	Layer	Avg_Reg cap (RMB mn)	Avg_Firm age	Firm number
				116,972
Total				
1st Step	1	76193.32	20.89	157
1st Step	2	2905.32	12.67	8558
1st Step	3	353.01	12.16	32406
1st Step	4	183.01	12.45	36218
1st Step	5	105.66	11.61	22298
1st Step	6	109.55	9.63	9240
1st Step	7	118.66	7.38	3752
1st Step	8	354.54	5.47	1764
1st Step	9	237.99	4.84	811
1st Step	10+	136.84	3.63	1768
Total				*113,336*
2nd Step	1	4163.32	15.73	1023
2nd Step	2	563.18	12.60	15576
2nd Step	3	195.05	12.28	38121
2nd Step	4	130.18	11.84	31125
2nd Step	5	96.66	11.64	14649
2nd Step	6	79.98	11.05	6795
2nd Step	7	94.27	10.62	3444
2nd Step	8	59.62	7.56	1548
2nd Step	9	74.82	7.51	453
2nd Step	10+	72.29	7.45	602
Total				*489,872*
3rd Step	1	86.07	18.17	328221
3rd Step	2	80.96	12.20	92492
3rd Step	3	81.63	10.54	42720
3rd Step	4	114.54	8.96	16130
3rd Step	5	78.58	6.88	6504
3rd Step	6	54.94	5.68	2150
3rd Step	7	51.63	4.56	916
3rd Step	8	126.61	5.47	363
3rd Step	9	49.52	3.77	250
3rd Step	10+	1263.03	3.26	126

Panel D: Summary of Partial SOEs Layer by Layer in Ownership Trees (Threshold = 10%)

Step	Layer	Avg_Reg cap (RMB mn)	Avg_Firm age	Firm number
Total				*185,579*
1st Step	1	76591.02	20.63	163
1st Step	2	2477.75	11.87	11078
1st Step	3	419.96	11.31	43182
1st Step	4	203.97	11.25	53659
1st Step	5	112.11	10.43	36445
1st Step	6	131.53	8.08	19550
1st Step	7	137.20	6.65	9704
1st Step	8	145.34	5.73	5636
1st Step	9	184.22	5.56	2651
1st Step	10+	120.00	3.97	3511
Total				*168,166*
2nd Step	1	4092.47	15.56	1002
2nd Step	2	721.15	12.17	18021
2nd Step	3	266.81	11.79	48255
2nd Step	4	159.71	11.07	46234
2nd Step	5	132.82	10.21	25742
2nd Step	6	132.30	8.67	13764
2nd Step	7	89.52	6.59	6832
2nd Step	8	73.43	5.08	3287
2nd Step	9	58.79	5.26	1804
2nd Step	10+	42.22	5.75	3225
Total				*614,789*
3rd Step	1	107.58	17.54	360319
3rd Step	2	108.51	11.52	121630
3rd Step	3	114.22	9.56	68071
3rd Step	4	107.68	8.00	32667
3rd Step	5	82.94	6.68	15575
3rd Step	6	80.81	5.56	7559
3rd Step	7	63.27	6.36	4332
3rd Step	8	59.55	6.61	2266
3rd Step	9	163.04	5.23	962
3rd Step	10+	57.11	4.08	1408

Panel E: Summary of Partial SOEs Layer by Layer in Ownership Trees (Threshold = 0%)

Step	Layer	Avg_Reg cap (RMB mn)	Avg_Firm age	Firm number
Total				*303,559*
1st Step	1	75386.92	20.29	169
1st Step	2	2528.91	11.69	13377
1st Step	3	489.31	10.81	55950
1st Step	4	217.66	10.33	77519
1st Step	5	141.04	8.97	62616
1st Step	6	115.36	7.11	40741
1st Step	7	132.86	5.57	24920
1st Step	8	80.51	4.92	14239
1st Step	9	97.25	4.52	7504
1st Step	10+	86.40	4.25	6524
Total				*282,570*
2nd Step	1	4162.77	15.49	971
2nd Step	2	841.27	12.20	20052
2nd Step	3	340.80	11.41	59001
2nd Step	4	229.94	10.34	65590
2nd Step	5	179.08	8.79	50142
2nd Step	6	125.45	6.50	35288
2nd Step	7	151.92	5.10	22549
2nd Step	8	94.14	4.81	12409
2nd Step	9	174.38	4.53	7394
2nd Step	10+	105.43	5.75	9174
Total				*778,472*
3rd Step	1	135.09	17.14	388266
3rd Step	2	175.10	11.01	155714
3rd Step	3	123.67	8.67	108558
3rd Step	4	81.78	6.96	65748
3rd Step	5	91.75	6.28	31740
3rd Step	6	1204.08	5.51	15398
3rd Step	7	108.64	5.44	7630
3rd Step	8	92.66	5.43	3185
3rd Step	9	81.48	6.02	1254
3rd Step	10+	51.67	8.99	979

Table 3: Summary Statistics of SOEs identified by our proposed measure

This table reports the summary statistics of the SOEs that we identify using ownership trees.

