The Transformative Effects of Privatization in China

A Natural Experiment Based on Politician Career Concern

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Abstract

The serious implications of privatizing state-owned enterprises for politicians, managers, and investors make such decisions highly contingent on firm characteristics and past performance, complicating the identification of the privatization effects. A unique opportunity for this identification arises from a rule of promotion of local politicians based on age requirements in China. This paper finds that Chinese cities whose top officials were older than age 58 were 20 percent less likely to privatize local state-owned enterprises during the wave of state-owned enterprise restructuring starting in the late 1990s. Relying on the regression discontinuity design, the analysis finds that privatizations led to productivity gains of more than 170 percent, an order of magnitude larger than the traditional estimates based on the firm fixed effect specification (including its random-growth variant). The paper further finds that the privatization effects are significantly larger when the government is less involved in the affairs of local firms. The findings underscore the need to deal with the time-varying selectivity of privatizations and highlight the crucial role that state-owned enterprise privatizations played in China's economic takeoff.

The Transformative Effects of Privatization in China:

A Natural Experiment Based on Politician Career Concern[1]

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1. Introduction

After the Thatcher government popularized large-scale privatizations four decades ago, the policy has been widely used throughout the world, especially by developing and transition countries with large shares of state-owned enterprises (SOEs). The literature surrounding the effects of privatization is huge, as shown in several influential surveys across different generations of research (Megginson and Netter 2001; Djankov and Murrell 2002; Estrin et al. 2009; Megginson 2017). These studies tend to find modest gains in firm performance, while acknowledging the selectivity of privatizations. In this paper, we revisit this literature by addressing three questions: What determines a politician's decision to privatize an SOE? How large are the causal effects of privatization in China? How do the effects of privatization depend on local government activism (i.e., its direct involvement in local firms)?

To make sense of the large literature on privatization effects, we need to consider several facts. First, privatizations tend to be selective based on past firm performance and characteristics. The public or private ownership of firms is a key dichotomy in shaping the basic structure of an economy, and has occupied the attention of generations of economists who have debated the merits and flaws of state ownership (Bardhan and Roemer 1992, 1993; Shleifer and Vishny 1994; Stiglitz 1994). Privatizations of SOEs, thus, not surprisingly, reflect deliberate considerations of many involved parties. When SOEs are profitable, the politicians in charge benefit from controlling access to these firms' cash flows, and through arranging jobs in these lucrative firms. When SOEs are unprofitable, the government shoulders the burden of keeping them afloat. Thus, privatization decisions are not made in pure pursuit of efficiency. Instead, they are made to benefit politicians and advance their careers. The types of firms that can be privatized also depends on investor demand. Highly non-profitable firms do not attract buyers and are difficult to privatize. Most existing studies on the effects of privatization rely on the firm fixed effect model, and do not otherwise deal with selectivity of privatization. Second, the causal effects of privatizations should differ across countries and periods. A convincing conclusion from the survey of privatization literature is that the effects of privatization differ by the institutional context of privatizations (Djankov and Murrell 2002; Estrin et al. 2009): more positive effects or associations, for instance, have been consistently

found in CEE (Central and Eastern Europe) rather than CIS countries (i.e., Commonwealth of Independent States, countries formerly affiliated with the Soviet Union). A thorough understanding of privatization effects thus requires us to account for the selectivity of privatization, and the political and economic contexts in which privatizations take place.

Surveys agree that a glaring shortcoming in the literature surrounding the aftermath of privatization is a lack of convincing studies on the causal effect of privatization on firm performance in China. Most studies on privatization focus on CEE and CIS countries, with occasional exceptions on other large countries such as the United States, Mexico, and India (Megginson and Netter 2001; Djankov and Murrell 2002; Estrin et al. 2009). Much less work is done on privatization in China. Estrin et al. (2009) concludes, "There are as yet no TFP studies using data from China that employ robust methodologies and, perhaps because of this, the available papers find diverse results, with the effect of nonstate ownership being mostly positive but sometimes statistically insignificant and sometimes negative" (Estrin et al. 2009, p. 702).

This deficiency has not been successfully addressed in the past decade, even though this period has witnessed strong interest in, and more studies on, privatizations in China. In the most recent survey on privatization around the world, Megginson (2017) finds that in the new literature on privatization, papers on China accounted for the largest share among all regions. However, most of the papers are on share issue privatizations (SIPs), that is, partial privatization for publicly listed SOEs with the government retaining strong control,[2] and these account for a tiny share of privatizations in China. Under the slogan of "grabbing the big and letting go the small," the vast majority of the privatized SOEs under the SOE restructuring program near the turn of this century were much smaller and non-listed, and they were afterwards truly private firms (Xu et al. 2005). Since the literature has suggested that the effects of full privatization are much more pronounced than partial privatization (Li and Xu 2004, Megginson 2005), the effects of SIPs are not likely to be representative of full privatization effects in China. Convincing identification of the privatization effect in China remains rare.

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[2] See Sun and Tong (2003), Chen et al. (2008), Berkman, Cole and Fu (2010), Li et al. (2011), Tan et al. (2015), Liao, Liu and Wang (2014). See also additional references on SIPs in China in Megginson (2017).

Yet understanding the effects of China's privatization is particularly relevant in light of the diverse interpretation of the Chinese experience. Unbeknown to most, China features the world's largest privatization program. Indeed, China's privatization of SOEs at the turn of the century is the largest privatization program in human history (Megginson, Nash and Van Randenborgh 1994). The total amount of worldwide revenues raised by privatization, as estimated by the end of the last century, was $860 billion (D'Souza and Megginson 1999), while a conservative estimate of the revenues raised from China's privatization program alone is US$700 billion (Gan, Guo and Xu 2017). Despite its gigantic privatization program, China's government involvement in the economy has also been exceedingly strong, and China's experience has contributed to the popularity of state capitalism. As of 2018, SOEs still accounted for 27.1 percent of total industrial output, and 13.2 percent of total urban employment in China.[3] Indeed, China's post-reform economic system can be characterized as a dual-track system with both a strong government and strong marketization (Lau, Qian and Roland 2000). Even though this system was used to jump-start the reform program to reduce resistance, the dual track of strong marketization and strong government control has remained intact to this day (Long, Xu and Yang 2020). Is China's growth a result of privatization, competition and opening up, or a result of its strong state control, industrial policies and a large SOE sector?

Not surprisingly, both of these interpretations have strong proponents. Some pundits emphasize strong government involvement as fundamental to Chinese growth in the past decades. Ramo (2004), for instance, coined the term Beijing Consensus, to characterize China's unique approach to managing its economy. Others quickly embraced his interpretation and endorsed strong and direct government involvement in the economy, claiming that the Beijing-Consensus approach would dominate the 21st century (Halper 2010).[4] Some influential economists have also embraced the strong government interpretation, including industrial policies (Lin 2012; Rodrik, 2006; Stiglitz 1994, 2008), or the sufficiency of competition without changes in state ownership (Lin, Cai, and Zhou 1998). In contrast, many economists argue that China's strong growth in the past decades reflects its adoption of standard

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[3] The figures are from *China Statistical Yearbooks*.
[4] See Yao (2015) for a discussion of how the overall Chinese experience corresponds to the Beijing Consensus.

recommendations such as marketization, privatization, and opening up (Yao 2015; Brandt et al. 2016; Megginson, 2017; Wu, 2018; Zhang 2019). Zhang (2019), for instance, offers evidence that *improvement* in the level of marketization is strongly and positively associated with China's provincial GDP growth rates. Relatedly, Brandt, Kambourov and Storesletten (2016) offered evidence that the reduction of the state sector contributed to narrowing regional disparity in the past two decades. Understanding the extent and effects of privatization is thus critically important for guiding other developing countries to achieve economic growth, and understanding what China needs to do next. Indeed, Rodrik (2006) implicitly interpreted China's experience in the 1990s as evidence against the importance of privatization for economic success as follows:

> "Rapid economic growth in China, India, and a few other Asian countries has resulted in an *absolute* reduction in the number of people living in extreme poverty. The paradox is that that was unexpected too! China and India increased their reliance on market forces, of course, but their policies remained highly unconventional. With high levels of trade protection, *lack of privatization* (emphasis added), extensive industrial policies, and lax fiscal and financial policies through the 1990s, these two economies hardly looked like exemplars of the Washington Consensus. Indeed, had they been dismal failures instead of the successes they turned out to be, they would have arguably presented stronger evidence in support of Washington Consensus policies" (Rodrik 2006, p. 975).

Given the importance of sound policy recommendations based on the Chinese experience, the continued misunderstanding of China's privatization, it is important to identify the causal effect of privatization in China. This requires using comprehensive Chinese SOE data and a credible identification strategy.

Importantly and fortunately, the manner in which Chinese SOEs were selected for privatization grants us a unique opportunity to identify the causal effects of privatization. The literature has focused on the selectivity of privatization from the perspective of investors, where private and foreign investors tend to purchase firms with good performance (Estrin et al. 2009). The Chinese privatization case differs in this aspect. In China, the SOE restructuring program was decentralized to the local governments, which implemented the privatization programs of

SOEs under their oversight (Huang et al. 2017). The main incentives of the local governments were to get rid of loss-making SOEs to unburden the governments. Under the central government's mandate to completely restructure, most SOEs, invariably possessing valuable urban land, could be, and had been, sold. We can thus use, with details to be shown later, rule-based political incentives of local politicians as the instrumental variable for identifying the privatization effects.

Using a large data set that covers *all* Chinese industrial SOEs from 1998 to 2009, we first document that the rule-based promotion incentives of local politicians (i.e., at the prefectural-level city) affected their privatization decisions. As a result of the Chinese Communist Party's bureaucratic rule that limited promoting local politicians within a specific age range, their promotion probability drops sharply and robustly when reaching age 58. Indeed, using a regression discontinuity framework, we find that local politicians become reluctant to privatize SOEs under their oversight when they get sufficiently "old" and the underlying political benefits disappear. To exclude the possibility that other unknown local economic factors might drive the result, we examine the privatization likelihood of SOEs under the oversight of the provincial or the central government in the same region, and we do not find it related to the local politician's age.

We next study the impact of privatization on firm productivity. First, without dealing with time-varying selectivity, we use ordinary least squares, fixed-effects and the firm random growth specifications. We find that privatization in China is associated with productivity improvements within the range of effects found in the earlier literature on Eastern European and CIS countries that were formally affiliated with the Soviet Union, with the magnitude on the high end of the range. Since privatization is not a random event, we then address the time-varying selectivity of privatizations with the dummy variable of the local politician's age exceeding 58. Results from the instrumental variable estimation show that privatizations lead to dramatic increases in firms' productivity by more than 170 percent, an order of magnitude higher than that based on the workhorse model of firm fixed effects. Privatizations also have strong and positive effects on profitability. Moreover, we find the privatization effects are

higher in regions with lower government intervention, which suggests that marketization facilitates effective privatization.

Our paper adds to the literature on privatization effects around the world. Most of the previous studies find that privatization tends to be associated with better firm performance, while some other studies show that government ownership is not necessarily less efficient than private ownership.[5] Part of the reason for this diversity in the findings is no doubt due to the selective nature of privatization (Djankov and Murrell 2002; Estrin et al. 2009; Dinc and Gupta 2011). Perhaps because of the difficulties in finding excludable instruments—and the non-existence of randomization in privatization of SOEs—most existing studies of privatization rely on before-after changes or the firm fixed effect specification, or the firm-specific random-growth model.[6] Such specifications cannot deal successfully with the selectivity of privatization with respect to time-varying firm characteristics that might be important for privatizations.[7] We contribute to the discussion by using the natural experiment of privatizations caused by the rule-based career incentives of local politicians to identify the causal effects of privatization. Furthermore, we add to the literature on privatization effects by adding credible evidence from China, a key region that has seen more privatizations than anywhere else in the world (Megginson 2017), but is lacking credible evidence on the effect of privatization on productivity (Estrin et al. 2009). By demonstrating large causal effects of privatization in China, we offer evidence that the privatization of SOEs was a key factor behind China's economic takeoff.

