CAN A TIGER CHANGE ITS STRIPES? REFORM OF CHINESE STATE-OWNED
ENTERPRISES IN THE PENUMBRA OF THE STATE

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ABSTRACT

The majority of state-owned enterprises (SOEs) in China were privatized through ownership reforms over the last three decades. Using a comprehensive dataset of all medium and large enterprises in China between 1998 and 2013, we show that privatized SOEs continue to benefit from government support relative to private enterprises. Compared to private firms that were never state-owned, privatized SOEs are favored by lower interest loans and higher government subsidies. Moreover, both SOEs and privatized SOEs significantly underperform relative to private firms, despite some improvements post-privatization. An exception is in improvements in productivity growth, where former SOEs match or exceed their private sector counterparts–results consistent with recent research. We also implement staggered difference-in-differences and matching estimation to account for treatment over multiple periods and selection into privatization. The tiger can change its stripes; however, former SOEs face a more supportive industrial policy regime relative to their private sector counterparts, affecting their performance.

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I. Introduction

The effect of ownership on firm performance is one of the central topics in strategy research (Ramaswamy, 2001; Xia, et al., 2015; Fitza and Tihanyi, 2017). In the context of emerging economies, a large literature has analyzed the role of state ownership and privatization in economic reforms (Ramamurti, 2000; Zhou et al., 2017). Conventional wisdom suggests that privatization of state-owned enterprises (SOEs) should reduce state favoritism, increase competition, and enhance firm performance. Summarizing the literature, Shleifer (1998) concluded that private ownership should be preferred to public ownership when the incentives to innovate and to contain costs are strong. Ehrlich et al. (1994) and Karpoff (2001) reached similar conclusions based on the argument that the principal of SOEs (i.e., the government) either cannot or does not choose to monitor the managers properly.

In this paper, we take advantage of the longitudinal data on China's gradual privatization process to isolate the effect of internal ownership from the effect of external policy environments. Specifically, we address two related questions. First, we examine what ownership reform really means, particularly in the Chinese context. In China, reform generally means installing Western ownership and governance in existing state-owned or controlled enterprises. Have such reforms affected performance for former SOEs? Or do former SOEs continue to behave as if they were still state controlled? In other words, can the tiger (former SOE) change its stripes?

To address this question, we associate a variety of performance measures, such as return on assets (ROA), total factor productivity growth (TFPG), and patent filings, with changes in state ownership. Privatization is defined as a move to equity shares below 50 percent and elimination of state control. While a number of researchers have compared SOEs' performance

with private enterprises—and most tend to find that SOEs perform worse—very few have explored how *former SOEs* performed relative to always-private enterprises.

Two recent studies cast light on this question. Li and Zhang (2022) explore whether the establishment of significantly greater monitoring and oversight of SOEs in 2003 enhanced their performance. Li and Zhang (2022) find that SOEs in China exhibited 20 percent lower levels of productivity than their private sector counterparts. One important finding in their study is that the creation of SASAC cut input prices paid by SOEs and improved performance, reducing the productivity gap with always-private enterprises by 50 percent. In this paper, we examine post-privatization performance of SOEs, whereas Li and Zhang (2022) explore how to improve performance–through the introduction of SASAC–of enterprises that *remain* state-owned. Our work is complementary to their study in several other dimensions: we focus on a wider array of performance measures, narrow in on post-privatization performance up until the year 2013 (Li and Zhang (2022) stop in 2007), and examine other environmental considerations such as subsidies and loan conditions.

Another highly relevant and important study is Chen, Igami, Sawada, and Xiao (2021), which explores the impact of privatization on productivity performance of SOEs in China for the 1998 through 2007 period. Chen et al. (2021) show evidence of and correct for significant selection into ownership change of privatized establishments in China. Their primary results indicate that privatizing firms converged to private firm productivity levels over time, allowing them to reconcile previous conflicting evidence on the positive effects of privatization on productivity performance for Chinese enterprises.

A second contribution of our paper, not addressed by Chen et al. (2021) or others, is that we ask whether the policy environment facing former SOEs has changed with ownership. While

Li and Zhang (2022) focus on changes in institutional oversight through the formation of SASAC, we concentrate on policy tools that include subsidies, interest rates, loans, and trade tariffs–key elements of China's industrial policies. Policy environments have significant influence on firms' relative competitiveness (Cuervo-Cazurra and Dau, 2009; Chang and Wu, 2014) and the value of firm-business ties (Peng, 2003; Haverman, et al., 2017). State ownership not only affects efficiency, but also firms' access to crucial resources (Zhou et al., 2016). To the extent that current and former SOEs may be receiving extra support in the form of soft budget constraints—manifested often through subsidies and the provision of low-interest loans—performance may be affected by a government that continues to interact with former SOEs in the same way.

Using a comprehensive dataset of all medium and large enterprises in China between 1998 and 2013, we show that privatized SOEs continue to benefit from government support relative to private enterprises. We also examine post-privatization performance. Both SOEs and to a lesser extent former (but now private) SOEs under-perform in profitability compared to private firms, suggesting a misallocation of resources. Nevertheless, there are clear improvements post-privatization, especially when the performance measure is productivity or return on assets. The tiger can change its stripes; however, the government's behavior in terms of the industrial policy environment is sticky.

One implication of our research is the following: non-state firms that at any point in their history were state-owned are very different from non-state firms with no past state ownership. These privatized enterprises, which we call "former SOEs", enjoy lower interest rates, larger loan facilities, and more subsidies while suffering poorer performance than never-SOEs. Former SOEs behave differently from always-private firms regardless of their ownership form. For

example, firms listed as legal-person ownership (LPO), which in the past had been treated as a stalking horse for state ownership, behave just like other private firms. These results suggest that there also exists a substantial gray zone between SOEs and private firms operating in the penumbra of the state. The challenge for researchers is to locate these firms more precisely and understand their roles in China's economic development.

Two important identification challenges that we address are potential selection into privatization and privatization of different cohorts of firms over multiple periods. Much research, including Chen et al. (2021), has pointed out that the establishments which were privatized in China were not randomly selected. One frequent adage that summarizes the approach of the Chinese government in the early 2000s is "grasp the large, let go of the small". If firms were selected for privatization or there were heterogeneous treatment effects of privatization across cohorts, then a standard two-way fixed-effect specification of difference-in-differences which allows for both time and group fixed effects may yield biased results. We follow the procedure proposed by Callaway and Sant'Anna (2021) when faced with these challenges in the context of difference-in-differences estimation with multiple time periods. By accounting for selection into privatization which differed across establishment size, provinces, and sectors, we are able to explore the robustness of our results.

In the rest of the paper, Section II provides a brief literature review, and how this paper fits into the literature. Section III presents the data and framework for empirical analysis. Section IV presents results comparing policy treatment of SOEs, former SOEs, and private enterprises. Section V measures the impact of ownership changes on performance. Section VI shows the robustness of the findings by applying Callaway and Sant'Anna (2021) and propensity score matching techniques. Section VII concludes.

II. Literature Review

Among the large literature examining the relationship between ownership and firm performance—see Megginson and Netter (2001) for an empirical survey and Radić, Ravasi, and Munir (2021) for a recent review—China's massive privatization program has drawn particular attention from strategy and economics scholars (Ralston et al., 2006; Bai, Lu, and Tao, 2009; Xia and Walker, 2015; Chen et al., 2021). Andrei Shleifer, writing in 1998 at the start of China's reform period, concluded that private ownership should generally be preferred to public ownership when the incentives to innovate and to contain costs need to be strong, especially when competition between suppliers, reputational mechanisms, and the possibility of provision by not-for-profit firms is brought into play. Similarly, Ehrlich et al. (1994) and Karpoff (2001) argue that public-sector ownership is always inferior to private sector ownership, because the principal (the government) either cannot or does not choose to monitor the managers properly. This approach focuses on ownership as the explanation for poor public-sector performance.

Consistent with the above arguments, most studies find that public-sector enterprises perform poorly relative to their private-sector counterparts. This is true both for financial performance and innovation. On the financial side, Bai et al. (2009) demonstrate profitability gains among privatized firms, mostly due to the reduction in managerial expenses. The performance effect remains even after accounting for endogenous selection on which SOEs to privatize (Chen et al., 2021), or using political patronage (Dinc and Gupta, 2011) and politicians' career concerns (Huang et al., 2024) as instruments for privatization. Wang, Wang, and Xu (2024) further compare the impact of privatization on heterogeneous firms and show that privatizing the worst performing ("zombie" SOEs) generates the most significant increase in productivity, profitability, and growth. On the innovation front, Wei et al. (2017) and Zhou et al.

(2017) show that although SOEs have received more resources, their performance in innovation is lackluster compared to private enterprises, which suggests misallocation of public fiscal resources.

While the baseline comparison is clear, other studies get mixed or ambiguous results. A typical illustration is provided by DeWenter and Malatesta (2001), who compare the 500 largest firms globally in 1975, 1985, and 1995. They find that ROA and ROE (return on equity) are significantly higher for private enterprises relative to public ones. For privatized firms, however, they find inconsistent results: performance increases post-privatization, while leverage and employment increase mainly pre-privatization. Market returns from privatization are positive in Hungary, Poland, and the United Kingdom but insignificant elsewhere.

One explanation for the conflicting evidence is that SOEs and private firms differ along many dimensions, from their heritage (Liu, et al., 2020; Ralston et al., 2006) to political embeddedness (Fan, Wong, and Zhang, 2007; Haveman et al., 2017). Thus, efficiency gains from privatization depend on a variety of internal and external factors, including the degree of competition, the regulatory environment, the magnitude of market failure, and the administrative capabilities of the government. Peltzman (1971) questioned whether changing ownership alone can affect firm behavior. From the perspective of internal factors, Shleifer and Vishny (1994) present a formal model to show that privatization enhances efficiency only if "control rights" over employment are shifted to the plant manager. In institutional environments where the state has strong control over all firms—public or private—the ownership effects may not be obvious (Milhaupt and Zheng, 2014).

Along those lines, Boardman and Vining (1989) argue that studying the effects of

privatization is relevant only for firms in competitive environments. Empirical studies have also shed light on the importance of environmental contingencies. For example, Bartel and Harrison (2003) use a panel of public and private manufacturing establishments in Indonesia and measure two important environmental factors: (1) soft budget constraints and (2) the degree of internal and external competition. They show that both changes in ownership and that changes in the environment matter. Similarly, Boubakri, Cosset, and Walid (2008) use a multi-country sample to show that over 30% of privatized firms maintain their political connections, by having a politician or an ex-politician on their board of directors. More recently, Li and Zhang (2022) show that external monitoring by the government—proxied by the establishment of the State-owned Assets Supervision and Administration Commission (SASAC)—significantly improved the performance of SOEs.