Panel A: SOEs: Threshold=100%

Variable	Obs.	Mean	Std. Dev.	Min	25%	50%	75%	Max
1st Step: Central SOEs (by SASAC of the State Council; Ministry of Finance)								
Reg cap (RMB mn)	35,635	81,096	1.553e+06	0	50	524	5,000	1.550e+08
Firm age	37,564	15.39	9.939	0	6	16	24	67
2nd Step: Provincial SOEs (100% owned by provincial governments)								
Reg cap (RMB mn)	34,693	25,161	198,126	0	75	580.5	4,360	1.100e+07
Firm age	35,588	15.35	10.91	0	5	15	24	67
3rd Step: Additional 100% State-owned companies by local city or county governments								
Reg cap (RMB mn)	284,803	5,344	57,637	0	22	87	644	9.872e+06
Firm age	288,784	18.86	10.39	0	11	21	25	67

Panel B: SOEs: Threshold = 50%

Variable	Obs.	Mean	Std. Dev.	Min	25%	50%	75%	Max
1st Step: Central SOEs (by SASAC of the State Council; Ministry of Finance)								
Reg cap (RMB mn)	80,838	58,001	1.255e+06	0	100	1,000	5,795	1.550e+08
Firm age	84,097	12.71	9.637	0	4	12	20	67
2nd Step: Provincial SOEs (100% owned by provincial governments)								
Reg cap (RMB mn)	77,492	24,174	197,155	0	100	800	5,000	1.990e+07
Firm age	79,255	12.82	10.05	0	4	12	21	67
3rd Step: Additional 100% State-controlled companies by local city or county governments								
Reg cap (RMB mn)	399,819	7,320	128,896	0	30	109.5	1,000	6.690e+07
Firm age	405,714	16.87	10.43	0	8	18	24	67

Panel C: SOEs: Threshold = 30%

Variable	Obs.	Mean	Std. Dev.	Min	25%	50%	75%	Max
1st Step: Central SOEs (by SASAC of the State Council; Ministry of Finance)								
Reg cap (RMB mn)	111,990	50,119	1.078e+06	0	100	1,000	7,000	1.550e+08
Firm age	115,928	11.56	9.415	0	3	10	19	67
2nd Step: Provincial SOEs (100% owned by provincial governments)								
Reg cap (RMB mn)	109,915	23,571	191,383	0	100	1,000	5,000	1.990e+07
Firm age	112,259	11.91	9.730	0	3	10	19	67
3rd Step: Additional 100% State-controlled companies by local city or county governments								
Reg cap (RMB mn)	470,466	8,565	161,197	0	40	170	1,246	6.690e+07
Firm age	477,284	15.78	10.50	0	6	17	24	67

Panel D: SOEs: Threshold = 10%

Variable	Obs.	Mean	Std. Dev.	Min	25%	50%	75%	Max
1st Step: Central SOEs (by SASAC of the State Council; Ministry of Finance)								
Reg cap (RMB mn)	179,118	41,813	868,864	0	150	1,000	7,720	1.550e+08
Firm age	184,073	10.18	9.073	0	2	8	17	67
2nd Step: Provincial SOEs (100% owned by provincial governments)								
Reg cap (RMB mn)	163,298	25,842	225,222	0	111	1,000	5,250	4.130e+07
Firm age	166,570	10.62	9.355	0	2	8	18	67
3rd Step: Additional 100% State-controlled companies by local city or county governments								
Reg cap (RMB mn)	592,954	10,703	178,088	0	50	242	2,000	6.690e+07
Firm age	601,306	14.32	10.46	0	4	15	23	67