We also contribute to the literature on the politics of privatization. The role of political factors in shaping privatization decisions is studied both theoretically (Biais and Perotti 2002)

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[5] On positive effects of privatizations, see Megginson, Nash and Van Randenborgh (1994), Boubakri and Cosset (1998), La Porta and Lopez-de-Silanes (1999), D'Souza and Megginson (1999), Megginson and Netter (2001), Claessens and Djankov (2002), Gupta (2005), Djankov and Murrell (2002), Li and Xu (2004), and Estrin et al. (2009). On doubts on positive effects of privatization, see Caves and Christensen (1980), Kole and Mulherin (1997), and Anderson, Lee and Murrell (2000).

[6] A partial list of the papers relying on the firm fixed effects specification includes Megginson, Nash and Van Randenborgh (1994), Boubakri and Cosset (1998), La Porta and Lopez-de-Silanes (1999), Frydman et al. (1999), Claessens and Djankov (2002), D'Souza, Megginson and Nash (2005), Boubakri et al. (2005), Bai, Lu and Tao (2009), Jefferson and Su (2006), and Brown, Earle and Telegdy (2006, 2016).

[7] Dinc and Gupta (2011), in a more credible identification strategy, use political incentives of local politicians in India as the instrumental variable for privatization to identify the effects of privatization.

and empirically (Clarke and Cull 2002; Li and Xu 2002; Megginson 2005; Dinc and Gupta 2011). The privatization decisions are found to depend on firm performance (Du and Liu 2015), local economic conditions (Clarke and Cull 2002), politic costs in terms of local employment losses (Guo and Yao, 2005; Dinc and Gupta 2011; Gan, Guo and Xu 2017), and political benefits in terms of strength of pro-privatization interest groups (Li and Xu 2002). We contribute by demonstrating that in a non-democratic country, the rule-based career concerns of local politicians materially affect privatization decisions and thus economic efficiency.

2. Institutional Background

The political promotion system in China had a pronounced effect on the implementation of the privatization program.

Politician Promotion System in China

Different from the election-based selection of officials in democracies, China has a one-party top-down appointment system where local officials are appointed by the Organization Department of the Communist Party in the ladder directly above in the hierarchy (McGregor 2010). The promotion of a politician depends on their ability to deliver on key priorities of the central government such as economic growth, fiscal revenue, the maintenance of political order, among others (Maskin, Qian, and Xu 2000; Li and Zhou 2005; Xu 2011; Shih, Adolph and Liu 2012; Jia, Kudamatsu and Seim 2015; Yao and Zhang, 2015).

The incentives of Chinese local politicians change over their political careers, declining dramatically as they cross certain age thresholds (Kou and Tsai 2014; Gao, Long and Xu 2016). Age restrictions were first introduced as promotion regulations in the early 1980s, as part of the effort by Deng Xiaoping to retire elderly politicians and promote the vigor of the cadre body.[8] Under this regulation, all politicians except members of the Politburo faced strict non-promotion ages. For senior politicians at the level of provincial governors or ministers, the mandatory retirement age is 65. For all other politicians at lower levels, the mandatory non-promotion age is 60. The result is a rigid and step-by-step promotion timeline with few

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[8] See *The Decision by the Central Committee of the Communist Party of China on the Establishment of a Retirement System for Old Cadres (No. 13, 1982)* (i.e.《中共中央关于建立老干部退休制度的决定》通知, 中发 13 号, 1982).

exceptions. Strict non-promotion ages, in combination with designated and lengthy periods of tenure at each level, cause career stagnation a few years prior to the mandated retirement age. The retirement age of mayors and party secretaries at the *prefectural city* level is set at 60, and this would not change even if they are promoted to the next level of positions, e.g. deputy provincial governors. If the politician has not finished his five-year tenure when they reach the retirement age, they are usually given a maximum of two-year extension to finish their tenure. If the local politician is promoted to the next higher position *after* age 58, he will not be able to finish his tenure. To avoid this disorder in the tenure system, when a local politician reaches age 58, he is unlikely to be promoted—instead, he is likely to retire or be transferred to a ceremonial position (Xi, Yao and Zhang 2018). As a result, an upper bound of age 57 is implicitly imposed for officials at the prefecture level or below, and this rule is commonly referred to as "Seven-Up, Eight-Down (*Qishangbaxia*)."

Privatization in China

After China started market-oriented reforms in 1978, the profits and taxes per unit of net capital stock and working capital in industrial SOEs had fallen from 24 percent in 1978 to 7 percent in 1996 (Qian 2000), and more than one-third of SOEs had losses in 1996. Starting from the mid-1990s, China started to rejuvenate its ill-performing SOEs by incorporating private and foreign shareholders. Meanwhile, the affiliation and regulatory power of many SOEs was commensurately decentralized to the local governments (Xu, Zhu and Lin 2005; Xu 2011). The rising losses of SOEs and the heavy fiscal burdens on local governments fueled the pace of large-scale privatization in the late 1990s. In 1997, the central government officially announced its policy to restructure the state sector by allowing local governments to experiment with different ways to restructure SOEs. To facilitate economic turnaround, local governments were encouraged to privatize SOEs. In the Annual Survey of Industrial Firms (ASIF) used in this study, which accounts for the vast majority of Chinese industrial firms in terms of value added and employment, roughly 80% of local SOEs had been privatized by 2009.

Given the extraordinary scale of Chinese privatization and its potential implications, the number of studies on the impact of Chinese privatization is surprisingly small (Bai, Lu and Tao

2009; Du and Liu 2015; Gan, Guo and Xu 2017).[9] One of the reasons for this scarcity might be the difficulty in dealing with the selection bias in China's privatization process. The slogan of the restructuring reform was to "grab the big and to let go of the small." To "grab the big," large and important SOEs were corporatized and consolidated; to "let go the small," small and loss-making SOEs were mostly privatized. The government's discretion and selection in the privatization process makes the evaluation of the causal impact of privatization complicated. To identify the causal effects of privatization in China, we explore exogenous factors in the political promotion mechanism that could be used to address the selection bias associated with privatizations.

In China there might be a strong link between local politicians' promotion incentives and the privatization decision of local SOEs, which was under the control of the local government (Huang et al. 2017). Privatization entails significant costs for politicians, depriving their overt political connections with SOEs under their oversight, and therefore the associated control benefits. Moreover, privatization is usually followed by massive layoffs as part of the restructuring efforts, especially for the loss-making SOEs in this period. Indeed, between 1997 and 2002, over 27 million SOE workers, or about 27% of total SOE employment in 1997, had been laid off (Dong and Xu 2008). These layoffs would cost politicians some local support, though such support is not essential for their careers. On the other hand, privatization likely enhances corporate performance and thus delivers higher fiscal revenues and GDP growth (Chen et al. 2008; Bai, Lu and Tao 2009; Calomiris, Fisman and Yang 2010). Higher fiscal revenue and GDP growth likely boost the politician's chance of promotion (Maskin, Qian, and Xu 2000; Li and Zhou 2005; Xu 2011; Shih et al. 2012; Persson and Zhuravskaya 2016). Thus, in deciding whether to privatize a local SOE, local politicians face the trade-off between the benefit of economic gains and the cost of local unemployment and of the loss of control benefits. At the time of financial losses of SOEs in the late 1990s, due to sharp drops in rent associated with SOEs, political resistance to privatizations under the Chinese political system should be much lower than in the democratic societies, and the importance of local politicians looms especially large for privatization decisions. In particular, local politicians younger than 58,

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[9] See in the introduction other references on privatizations, especially share issue privatizations, in China.

facing stronger likelihood of promotion that would be enhanced by better economic performance coming with privatization, would be more eager to seek privatizing SOEs under their oversight.

3. Data

Our data set is the Annual Survey of Industrial Firms (ASIF) from 1998 to 2009 collected by China's National Bureau of Statistics. It includes *all* SOEs and all non-state firms with sales above five million yuan in the industrial sectors, accounting for about 90% of total industrial output value in China.[10] Since our goal is to study the incentives of local politicians (i.e., politicians at the prefectural city level or below),[11] we only keep SOEs that are affiliated with local governments (defined as those SOEs with the share of local government ownership exceeding 50 percent) in our baseline regressions. In constructing our panel, we follow the best practices in fixing some identification inconsistencies.[12]

We construct a dummy variable, *Privatized*, that equals one for a firm for the privatization year and the subsequent years if it is privatized during the sample years and 0 otherwise. An SOE is classified as being privatized in two ways: staying in the database with the state share dropping below 50 percent; exiting the data set, which implies privatization, and its sales being below five million yuan or being merged with small private firms. Out of 50,030 SOEs in our sample, 40,557 had been privatized by the end of our sample period.

We match the ASIF data of SOEs with a data set on local politicians in China, i.e., party secretaries in the prefectural-level cities. The politician data set has details of their personal information (age, gender, and education), as well as their career path (the appointment date, the next deputation, and promotions/demotions). We use provincial yearbooks for the names of city-level party secretaries, and search their resumes to identify their personal characteristics and career trajectory.[13] Macroeconomic variables including the city-level GDP and the

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[10] The industrial sector in this data set includes mining and manufacturing.

[11] Whenever referring to "local" we mean the prefectural-level city or below, which includes the county-level.

[12] A common issue that must be addressed when constructing a panel drawn on the ASIF data is that a small proportion of firms occasionally receives a new identification code due to restructuring, merger, or acquisition. See Appendix A for details on how we follow best practice in dealing with this issue.

[13] The primary internet sources are resumes of the politicians posted on the government website as well as Baidu Baike (http://baike.baidu.com/), a Chinese version of Wikipedia.

population are from China City Statistical Yearbook.[14] All time-varying variables are adjusted to the 1990 constant price with the province-specific GDP deflators from the China Statistical Yearbook.

Local party secretaries, with the greatest *de jure* and *de facto* power at all government levels in China (McGregor, 2010), have the ultimate decision power on the privatization of local SOEs. These officials are thus our focus. For the complete list of the 294 prefectural cities in China, we could collect information on 883 party secretaries in 282 cities from 1998 to 2009.

Figures 1a and 1b illustrate the age pattern and the age-of-promotion pattern of the city-level party secretaries in our sample of 2,631 city-year observations. The age of city-level party secretaries exhibits a hump-shaped distribution from 39 to 61, peaking around the average and the median age of 52. Most local party secretaries, with only a few exceptions, leave their positions in their late 50's. The incidence of promotion falls dramatically after the age of 55 and drop to zero once a politician reaches the age of 58. Overall, these observations corroborate our earlier discussion of the role of local politicians' age in their chance of promotion.

Panels B and C of Table 1 describe the summary statistics of all main and control variables.[15] About 88% of the city-level party secretaries have higher education. A small number of local party secretaries have experience working in the central government (4.1%), while most of them have experience working in provincial governments (55.1%). The SOEs in our sample generally displayed poor performance: the average leverage ratio is as high as 72%, whereas the return to asset (ROA) is low, with the averages being -0.3%, making slight losses.

4. Effects of Politicians' Age on Privatization

We provide evidence that privatization decisions are closely related to the age of city party secretaries. We first employ an ordinary least square (OLS) regression of the privatization dummy on a series of age dummies and control variables as follows:[16]

$$Privatized_{icjt} = \beta_0 + \sum_s \beta_s Age_{sct} + \delta X_{ict} + \alpha_c + \varphi_j + \gamma_t + \varepsilon_{it} \qquad (1)$$

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[14] Four municipalities, Beijing, Shanghai, Tianjin and Chongqing are under the direct administration of the central government and have the same rank as provinces. Thus, our sample does not include these four municipalities.