Our study stands at the cross-section of these two streams of literature: one that examines the effect of privatization without focusing on the ongoing impact of institutional environment (e.g., Bai et al., 2009; Chen et al., 2021), and the other that examines the effect of institutional oversight without examining ownership change (e.g., Li and Zhang, 2022). Ownership change alone does not necessarily turn a typical SOE into a typical private firm. The goal of this paper is to examine the performance of the same firm, before and after privatization. Doing so will allow us to tease out the effect of internal state ownership vs. external state support on the performance differences between SOEs and private enterprises.

III. Data and Analytical Framework

We begin by describing the data sources and then turn to our analytical framework.

Data Sources

Our main source of data is the Annual Industrial Survey (AIS) of the National Bureau of Statistics of China. Our sample includes firm-level data of all medium and large enterprises in manufacturing-related industries from 1998 to 2013. While there have been concerns about the quality of the AIS data (e.g., Brandt et al., 2014), it remains to date the most comprehensive firm-level data in China, with a survey of all enterprises with annual revenue greater than 5 million RMB, and greater than 20 million RMB beginning in 2011. Notably, although the AIS data have been widely utilized in recent empirical studies on China (Aghion et al., 2015; Berkowitz et al., 2016; Chang and Wu, 2014; Chen et al., 2016; Hsieh and Song, 2015), we are one of the few to substantially extend the data series after 2008. While the extended data offers a more limited set of variables, we otherwise find its quality to be similar, except for data in the year of 2010, which we subsequently drop from our analyses.[6] On the other hand, we believe the extension of the data beyond 2008 is an important step towards understanding the Chinese reform, especially intertwined with the global financial crisis and the Chinese economic stimulus program soon after. Table 1A summarizes key variables of interest in this paper.

We supplement the AIS data with sector-year level price indices from the Dios database to put all nominal values in constant 1998 values.[7]

Typology of Firms

A critical first step in understanding the efficacy of ownership reform is to understand the ownership of firms before and after the reform. There has been disagreement in the definition of

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[6] In particular, data after 2008 does not contain data on intermediary inputs, preventing us from estimating total factor productivity for those years. We conducted analyses on the continuity of the variables of interest over time to assess quality of the data.

[7] Throughout, sectors are defined at the two-digit sector code level, which yields 29 manufacturing sectors.

different types of firms in the literature. We propose a typology of firms that sheds light on the landscape of firm ownerships in China and provides a first step to understanding reforms.

We first group firms into two broad categories: SOEs and POEs (privately owned enterprises). There are three indicators in the AIS data that suggest the ownership of a firm: state control, capital ownership shares, and registration types. State control is a categorical variable indicating whether the firm's controlling shareholder, not necessarily the majority shareholder, is state-owned, collectively owned, or anything else. We follow Hsieh and Song (2015) and define state control as a binary variable equal to one if the controlling shareholder is the state.[8] Capital ownership shares include all six sources of capital ownership—state, collective, legal person, individual, foreign, and "Hong Kong, Taiwan, and Macau"—which sum to the total paid-in capital of the firm. We drop firms with positive foreign capital due to their different behavior. We define a firm's state capital share as its state capital as a percentage of the total paid-in capital. The third indicator for firm ownership is its registration type with the government. As pointed out in Hsieh and Song (2015), the use of registration types as a measure of firm ownership suffers from large inaccuracy and we also discard it. Following Hsieh and Song (2015), *we define a firm as state-owned if state control is equal to one or the state capital share exceeds 50 percent*. All other firms are treated as privately owned. Among the private firms, we further differentiate firms with positive legal person capital as legal person-owned (LPO) as it is difficult to pin down the ultimate ownership of these firms. Table 1B summarizes the resulting

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[8] The specific coding of the state control variable is as follows: 1 - state absolute control, 2 - state relative control, 3 - collective absolute control, 4 - collective relative control, 5 - others. The rule of defining state control changed in 2005: before 2005 (inclusive), control is defined to be by the state if ownership is either state absolute control (1) or state relative control (2); after 2005: control is defined to be by the state only if ownership is state absolute control (1).

distribution of firm ownership types. Note that the number of LPO firms, by our definition, fluctuated over time and comprised over 35 percent of total firms in 2013.

SOE Reforms

We now describe the privatization reform of SOEs in China during our sample period. Figure 1 tracks the government's aggressive reform agenda since 1998. While nearly 80 percent of SOEs exited, privatized SOEs in 2013 account for 13% of the number of SOEs in 1998. SOEs in 2013 only constituted 22% of the number of SOEs in 1998.

These SOEs and privatized SOEs constitute a large portion of the Chinese economy measured by their total output value (Figure 2). Comparing the two panels, we can see that the average size of privatized SOEs is smaller than those who remained SOEs, reflecting the "grasping the large, letting go of the small" policy. This policy of targeting firms based on size led us to include in later matching estimates the establishment's size as a criterion for selection.

Figures 1 and 2 show aggressive privatization beginning in 1998, with the consequence that by 2013 the share of total output accounted for by privatized SOEs is small. Given its small share, why should there be continued interest in the behavior and performance of privatized SOEs? The Chinese context provides a rich framework for understanding what is an ongoing topic of interest: Does privatization work? Does ownership of a firm and changes in that ownership matter? Equally important, Figure 2 shows that a significant share of output continues to be accounted for by continuing SOEs. Consequently, the scope for further improvements in efficiency with additional privatization is an important ongoing question for the future trajectory of the Chinese economy–indeed all economies with substantial shares of public sector enterprises.

Empirical Framework

In our analysis, we estimate if government policies and firm performance vary with ownership differences. We focus on the difference between SOEs, former SOEs, and always-POEs. In visual comparisons, we first inspect LPOs separately from other POEs, resulting in five ownership types including SOE, former SOE now LPO, former SOE now POE, always-LPO, and always-POE, due to early evidence suggesting that state and LPO ownership are indistinguishable in terms of their impact on firm performance (Wang, Xu, and Zhu, 2004). However, we do not find evidence of state influence hiding behind LPOs and instead find LPOs are like other POEs in our variables of interest. We thus combine LPOs and other POEs as POEs in subsequent econometric analyses. We do not include other categories, e.g., from private to SOE, because they are negligible in our sample period.

We conduct two sets of econometric analyses regarding the impact of ownership in the Chinese context. First, we estimate the impact of privatization, i.e., moving from public ownership to private ownership, using a difference-in-differences approach. We estimate the following equation:

$$Y_{it} = \alpha + \beta \cdot Privatization_{it} + Z_{it} + \lambda_i + \delta_t + \epsilon_{it}, (1)$$

where the outcome of interest includes a set of environment (industrial policy instruments) as well as performance measures. Environment measures include effective interest rates, loan sizes, and subsidy amounts. Performance measures—both financial and economic—include return on assets (ROA), total factor productivity growth (TFPG), and patent filings. We define and discuss these variables in more detail in the next two sections. We estimate equation (1) with firms that have ever been an SOE during our sample, i.e., current and former SOEs. $Privatization_{it}$ is an indicator variable that takes on a value of one if firm i has been privatized in year t, and zero

otherwise. Z_{it} is a vector of additional controls which we include for some specifications, in particular those estimating the impact of privatization on TFPG and ROA. We also include a full set of firm (i) and year (t) fixed effects.

Second, we compare the differences between former SOEs and their always-private counterparts. We estimate the following equation:

$$Y_{it} = \alpha + \beta \cdot FormerSOE_i + Z_{it} + \lambda_j + \delta_t + \epsilon_{it}, (2)$$

where the outcome variables are the same as in the first set of analyses. Different from the first set of analyses, we estimate equation (2) with former SOEs (only in their post privatization years) and always-POEs, with the goal of estimating the gap, if any, that still exists between former SOEs (now private) and those who were always private. $FormerSOE_i$ thus only varies at the firm level and indicates whether a firm is a former SOE, as opposed to an always-POE. We then include the additional controls Z_{it} and sector (j) and year (t) fixed effects.

There are several identification challenges with the proposed analyses. First, SOEs are selected for privatization based on characteristics such as their size, location, and sectors they operate in. Second, because privatization happened over time during our sample, identifying its impact with a two-way fixed-effect model may be problematic (de Chaisemartin and D'Haultfœuille, 2020; Goodman-Bacon, 2021). Third, former SOEs, while typically more similar to POEs than the average SOE, still differ in their characteristics. To mitigate these concerns, when estimating the treatment effect of privatization, i.e., equation (1), we also implement a staggered difference-in-differences approach while matching on firm size (in logs) and province and sector fixed effects (Callaway and Sant'Anna, 2021). To identify the differences between former SOEs and always-POEs, i.e., equation (2), we adopt a two-stage identification approach. In the first stage,

we estimate a propensity score for firm type based on firm size (in logs) and province, sector and year fixed effects. In the second stage, we estimate differences in outcome variables of interest based on the nearest neighbor match of the propensity score.

IV. Government Policies Comparison

We compare government policies towards SOEs, former SOEs, and always-POEs to test if there exists any policy favoritism towards SOEs and if so, whether such favoritism persists after privatization. These policies include financing policies (loan amounts and effective interest rates) and government subsidies. We begin with visual images and then move to econometric evidence to establish statistical significance and magnitudes.

Effective Interest Rates on Loans

Access to low-interest loans and other financing options are important for the growth of small firms (Song, Storesletten and Zilibotti, 2011). Figure 3 gives a first look at the effective interest rates paid by different types of firms in China. Effective interest rates are measured by dividing annual interest payment by the firm's current liabilities. Figure 3 makes it clear that always-POEs (both LPOs and POEs) pay much higher interest rates than private firms that were formerly state-owned. Before the 2008 crisis, the difference was over one percentage point (100 basis points) more in interest rates for private firms relative to former SOEs. This difference not only persists over time but also widened after 2008 to two percentage points (200 basis points). In contrast, the difference between SOEs and privatized SOEs is somewhat smaller. Interest rates for privatized SOEs are still 100 basis points higher than those paid by SOEs, but the difference did not change significantly over time. Note also that the *highest* interest rates are paid by LPOs that were never SOEs.

Volume of Loans

We next compare the volume of loans by ownership types. Loan volumes (as a fraction of output) are measured by current liabilities divided by firm output. The story is similar to the interest rate trends, as illustrated in Figure 4. Current SOEs have the highest ratio of liabilities to output, although the ratio declined dramatically over the sample period. Private enterprises have historically had a much lower loan ratio, and that ratio has declined only slightly. Former SOEs sit squarely between the two extremes, with loan ratios above the private sector but below SOEs. One interesting parallel with interest rates is the reversal in declining loan ratios with the financial crisis. Both SOEs and former SOEs show a reversal, while the uptick in loan ratios for private enterprises is more muted. With respect to the volume of loans, POEs and LPOs, whether or not former SOEs, are indistinguishable.