Panel E: SOEs: Threshold = 0%

Variable	Obs.	Mean	Std. Dev.	Min	25%	50%	75%	Max
1st Step: Central SOEs (by SASAC of the State Council; Ministry of Finance)								
Reg cap (RMB mn)	293,972	35,803	707,448	0	170.4	1,000	7,496	1.550e+08
Firm age	301,231	8.851	8.636	0	2	6	15	67
2nd Step: Provincial SOEs (100% owned by provincial governments)								
Reg cap (RMB mn)	274,709	26,926	280,898	0	148	1,000	5,958	6.690e+07
Firm age	280,217	8.988	8.823	0	2	6	15	67
3rd Step: Additional 100% State-controlled companies by local city or county governments								
Reg cap (RMB mn)	752,147	15,582	1.954e+06	0	50	380	2,740	1.680e+09
Firm age	763,603	12.96	10.34	0	3	12	22	67

Table 4: Comparison of the Proposed and Existing Definitions of SOEs: 2017

Panel A: Comparing Number of SOEs

This table compares the number of SOEs by the proposed definition of SOEs and by the existing definition of SOEs according to registration type in SAIC. Please note some SOEs are in the intersections of Central SOEs, Provincial SOEs and City SOEs, based on our search algorithm and identification strategy. The total number of SOEs according to the proposed measure here reports the actual total number of SOEs taking into consideration the potential double-counting issue.

	Revised SOEs					Existing measure of SOEs in SAIC
	100%	50%	30%	10%	0%	
Central SOEs	37,991	84,904	116,972	185,579	303,559	
Provincial SOEs	36,056	80,099	113,336	168,166	282,570	
City SOEs	299,665	417,764	489,872	614,789	778,472	
TOTAL	362,693	539,238	628,554	743,821	866,757	391,490

Panel B: Discrepancy of SOEs by the Proposed/Existing Measure

This table reports the intersection as well as the total number of SOEs by the proposed (ownership threshold set to be 30%) and existing measure. Our proposed measure identifies 628,544 SOEs, while the existing measure of SOEs by registration type from SAIC identifies 391,490 SOEs in total. Only 167,544 firms (26.7% of the total revised SOEs) are SOEs under both definitions.

	Revised SOEs	Revised non-SOEs	Total Existing SOEs
Existing SOEs	167,544	223,946	391,490
Existing non-SOEs	461,010		
Total Revised SOEs	628,554		

Table 5: Summary Statistics

This table reports the summary statistics of the AIS firm sample (for regression analysis).

Variable	# of obs.	Mean	Std. Dev.	Min	Max
Leverage	2,838,310	0.564	0.294	0.004	1.000
Firm age	2,838,142	2.067	0.841	0.000	4.159
Firm size	2,838,377	9.914	1.492	0.000	20.672
Firm growth	2,130,633	0.133	0.421	-1.545	2.052
ROA	2,836,789	0.107	0.199	-0.231	1.543
Profit rates	2,836,280	0.146	0.126	-0.245	0.868
TFP	2,434,300	0.013	0.859	-6.631	2.391
ncsoe100	2,838,425	0.007	0.082	0	1
ncsoe50	2,838,425	0.005	0.072	0	1
ncsoe30	2,838,425	0.003	0.055	0	1
ncsoe10	2,838,425	0.006	0.075	0	1
ncsoe0	2,838,425	0.008	0.086	0	1
npsoe100	2,838,425	0.005	0.073	0	1
npsoe50	2,838,425	0.005	0.073	0	1
npsoe30	2,838,425	0.003	0.059	0	1
npsoe10	2,838,425	0.004	0.060	0	1
npsoe0	2,838,425	0.008	0.087	0	1
nlsoe100	2,838,425	0.021	0.143	0	1
nlsoe50	2,838,425	0.005	0.073	0	1
nlsoe30	2,838,425	0.004	0.061	0	1
nlsoe10	2,838,425	0.005	0.068	0	1
nlsoe0	2,838,425	0.007	0.085	0	1
csoe_layer0	79,282	3.851	0.970	1	5
psoe_layer0	71,129	3.589	1.032	1	5
lsoe_layer0	118,391	1.443	0.847	1	5