[15] We report summary statistics for two samples, one used for the determinants of privatization, which cut the post-privatization observations for a firm, and another used for the effects of privatization, which keep all post-privatization observations.

[16] The results based on probit analysis are of course very similar and not reported.

The dependent variable, $Privatized_{icjt}$, is the dummy variable indicating whether an SOE i in city c and two-digit industry j is privatized in year t. Since privatization is rarely reversed, each SOE's observations after the year of privatization are dropped from the sample for the *current* empirical exercise. Age_{sct} refers to a series of age dummies of the party secretary, being one if the party secretary in city c and year t is s years old, with s taking the values of 51 and above. We treat party secretaries younger than age 51 as the reference group. We include city, industry and year fixed effects, and cluster the standard errors at the city level to accommodate for correlation in the error term within a city.

We control for firm characteristics, the party secretary's background, and the city's macro conditions (i.e., X_{ict}). The firm-level characteristics, all once-lagged, include labor productivity (*Labor prod*, the logarithm of the ratio of sales to the number of employees), the leverage ratio, the logarithm of total employees, and the return on asset (*ROA*). The characteristics of party secretaries include the indicator of having college education (*College*), the indicator of having work experience in the central government (*Central Experience*), and in the provincial government (*Provincial Experience*). The macroeconomic conditions in the city include the GDP growth rate and GDP per capita at the city level.

According to the OLS results in Table 2, the probability of the privatization of local SOEs drops abruptly when the age of the local party secretary passes the threshold of 58. The coefficients of the age dummies for age between 51 and 57 are all statistically insignificant, indicating no differences in the tendency to pursue privatization relative to that of a younger politician. However, when he becomes 58 years or older, the probability of an SOE proceeding with privatization drops by 4 percentage points. This is a large magnitude: relative to the mean of the privatization dummy of 0.209, it represents an increase of the probability of the privatization of 20.6 percent.[17] The results are robust to the inclusion of various sets of control variables, such as lagged firm performance, city-level macroeconomic conditions, and the party secretary's education and work experience. Local politicians are thus much less likely to pursue privatization of local SOEs after age 58, when they are passed over for promotion.

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[17] The coefficient of the dummy variable of age 60 is insignificant, perhaps reflecting that this age cell has too few observations (see Figure 1a).

There is apparent selectivity of privatizations based on firm characteristics. Smaller SOEs are more likely to be privatized, consistent with the government's mandate of restructuring SOEs by "grabbing the big and letting go the small." SOEs with higher leverage, representing higher fiscal burden, are more likely to be privatized. More importantly, worse-performing SOEs are more likely to be privatized, as shown by the negative signs of lagged labor productivity and profitability. Since all these firm characteristics are time-varying, controlling for firm fixed effects is unlikely to be sufficient in dealing with the endogeneity of privatizations.

Regression Discontinuity Design

The OLS estimation may yield biased estimates when there are unobservable differences between different cities governed by young or old politicians. Because, as discussed earlier, city party secretaries experience a significant drop in their probability of promotion from age 58 forward, we could rely on the regression discontinuity design (RDD) to address the selectivity associated with cities governed by young and old politicians. Assuming that unobserved variables vary smoothly around the age threshold (i.e., age 58), any discontinuity in the probability of privatization around this threshold should reflect the causal effects of the age-promotion rule. We use the following specification for the RDD estimation:

$$Privatized_{ijct} = \beta_0 + \beta_1 Dum(Age \geq 58)_{ct} + f(Age_{ct}) + \delta X_{ict} + \alpha_c + \varphi_j + \gamma_t + v_{it} \quad (2)$$

Where $Dum(Age \geq 58)_{ct}$ is a dummy variable that equals one if the local official's age is equal to or older than 58, and 0 otherwise. Age_{ct} is the running variable, and $f(Age_{ct})$ represents a flexible function of the official's age to account for different slopes on the two sides of the cutoff point. β_1 captures the decline in the probability of privatizations after the cutoff age of 58 for the city party secretary.

Estimating equation (2) could be done in two complementary ways, which provide a mutually reinforcing specification check (Lee and Lemieux 2010). The first is the parametric global polynomial approach in which we can control for a parametric function, i.e., a high-order polynomial (second or third order), in the running variable, and we use all the available data to estimate these equations. The second is the nonparametric local linear approach, in which we use a narrow bandwidth near the cutoff and control for a linear polynomial. We limit

the sample to consist of observations with the age of a city secretary in the range of 55-61 years old, using a bandwidth of ±3 years of age.[18]

The validity of the RDD approach relies on the "smoothness assumption," i.e., all the predetermined firm-level characteristics vary smoothly across the threshold (Imbens and Lemieux 2008). Therefore, to ensure the validity of the RDD, we conduct balance tests on the following variables: labor productivity, the leverage ratio, the logarithm of total employees, and the return on sales, all of which are once-lagged. Specifically, we estimate regressions of the form described in equation (2) using these characteristics as dependent variables. We use a local linear approach, and cluster the standard errors at the city level. The results in Table 3 show that the dummy variable of the party secretary being age 58+ is never significant in the balance test regressions, indicating that these characteristics do not significantly differ across this age threshold. Predetermined firm-level characteristics are thus balanced between those firms associated with the group of the older and of the younger party sectaries.

Columns (1) to (4) of Table 4 report the RDD results. The third-order results are shown in columns (1) to (2).[19] We focus on the coefficient of the indicator of the party secretary's age being 58 and older, which should be significantly negative if there is a sharp decline in the tendency of local politicians to pursue privatizations. This pattern is confirmed: the coefficient of the indicator of the party secretary's age being 58 and older is -0.050 and statistically significant, representing a drop in the privatization probability at the mean by about a quarter. The RDD results using the non-parametric local linear approach, in columns (3) and (4) of Table 4, remain similar. In column (4), the coefficient for the indicator of the party secretary's age being 58 and older is significant at -0.048. The results suggest that under China's age-promotion profile rule, the career concerns of city-level politicians have profound influence on their decisions to privatize local SOEs.

Placebo Test: Central and Provincial SOEs

We have shown that city-level politicians, once crossing the age threshold of non-promotion, are reluctant to privatize local SOEs. It is possible that some city-level factors correlated with

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[18] For simplicity, we manually set the regression bandwidth. Note that we have very limited choices of bandwidth here with the upper bound of age being 62 years old.

[19] The results using the quadratic specification of the running variable are similar.

the age of politicians might play a role in the privatization process. If the age-cutoff effect only reflects local politicians' incentives, it should appear only in the privatizations of SOEs under the control of the local politicians. In other words, the privatization of SOEs under the oversight of the *central* or *provincial* governments, although located in the same cities, was not determined by local politicians, and these SOEs' privatization should not be affected by the age and promotion incentives of city-level politicians.

We thus conduct a placebo test by exploiting the central and provincial SOEs sample to rule out the effect of any unobservable city-level factors. Among the sample of 9,813 central and provincial SOEs, 8,695 of them had been privatized in the sample period. We re-conduct the RDD regressions with the new sample and expect that the relationship between the age of the *local* politician and the privatization of these non-locally-governed SOEs does not change abruptly. The results are shown in Table 5. The coefficients of the local party secretary's age being 58 and older are insignificant in both the parametric and the non-parametric RDD. The magnitude of all point estimates is much smaller than those reported in Table 4. The placebo test thus suggests that unobservable local factors do not explain our previous results on the age threshold effect of local politicians on privatization of local SOEs.

Robustness Test: Other Definitions of Privatization

In our baseline results, we use a broad definition of SOE privatization: an SOE is considered to be privatized when the firm's state shares dropping below 50 percent, or when they exit the database. Since the ASIF data include all SOEs and all private firms with sales above 5 million yuan, when an SOE exits the database, it could only be three cases: (i) merging with private firms, which is clearly privatization; (ii) the SOE is privatized and the post-privatization sales drop below 5 million yuan, which again is privatization; (iii) merging with an SOE, in which case classifying the exited firm as being privatized causes misclassification. Case (iii) is a likely a small-probability event, and it can still be regarded as one way of SOE restructuring. Nevertheless, it is a misclassification of privatization. To check the robustness of our conclusions, we re-conduct the main regressions using a narrow definition of privatization, i.e. the criterion of the state share dropping below 50 percent for firms remaining in the database. We reach similar results using this narrow definition of privatization in both the OLS regression

and the RDD regressions (see appendix B for details). The drops in the probability of privatization for ages 58 and 59 remain large and statistically significant, with the magnitude being similar for age 59, and slightly smaller for age 58. When using the various RDD approaches, the qualitative and quantitative conclusions on the age threshold on the privatization likelihood also remain robust.

5. Effects of Privatization on Firm Productivity

We first present estimates on the association of privatizations and productivity based on the conventional specification, with and without, firm fixed effects. We then rely on the promotion discontinuity in the age of local politicians to identify the causal effects of privatization. We finally investigate how the privatization effects differ by local government activism.

Effects of Privatization Based on the Conventional Estimators

When estimating the effects of privatization on firm performance, each SOE's post-privatization observations are included in the sample. As noted above, our baseline definition of privatization is broad, that is, an SOE is considered to be privatized when the firm's state share dropping below 50 percent, or when they disappear from the database. However, when examining the effects of privatization, since we must have observations of post-privatization performance, the "SOE-exiters" are deleted in the sample here, and our broad and narrow definitions of privatization coincide. Our estimation of the privatization effects is thus subject to a caveat. The estimated effects do not represent the effect of privatization on privatized firms that were merged or those privatized firms whose sales fell under the threshold of five million yuan.

We first estimate two conventional specifications from the literature: the ordinary least square (OLS) model, and the firm fixed effect (FE) model:

$$Y_{ijct} = \beta_0 + \beta_1 Privatized_{ijct} + \delta Z_{ct} + (X_i * \lambda_t)'\theta + \gamma_i + \rho_{jt} + \varepsilon_{it} \qquad (3)$$

Here Y_{ijct} is the performance measures of firm i of city c and industry j in year t. We measure the performance of the firm using several measures of the total factor productivity, in particular, those based on the OLS approach (TFP_OLS), those based on the Olley-Pakes approach (TFP_OP), and those based on the index function approach (TFP_IN); all three measures are

closely correlated, with pair-wise correlation coefficients around 0.95. See appendix C for details of the constructions of these and other TFP measures.[20] The various measures of TFP have the virtue of capturing productive efficiency, and using various popular ways to measure TFP allows us to ensure the robustness of the productivity results. We in addition consider two alternative outcomes: labor productivity (*Labor Prod,* measured as the logarithm of sales per employment) and ROA, respectively. Labor productivity is more transparent, but it does not capture differences in inputs. We also look at the ROA because improving profitability was an objective of the SOE restructuring program. The dummy variable, $Privatized_{ijct}$, equals one for all the years after firm *i* has undertaken privatization and 0 otherwise. We control for Z_{ct}, the city-level macro variables (i.e., *GDP Per capita* and *GDP Growth*). We further control for industry-year fixed effects, ρ_{jt}, and the interaction terms between the firm-level pre-treatment characteristics, X_i, and year dummies, λ_t, in the regressions, thereby flexibly controlling for the time-varying effects of such characteristics on the outcome variables. In the OLS specification, we do not, but in the firm fixed-effects specification, we do control for the firm-level fixed effects γ_i. The FE specification has the advantage of controlling for all firm-specific time-invariant factors, but it cannot account for the endogeneity of privatization based on selection on time-varying firm factors.