Subsidies

We conclude this section with an examination of the allocation of subsidies. Figure 5 shows the amount of subsidies received as a fraction of output by ownership types. The results are again consistent with former SOEs occupying a middle area in between actual SOEs and always-POEs (LPOs and POEs). POEs have the lowest subsidies as a fraction of output at around 0.2% with a muted uptick after the financial crisis.[9] SOEs receive the highest amount of support, between 0.8% and 1% prior to 2008 and increasing to over 1% in 2013. Former SOEs are between these two extremes hovering around 0.4%-0.6% prior to 2008 and also with a noticeable uptick in the years after the financial crisis. With this measure, POEs and LPOs are again indistinguishable.

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[9] Unfortunately, we do not have data on subsidies in the years of 2008 and 2009. And data from 2010 were dropped due to data quality issues.

Quantifying the Differences

We now provide regression analyses that confirm the broad trends outlined in the previous figures. Table 2 presents results estimating the impact of privatization on the government policy support firms receive. Specifically, we estimate equation (1) while restricting our sample to firms that have ever been an SOE during our sample, i.e., SOEs and former SOEs. In column 1, we find that former SOEs paid 39 basis points higher in effective interest rates after privatization relative to SOEs. At the same time, former SOEs received loans that are 13.25 percentage points (as a share of output) less after privatization (column 2). Former SOEs also received less subsidies (as a share of output), although the difference is small and noisy. Table 2 shows that, post privatization, former SOEs received less government support in the form of low interest loans and subsidies than SOEs.

Table 3 then compares the government support received by former SOEs and their always-private counterparts. To that end, we estimate equation (2) while restricting our sample to former SOEs (in their post privatization years) and always-POEs.[10] In column 1, we find that, while former SOEs paid higher effective interest rates after privatization (by 39 basis points), they still paid interest rates that are 187 basis points lower than firms who had always been private. Similarly, former SOEs received less loans and subsidies after privatization but 33.6 percentage points more loans and 0.22 percentage points more subsidies (as a share of output) than always-POEs. Table 3 thus shows that government policies, in the form of low-interest loans and subsidies, favor state-owned enterprises, and more interestingly, appear to be sticky post privatization.

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[10] Since, by our definition, there are no former SOEs in 1998, the first year in our sample, we exclude observations from 1998 in any analysis comparing former SOEs with always POEs (including the propensity score matching analyses).

One possible explanation of the differences identified above is that there are legacy agreements still in effect after privatization. For example, if a state bank extended a low-interest loan to a SOE and the SOE was privatized before the loan was due, then we would observe lower interest rates enjoyed by the newly privatized firm. We later (in Figure 7) present evidence against this hypothesis where we show the impact of privatization on interest rates to be immediate.

To summarize, the evidence suggests that, compared with POEs, current SOEs were heavily favored over the sample period in terms of interest rate terms, loan amounts, and subsidies. POEs and LPOs that were formerly SOEs fell in between the two groups, with more favorable treatment than establishments that were always private but less favorable treatment than current SOEs.

V. Firm Performance Comparisons

We explore three alternative measures of to test the effect of ownership change on performance: return on assets (ROA), patent filings, and total factor productivity growth (TFPG). In this section, we define our performance measures and report our results comparing performance post privatization. We explore performance using two separate control groups in separate exercises: (1) privatized establishments compared to SOEs that were never privatized, and (2) privatized establishments relative to always privately owned enterprises.

Return on Assets (ROA)

Figure 6 shows ROA for our five categories of enterprises, where ROA is measured by dividing total profits by total assets. At the beginning of the sample period, SOEs had on average a negative ROA but it shifted to positive over time. All groups of enterprises have experienced

rising ROAs, but both the levels and the growth rates have been higher for private enterprises. Beginning in 2004, ROAs in the private sector increased even more rapidly, leading the already sizable gap of nearly 10 percentage points to widen even more. Former SOEs were again in between the two extremes, exhibiting slightly higher returns than SOEs but significantly lower than always-private enterprises. The ROAs of POEs and LPOs, whether or not former SOEs, are indistinguishable.

Patent Filings

We investigate patenting activities during a shorter sample of 1998-2009, where we obtain firms' patent filings data from He et al. (2016). During this time, innovation activities significantly increased in China both in the number of firms filing at least one patent annually and the number of patents filed per firm.[11] We explore differences in patent filings across ownership types.

Quantifying Differences in ROA and Patent Filings

Tables 4 and 5 present econometric evidence confirming the observations in Figure 9 and exploring differences in patent filings across ownership types.

In Table 4, we again estimate equation (1) with SOEs and former SOEs. We find that former SOEs had a ROA that was 1.89 percentage points higher after privatization. Contrasting this result to our previous findings, former SOEs after privatization received less government support than SOEs but performed better in terms of ROA. We measure firms' patent activities in two ways. First, we measure a patent probability as the likelihood of a firm filing for any patent in a given year (then weighted per 1 billion RMB in its assets). Secondly we construct the number of patents as the total number of a firm's filed patents in a given year (with the same

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[11] We note that patent filing is not a perfect measure of innovation. It only measures quantity instead of quality, and it is affected by the propensity of patenting, which differs across firms due to different policy incentives they receive.

weight). Estimates of both measures of patent filings are, as shown in columns 2 and 3 of Table 4, noisy.

Table 5 compares if former SOEs, with improved performance, now perform as well as their always-private counterparts. Equation (2) is estimated with data from former SOEs and always-POEs. Column 1 shows that former SOEs still lagged always-POEs in ROA by a large margin of 7.29 percentage points. Estimates of patent filings are again imprecise.

Taken together, we find that privatization led to better performance in terms of ROA but former SOEs still underperformed relative to always-POEs.

Exploring the Impact of Privatization on Total Factor Productivity Growth

In this section, we use Olley and Pakes (1996) to correct for the potential endogeneity of input choice and sample selection (entry and exit), modified to allow tariffs to play a role in the OP (Olley-Pakes) estimation. To be consistent with important papers (Chen et al., 2021; Li and Zhang, 2022) analyzing the role of SOEs in affecting productivity growth in China, we redefine state ownership to indicate either at least a 50 percent state equity ownership share or registration type indicating state ownership. A broad literature on estimating production functions suggests that using ordinary least squares (OLS) may lead to biased input estimates when estimating productivity, because OLS assumes that choice of labor, capital and material inputs are exogenously determined relative to output choice. Griliches and Mairesse (1995) were among the first to make the case that input choices should be considered as endogenous, since decisions are affected by output and productivity. While using firm fixed effects in estimation does account for unobserved firm specific differences, they cannot address possible productivity shocks that change over time and jointly affect both inputs and outputs. Therefore OLS is likely to result in biased input coefficients in production function estimation. Another source of

mismeasurement is due to selection, as firms enter as well as exit the sample depending on viability over the long term.

Olley and Pakes (1996) address the endogeneity problem as follows. Let us consider the following Cobb-Douglas production function in logs:

$$y_{it} = b_k k_{it} + b_l l_{it} + b_m m_{it} + \omega_{it} + \epsilon_{it} ,$$

where y_{it}, k_{it}, l_{it}, and m_{it} represent log of output, capital, labor, and materials, respectively. The ω_{it} is the productivity and ϵ_{it} is the error term (or a shock to productivity). The key difference between the two is that ω_{it} affects the firm's input demand while ϵ_{it} does not. OP also make timing assumptions—for example capital is assumed to be fixed and subject to an investment process. Specifically, at the beginning of every period, the investment level a firm decides together with the current capital value determines the capital stock at the beginning of the next period, i.e.,

$$k_{i,t+1} = (1 - s)k_{it} + i_{it}.$$

The key innovation of OP estimation is to use a firm's observable characteristics to model a monotonic function of the firm's productivity. Since the investment decision depends on both productivity and capital, OP formulate investment as follows,

$$i_{it} = i_{it}(\omega_{it}, k_{it}).$$

Given that this investment function is strictly monotonic in ω_{it}, it can be inverted to obtain

$$\omega_{it} = f_t(i_{it}, k_{it}).$$

Substituting this into the production function, we get the following,

$$y_{it} = b_k k_{it} + b_l l_{it} + b_m m_{it} + f_t(i_{it}, k_{it}) + \epsilon_{it}$$

$$= b_l l_{it} + b_m m_{it} + f_t(i_{it}, k_{it}) + \epsilon_{it}$$

We modified the original OP approach to also incorporate tariffs into the estimation of input coefficients as they may affect the unobserved productivity term. We use the OP approach–taking into account both selection and potential simultaneity–to recover input coefficients on labor and capital.

With input coefficients derived from OP, we are able to calculate Total Factor Productivity (TFP). Moulton (1990) showed that the standard errors from OLS will be underestimated. As Moulton demonstrated, failing to take account of this serious downward bias in the estimated errors results in spurious findings of the statistical significance for the aggregate variable of interest. To address this issue, the standard errors in the paper are clustered for all observations in the same industry.

In auxiliary tables available on request, we compare the coefficient estimates using OLS with firm fixed effects and the OP approach. OP (1996), as well as Levinsohn and Petrin (2003) (henceforth LP) predict that after correcting for both selection and endogeneity, the coefficient on labor and intermediate inputs should decrease, while the coefficient on capital should increase. The results are generally consistent with these predictions across ownership classes. The coefficient on capital inputs is higher using OP across all specifications. We also generally find that the coefficient on the labor shares and material shares are lower with OP. What is unusual across all specifications is that the labor share is very low, compared to estimates for other countries, while the coefficient for input costs is very high. We performed a number of robustness checks to ensure that these estimates are correct, including comparing the calculated input coefficient to the share of labor expenditures in total output. Second, we compared the implied average wages from our sample (calculated by dividing total wages by the number of

employees with average wages reported in the Chinese Statistical Yearbook for 1998 through 2007. We feel confident that the factor shares implied by the OLS and OP coefficient estimates are broadly consistent with the factor shares in our data as well as external evidence.

The biggest disadvantage of applying the OP procedure is that many firms report zero or negative net investment. As a robustness check, we also employed the procedure suggested by Levinsohn and Petrin, which uses intermediate inputs as a proxy for unobserved productivity shocks. To save on space we only report the results using the OP, not the LP procedure. We estimate separate input coefficients and consequently measures of TFP by ownership type, which is similar to the approach taken by Chen et al. (2021). Since foreign firms are quite different in their behavior and potentially in their production function technologies, we also exclude any enterprises with some foreign ownership.