Table 6: Effects of State Ownership on Firm Growth

The table reports the results of the regressions examining the effect of state ownership on firm growth. *Firm growth* is defined by the growth rate of total assets. Specifically, we divide firms controlled by governments (central, provincial or city governments) into 5 groups – 100% (SOEs), 50-100% (SOEs), 30-50% (SOEs), 10-30% (partial SOEs) and 0-10% (partial SOEs) based on the total state ownership that we have calculated along the ownership trees. The benchmark is firms who do not have state capital. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)
	Growth of Total Asset		
	Central Government	*Provincial Government*	*City Government*
0-10%	0.0632***	0.0675***	0.0147*
	(0.0149)	(0.0175)	(0.00855)
10-30%	0.0972***	0.0514**	-0.0192*
	(0.0207)	(0.0238)	(0.0110)
30-50%	0.0741***	0.0767***	-0.0354***
	(0.0257)	(0.0246)	(0.0126)
50-100%	0.0505**	0.0934***	-0.0333***
	(0.0201)	(0.0222)	(0.0113)
100%	-0.000790	0.00666	-0.0391***
	(0.0138)	(0.0230)	(0.00829)
Leverage	0.0234***	0.0234***	0.0233***
	(0.00235)	(0.00235)	(0.00236)
ROA	0.335***	0.335***	0.335***
	(0.00360)	(0.00360)	(0.00360)
Firm age	0.00769***	0.00767***	0.00741***
	(0.000985)	(0.000984)	(0.000985)
Firm size	-0.445***	-0.445***	-0.445***
	(0.00135)	(0.00135)	(0.00135)
Firm Fixed Effect	Yes	Yes	Yes
City * Year FE	Yes	Yes	Yes
CIC2 * Year FE	Yes	Yes	Yes
Observations	1,930,574	1,930,574	1,930,574
R-squared	0.451	0.451	0.451

Table 7: Effects of State Ownership on Firm Profitability

The table reports the results of the regressions examining the effect of state ownership on firm profitability. In Panel A, firm profitability is measured by profits in main businesses over total sales. Specifically, we divide firms controlled by governments (central, provincial or city governments) into 5 groups – 100% (SOEs), 50-100% (SOEs), 30-50% (SOEs), 10-30% (partial SOEs) and 0-10% (partial SOEs) based on the total state ownership that we have calculated along the ownership trees. The benchmark is firms who do not have state capital. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Effects of State Ownership on Firm Profit Rate

VARIABLES	(1)	(2)	(3)
		Profit Rate	
	Central Government	*Provincial Government*	*City Government*
0-10%	0.0111**	0.0151***	0.0109***
	(0.00541)	(0.00517)	(0.00253)
10-30%	0.00812	-0.000187	-0.00449
	(0.00568)	(0.00927)	(0.00326)
30-50%	0.00271	0.0159*	-0.0248***
	(0.00776)	(0.00830)	(0.00549)
50-100%	0.00339	0.00766	-0.00579
	(0.00704)	(0.00786)	(0.00366)
100%	-0.0302***	-0.00105	0.000195
	(0.00629)	(0.00738)	(0.00310)
Leverage	-0.00489***	-0.00489***	-0.00492***
	(0.000511)	(0.000511)	(0.000511)
Firm age	0.000139	0.000191	0.000139
	(0.000280)	(0.000280)	(0.000280)
Firm size	0.00341***	0.00341***	0.00341***
	(0.000201)	(0.000201)	(0.000201)
Firm FE	Yes	Yes	Yes
Year * City FE	Yes	Yes	Yes
Year * CIC2 FE	Yes	Yes	Yes
Observations	1,985,324	1,985,324	1,985,324
R-squared	0.673	0.673	0.673

Panel B: Effects of State Ownership on Firm ROA

VARIABLES	(1)	(2)	(3)
	Central Government	Return on Assets (ROA) *Provincial Government*	*City Government*
0-10%	-0.00299	-0.00495	-0.0105***
	(0.00337)	(0.00375)	(0.00234)
10-30%	0.000252	-0.00474	-0.0149***
	(0.00514)	(0.00912)	(0.00318)
30-50%	-0.00784	-0.00358	-0.00605*
	(0.00585)	(0.00593)	(0.00354)
50-100%	-0.0151***	-0.0186***	-0.00867**
	(0.00512)	(0.00492)	(0.00361)
100%	-0.00772***	-0.0164***	-0.00752***
	(0.00297)	(0.00536)	(0.00228)
Leverage	-0.0213***	-0.0213***	-0.0213***
	(0.000770)	(0.000770)	(0.000770)
Firm age	0.00399***	0.00398***	0.00400***
	(0.000339)	(0.000339)	(0.000339)
Firm size	-0.00924***	-0.00924***	-0.00925***
	(0.000313)	(0.000313)	(0.000313)
Firm FE	Yes	Yes	Yes
Year *City FE	Yes	Yes	Yes
Year*CIC2 FE	Yes	Yes	Yes
Observations	1,986,297	1,986,297	1,986,297
R-squared	0.729	0.729	0.729