According to the OLS results in Panel A of Table 6, privatizations are invariably associated with a large effect on firm productivity or profitability. Privatizations are associated with a higher TFP_OP or TFP_IN by 20-22 log points,[21] and a higher labor productivity by 26 log points. Privatizations are also associated with an increase in profitability by 1.1 percentage points.

According to the firm-FE results in Panel B of Table 6, the magnitudes of the privatization effects are in the same ballpark as the OLS estimates, though slightly smaller. Privatization is associated with an increase in TFP_IN and in TFP_OP by 14 and 16 log points, respectively. The TFP effects are all slightly smaller than the labor productivity effects of 17.7 log points.

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[20] In constructing the index function TFP (*TFP_IN*), we rely on factor shares based on OECD countries (Bentolila and Saint-Paul 2003). We have also tried using the factor shares based on our own data and obtained qualitatively similar conclusions. Using factor shares based on our own data is inappropriate since the factor shares reflect choices associated with privatization itself and are thus contaminated. See appendices C and D.

[21] We focus on TFP_OP and TFP_IN because they better deal with various biases associated with estimating TFP using the OLS method. But results using all three TFP measures are qualitatively very similar.

The FE estimate of the privatization effects on productivity is located at the high end of the spectrum of the privatization effects in the literature. For instance, Brown, Earle and Telegdy (2006) find the productivity effects to be around 15-50 percent in Romania, 8-28 percent in Hungary, 2-16 percent in Ukraine, and -5 to 14 percent in Russia. Estrin et al. (2009) similarly would place our FE estimate of around 15 percent at the high-end of the estimates in Eastern European and the CIS countries. In addition, privatization is positively associated with ROA by 1.2 percentage points, or an increase of 0.1 standard deviation (11.2 percent).

The preferred specification in two key papers of the literature on privatization effects (Brown, Earle and Telegdy 2006; Brown, Earle, and Gehlbach 2009), likely an important improvement over the firm fixed effects model, is to allow for firm-specific random growth rates, as in the impact evaluation literature (Heckman and Hotz 1989). In particular, besides firm fixed effects, this fixed-effects and fixed-trend (FE-FT) specification allows for firm-specific fixed effects and growth rates, as follows:

$$Y_{ijct} = \beta_1 Privatized_{it} + \delta Z_{ct} + (X_i * \lambda_t)'\boldsymbol{\theta} + \gamma_i + t\tau_i + \delta_t + u_{it} \qquad (5)$$

In practice, the FE-FT model is estimated in two steps: first detrending all variables for each firm separately, and then re-estimating the model with these detrended variables. The results are shown in Panel C of Table 6.

The effects based on the FE-FT specification are qualitatively similar to the FE estimation, but significantly smaller. For instance, the effect of privatization based on TFP_IN is 2.6 log points, roughly 20 percent of the FE estimate. Similarly, the FE-FT estimate of the effect of privatization on labor productivity is 5.7 log points, or about 30 percent of the FE estimate. These FE-FT estimates would place the productivity effects of privatization in the middle of the range found in the literature (see Estrin et al. 2009).

Based on the OLS, the FE, and the FE-FT estimations, privatizations in China had positive associations with productivity, and the magnitude ranges from moderate (such as 3 log points based on the FE-FT specification) to large (such as 16 log points based on the FE specification).

Instrumental Variable Estimation

As shown before, the privatization of SOEs is strongly related to time-varying firm characteristics. To deal with the endogeneity issue, we use the following two-stage, least

squares specification under a fuzzy regression discontinuity framework. We use the dummy variable of the local politician's age being 58 and older (i.e., *Dum(Age≥58)*) as the instrument variable for the privatization decision. We control for the second-order polynomial of the running variable (i.e., the politician's age) and other control variables as in equation (3).

$$Privatized_{i,jct} = \alpha_0 + \alpha_1 Dum(Age \geq 58)_{ct} + f_1(Age_{ct}) + \delta_1 Z_{ct} + (X_i * \lambda_t)' \boldsymbol{\theta_1} + \gamma_{1i} + \rho_{1jt} + v_{it}$$

$$Y_{i,jct} = \beta_0 + \beta_1 Privatized_{i,jct} + f_2(Age_{ct}) + \delta_2 Z_{ct} + (X_i * \lambda_t)' \boldsymbol{\theta_2} + \gamma_{2i} + \rho_{2jt} + \varepsilon_{it} \qquad (6)$$

The IV regressions are reported in Panel D of Table 6. The first-stage results show that *Dum(Age≥58)* is negatively related to privatization, as documented before. The F-statistics of *Dum(Age≥58)* in the first stage are close to 20, suggesting that the instrument variable is not weak (Staiger and Stock 1997). The second-stage estimation suggests that after dealing with endogeneity, privatization improves TFP_IN by around 100 log points (or 173 percent), TFP_OP by 143 log points (or 318 percent), an order of magnitude larger than the FE- or FE-FT-based estimates. Similar patterns also exist for labor productivity and ROA. The effects of privatization on profitability, for instance, is many times higher than those based on the FE or the FE-FT specifications.

Since the literature places the effects of privatization somewhere between no effects (or even negative effects) and large (i.e., more than 15 percent) (Brown, Earle and Telegdy 2006; see also Estrin et al. 2009), our estimates of the causal effects of privatization on productivity is an order of magnitude larger than what the literature finds in the rest of the world. Thus, the OLS, the firm-FE and the FE-FT specifications likely substantially underestimates the causal effects of privatization. This is not surprising, since we know from the institutional background that privatization is likely negatively selected on time-varying firm characteristics: under the Chinese SOE restructuring/privatization program, local governments explicitly tried to let go of loss-making SOEs, and had strong incentives to keep well-performing SOEs for control benefits. The findings here suggest that the causal effects of privatization in China are, in magnitudes, not marginal or modest, as suggested by the conventional estimators based on the OLS of the firm-FE estimation, but transformational based on the plausible instrumental variable.

Government Influence and the Effects of Privatization on TFP

Chinese local governments have been heavily involved in local firms, especially in SOEs and privatized firms (Cull et al. 2015; Harrison et al. 2019). As discussed earlier, pundits have argued over whether Chinese growth has been due to heavy-handed government guidance or allowing the market to work. To shed light on this key concern, here we examine how the effects of privatization depend on government activism in dealing with firms in general. The more the government remains active in dealing with firms, the less privatized firms act like true private firms, and thus the effects of privatization are likely smaller. Indeed, Harrison et al. (2019) offer evidence that Chinese privatized firms behave like a mixture of SOEs and private firms, still enjoying subsidies from the government, and performing more poorly than true private firms but nevertheless having significantly better performance than SOEs. Thus, where the government is more active, privatized firms are more likely to behave like SOEs, and we expect the effects of privatization to be more muted.

Our proxy of the extent of government activism is based on the World Bank Enterprise Survey data in 120 Chinese cities in 2005. In the survey, the firm is asked to rate "the percent of officials in various government departments that facilitate the development of the firm," which captures the strength of interactions between the government and the firm. This variable is averaged to the city level to capture regional variations. In Panel A of Table 7, we provide the firm-FE and the IV estimates of the effect of privatization that hinges on our proxy of government activism.[22]

Consistent with our expectation, the effects of privatization are significantly lower where local government activism is stronger. Relying on the IV estimate and TFP_IN, the average effects of privatization on productivity is 102 log points at the mean level of local government activism (i.e., 0.407), and it is 180 log points at one standard deviation (i.e., 0.213) below the mean. Government activism thus reduces the effects of privatization.

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[22] Using the same logic as before, the privatization dummy's instrumental variable is the dummy of the age of the local party secretary is 58 or older, and the instrumental variable for the interaction term of privatization and local government activism is the latter times the dummy of the age of the local party secretary being 58 or older.

6. Conclusion

Our paper deals with two critical issues in the literature of privatization: the lack of convincing identification of privatization effects due to the selectivity on time-varying firm characteristics, and the lack of understanding of the causal effects of privatization on productivity in the country where the scale of privatization has been the greatest. To address these issues, we take advantage of the bureaucratic rules surrounding the promotions of local politicians, wherein their chance of promotion drastically drops once crossing the age threshold of 58. After empirically confirming this pattern, we use the dummy variable of city party secretaries crossing the age threshold as the instrument to identify the effects of privatization in firm productivity regressions, while allowing the age of the city party secretaries to have direct effect. We find that, without controlling for time-varying selectivity and using the OLS, the firm fixed-effects and/or the firm random growth specifications, privatization in China is associated with productivity improvements within the range of effects found in earlier literature on Eastern European and CIS countries, on the relatively high end of the spectrum of those estimates. However, once addressing the time-varying selectivity of privatization with our RDD instrument, the effects of privatization increase to more than 170 percent, an order of magnitude higher than the workhorse fixed-effects estimate. Privatizations also have strong and positive effects on profitability. Privatizations thus drastically transform the loss-making SOE sectors. Moreover, we find the privatization effects to be much higher in regions with lower government activism, which implies that marketization and privatization are complements.

Our findings have several implications. First, in light of the large disparity between our RDD-based instrumental variable estimates and those of conventional fixed-effects-based specifications, the causal effects of privatization were likely substantially underestimated in the past. In other words, negative selectivity based on time-varying characteristics of SOEs could be of first-order importance. Future studies of the effects of privatization should seriously address the importance of selectivity on time-varying factors. This selectivity is indeed intuitive: SOE performances vary greatly over time, depending on the entry barriers to non-state firms, market competition, among other factors, all of which vary over time. Only *when* SOEs

perform badly and pose serious fiscal burdens does the government then have strong incentives to privatize, as in the case of China in the late 1990s in the Zhu Rongji era. Second, because China features the largest privatization program in the world, and we have found the privatization effects to be transformative, the privatization program must be viewed as a critical component for China's growth since the mid-1990s. Recently, in many countries and perhaps especially in China, state capitalism where the government is strongly involved in running corporations has become more popular (Megginson 2017). Reevaluating the role of privatization in China's growth has thus become even more important. In light of SOEs' non-trivial share of the Chinese economy (Huang et al. 2017) and China's slowing down in growth, further privatizations should clearly be considered for the future. Relatedly, our finding that stronger local government activism in firm affairs reduces the effects of privatization also underscores the importance of reducing the interference of governments in firms' business affairs.

Our findings here should not be interpreted as implying huge causal effects of privatization in every institutional context. The privatization literature has emphasized repeatedly that the effects of privatization depend critically on the underlying institutional background. When China's then premier Zhu Rongji undertook the privatization program in the late 1990s, SOEs were on average losing money, and their performance was at the lowest level possible. Political opposition to privatization was low, and local governments could experiment with various ways to privatize SOEs. Moreover, the liberalization reforms in the 1980s set up a solid platform for privatized firms to prosper (Li, Li and Zhang, 2000; Huang 2012). The huge causal effects of privatization for the Chinese SOE privatization program thus have their favorable pre-conditions and are likely to hold only in countries with a large loss-making SOE sector and favorable pre-privatization conditions such as strong competition. Nevertheless, our findings imply that in many contexts, the effects of privatization are likely under-estimated in important ways. Thus, future research in different institutional contexts that relies on credible identification strategies is important to uncover the distribution of causal effects of privatizations around the world.

Reference

Anderson, J. H., Y. Lee, and P. Murrell. 2000. Competition and privatization amidst weak institutions: evidence from Mongolia. *Economic Inquiry* 38(4), 527-549.

Bai, C. E., J. Lu, and Z. Tao. 2009. How does privatization work in China? *Journal of Comparative Economics* 37(3), 453-470.

Bardhan, P., and J. E. Roemer. 1992. Market socialism: a case for rejuvenation. *Journal of Economic Perspectives* 6(3), 101-116.