Tables 6A, 6B and 7 report our results examining the impact of privatization on the OP measure of total factor productivity growth. Since all specifications allow for establishment level fixed effects, we interpret the results to indicate determinants of productivity growth, not levels.[12] We implement a version of equation (1), including in the vector Z measures of industrial policies directed at establishments as well as sector-level controls. The vector Z includes as controls a number of firm-specific measures of industrial policy support, including whether or not the establishment received subsidies, tax breaks, and lower interest rates. Sector-level

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[12] The results in Tables 6 and 7 may not be directly comparable to Chen et al. (2021) and Li and Zhang (2022), both of which focus on the determinants of productivity *levels*. Our focus is instead on the determinants of productivity *growth*. A number of the controls in Li and Zhang (2022) such as age, size, Research and Development Expenditures and Capital are subsumed into our establishment fixed effect–our identification hinges on the relationship between changes in ownership and changes in TFP.

estimates include: foreign share at the sector level, export shares at the sector level, as well as input and output tariffs at the sector level. All Z level variables vary across years.

The first three columns of Table 6A include both privatizing enterprises and SOEs. The control group is consequently those state-owned enterprises–defined as either registered as an SOE or with at least 50 percent state share ownership–that never become privatized. The first column includes no controls for industrial policies (subsidies, tax breaks, low interest loans), while the second column includes those controls. Both columns (1) and (2) show that regardless of additional controls the movement to privatization is associated with an increase in productivity growth of 2.4 percentage points. Since average productivity growth over this period estimated using the OP approach was 5.5 percent annually between 1998 and 2007, this indicates that an establishment that was privatized moved from a productivity growth rate that was half of that of private sector enterprises. The improvement in growth rate is not affected by adding controls for industrial policy–suggesting a strong effect of privatization on productivity catch-up regardless of industrial policies in effect.

In the third column, we introduce a lead variable equal to 1 the year prior to privatization. This lead variable allows us to measure whether firms improved performance in the year prior to privatization, relative to their own past performance. The coefficient is positive and significant, indicating that establishments did improve performance one year prior to changing ownership. This positive and significant coefficient provides support for taking into account selection into privatization, but does not appreciably affect the main results in the first two columns. The evidence in the first three columns of Table 6A indicates a very large increase in productivity growth associated with privatization when the control group is SOEs.

The last three columns of Table 6A use private enterprises as the control group for privatizing entities. We continue to see that the growth rate of productivity for privatizing firms exceeded that of already private firms, indicating the kind of catchup documented by Chen et al. (2021). While the growth rate differential vis-a-vis private enterprises is not as great as when the comparison group is SOEs, the growth differential is still significant and important. When industrial policy controls are added, the growth differential declines, in part because those supports are different for privatized firms, allowing them to appear more productive. Nevertheless, there is evidence of higher growth rates for privatizing enterprises relative to not only SOEs but also relative to private enterprises.

The literature we review in this paper uses a range of measures for SOE ownership. To be consistent with other recent studies on SOEs' productivity (Chen et al., 2021; Li and Zhang, 2022), our analyses of TFPG use both the registration measure of state ownership, which is a dummy variable, and the percentage of state equity ownership in capital shares, which ranges between zero percent and 100 percent. One question is which of these measures is more important. In Table 6B we include both measures of privatization in the same regression, allowing us to report the relative weights of the two. The results in Table 6B show that changes in both measures independently are associated with productivity improvements, but the registration measure shows larger gains.

Li and Zhang (2022) show that better external monitoring of SOEs through SASAC led to significant improvements in performance for SOEs. In Table 7, we take into account improved monitoring of SOEs to see if this changes the favorable outcomes for privatizing firms. Following Li and Zhang (2022), we capture the impact of SASAC through a dummy which is equal to 1 from 2004 onwards and interacted with SOE ownership. The results corroborate the

improvement in productivity growth documented by Li and Zhang (2022), with a positive and significant coefficient on the interaction term. The coefficient on the interaction term, at 0.016, indicates that with greater oversight due to the formation of SASAC, total factor productivity improved by 1.6 percent per year, which accounts for half of the productivity growth differential between public and private enterprises. Yet privatization continued to yield significant improvements in productivity, even after accounting for the benefits of improved monitoring of remaining SOEs. The results are unaffected by including controls for industrial policy instruments in the second column, or by including a lead variable to capture selection into privatization in the third column of the table.

Discussion

Ownership matters (Triebs and Pollitt, 2019). However, information on registration, ownership, and nominal control of a firm may miss critical avenues of state influence, especially preferential policies extended to the private sector. Our analyses indicate that ownership change alone is not enough to level the playing field. Even though privatization removed state ownership, privatized former SOEs continue to receive preferential policy treatment and continue to lag behind always-POEs in financial performance, although their productivity performance is comparable.

This paper mainly contributes to two literatures. To the ownership literature, a close examination of former SOEs allows us to tease out the ownership effect associated with corporate governance and ownership effect associated with policy environments, which sheds light on what privatization really means (Ramamurti, 2000; Boubakri et al., 2008). To the policy literature, our analysis highlights policy influence beyond the state owned sector. As long as the implementation of industrial policies depends on local resources and capabilities (Lazzarini,

2015), the composition of firms in the penumbra of the state will have significant implications for policy effectiveness.

Of course, we are aware of the limitations of this study. First, we only speak on the relative performance of SOEs, former SOEs, and POEs, not their absolute trajectories. While the change of former SOEs after privatization is the focus of this study, firms in other categories were also changing in the same period. For example, SOEs were becoming increasingly market oriented (Ralston et al., 2006) and private entrepreneurs were securing seats in the legislative seats (Hou, 2019). Thus, the reality is a more dynamic picture than what we can capture in this paper. Second, we did not consider firm entry and exit and the different hurdles faced by firms of different ownership structures (Chang and Wu, 2014). We may miss important information in industry dynamics. Finally, this study is based on data from one country only. As firm-level, industry-level, and country-level factors jointly determine the trajectory of economic reforms (Ramamurti, 2000), we cannot speak for the generalizability of our findings.

VI. Robustness: Staggered Difference-in-Differences and Propensity Score Matching

In this section, we first implement a staggered difference-in-differences ("Staggered DiD") model (Callaway and Sant'Anna, 2021) conditional on firm characteristics that may affect which firms get privatized. Following Callaway and Sant'Anna (2021), we first estimate a treatment effect for each cohort of firms based on when they first became privatized, using both the "never treated" (always-SOEs) and "not-yet treated" firms as control groups. We condition the model on firm size and province and sector fixed effects to mitigate concerns that treatment assignment may not be random (Heckman et al., 1997; Callaway and Sant'Anna, 2021). We then check if the parallel trends assumption holds conditional on these characteristics.

Table 8 reports the aggregate average treatment effect of privatization on the government support SOEs and former SOEs received using weights proposed by Callaway and Sant'Anna (2021). Compared to results reported in Table 2 (estimated using the two-way fixed-effects model), we still find that former SOEs received less government support post privatization, although the estimated treatment effects are smaller after accounting for the staggered treatment timing and differences in firm characteristics. We now estimate that former SOEs paid 24 basis points (compared to 39 basis points in Table 2) more in effective interest rates and received 4.87 percentage points (as a share of output) less in loans (compared to 13.25 percentage points in Table 2) after privatization. Estimates of subsidies received are also smaller in magnitude and the differences are still imprecise.

Figures 7 through 9 display event study plots where we check the parallel trends assumption and visualize the estimated treatment effects. Figure 7 shows that for effective interest rates, conditional on firm characteristics, SOEs and those later privatized former SOEs have similar trends leading up to the treatment years. After privatization, former SOEs display higher effective interest rates relative to those not (yet) privatized. Figure 8, on the other hand, shows former SOEs received less loans than those not (yet) privatized even prior to privatization and thus puts the estimate around loan size in question. Interestingly, it appears that post privatization, former SOEs received more loans over time. Finally, Figure 9 shows the imprecisely estimated impact of privatization on the amount of subsidies received by firms.

Turning to firm performance, Table 9 presents results from the staggered difference-in-differences model on the effect of privatization. Again, we find a statistically significant increase of 1.37 percentage points in ROA after privatization, which is smaller than our previous estimate of 1.89 percentage points in Table 4. Estimates of patent filings are still noisy. Estimates of

TFPG are still significant and also smaller in magnitudes than before (Table 6). Figure 10 shows that the parallel trends assumption holds conditionally for ROA and visualizes its increase after privatization. Figures 11 and 12 show the imprecisely estimated results of patent filings. Figures 13 and 14 show that the parallel trends assumption roughly holds when using always-POEs as controls but not when using SOEs as controls.

In our second set of robustness analyses, we use propensity score matching (PSM) techniques to mitigate concerns that former SOEs may differ in their characteristics than their always-private counterparts, making the comparison in equation (2) an unfair one. To construct propensity scores, we first run a Probit model for the likelihood to be a former SOE (using data of former SOEs and always-POEs):

$$FormerSOE_i = \alpha + \beta \cdot log(FirmSize_{it}) + \gamma_i + \lambda_j + \delta_t + \epsilon_{it}$$

where $FormerSOE_i$ is the same indicator variable in equation (2) which takes on a value of one if firm i is a former SOE and zero if it is an always-POE. Firm size is measured by a firm's total assets each year. γ_i is a set of dummies indicating the province firm i is located in. λ_j includes a set of two-digit sector dummies. δ_t is a set of year dummies. We then match former SOEs with always-POEs based on the nearest neighbor in the predicted propensity scores and estimate their differences in government policies and firm performance after matching. Finally, we perform a formal pairwise t-test comparison between the matched former SOEs and always-POEs in their firm size to confirm that they are no longer systematically different.

Tables 10 and 11 present the results. Comparing Table 10 to Table 3 (estimated by OLS), we find similar results: former SOEs, despite receiving less support from the government after privatization, still paid 114 basis points (compared to 187 basis points in Table 3) less in

effective interest rate than those who were always private, as well as received 19.18 percentage points (compared to 33.6 percentage points in Table 3) more loans and 0.09 percentage points (compared to 0.22 percentage points in Table 3) more subsidies (both as a share of output). Matching on firm characteristics indeed reduced the magnitudes of these estimates compared to those in Table 3. Finally, Table 10 shows that after matching the difference in firm size between former SOEs and always-POEs is small and statistically indistinguishable.

Table 11 contrasts with Table 5 and shows estimates of differences in firm performance between former SOEs and always-POEs after matching. We find that, after matching, former SOEs still underperformed in ROA by 4.65 percentage points (compared to 7.29 percentage points in Table 5) relative to always-POEs, again smaller in magnitude than the OLS estimate without matching. T-test shows that the difference in firm size between the two groups after matching is small and statistically insignificant. Estimates of patent filings are still noisy.

To summarize, we find that former SOEs after privatization received less government support and performed better than SOEs, but these changes are not enough for them to be on par with always-private enterprises—former SOEs still received more government support and performed worse than always-POEs. The estimates are smaller in magnitude but mostly robust to alternative models of staggered difference-in-differences and propensity score matching. One exception is the impact of privatization on loan size where the staggered difference-in-differences model shows that the parallel trends assumption may not hold.