Table 8: Effects of State Ownership on Firm Productivity

The table reports the results of the regressions examining the effect of state ownership on firms' total factor productivity (TFP). Specifically, we divide firms controlled by governments (central, provincial or city governments) into 5 groups – 100% (SOEs), 50-100% (SOEs), 30-50% (SOEs), 10-30% (partial SOEs) and 0-10% (partial SOEs) based on the total state ownership that we have calculated along the ownership trees. The benchmark is firms who do not have state capital. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)
	Total Factor Productivity (TFP)		
VARIABLES	*Central Government*	*Provincial Government*	*City Government*
0-10%	0.0586**	0.0700**	0.0432***
	(0.0280)	(0.0295)	(0.0154)
10-30%	0.0622*	0.0479	0.00697
	(0.0354)	(0.0450)	(0.0203)
30-50%	0.0893*	0.133***	0.0477*
	(0.0461)	(0.0493)	(0.0249)
50-100%	0.0941**	-0.0693*	0.0408**
	(0.0421)	(0.0376)	(0.0205)
100%	0.0167	0.0113	-0.0175
	(0.0259)	(0.0387)	(0.0154)
Leverage	-0.0304***	-0.0305***	-0.0305***
	(0.00340)	(0.00340)	(0.00340)
Firm age	-0.0216***	-0.0218***	-0.0217***
	(0.00191)	(0.00191)	(0.00191)
Firm size	0.0430***	0.0430***	0.0430***
	(0.00144)	(0.00144)	(0.00145)
Firm FE	YES	YES	YES
Year * City FE	YES	YES	YES
Year * CIC2 FE	YES	YES	YES
Observations	1,771,360	1,771,360	1,771,360
R-squared	0.758	0.758	0.758

Table 9: Effects of State Ownership on Firm Performance: Central vs. Local Governments

The table reports the results of the regressions examining the effect of state ownership on firm performance. We run the following regression

$$y_{it} = \beta_c cent_{it} + \beta_p prov_{it} + \beta_l city_{it} + \alpha_i + \alpha_{ct} + \alpha_{ind,t} + X_{it} + \epsilon_{it}$$

where α_i is the firm fixed effect, $\alpha_{ind,t}$ is the industry cross year fixed effect and α_{ct} is the city cross year fixed effect. X_{it} is the time varying firm characteristics, including leverage, firm age and firm size, all in lagged terms. $cent_{it}$ is 1 if the firm is directly or indirectly owned by central government, otherwise 0. $prov_{it}$ is 1 if the firm is directly or indirectly owned by provincial government. $local_{it}$ is 1 if the firm is directly or indirectly owned by local city government, otherwise 0, using the ownership threshold 0%. All errors are clustered at firm level. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1) Growth of total asset	(2) ROA	(3) Profit Rate	(4) TFP
β_c	0.0409***	-0.00251	-0.00791**	0.0477***
	(0.0103)	(0.00211)	(0.00343)	(0.0169)
$\beta_p - \beta_c$	0.00557	-0.00461	0.0194***	-0.0382
	(0.0194)	(0.00410)	(0.00623)	(0.0309)
$\beta_l - \beta_c$	-0.0522***	-0.00668***	0.00634	-0.0325*
	(0.0117)	(0.00259)	(0.00387)	(0.0195)
Leverage	-0.000709	-0.0213***	-0.00490***	-0.0305***
	(0.00247)	(0.000770)	(0.000512)	(0.00340)
Firm age	0.0264***	0.00396***	0.000156	-0.0215***
	(0.00127)	(0.000339)	(0.000280)	(0.00191)
Firm size	-0.458***	-0.00924***	0.00341***	0.0430***
	(0.00138)	(0.000313)	(0.000201)	(0.00144)
Firm FE	Yes	Yes	Yes	Yes
Year*City FE	Yes	Yes	Yes	Yes
Year*CIC2 FE	Yes	Yes	Yes	Yes
Observations	1,827,539	1,986,297	1,985,324	1,771,360
R-squared	0.448	0.729	0.673	0.758

Table 10: Effects of State Ownership on Firm Performance: Hierarchical Distance to Governments