Bardhan, P., and J. E. Roemer. 1993. *Market socialism: the current debate*. Oxford University Press, USA.

Bentolila, S., and G. Saint-Paul. 2003. Explaining movements in the labor share. *Contributions in Macroeconomics* 3(1).

Berkman, H., R. A. Cole, and L. J. Fu. 2010. Political connections and minority shareholder protection: Evidence from securities-market regulation in China. *Journal of Financial and Quantitative Analysis* 45(6), 1391-1417

Biais, B., and E. Perotti. 2002. Machiavellian privatization. *American Econ. Rev.* 92(1), 240-258.

Boubakri, N., and J. C. Cosset. 1998. The financial and operating performance of newly privatized firms: evidence from developing countries. *Journal of Finance* 53(3), 1081-1110.

Boubakri, N., J. C. Cosset, K. Fischer, and O. Guedhami. 2005. Privatization and bank performance in developing countries. *Journal of Banking and Finance* 29(8-9), 2015-2041.

Brown, J. David., J. S. Earle, S. Gehlbach. 2009. Helping hand or grabbing hand? state bureaucracy and privatization effectiveness. *American Political Science Rev.* 103(2), 264-283.

Brown, J. D., J. S. Earle, and A. Telegdy. 2006. The productivity effects of privatization: longitudinal estimates from Hungary, Romania, Russia, and Ukraine. *Journal of Political Economy* 114(1), 61-99.

Brown, J. D., J. S. Earle, A. Telegdy. 2016. Where does privatization work? Understanding the heterogeneity in estimated firm performance effects. *J. of Corporate Finance* 41(1), 329-362.

Brandt, L., J. Van Biesebroeck, and Y. Zhang. 2012. Creative accounting or creative destruction? firm-level productivity growth in Chinese manufacturing. *Journal of Development Economics* 97(2), 339-351.

Brandt, L., G. Kambourov, and K. Storesletten. 2016. Firm entry and regional growth disparities: the effect of SOEs in China. Working Paper, University of Toronto.

Calomiris, W. C., R. Fisman, and Y. Yang. 2010. Profiting from government stakes in a command economy: evidence from Chinese asset sales. *Journal of Financial Economics* 96(3), 399-412.

Caves, D. W., C. Laurits. 1980. The relative efficiency of public and private firms in a competitive environment: the case of Canadian railroads. *J. of Political Economy* 88(5), 958-976.

Chen., G., M. Firth, Y. Xin, and X. Liping. 2008. Control transfers, privatization, and corporate performance: Efficiency gains in China's listed companies. *Journal of Financial and Quantitative Analysis* 43(1), 161-190.

Clarke, G. R., and R. Cull. 2002. Political and economic determinants of the likelihood of privatizing Argentine public banks. *The Journal of Law and Economics* 45(1), 165-197.

Claessens, S., and S. Djankov. 2002. Privatization benefits in Eastern Europe. *Journal of Public Economics* 83(3), 307-324.

Cull, R., W. Li, B. Sun, and L. C. Xu. 2015. Government connections and financial constraints: evidence from a large representative sample of Chinese firms. *Journal of Corporate Finance* 32(1), 271-294.

Dinc, I. S., and N. Gupta. 2011. The decision to privatize: finance and politics. *The Journal of Finance* 66(1), 241-269.

Djankov, S., and P. Murrell. 2002. Enterprise restructuring in transition: a quantitative survey. *Journal of Economic Literature* 40(3), 739-792.

Dong, X. Y., and L. C. Xu. 2008. The impact of China's millennium labor restructuring program on firm performance and employee earnings. *Economics of Transition* 16(2), 223-245.

D'souza, J., and W. Megginson. 1999. The financial and operating performance of privatized firms during the 1990s. *The Journal of Finance* 54(4), 1397-1438.

D'Souza, J., W. Megginson, and R. Nash. 2005. Effect of institutional and firm-specific characteristics on post-privatization performance: evidence from developed countries. *Journal of Corporate Finance* 11(5), 747-766.

Du, J., and X. Liu. 2015. Selection, staging, and sequencing in the recent Chinese privatization. *The Journal of Law and Economics* 58(3), 657-682.

Estrin, S., J. Hanousek, E. Kŏcanda, and J. Svenjnar. 2009. Effects of privatization and ownership in transition economies. *Journal of Economic Literature* 47(3), 699-728.

Frydman, R., C. Gray, M. Hessel, and A. Rapaczynski. 1999. When does privatization work? The impact of private ownership on corporate performance in the transition economies. *The Quarterly Journal of Economics* 114(4), 1153-1191.

Gan, J., Y. Guo, and C. G. Xu. 2017. Decentralized privatization and change of control rights in China. *The Review of Financial Studies* 31(10), 3854–3894.

Gao, N., C. X. Long, and L. C. Xu. 2016. Collective leadership, career concern, and the Housing market in China: the role of standing committees. *Review of Development Economics* 20(1), 1-13.

Guo, K., Y. Yao. 2005. Causes of privatization in China: Testing several hypotheses. *Economics of Transition* 13(2), 211-238.

Gupta, N. 2005. Partial privatization and firm performance. *Journal of Finance* 60(2), 987-1015.

Halper, S., 2010, The Beijing consensus: how China's authoritarian model will dominate the twenty-first century, Basic Books.

Harrison, A., M. Meyer, P. Wang, L. Zhao, and M. Zhao. 2019. Can a tiger change its stripes? Reform of Chinese state-owned enterprises in the penumbra of the state. NBER Working Paper No. 25475.

Heckman, J. J., and V. J. Hotz. 1989. Choosing among alternative nonexperimental methods for estimating the impact of social programs: the case of manpower training. *Journal of the American Statistical Association* 84(408), 862-874.

Huang, Y. 2012. How did China take off? *Journal of Economic Perspectives* 20(4), 147-170.

Huang, Z., L. Li, G. Ma, and L. C. Xu. 2017. Hayek, local information, and commanding heights: decentralizing state-owned enterprises in China. *American Economic Review* 107(8), 2455-78.

Imbens, G. W., and L. Thomas. 2008. Regression discontinuity designs: a guide to practice. *Journal of Econometrics* 142(2), 615-635.

Jefferson, G. H., and J. Su. 2006. Privatization and restructuring in China: evidence from shareholding ownership, 1995–2001. *Journal of Comparative Economics* 34(1), 146-166.

Jia, R., M. Kudamatsu, and D. Seim. 2015. Political selection in China: the complementary roles of connections and performance. *Journal of the European Economic Association* 13(4), 631-668.

Kole, S. R., and J. H. Mulherin. 1997. The government as shareholder: a case from the US. *Journal of Law and Economics* 40(1), 1-22.

Kou, C. W., and W. H. Tsai. 2014. "Sprinting with small steps" towards promotion: solutions for the age dilemma in the CCP cadre appointment system. *The China Journal* 71(1), 153-171.

La Porta, R. and F. Lopez-de-Silanes. 1999. The benefits of privatization: evidence from Mexico. *The Quarterly Journal of Economics* 114(4), 1193-1242.

Lau, L. J., Y. Qian, and G. Roland. 2000. Reform without losers: An interpretation of China's dual-track approach to transition. *Journal of Political Economy* 108(1), 120-143.

Lee, D. S., and T. Lemieux. 2010. Regression discontinuity designs in economics. *Journal of Economic Literature* 48(2), 281-355.

Li, H., and L. Zhou. 2005. Political turnover and economic performance: the incentive role of personnel control in China. *Journal of Public Economics* 89(9–10), 1743–1762.

Li, K., T. Wang, Y. Cheung, and P. Jiang. 2011. Privatization and risk sharing: evidence from the split share structure reform in China. *Review of Financial Studies* 24(7), 2499-2525.

Li, S., L. Shuhe, and W. Zhang. 2000. "The Road to Capitalism: Competition and Institutional Change in China." *Journal of Comparative Economics* 28: (2):269–292

Li, W., and L. C. Xu. 2002. The political economy of privatization and competition: cross-country evidence from the telecommunications sector. *Journal of Comparative Economics* 30(3), 439-462.

Li, W., and L. C. Xu. 2004. The impact of privatization and competition in the telecommunications sector around the world. *Journal of Law and Economics* 47(2), 395-430.

Liao, L., B. Liu, and H. Wang. 2014. China's secondary privatization: perspectives from the split-share structure reform. *Journal of Financial Economics* 113(3), 500-518.

Lin, JY. 2012. *Demystifying the Chinese Economy.* Cambridge: Cambridge University Press.

Maskin, E., Y. Qian, and C. Xu. 2000. Incentives, information, and organizational form. *The Review of Economic Studies* 67(2), 359-378.

McGregor, R. 2010. The party: the secret world of China's communist rulers. New York: Harper Collins Press.

Megginson, W., and J. Netter. 2001. From state to market: a survey of empirical studies on privatization. *Journal of Economic Literature* 39(2), 321-389.

Megginson, W. 2005. The financial economics of privatization. *Oxford University Press.*

Megginson, W. 2017. Privatization, state capitalism, and state ownership of business in the 21st century. *Foundations and Trends in Finance* 11(1-2), 1-153.

Megginson, W., R. C. Nash, and M. Van Randenborgh. 1994. The financial and operating performance of newly privatized firms: an international empirical analysis. *The Journal of Finance* 49(2), 403-452.

Persson, P., and E. Zhuravskaya. 2016. The limits of career concerns in federalism: evidence from China. *Journal of the European Economic Association* 14(2), 338-374.

Pomeranz, K. 2000. The great divergence: China, Europe, and the making of the modern world economy. Princeton: Princeton Press.

Qian, Y. 2000. The institutional foundations of China's market transition. *Annual World Bank Conference on Development Economics 1999*. The World Bank, 289-310.

Ramo, J.C., 2004, The Beijing Consensus. Foreign Policy Centre.

Rodrik, D. 2006. "Goodbye Washington Consensus, Hello Washington Confusion? A Review of the World Bank's *Economic Growth in the 1990s: Learning from a Decade of Reform. Journal of Economic Literature* XLIV, 973-987.

Shih, V., C. Adolph, and M. Liu. 2012. Getting ahead in the communist party: explaining the advancement of central committee members in China. *American Political Science Review* 106(1), 166-187.

Shleifer, A., and R. W. Vishny. 1994. The politics of market socialism. *Journal of Economic Perspectives* 8(2), 165-176.

Staiger, D., and J. H. Stock. 1997. Instrumental variables regression with weak instruments. *Econometrica* 65(3), 557-586.

Stiglitz, J. E. 1994. Whither socialism. Cambridge: MIT Press.

Stiglitz, J. 2008. Is there a Post-Washington Consensus Consensus? In *The Washington Consensus Reconsidering: Toward a New Global Governance*. Edited by N. Serra and J. Stiglitz, 41-56. New York: Oxford University Press.

Sun, Q., and W. H. Tong. 2003. China share issue privatization: the extent of its success. *Journal of Financial Economics* 70(2), 183-222.

Tan, Y., X. Tian, X. Zhang, and H. Zhao. 2015. The real effects of privatization: evidence from China's split share structure reform. Kelley School of Business Research Paper: 2014-33.

Williamson, J. ed. 1990. *Latin American Adjustment: How Much has it Happened?* Washington, D.C.: Institute for International Economics.

Wu, J. 2018. China's Economic Reform Process. (Zhongguo Jinji Gaige Jincheng.) Beijing: China Macropaedia Press (Zhongguo dabaike quanshu chubanshe).

Xi, T., Y. Yao, and M. Zhang. 2018. Competence versus incentive: evidence from city officials in China. *Journal of Comparative Economics* 46(4), 1046-61.

Xu, C. 2011. The fundamental institutions of China's reforms and development. *Journal of Economic Literature* 49(4), 1076–1151.