VII. Decomposing the Effects of Ownership and Environment on Firm Performance, and Closing the Performance Gap Associated with Government Support

The results in Tables 2-5 demonstrate that both firm performance (in terms of ROA) and the environment facing former SOEs—namely the provision of (low-interest) loans and subsidies sometimes referred to collectively as a "soft budget constraint"—change when ownership changes. Former SOEs face less of these soft budget constraints than SOEs but still receive extra support when compared to always-POEs. Furthermore, the previous section suggests that changes in these soft budget constraints also impact firm performance. The evidence is consistent with the view that a more competitive environment for former SOEs could be associated with improved performance.

We first decompose the effects of changes in ownership and the environment on firm performance by re-estimating equations (1) and (2) and including in Z_{it} lagged variables of government policies, i.e., effective interest rates, loan sizes, and subsidy amounts. Table 12 presents the results. First, compared to results in Tables 4 and 5, both estimates of the effect of privatization and the difference between former SOEs and always-POEs are smaller after controlling for government policies. Second, we find that having soft budget constraints—lower interests and more loans and subsidies—negatively impacts firms' ROA, which partially explains the differences between SOEs, former SOEs, and always-POEs due to the differential policies they receive. In particular, almost half of the ROA differential between former SOEs and always-POEs can be explained by their differential policy treatments.

Next, we illustrate how privatization impacts firms' ROA and potential further gains by closing the soft budget constraints gap between former SOEs and always-POEs. Table 13 presents this analysis. Privatization first has a direct effect on ROA, according to column 1 of Table 12, of an 1.65% increase. Secondarily, privatization also has an indirect impact on ROA through its impact on the government support firms receive. With estimates in Table 8 (effects of

privatization on policies using staggered DiD) and column 1 of Table 12 (effects of policies on performance), back-of-the-envelope calculation suggests that this indirect effect of privatization on ROA is roughly 0.003% through higher effective interest rates, 0.025% through smaller loan sizes, and little impact through subsidy amounts, totaling roughly 0.03% in ROA increase. Thus, together, changing firm ownership from public to private has a combined positive effect of 1.68% on ROA.

As we have shown, however, privatization alone still leaves a gap in performance between former SOEs and always-POEs. Part of the reason for the remaining gap is due to the soft budget constraint former SOEs still receive relative to always-POEs. We demonstrate how much gains in ROA can be had by closing the gap in soft budget constraints. Taking estimates in Table 10 (estimated gap in policies using PSM) and column 2 of Table 12 (effects of policies on performance), our back-of-the-envelope calculation suggests a further increase of 0.48% through higher effective interest rates, 1.34% through smaller loan sizes, and 0.02% through lower subsidy amounts, totaling 1.84% of further ROA gains for former SOEs had the gap in soft budget constraints been eliminated, representing a further 110% (1.84%/1.68%) gain in ROA beyond privatization alone. These results suggest that the full benefits of privatization of former SOEs have yet to be achieved.

VIII. Conclusions

Privatization has been a crucial part of economic reform in China. However, we still have much to learn on how privatization changes the performance of privatized companies, as privatization changes two conditions at the same time. On the one hand, privatization may lead to stronger incentives for innovation and budget control. On the other hand, the privatized firm

may lose the privileged treatment it once enjoyed. So the net outcomes are not clear. Using a comprehensive dataset of all medium and large enterprises in China between 1998 and 2013, spanning the stimulus package following the 2008 financial crisis, we show that former SOEs continue to benefit from government support relative to private enterprises, receiving low-interest loans and government subsidies, especially after 2008. Moreover, both SOEs and former SOEs significantly underperform private firms in profitability, despite significant improvements in productivity performance post-privatization. In sum, the tiger can change his stripes— performance outcomes improve post-privatization. However, the government's behavior seems to be quite sticky—former SOEs retain larger access to large loans, concessionary interest rates, and outright subsidies.

Our results for China over the period of 1998 through 2013 show that privatization alone still leaves a gap in profitability between former SOEs and always-private enterprises. The most effective changes are associated with *both* ownership transformations as well as industrial policy shifts. The greatest benefits from privatization arise when it is combined with changes in industrial policies. We show an increase in ROA for Chinese SOEs of 1.68 percentage points with privatization, which could more than double if there was a closing of the soft budget constraint. These results suggest that the full benefits of privatization for Chinese SOEs have yet to be achieved.