This table reports the results of the regressions examining how the distance to governments affect firm performance. Specifically, firms are classified into three groups: those owned by central, provincial and city governments. We run the following regression:

$$y_{it} = \beta_d\, Dist_{it} + \beta_{10}\, I_{10-30} + \beta_{30}I_{30-50} + \beta_{50}I_{50-100} + \beta_{100}I_{100} + \alpha_{ct} + \alpha_{ind,t} + X_{it} + \epsilon_{it}$$

where $Dist_{it}$ is the hierarchical distance to governments (as roots in our ownership trees) measured as the number of layers in the ownership trees. I_{10-30} is 1 if the state ownership falls between 10 and 30 percent. Definitions are similar for other dummies of state ownership. All errors are clustered at firm level. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Subsample of Firms Owned by Central Governments

VARIABLES	Firm Owned by Central Government			
	(1)	(2)	(3)	(4)
	Firm Growth	Profit Rate	ROA	TFP
Distance from the root	-0.0183***	0.00673***	0.00386***	0.0247**
	(0.00205)	(0.00155)	(0.000956)	(0.00959)
10-30%	-0.0157***	-0.00319	0.00556**	0.0568***
	(0.00483)	(0.00359)	(0.00253)	(0.0215)
30-50%	-0.0314***	-0.00411	0.00345	-0.000133
	(0.00596)	(0.00459)	(0.00301)	(0.0268)
50-100%	-0.0409***	-0.00465	0.00358	0.0616**
	(0.00500)	(0.00403)	(0.00259)	(0.0240)
100%	-0.0391***	-0.0272***	-0.00482*	-0.0228
	(0.00526)	(0.00419)	(0.00248)	(0.0253)
Leverage	-0.0374***	-0.0865***	-0.0856***	-0.162***
	(0.00663)	(0.00442)	(0.00310)	(0.0273)
Firm age	-0.0209***	0.00356**	-0.00604***	-0.107***
	(0.00208)	(0.00140)	(0.000788)	(0.00807)
Firm size	-0.0275***	0.00511***	-0.00491***	0.140***
	(0.00116)	(0.000773)	(0.000521)	(0.00472)
Ownership FE	Yes	Yes	Yes	Yes
Year*City FE	Yes	Yes	Yes	Yes
Year*CIC2 FE	Yes	Yes	Yes	Yes
Observations	58,821	65,153	65,255	58,903
R-squared	0.126	0.250	0.215	0.204

Panel B: Subsample of Firms Owned by Provincial Governments

| VARIABLES | Firm Owned by Provincial Government | | | |
| | (1) | (2) | (3) | (4) |
	Asset Growth	Profit Rate	ROA	TFP
Distance from the root	-0.0117***	0.00332**	0.00334***	-0.00214
	(0.00204)	(0.00160)	(0.00101)	(0.00952)
10-30%	-0.0264***	-0.00644	0.000462	-0.00526
	(0.00572)	(0.00419)	(0.00300)	(0.0255)
30-50%	-0.0346***	-0.00676	0.00140	0.0553**
	(0.00588)	(0.00458)	(0.00299)	(0.0274)
50-100%	-0.0413***	-0.0148***	-0.00823***	-0.0891***
	(0.00563)	(0.00412)	(0.00274)	(0.0249)
100%	-0.0456***	-0.0220***	-0.0130***	-0.212***
	(0.00602)	(0.00474)	(0.00279)	(0.0289)
Leverage	-0.0590***	-0.0947***	-0.0870***	-0.0997***
	(0.00728)	(0.00460)	(0.00320)	(0.0286)
Firm age	-0.0236***	0.00839***	-0.00486***	-0.150***
	(0.00229)	(0.00147)	(0.000884)	(0.00914)
Firm size	-0.0279***	0.00209**	-0.00582***	0.149***
	(0.00130)	(0.000834)	(0.000526)	(0.00527)
Ownership FE	Yes	Yes	Yes	Yes
Year*City FE	Yes	Yes	Yes	Yes
Year*CIC2 FE	Yes	Yes	Yes	Yes
Observations	51,914	57,696	57,750	51,929
R-squared	0.143	0.252	0.230	0.250