Xu, L. C., T. Zhu, and Y. Lin. 2005. Politician control, agency problems, and ownership reform: evidence from China. *Economics of Transition* 13(1), 1-24.

Yao, Y.. 2015. Beijing Consensus. In *The Wiley Blackwell Encyclopedia of Race, Ethnicity, and Nationalism.* *https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118663202.wberen577.*

Yao, Y., M. Zhang. 2015. Subnational Leaders and Economic Growth: Evidence from Chinese Cities. *Journal of Economic Growth* 20(4), 405-436.

Zhang, W. 2019. The China model view is factually false. *Journal of Chinese Economic and Business Studies,* DOL: 10.1080/14765284.2019.1663696.

Zhu, X. 2012. "Understanding China's Growth: Past, Present and the Future." *Journal of Economic Perspectives* 26(4), 103-124.

Figure 1a: Distribution of local politicians' age
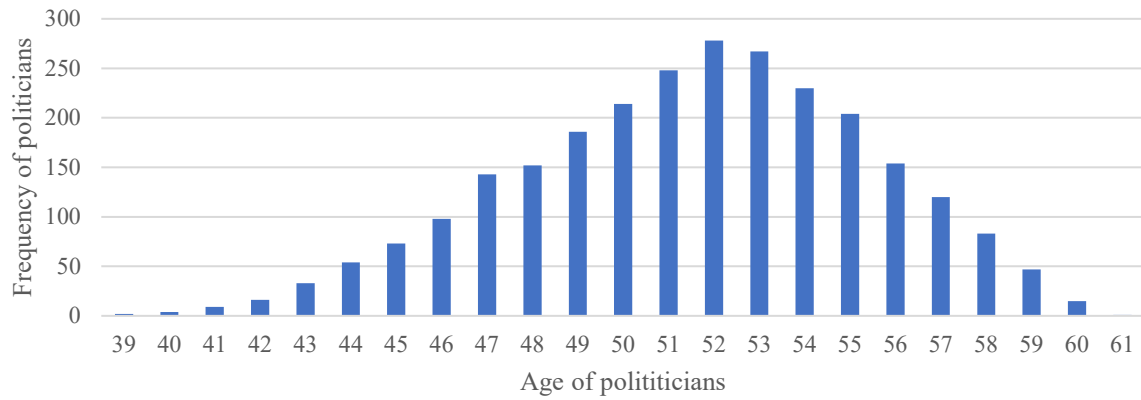
Figure 1b: The age of local politicians in the year of promotion
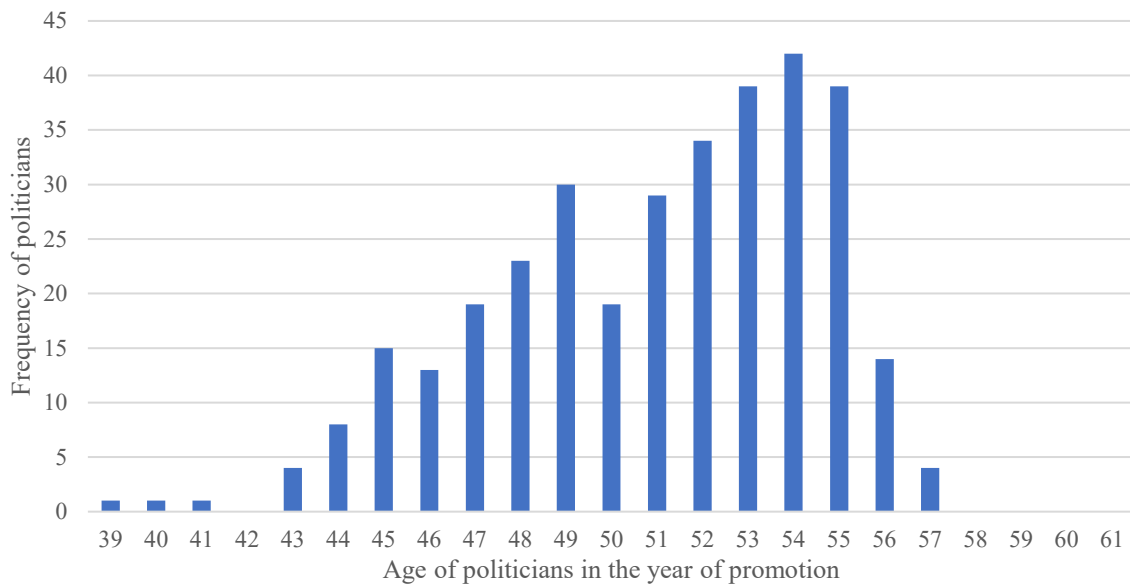
Figure 1a depicts the distribution of local officials' ages on the city-year level. Here local officials refer to the prefecture-level city party secretaries. There are 2,631 city-year observations in the sample. Figure 1b shows the number of officials that were promoted to a higher-level position at a certain age. A higher-level position means a vice-provincial status, such as a vice provincial governor.

Table 1: Variable definitions and summary statistics

This table provides a brief description of the variables and the summary statistics.

Panel A. variable definitions

Variable	Variable Description
Privatized	A dummy variable indicating the privatization of the firm: *Privatized* equals 1 if its state share falls below 50% or it exits from the database.
Age	The age of the city party secretary.
College	The dummy variable equals 1 if the city party secretary has college education and 0 otherwise.
Central Experience	The dummy variable indicating the city party secretary having experience serving in the central government.
Provincial Experience	The dummy variable indicating the city party secretary having experience serving in the provincial government.
Labor prod	The labor productivity of the firm calculated as ln (sales/employment).
Leverage	The leverage ratio of the firm, calculated as total debt/total asset.
GDP Per capita	GDP per capita (of thousand RMB in the 1990 constant price) of the city.
GDP Growth	The real growth rate of GDP (%) of the city.
Government activism	The city-level average "*percent of the officials in the department who facilitate the development of the company*" in city. Data is from the World Bank Enterprises Survey for China (2005). We obtain the city average from firm-level data.
TFP_OP	Total factor productivity (TFP) of the firm calculated using the Olley-Pakes method (see Appendix C for details).
TFP_OLS	TFP of the firm calculated using the OLS method (see Appendix C for details).
TFP_IN	TFP of the firm calculated using the index number method (see Appendix C for details).
TFP_CS	TFP of the firm calculated using the index function method, with the cost shares generated from the ASIF data (see Appendix C for details).

Panel B. Summary statistics of the sample before and in the year of privatization

	Obs.	Mean	Median	Std. Dev.	Min	Max
Privatized$_{it}$	151,269	0.268	0.000	0.443	0.000	1.000
Age$_{t-1}$	151,269	51.822	52.000	4.092	39.000	61.000
Labor prod$_{t-1}$	151,269	4.056	4.042	1.383	-0.113	8.001
Leverage$_{t-1}$	151,269	0.722	0.696	0.402	0.001	2.669
ROA$_{t-1}$	151,269	-0.003	0.000	0.111	-0.426	0.878
GDP per capita$_{t}$ (thousand RMB)	151,269	7.483	5.103	8.636	1.500	85.829
GDP growth (%)$_{t}$	151,269	9.532	10.710	6.286	-17.600	26.300
College$_{t}$	151,269	0.881	1.000	0.324	0.000	1.000
Central Experience$_{t}$	151,269	0.041	0.000	0.199	0.000	1.000
Provincial Experience$_{t}$	151,269	0.551	1.000	0.497	0.000	1.000

Panel C. Summary statistics of the sample including post-privatization observations

	Obs.	Mean	Median	Std. Dev.	Min	Max
TFP_OP	99,703	1.767	1.872	1.433	-3.377	5.176
TFP_OLS	125,407	0.820	0.856	1.365	-4.010	4.382
TFP_IN	125,407	1.324	1.443	1.543	-3.360	5.033
TFP_CS	169,143	-0.463	-0.388	1.487	-5.943	3.494
Government activism	119,492	0.407	0.351	0.213	0.095	0.994

Table 2: Official age and privatization of local SOEs

The table reports the effects of local politicians' age on the tendency of privatization by including a series of age dummies of local politicians. The dummy variable *Privatized* equals to 1 when the SOE experiences privatization in the specific year and 0 otherwise. As privatization is mostly irreversible in our sample, we delete the observations after *Privatized* has turned 1, leaving 151,269 observations in the regressions. Control variables include macroeconomic conditions and officials' individual characteristics (education level, prior experience of working in the central authorities and provincial level). Industry and city fixed effects are controlled. All standard errors clustered at the city level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable: *Privatized*	(1)	(2)	(3)	(4)
Dum(Age=51)	-0.008	-0.007	-0.006	-0.006
	(0.010)	(0.009)	(0.010)	(0.010)
Dum(Age=52)	0.015	0.015	0.014	0.016
	(0.011)	(0.011)	(0.011)	(0.011)
Dum(Age=53)	0.001	0.001	0.001	0.002
	(0.012)	(0.011)	(0.011)	(0.011)
Dum(Age=54)	-0.006	-0.006	-0.006	-0.004
	(0.014)	(0.013)	(0.013)	(0.013)
Dum(Age=55)	-0.001	-0.002	-0.002	0.001
	(0.012)	(0.011)	(0.011)	(0.012)
Dum(Age=56)	0.017	0.017	0.017	0.020
	(0.016)	(0.016)	(0.016)	(0.015)
Dum(Age=57)	-0.006	-0.006	-0.007	-0.004
	(0.014)	(0.014)	(0.014)	(0.015)
Dum(Age=58)	-0.042**	-0.042**	-0.042**	-0.039**
	(0.017)	(0.017)	(0.017)	(0.018)
Dum(Age=59)	-0.047*	-0.049**	-0.049**	-0.043*
	(0.024)	(0.024)	(0.024)	(0.024)
Dum(Age=60+)	0.004	-0.002	-0.002	0.008
	(0.039)	(0.037)	(0.037)	(0.037)
Labor prod$_{t-1}$		-0.021***	-0.021***	-0.021***
		(0.002)	(0.002)	(0.002)
ROA$_{t-1}$		-0.147***	-0.147***	-0.146***
		(0.018)	(0.018)	(0.018)
Leverage$_{t-1}$		0.044***	0.044***	0.044***
		(0.005)	(0.005)	(0.005)
Ln(employment$_{t-1}$)		-0.035***	-0.035***	-0.035***
		(0.002)	(0.002)	(0.002)
GDP Per capita$_{t-1}$			-0.001	-0.001
			(0.010)	(0.009)
GDP Growth$_{t-1}$			0.001	0.001
			(0.001)	(0.001)
College				0.025*
				(0.013)
Central Experience				-0.019
				(0.020)
Provincial Experience				0.004
				(0.009)
Industry FE and City FE	Yes	Yes	Yes	Yes
N	151,269	151,269	151,269	151,269
R-square	0.097	0.113	0.113	0.114

Table 3: Balance tests

This table reports the results of the balance tests. We limit the sample to consist of observations with the age of a city secretary in the range of 55-61 years old. The dependent variables are once-lagged labor productivity (*Labor prod*), firm's leverage ratio (*Leverage*), the logarithm of total employees (*Ln(employment))*, and the return on sales (*ROA*) respectively. The purpose of the balance tests is to show that the control variables vary smoothly around the age threshold, thus discontinuities around the threshold reflect the causal effect of the decrease of promotion probability. Definitions of other variables are the same as the previous tables. Standard errors clustered at the city level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)
	Labor prod$_{t-1}$	*Leverage$_{t-1}$*	*Ln(employment$_{t-1}$)*	*ROA$_{t-1}$*
Dum(Age≥58)	0.005	0.014*	0.027	-0.004
	(0.026)	(0.008)	(0.026)	(0.003)
Age-58	-0.021*	-0.006*	0.021*	-0.000
	(0.011)	(0.003)	(0.013)	(0.001)
(Age-58) Dum(Age≥58)*	-0.004	0.014*	-0.093	0.004
	(0.054)	(0.007)	(0.056)	(0.005)
Industry FE and City FE	Yes	Yes	Yes	Yes
N	43,591	43,591	43,591	43,591
R-square	0.313	0.111	0.172	0.094