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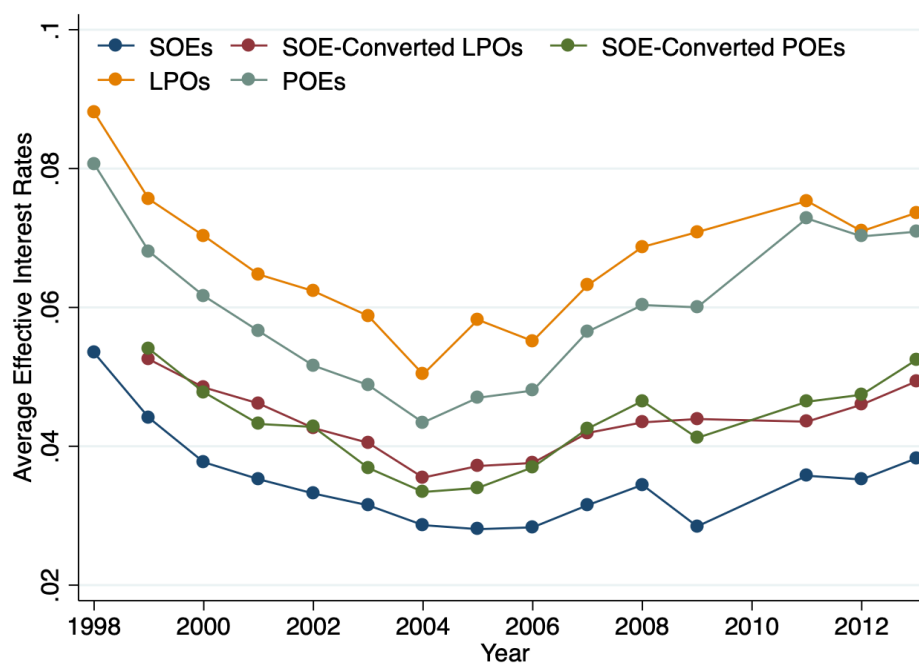
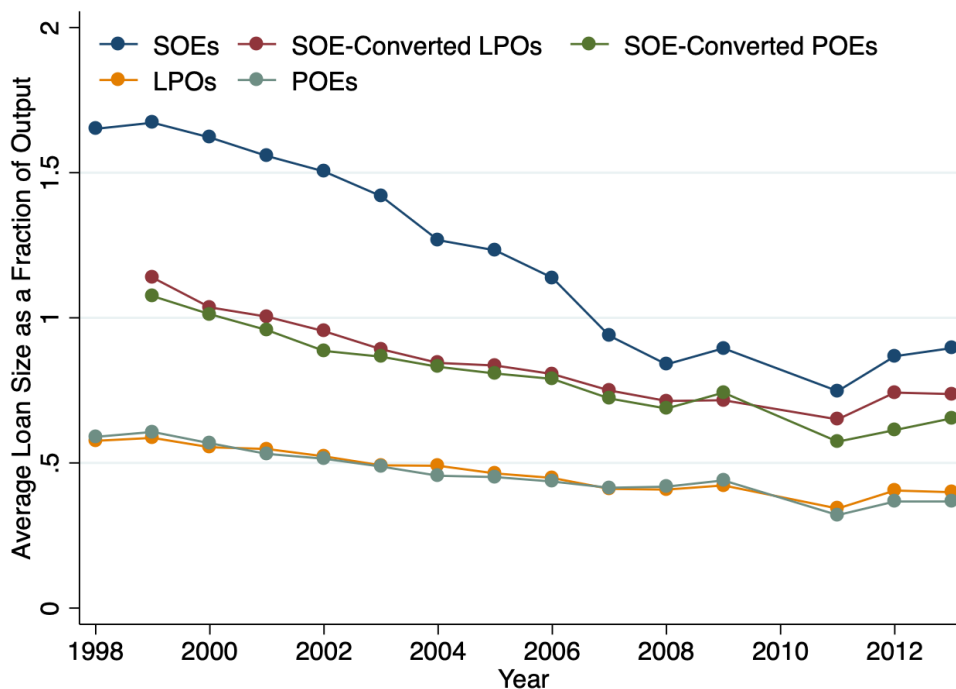**Figure 1: Chinese SOE Reforms 1998-2013: Number of SOEs and Privatized SOEs**
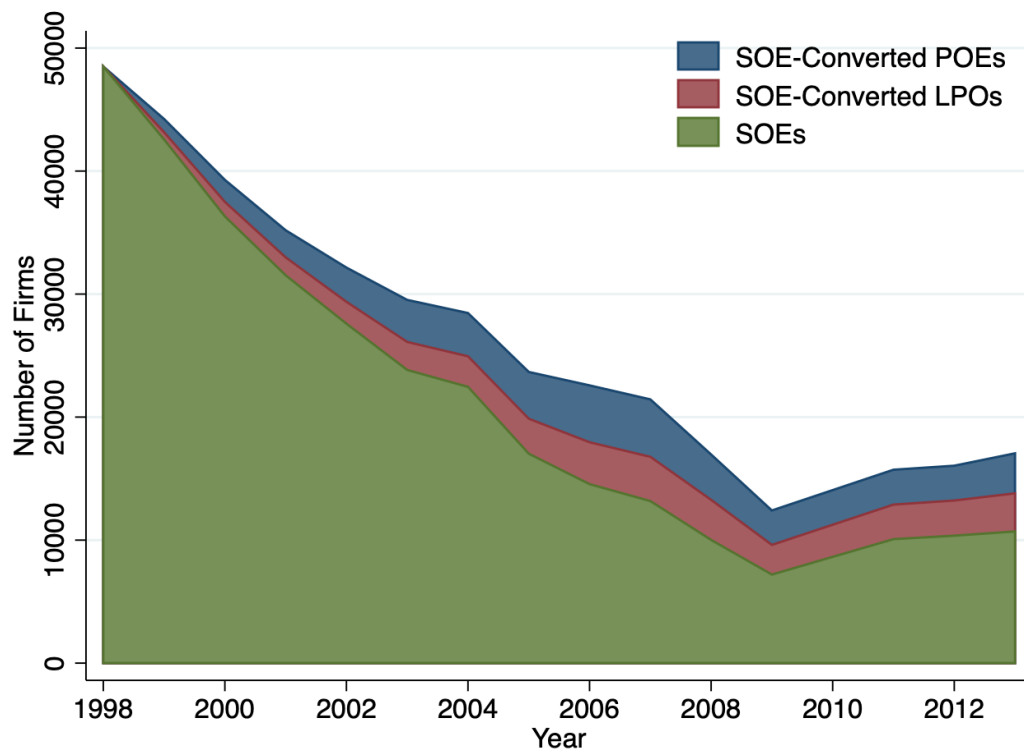
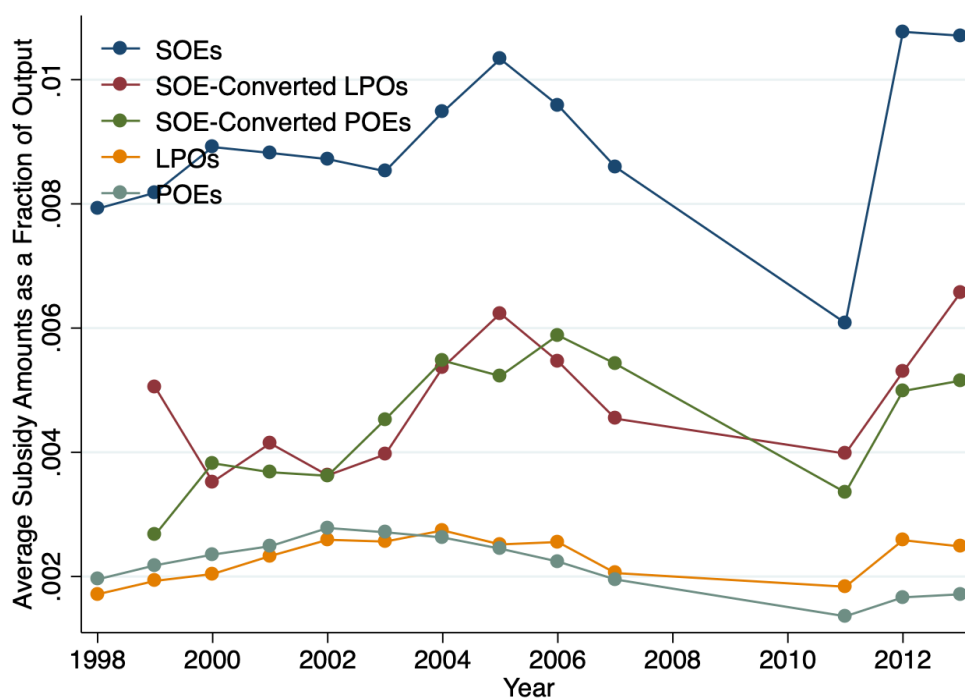**Figure 2: Output Shares by Ownership Types**
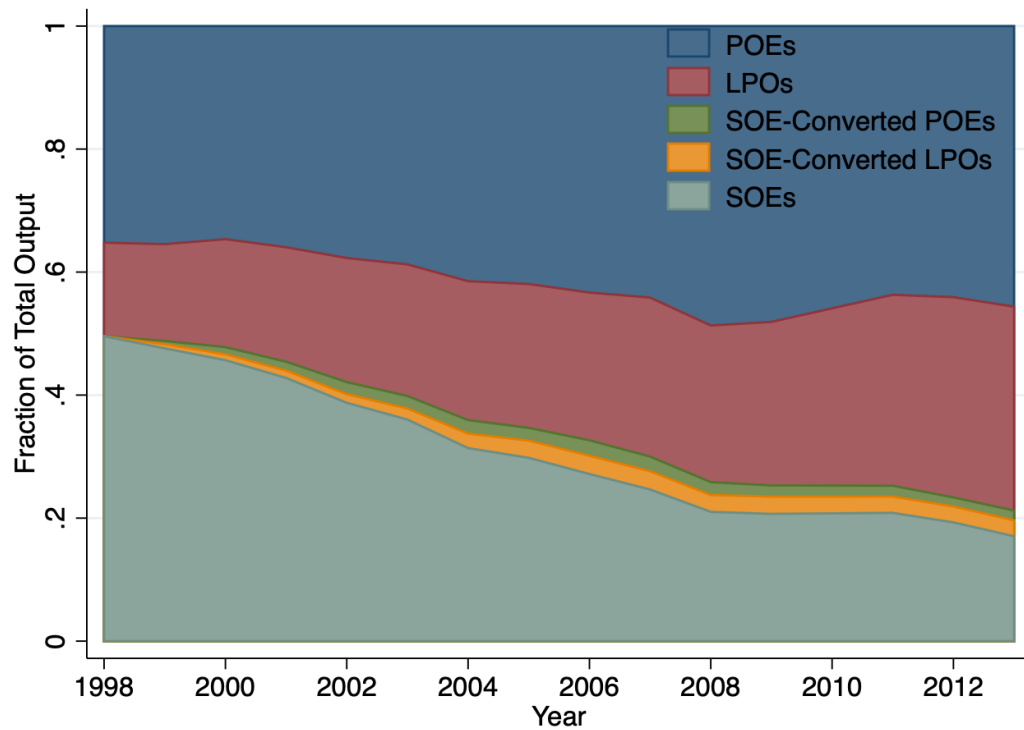
Figure 3: Effective Interest Rates by Ownership Types
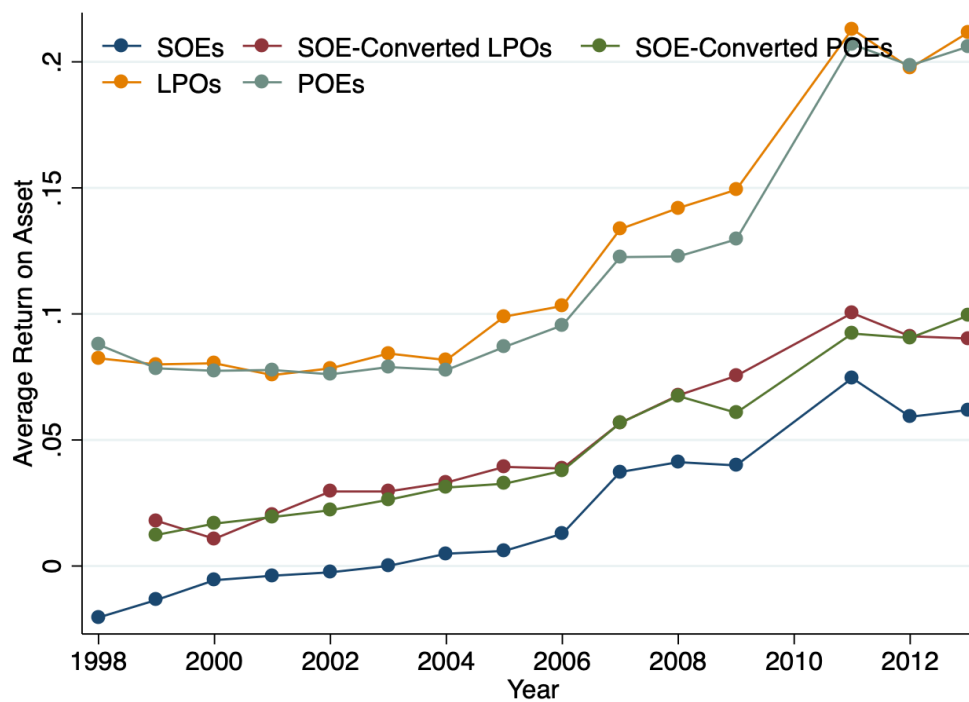

Figure 4: Volume of Loans by Ownership Types

Figure 5: Subsidies by Ownership Types

Figure 6: Return on Assets by Ownership Types

Figure 7: Event Study Plot, Staggered DiD: Effective Interest Rate
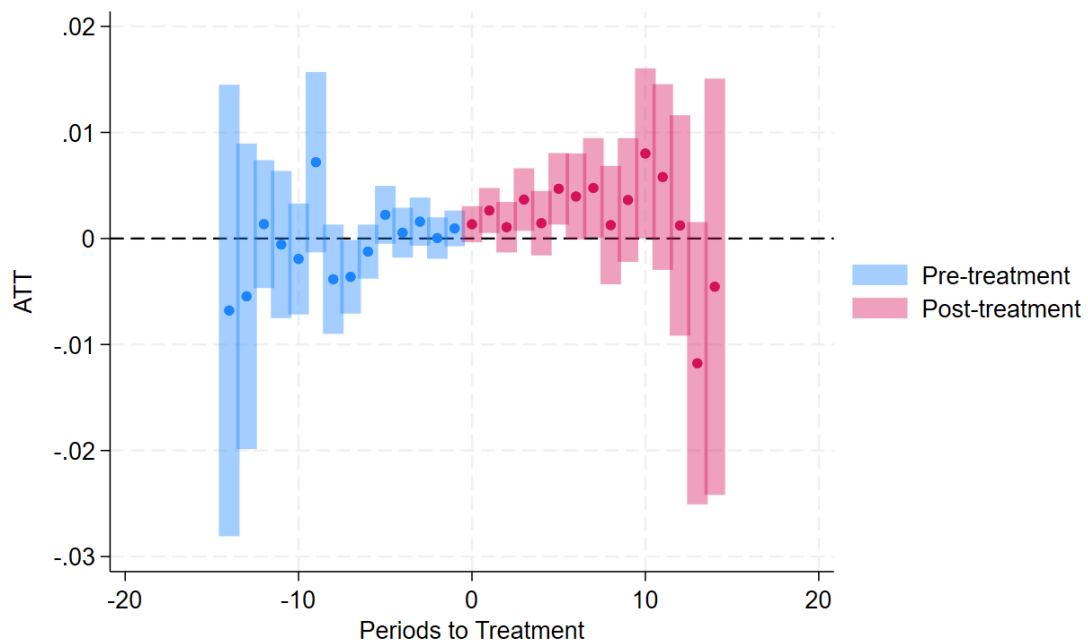
Notes: Time zero represents the first treatment period.

Figure 8: Event Study Plot, Staggered DiD: Loan Size

Notes: Time zero represents the first treatment period.