Panel C: Subsample of Firms Owned by City Governments

VARIABLES	(1) Growth of total asset	(2) Profit Rate	(3) ROA	(4) TFP
	Firm Owned by City Government			
Distance from the root	0.00119	0.00146	0.00229**	0.0242***
	(0.00185)	(0.00128)	(0.00106)	(0.00790)
10-30%	-0.0271***	-0.0106***	-0.00225	-0.0380*
	(0.00472)	(0.00348)	(0.00262)	(0.0223)
30-50%	-0.0420***	-0.0176***	0.00121	-0.0148
	(0.00511)	(0.00395)	(0.00305)	(0.0247)
50-100%	-0.0459***	-0.0169***	-0.00274	-0.0911***
	(0.00480)	(0.00360)	(0.00260)	(0.0220)
100%	-0.0407***	-0.0160***	0.00614***	-0.0955***
	(0.00441)	(0.00331)	(0.00235)	(0.0207)
Leverage	-0.0424***	-0.0667***	-0.0831***	-0.301***
	(0.00467)	(0.00304)	(0.00223)	(0.0190)
Firm age	-0.0129***	0.00493***	-0.00350***	-0.124***
	(0.00176)	(0.00113)	(0.000766)	(0.00693)
Firm size	-0.0277***	0.00484***	-0.00934***	0.112***
	(0.000930)	(0.000626)	(0.000451)	(0.00395)
Ownership FE	Yes	Yes	Yes	Yes
Year*City FE	Yes	Yes	Yes	Yes
Year*CIC2 FE	Yes	Yes	Yes	Yes
Observations	90,978	99,518	99,600	91,712
R-squared	0.098	0.217	0.248	0.260

Table 11: State Ownership and Loan Access

This table reports the results of regressions examining the effects of state ownership and hierarchical distance to governments on loan access. The dependent variable is weighted loan spreads at firm-year level for matched firms. All errors are clustered at firm level. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Effect of State Ownership on Loan Access

VARIABLES	(1)	(2)	(3)
	Weighted Loan Spreads		
	Central Government	Provincial Government	City Government
0-10%	-0.00248***	-0.00142**	-0.00193***
	(0.000607)	(0.000608)	(0.000610)
10-30%	-0.000786	-0.00187**	-4.26e-05
	(0.000787)	(0.000739)	(0.000775)
30-50%	-0.00180	-0.00229***	-0.000275
	(0.00116)	(0.000861)	(0.00128)
50-100%	-0.00206**	-0.00215**	-0.00204*
	(0.00102)	(0.000928)	(0.00112)
100%	-0.00149*	-0.00210**	-0.00146
	(0.000862)	(0.000817)	(0.00103)
Leverage	-0.00105***	-0.00107***	-0.00106***
	(0.000376)	(0.000377)	(0.000376)
ROA	0.000712	0.000703	0.000723
	(0.000524)	(0.000524)	(0.000523)
Firm age	-0.000737***	-0.000728***	-0.000724***
	(0.000138)	(0.000139)	(0.000138)
Firm size	-0.00135***	-0.00134***	-0.00138***
	(7.96e-05)	(8.02e-05)	(7.91e-05)
Log maturity	0.00530***	0.00531***	0.00529***
	(0.000227)	(0.000228)	(0.000229)
Log loan amt	-0.000729***	-0.000726***	-0.000730***
	(8.84e-05)	(8.85e-05)	(8.86e-05)
Firm FE	NO	NO	NO
Year FE	YES	YES	YES
CIC2 FE	YES	YES	YES
Observations	10,410	10,410	10,410
R-squared	0.435	0.435	0.434

Panel B: Effect of Hierarchical Distance to Governments on Loan Access

VARIABLES	(1)	(2)	(3)
	Weighted Loan Spreads		
	Central SOEs	Provincial SOEs	City SOEs
Distance from the root	0.000310	0.000167	0.000530
	(0.000487)	(0.000445)	(0.000517)
10-30%	0.00143	-0.000599	0.00308**
	(0.00114)	(0.00132)	(0.00120)
30-50%	0.000991	-0.00131	0.00237
	(0.00150)	(0.00133)	(0.00176)
50-100%	0.000984	-0.00112	0.00102
	(0.00136)	(0.00123)	(0.00164)
100%	0.00174	-0.00237	0.00114
	(0.00138)	(0.00158)	(0.00137)
Leverage	-0.00140	-0.000784	-0.00221
	(0.00228)	(0.00216)	(0.00212)
Firm age	0.000689	0.00126**	0.00140**
	(0.000565)	(0.000560)	(0.000617)
Firm size	-0.00142***	-0.00100***	-0.00195***
	(0.000355)	(0.000375)	(0.000404)
Log maturity	0.00399***	0.00470***	0.00372***
	(0.000626)	(0.000837)	(0.00135)
Log loan amt	-0.000106	-0.000662*	-0.000381
	(0.000316)	(0.000371)	(0.000461)
Firm FE	NO	NO	NO
Year FE	YES	YES	YES
CIC2 FE	YES	YES	YES
Observations	336	318	321
R-squared	0.509	0.554	0.535