Table 4: Privatization and age of local officials: Regression Discontinuity Design

This table reports the parametric and non-parametric results of the Regression Discontinuity Design (RDD). The dependent variable, $Privatized_{it}$, is the dummy variable indicating whether a firm i is privatized in year t. $Dum(Age \geq 58)$ is a dummy variable equaling 1 if the official's age is 58+ and 0 otherwise. In columns (1)-(2) we report the results of RDD with the global parametric polynomial approach. We control for the third order polynomial in the running variable. Columns (3) and (4) report the non-parametric local linear approach results of RDD. Standard errors clustered at the city level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)
Privatized	Cubic Parametric RDD		Local Linear RDD	
Dum(Age≥58)	-0.050**	-0.051***	-0.046**	-0.048**
	(0.020)	(0.019)	(0.022)	(0.020)
Age-58	0.004	0.005	-0.001	0.000
	(0.008)	(0.008)	(0.007)	(0.007)
(Age-58)* Dum(Age≥58)	-0.103	-0.084	0.017	0.014
	(0.085)	(0.080)	(0.020)	(0.020)
(Age-58)^2	0.001	0.001		
	(0.001)	(0.001)		
(Age-58)^2* Dum(Age≥58)	0.123	0.098		
	(0.089)	(0.082)		
(Age-58)^3	0.000	0.000		
	(0.000)	(0.000)		
(Age-58)^3*Dum(Age≥58)	-0.031	-0.023		
	(0.021)	(0.019)		
Other controls	No	Yes	No	Yes
Industry FE and City FE	Yes	Yes	Yes	Yes
N	151,269	151,269	43,742	43,742
R-square	0.096	0.113	0.105	0.125

Table 5: Placebo test: Privatization of central and provincial SOEs

This table reports the result on the relationship between age structure and privatization using a placebo sample of provincial and central SOEs. Columns (1)-(2) show the parametric global polynomial results, and columns (3) and (4) show the non-parametric local linear results. All the variables and specifications are the same as the previous tables. Standard errors clustered at the city level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)
Privatized	Cubic Parametric RDD		Local Linear RDD	
Dum(Age≥58)	-0.026	-0.026	-0.016	-0.020
	(0.021)	(0.021)	(0.022)	(0.021)
Age-58	-0.003	-0.003	-0.003	-0.002
	(0.009)	(0.009)	(0.008)	(0.008)
(Age-58) Dum(Age≥58)*	-0.197**	-0.185**	0.000	-0.006
	(0.090)	(0.081)	(0.018)	(0.017)
(Age-58)^2	-0.000	-0.000		
	(0.001)	(0.001)		
(Age-58)^2 Dum(Age≥58)*	0.235**	0.217**		
	(0.098)	(0.090)		
(Age-58)^3	-0.000	-0.000		
	(0.000)	(0.000)		
*(Age-58)^3*Dum(Age≥58)*	-0.061***	-0.057***		
	(0.023)	(0.021)		
Other controls	No	Yes	No	Yes
Industry FE and City FE	Yes	Yes	Yes	Yes
N	34,801	34,801	10,668	10,668
R-square	0.178	0.190	0.241	0.249

Table 6: Effects of privatization: OLS, FE, FE-FT and IV regression

This table reports the effects of privatization by regressing the performance measures, *TFP*, labor productivity *(Labor Prod)* and *ROA* on the privatization indicator *Privatized.* Here we use three measures of *TFP* calculated using the Olley-Pakes methods (*TFP_OP*), OLS (*TFP_OLS*), and Index Number methods (*TFP_IN*), respectively. Note that in these panels, the post-privatization observations of privatized firms are included in the sample. Since the data source does not contain the necessary data to compute TFP for 2008 and 2009, our analysis of firm outcomes in columns (1) to (5) use the data ending in 2007. Panels A and B report the regression results without and with firm fixed effects, respectively. Panel C reports the effects of privatization using FE-FT model. We regress the detrended performance measures (*y*), ΔTFP, ΔROA and labor productivity ($\Delta Labor$ *Prod*) on the detrended dummy variable, $\Delta Privatized$. Control variables are the same as those in Panel B. In Panel D we adopt the fuzzy RD framework by using a dummy variable, *Dum(Age≥58)*, as the instrumental variable of privatization. We control for quadratic polynomials in the regressions. In all regressions through Panel A-D, we control for the industry-year fixed effects, and the interaction of year dummies with initial sales, initial ROA, and initial TFP, as well as the city-level macro variables (i.e., GDP Per capita and GDP Growth). Standard errors clustered at the firm level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. OLS regressions

	(1)	(2)	(3)	(4)	(5)
	TFP_OP	*TFP_OLS*	*TFP_IN*	*Labor Prod*	*ROA*
Privatized	0.220***	0.188***	0.202***	0.258***	0.011***
	(0.013)	(0.012)	(0.012)	(0.009)	(0.001)
GDP Per capita$_{t-1}$	0.017***	0.018***	0.021***	0.047***	-0.001***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.000)
GDP Growth$_{t-1}$	0.002***	0.002***	0.002***	0.003***	0.000***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Year FE*Initial firm attributes	YES	YES	YES	YES	YES
Year FE*Industry FE	YES	YES	YES	YES	YES
N	95,212	119,954	119,954	187,822	187,822
R-square	0.629	0.615	0.704	0.680	0.344

Panel B. The FE regressions

	(1)	(2)	(3)	(4)	(5)
	TFP_OP	*TFP_OLS*	*TFP_IN*	*Labor Prod*	*ROA*
Privatized	0.161***	0.136***	0.143***	0.177***	0.012***
	(0.012)	(0.011)	(0.011)	(0.008)	(0.001)
GDP Per capita$_{t-1}$	0.016**	0.008	0.016**	0.024***	-0.002***
	(0.007)	(0.006)	(0.006)	(0.004)	(0.001)
GDP Growth$_{t-1}$	0.001	0.000	0.000	-0.001	0.000***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Year FE*Initial firm attributes	YES	YES	YES	YES	YES
Year FE*Industry FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
N	89,314	113,485	113,485	178,601	178,601
R-square	0.786	0.783	0.835	0.841	0.614

Panel C. The FE-FT regressions

	(1)	(2)	(3)	(4)	(5)
	ΔTFP_OP	ΔTFP_OLS	ΔTFP_IN	ΔLabor Prod	ΔROA
Δprivatized	0.032**	0.019	0.026**	0.057***	0.005***
	(0.014)	(0.013)	(0.013)	(0.008)	(0.001)
ΔControls	YES	YES	YES	YES	YES
Year FE*Initial firm attributes	YES	YES	YES	YES	YES
Year FE*Industry FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
N	62,090	80,740	80,740	130,257	130,257
R-square	0.181	0.174	0.172	0.202	0.160

Here Δ means first difference.

Panel D. The IV regressions

	(1)	(2)	(3)	(4)	(5)
	TFP_OP	TFP_OLS	TFP_IN	Labor Prod	ROA
2nd stage					
Privatized	1.431**	1.191**	1.003*	1.755***	0.145***
	(0.592)	(0.534)	(0.522)	(0.494)	(0.053)
GDP Per capita$_{t-1}$	0.003	-0.003	0.008	0.022***	-0.003***
	(0.010)	(0.008)	(0.008)	(0.005)	(0.001)
GDP Growth$_{t-1}$	0.000	-0.000	-0.000	-0.001**	0.000*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Quadratic polynomials of age	YES	YES	YES	YES	YES
Year FE*Initial firm attributes	YES	YES	YES	YES	YES
Year FE*Industry FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
N	89,314	113,485	113,485	178,601	178,601
R-square	0.740	0.752	0.819	0.768	0.534
1st stage					
Dum (Age≥58)	-0.034***	-0.032***	-0.032***	-0.025***	-0.027***
	(0.007)	(0.006)	(0.006)	(0.004)	(0.004)
GDP Per capita$_{t-1}$	0.010***	0.009***	0.009***	0.002	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
GDP Growth$_{t-1}$	0.000	0.000	0.000	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Quadratic polynomials of age	YES	YES	YES	YES	YES
Year FE* Initial firm attributes	YES	YES	YES	YES	YES
Year FE*Industry FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
N	89,314	113,485	113,485	178,601	178,601
R-square	0.702	0.704	0.705	0.700	0.696
First stage F-statistic	25.241	24.528	24.813	39.210	12.012

Table 7. Government Involvement and the effects of privatization on TFP

This table reports the interaction between government activism and the effects of privatization. We include the measure of government activism, and its interaction terms with the privatization dummy variable, *Privatized*. The definitions of other variables and control variables are the same as those defined in Table 6. We report the results of the FE regressions in the column (1)-(3) and IV regressions in (4)-(6) in each of the panels. We also control for firm-level fixed effects, and the industry-year fixed effects, and the interaction of year dummies with initial sales, initial ROA, and initial TFP, as well as the city-level macro variables (i.e., GDP Per capita and GDP Growth). Standard errors clustered at the firm level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable:	Firm FE			IV Regression (2nd stage)		
	(1)	(2)	(3)	(4)	(5)	(6)
	TFP_OP	*TFP_OLS*	*TFP_IN*	*TFP_OP*	*TFP_OLS*	*TFP_IN*
*Privatized * Government activism*	0.072	0.058	0.055	-4.569**	-3.846**	-3.671**
	(0.057)	(0.056)	(0.054)	(1.933)	(1.556)	(1.512)
Privatized	0.127***	0.107***	0.116***	3.247***	2.794***	2.517***
	(0.027)	(0.027)	(0.026)	(1.165)	(0.968)	(0.939)
Quadratic polynomials of age	No	No	No	YES	YES	YES
Other controls	YES	YES	YES	YES	YES	YES
Year FE*Initial firm attributes	YES	YES	YES	YES	YES	YES
Year FE*Industry	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
N	60,865	73,915	73,915	60,865	73,915	73,915
R-square	0.783	0.781	0.828	0.702	0.721	0.791

Appendix A: Construction of the panel from the ASIF data

Construction of the panel from the ASIF data. In the dataset, every firm is given a unique firm code. A small number of firms may have changed their firm codes within the sample period but remained in the sample. To address this issue, we follow Brandt et al. (2012) and Yang (2015) to obtain unique firm codes based on the firm's name, zip code, telephone number, and founding year. We clean the data as follows. First, if the year t observation of a firm cannot be matched to any firm's observation in year $t+1$ based on the firm code, we try to find a firm with the same name in year $t+1$, and match them by giving the year $t+1$ observation the same firm code as the year t observation. Second, for those firms that cannot be matched by the code or name, we rely on the combinations of the zip code, telephone number and the founding year to match them. We delete firms with missing key information, i.e. assets, fixed assets, sales and employment. Table A1 presents the frequency with which we can link the observations in different years for both SOEs and non-SOEs.