Figure 9: Event Study Plot, Staggered DiD: Subsidy Amount
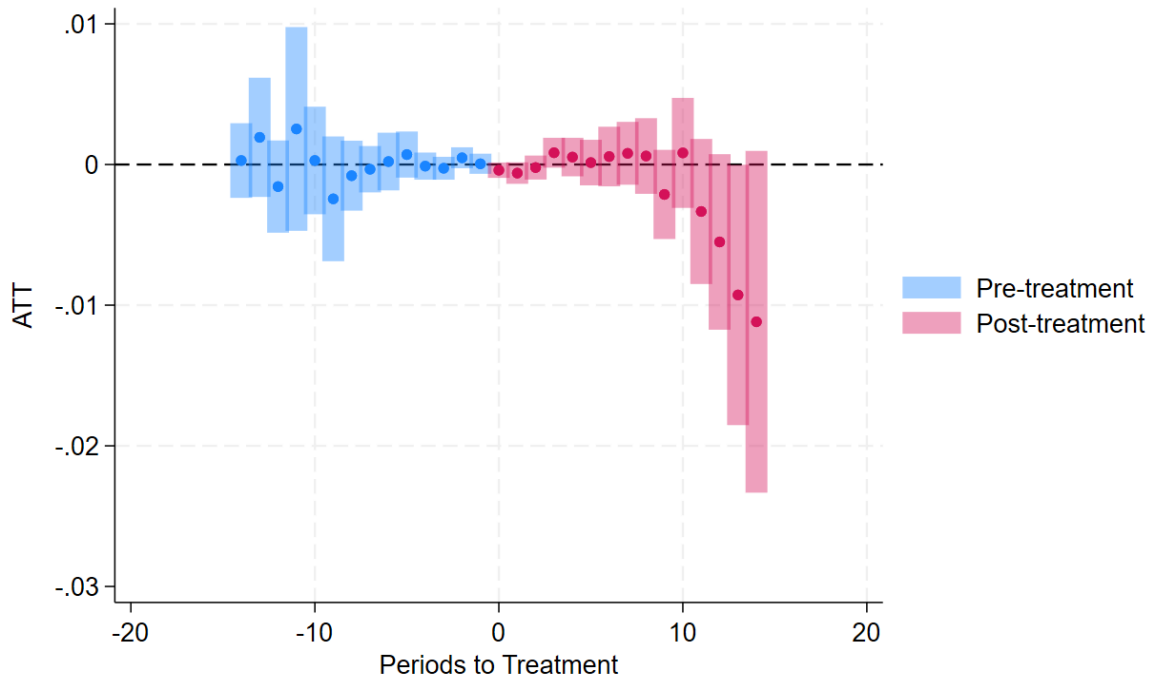
Notes: Time zero represents the first treatment period.

Figure 10: Event Study Plot, Staggered DiD: Return on Assets

Notes: Time zero represents the first treatment period.

Figure 11: Event Study Plot, Staggered DiD: Patent Probability

Notes: Time zero represents the first treatment period.

Figure 12: Event Study Plot, Staggered DiD: Number of Patents

Notes: Time zero represents the first treatment period.
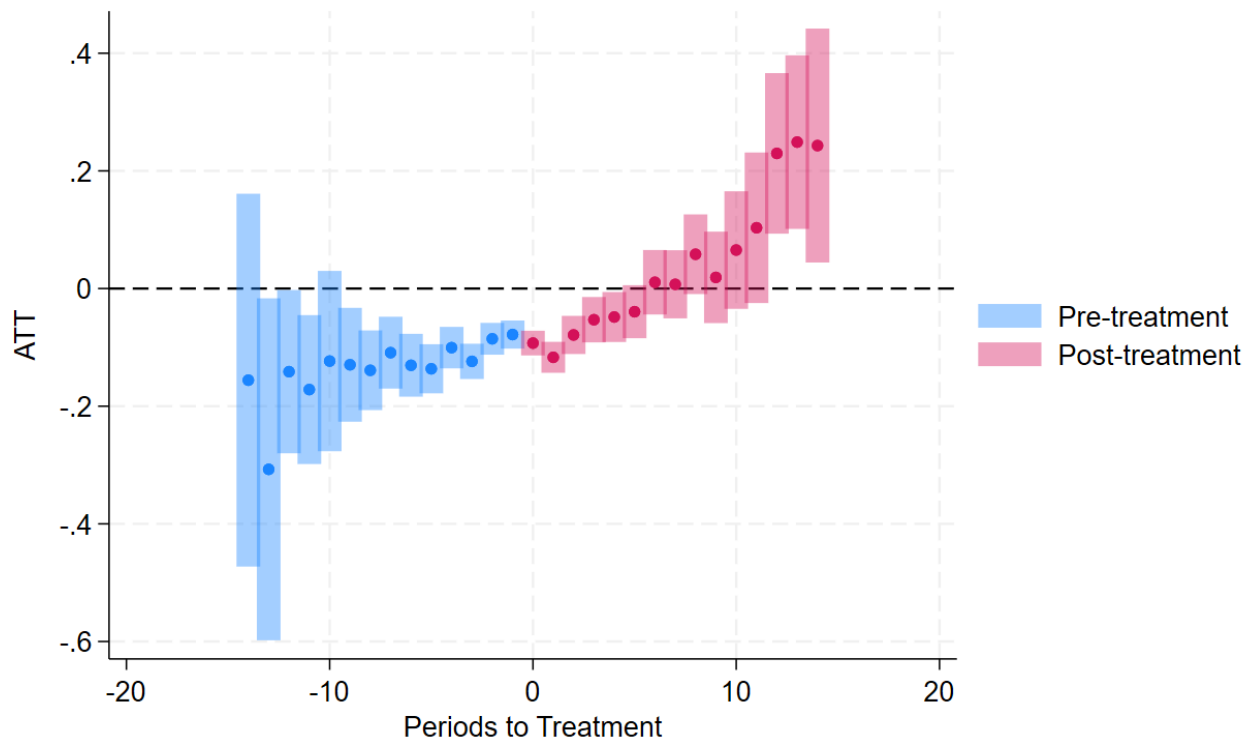
Figure 13: Event Study Plot, Staggered DiD: TFPG, Former SOEs vs SOEs
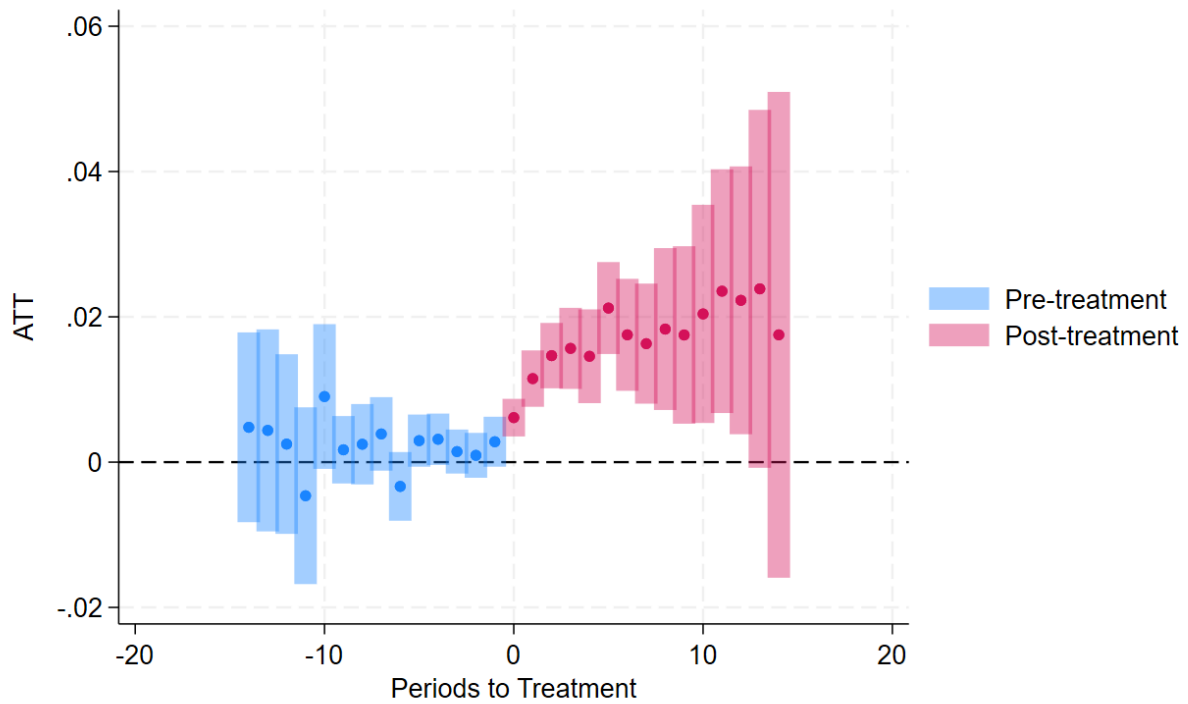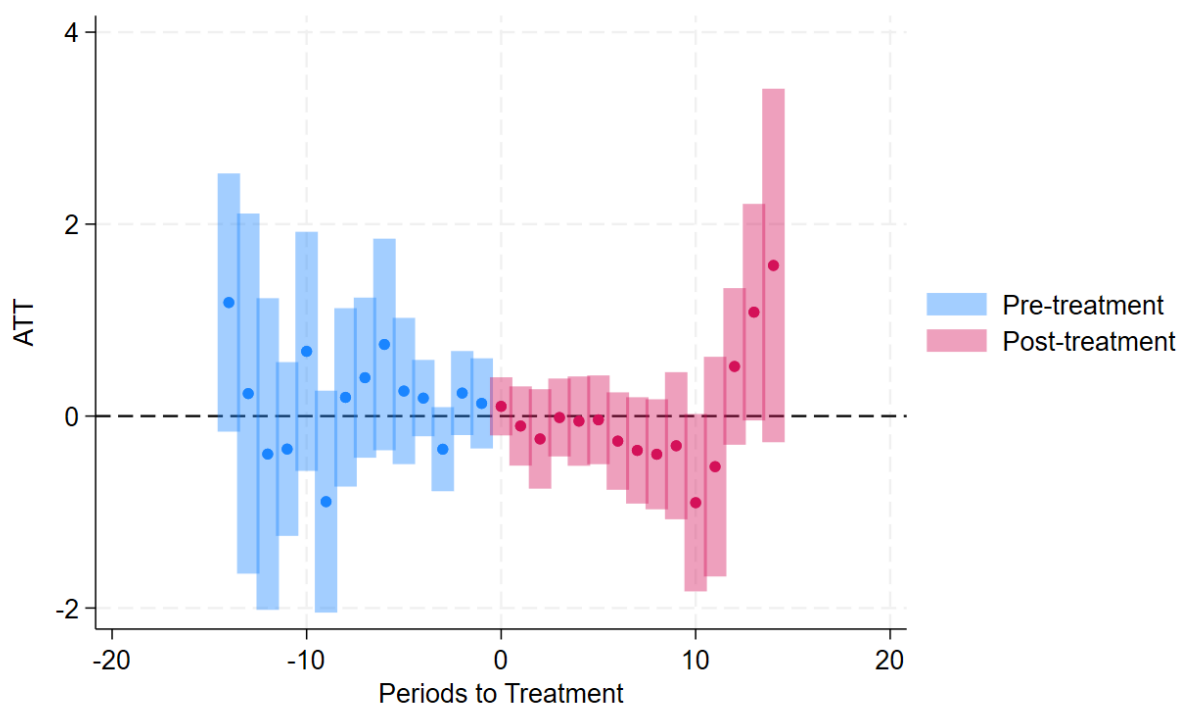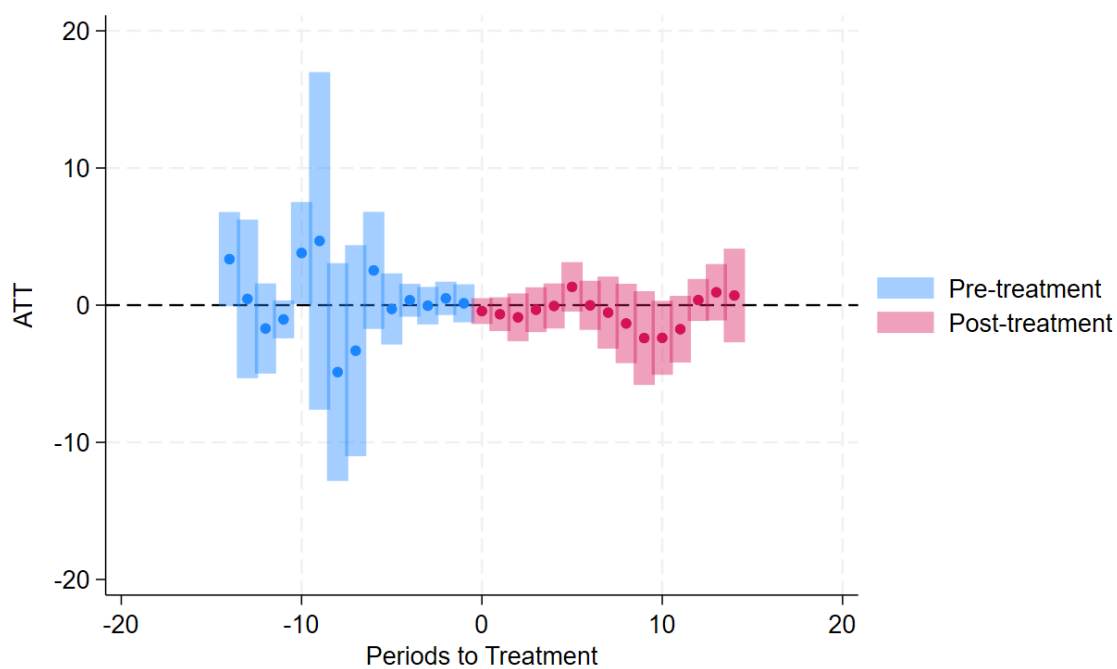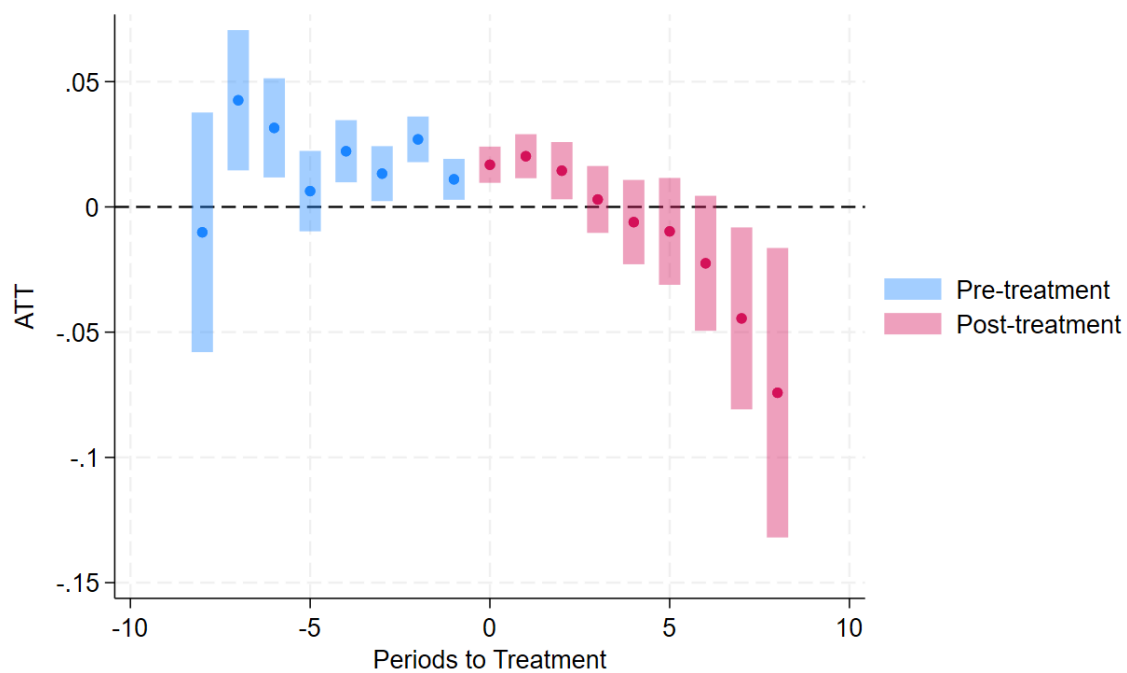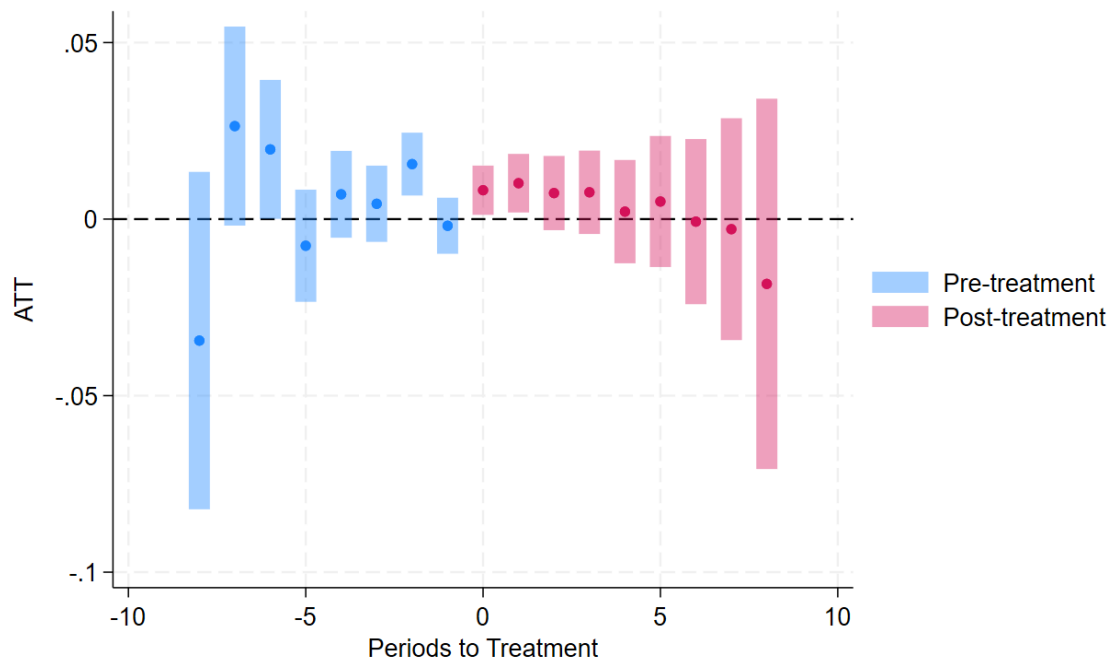