Appendix

Table A.1 Variable List and Definition

Variable	Definition	Source
ROA	Net income before extraordinary items/Total assets	
Leverage	Total liabilities/Total assets	
Firm age	Natural logarithm of firm age (current year- firm established year)	
Firm size	Natural logarithm of firm total assets in thousand RMB	AIS
Firm growth	Growth rate of total assets	
TFP	TFP is calculated by dividing output by the weighted average of labor (70%) and capital (30%) input.	
Profit rates	Profits in main businesses over total sales	
Reg cap	Firm registered capital at SAIC	iFind
Distance from the root	Hierarchical distance (from 1 to 5) to the governments in ownership trees	

Table A.2 Effect of State Ownership on Firm Growth and Performance

This table reports the results of the regressions examining the effect of state ownership on firm growth and performance, by putting together 15 state ownership dummies in one model set-up, based on Table 6-8. The benchmark is firms who do not have state capital. All variables are defined in Appendix Table A.1. Robust standard errors clustered by firm are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1) Growth of total asset	(2) Profit Rate	(3) ROA	(4) TFP
0-10% (Central)	0.0386**	0.00442	0.00350	0.0444
	(0.0172)	(0.00601)	(0.00389)	(0.0312)
10-30% (Central)	0.0771***	0.00477	0.00607	0.0535
	(0.0221)	(0.00594)	(0.00518)	(0.0373)
30-50% (Central)	0.0547**	0.000571	-0.000915	0.0834*
	(0.0255)	(0.00783)	(0.00604)	(0.0474)
50-100% (Central)	0.0394*	0.00217	-0.0117**	0.0854**
	(0.0204)	(0.00711)	(0.00509)	(0.0421)
100% (Central)	0.000434	-0.0282***	-0.00714**	0.0111
	(0.0138)	(0.00618)	(0.00301)	(0.0259)
0-10% (Provincial)	0.0408**	0.0113*	-0.00315	0.0275
	(0.0197)	(0.00579)	(0.00429)	(0.0324)
10-30% (Provincial)	0.0267	-0.000668	-0.00275	0.00888
	(0.0247)	(0.00940)	(0.00919)	(0.0454)
30-50% (Provincial)	0.0491*	0.0158*	-0.00158	0.0897*
	(0.0253)	(0.00869)	(0.00610)	(0.0513)
50-100% (Provincial)	0.0717***	0.00690	-0.0171***	-0.108***
	(0.0232)	(0.00805)	(0.00504)	(0.0397)
100% (Provincial)	0.00221	0.000331	-0.0154***	-2.69e-05
	(0.0229)	(0.00748)	(0.00539)	(0.0388)
0-10% (City)	0.00457	0.00944***	-0.0101***	0.0353**
	(0.00862)	(0.00257)	(0.00238)	(0.0157)
10-30% (City)	-0.0277**	-0.00545*	-0.0144***	0.00215
	(0.0110)	(0.00328)	(0.00317)	(0.0203)
30-50% (City)	-0.0440***	-0.0239***	-0.00494	0.0398
	(0.0126)	(0.00544)	(0.00357)	(0.0252)
50-100% (City)	-0.0385***	-0.00640*	-0.00821**	0.0387*
	(0.0113)	(0.00367)	(0.00360)	(0.0206)
100% (City)	-0.0376***	-0.000139	-0.00772***	-0.0165
	(0.00829)	(0.00309)	(0.00228)	(0.0154)
Leverage	0.0234***	-0.00490***	-0.0213***	-0.0304***
	(0.00235)	(0.000511)	(0.000770)	(0.00340)
ROA	0.335***	-	-	-
	(0.00360)	-	-	-
Firm age	0.00773***	0.000135	0.00395***	-0.0216***
	(0.000985)	(0.000280)	(0.000339)	(0.00191)
Firm size	-0.445***	0.00340***	-0.00924***	0.0430***
	(0.00135)	(0.000200)	(0.000313)	(0.00144)
Ownership FE	Yes	Yes	Yes	Yes

Year*City FE	Yes	Yes	Yes	Yes
Year*CIC2 FE	Yes	Yes	Yes	Yes
Observations	1,930,574	1,985,324	1,986,297	1,771,360
R-squared	0.452	0.673	0.729	0.758