Table A1. Evolution of the raw panel over time

Year	Total firms	Entrants	Incumbent, linked using		Exiting (in the next year)
			NBS ID	Other information	
1998	164,452				28,709
1999	161,439	25,696	130,863	4,880	27,672
2000	162,350	28,583	130,538	3,229	36,395
2001	170,780	44,825	117,526	8,429	24,356
2002	181,149	34,725	142,950	3,474	28,378
2003	196,204	43,433	146,605	6,166	51,295
2004	274,750	129,841	137,681	7,228	45,085
2005	271,819	42,154	226,675	2,990	25,819
2006	301,943	55,943	243,728	2,272	28,485
2007	336,742	63,284	271,629	1,829	

Note: Entrants are those that first appear in the sample in the specific year. Exiting means dropping out of the sample in the next year. The ASIF dataset includes all SOEs, and all non-state firms with sales exceeding five million yuan. Thus, a firm's entry year may differ from its establishment year. Similarly, a firm's exiting year may differ from its death year.

Appendix B: Robustness test: Sample of narrowly-defined privatization

This table reports the main results using a more conservative definition of privatization: *Privatized* equals 1 only when the state share drops below 50% but staying in the database. All the variables and specifications are exactly the same as the previous tables. t-statistics are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. OLS Regression with age dummies

Dependent Variable: *Privatized*	(1)	(2)
Dum(Age=51)	-0.007	-0.007
	(0.005)	(0.004)
Dum(Age=52)	0.003	0.002
	(0.005)	(0.005)
Dum(Age=53)	0.000	-0.002
	(0.006)	(0.005)
Dum(Age=54)	-0.002	-0.004
	(0.007)	(0.006)
Dum(Age=55)	-0.010*	-0.013**
	(0.005)	(0.005)
Dum(Age=56)	0.004	0.002
	(0.007)	(0.006)
Dum(Age=57)	-0.001	-0.003
	(0.007)	(0.007)
Dum(Age=58)	-0.028***	-0.028***
	(0.010)	(0.009)
Dum(Age=59)	-0.031*	-0.027
	(0.019)	(0.017)
Dum(Age=60)	-0.021	-0.020
	(0.029)	(0.029)
Controls	No	Yes
Industry FE and City FE	Yes	Yes
N	151,269	151,269
R-square	0.166	0.184

Panel B. Regression Discontinuity Design

Dependent Variable: *Privatized*	Cubic parametric RDD	Local linear RDD
Dum(Age≥58)	-0.029**	-0.033**
	(0.012)	(0.013)
$Age^{\#}, Age^{\#} * Dum(Age-58)$	Yes	Yes
All quadratic terms related to the above	Yes	No
All cubic terms on $Age^{\#}, Age^{\#} * Dum(Age-58)$	Yes	No
Controls, Industry FE and City FE	Yes	Yes
N	151,269	43,742
R-square	0.166	0.196

Note. $Age^{\#}$ is (Age-58).

Appendix C. Estimating TFP

Here we describe how we estimate the firm-level TFP in three ways.

We use a standard log-linear Cobb-Douglas production function to estimate the firm-level TFP. Specifically, the TFP of firm i in year t is the estimated residual from the regression:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + u_{it} \tag{A1}$$

where y_{it} is the logarithm of value-added, and k_{it} and l_{it} are the logarithms of capital and labor, respectively. To allow for different factor intensities across industries, we estimate equation (A1) separately for each two-digit industry. TFP can be interpreted as the relative productivity of a firm within its industry.

Real value added is obtained by subtracting the real input from the real output. We use the two-digit ex-factory price index from *China Urban Living and Price Statistics* to deflate the output. The input deflator is calculated based on the available output deflators at the two-digit industry level and information from the National Input-Output (IO) tables in 1997, 2002, and 2007. From the IO tables, we know how much inputs are needed to produce a unit of output. Then the average input price index is the weighted average of the price indices of those inputs. Thus, to obtain the input deflator for each industry, we calculate a weighted average of the input deflators, using as weights the coefficients in the IO table.[23]

In the ASIF dataset, firms report the total annual employment, but they do not report the real capital stock. Instead, the firms report the value of their fixed capital stock at the original purchase prices. As these book values are the sum of the nominal values for different years, they are not equal to the real capital stock and are not comparable across time and across firms. Since we do not have all past investments of a firm to construct the real capital stock, we follow Brandt, Van Biesebroeck and Zhang (2012) and make several assumptions to convert the value of their capital stock at the original purchase prices into the real values using the following procedures.

First, we estimate the nominal value of the capital stock for each year between a firm's birth year and the first year in which the firm appears in our data set. We assume that it is 1998, the first year of our panel. We assume that the growth rate of the nominal capital stock of each firm equals to the growth rate of the nominal capital stock in the corresponding two-digit industry as reported in the *China Statistical Yearbooks*.[24] We then calculate the nominal capital stock in 1998 as follows:

$$NK_{1998} = NK_s \prod_{\tau=s}^{1998}(1 + r_\tau) \tag{A2}$$

Where NK_{1998} is the nominal captial stock in 1998 reported in the ASIF data, s indicates the firm's first year of operation, NK_s is the nominal captial stock of the firm in its birth year, and r_τ is the growth rate of the nominal capital stock in the two-digit industry in year t, as reported by the *China Statistical Yearbooks*. From equation (A2), we calculate the nominal stock in each year between the firm's birth year and 1998.

Second, the annual nominal investment NI_t is the change in the nominal capital stock between two consecutive years, that is,

$$NI_t = NK_t - NK_{t-1} \tag{A3}$$

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[23] The 1997 IO table is used to construct the input deflators of 1998-2000, the 2002 IO table is used to construct the input deflators of 2001-2005, and the 2007 IO table is used to construct the input deflators in 2006-2007.
[24] Since *China Statistical Yearbooks* report the growth rate of nominal capital stock in the two-digit industry from 1986, we assume that firms established before 1986 are established in 1986.

Third, we derive the real capital stock for each year between the firm's birth year and 1998. We deflate the annual nominal investment in each year NI_t into the real value RI_t using the investment deflator, which is in *China Statistical Yearbooks* from 1990. For years 1986-1989, we use the investment deflator constructed by Perkins and Rawski (2008).

Fourth, we obtain the real capital stock in 1998 with the perpetual inventory method. Specifically,

$$RK_t = (1 - \delta)RK_{t-1} + RI_t \tag{A4}$$

Where RK_t is the real capital stock in year *t*, and δ is the depreciation rate as estimated by:

$$\frac{\text{Accumulated depreciation reported in 1998}}{1998-s}/NK_{1998} \tag{A5}$$

Finally, we obtain the annual real investment and the real capital stock after 1998. For years after 1998, we use the observed change in the firm's nominal capital stock at the original purchase prices as our estimate of the nominal annual investment, that is, the nominal annual investment NI_t is still obtained from $NK_t - NK_{t-1}$. The real fixed investment RI_t is obtained by deflating NI_t with the investment deflator in *China Statistical Yearbooks*. The real capital stock is constructed using the perpetual inventory method, that is,

$$RK_t = RK_{t-1} - Depreciation_t + RI_t \tag{A6}$$

$Depreciation_t$ is annual depreciation that is reported in ASIF, again deflated by the investment deflators in *China Statistical Yearbooks*.

We estimate equation (A1) by ordinary least squares (OLS). We call this TFP-OLS. While this approach is commonly used in the literature, the existing research has argued that the OLS estimates suffer from two endogeneity issues: simultaneity of input choices and selection biases. These two issues will generate biased estimates of β_k and β_l, and therefore biased estimates of the TFP. A variety of techniques have been suggested to address these issues. We use the widely-used method proposed by Olley and Pakes (1996). We call this TFP-OP.

As another key measure of TFP, we use a straightforward index number approach, which does not require estimating any parameters. To implement, the industry-specific wage share in the output is used to measure β_l. One minus this share is used to measure β_k. Here the assumption is that a cost-minimizing firm will make sure that the relative factor price ratio equals the local elasticity of substitution between the inputs of the production technology. To avoid potential bias from the cost shares using our own data—the cost shares in our data might reflect the ownership restructuring directly—we rely on the estimates of the factor shares at the two-digit industry level from Saint-Paul and Bentolila (2003), as in Bloom, Sadun and Van Reenen (2012). We call this TFP-IN.

Overall, these three approaches yield quite similar results. The correlations of these productivity measures are fairly high (see Table C1 in this appendix): that between TFP-OLS and TFP-IN is 0.955; that between TFP-IN and TFP-OP is 0.937. Thus, it is not surprising that our results do not hinge on how we measure productivity.

Our index function approach relies on factor shares from Saint-Paul and Bentolila (2003). This has the virtue of not relying on the cost shares estimated from our own data. After all, the cost shares from the dataset itself might reflect the allocation effects of ownership restructuring itself, and thus bias the TFP measurements based on the cost shares from the data. However, it is also possible that the cost share based on our own data might better capture the underlying technologies and using them might result in more accurate measurements of TFP. We thus also experimented with the

measure of firm-level TFP based on the cost shares from the data, as in Hau, Huang and Wang (2019). We call this TFP-CS, which appears to be less closely related to other measures of TFP.

Table C1: The Correlation matrix of different TFP measures

	TFP_OP	*TFP_OLS*	*TFP_IN*	*TFP_CS*
TFP_OP	1			
TFP_OLS	0.935	1		
TFP_IN	0.937	0.955	1	
TFP_CS	0.432	0.485	0.435	1

Reference

Bentolila, S., and G. Saint-Paul. 2003. Explaining movements in the labor share. *Contributions in Macroeconomics* 3(1).

Bloom, N., R. Sadun, and J. Van Reenen. 2012. The organization of firms across countries. *Quarterly Journal of Economics* 127(4), 1663-1705.

Brandt, L., J. Van Biesebroeck, and Y. Zhang. 2012. Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing. *Journal of Development Economics* 97(2), 339–351.

Hau, H., Y. Huang, and G. Wang. 2019. Firm response to competitive shocks: evidence from China's minimum wage policy. Working paper.

Olley, G. S., and A. Pakes. 1996. The dynamics of productivity in the telecommunications equipment industry. *Econometrica* 64(6), 1263–1297.

Perkins, D., and T. Rawski. 2008. Forecasting China's Economic Growth to 2025. *China's Great Economic Transformation*, edited by Brandt, L., and T. Rawski, Cambridge University Press, 829-886.

Saint-Paul, G. and S. Bentolila. 2003. Explaining Movements in the Labor Share. *B.E. Journal of Macroeconomics* 3(1), 1-33.

Appendix D. Estimates of the privatization effects using TFP_CS

Table D: Effects of privatization: Alternative TFP measures

This table re-estimate the economic effects of privatization in Table 6 using the index function TFP using cost shares from ASIF data, i.e., *TFP_CS* (see Appendix C for details). Specifications are the same as those in Table 6. Columns (1) and (2) reports the simple OLS regression results with and without firm fixed effects, respectively. Column (3) reports the economic effects of privatization using FE-FT model (Brown, Earle and Telegdy 2006; Brown, Earle, and Gehlbach 2009). We regress the detrended performance measures the detrended dummy variable of *Privatized*. In column (4), we use a dummy variable, *Dum(Age≥58)*, as the instrumental variable of privatization, which equals 1 when the age of the official is equal to or above 58 and 0 otherwise. We control for quadratic polynomials and city-level macro variables (*GDP Per capita* and *GDP Growth*). The control variables are the same as those in Table 6. We also control for firm-level fixed effects (except for column (1)), and the industry-year fixed effects, and the interaction of year dummies with initial sales, initial ROA, and initial TFP. For the lack of enough data to calculate TFP, the observations in (1) -(4) columns ends in 2007. Standard errors clustered at the firm level are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable: *TFP_CS*	OLS (without firm FE)	Firm FE	FE-FT model	IV Regression (2nd stage)
	(1)	(2)	(3)	(4)
Privatized	0.153***	0.132***	0.037***	1.616**
	(0.014)	(0.011)	(0.012)	(0.666)
Other controls	Yes	Yes	Yes	Yes
N	163,758	155,379	112,887	155,379
R-square	0.995	0.998	0.998	0.997