Notes: Time zero represents the first treatment period.

Figure 14: Event Study Plot, Staggered DiD: TFPG, Former SOEs vs Always-POEs

Notes: Time zero represents the first treatment period.

Table 1A: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
Interest Payments	2718185	1411.034	16670.041
Current Liabilities	2901174	47385.79	596206.33
Output	2930240	122570.11	1051884.6
Subsidies	2191502	252.869	5859.614
Total Assets	2938504	96944.565	1079248.8
Total Profits	2941342	6675.609	94969.629
Effective Interest Rates	1835161	.059	.102
Loan Volumes	2869646	.546	.874
Subsidy Amounts	2179395	.003	.021
Return on Assets	2935300	.115	.27
Patent (Y/N) per 1B in Assets	2938504	1.155	292.025
Num. Patents per 1B in Assets	2938504	3.945	592.365

Notes: 2010 data are omitted. Firms with foreign capital are dropped. Interest payments, current liabilities, output, subsidies, total assets, and total profits are measured in thousands of RMB. Effective interest rates are measured as interest payments divided by current liabilities, and resulting outliers of less than zero percent or greater than 100 percent are removed. Loan volumes are measured as current liabilities divided by output, and resulting outliers of greater than 1000 percent are removed. Subsidy amounts are measured as subsidies divided by output, and resulting outliers of less than zero percent or greater than 100 percent are removed. Returns on assets are measured as total profits divided by total assets, and resulting outliers of less than negative 100 percent or greater than 1000 percent are removed. Patent (Y/N) per 1B in assets are measured as whether a firm filed any patent in a year divided by total assets and multiplied by 1e+6 (total assets already measured in thousands). Number of patents per 1B in assets are measured by the number of patents filed by a firm in a year divided by total assets and multiplied by 1e+6 (total assets already measured in thousands).

Table 1B: Number of Firms by Ownership Types

Year	State Owned	Privately Owned		Total
		LPO	POE	
1998	48502	20211	58310	127023
1999	42576	21582	58569	122727
2000	36321	24534	62720	123575
2001	31533	28319	72325	132177
2002	27597	31574	82200	141371
2003	23835	39187	95080	158102
2004	22462	55953	143377	221792
2005	17026	57586	135750	210362
2006	14551	65024	154947	234522
2007	13175	82507	180529	276211
2008	10017	66253	152762	229032
2009	7199	50459	113442	171100
2011	10078	85550	152625	248253
2012	10361	94236	155790	260387
2013	10705	102385	173417	286507

Notes: 2010 data are omitted. Firms with foreign capital are dropped. SOEs are firms that either have state control or have state capital shares greater than 50%. All other firms are treated as privately owned. LPOs are firms with positive legal person capital shares. Other privately owned firms are POEs.

Table 2: Effect of Privatization on Government Policies

	Interest Rate	Loan Size	Subsidy Amount
Privatization	0.0039***	-0.1325***	-0.0005*
	(0.0005)	(0.0088)	(0.0003)
Observations	226,607	317,153	298,378

Notes: This table estimates the treatment effect of privatization (equation (1)) on the government support firms receive with the sample restricted to SOEs and former SOEs. Firm and year fixed effects are controlled for but not reported. Standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3: Differences in Government Policies between Former SOEs and Always-POEs

	Interest Rate	Loan Size	Subsidy Amount
Former SOEs	-0.0187***	0.3360***	0.0022***
	(0.0005)	(0.0028)	(0.0001)
Observations	1,527,146	2,431,113	1,764,956

Notes: This table estimates differences between former SOEs and always-POEs (equation (2)) in the government support they receive with the sample restricted to former SOEs and always-POEs. Sector and year fixed effects are controlled for but not reported. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Effect of Privatization on Firm Performance

	Return on Assets	Patent Probability	Number of Patents
Privatization	0.0189***	-0.0701	-0.7296*
	(0.0009)	(0.1616)	(0.4023)
Observations	335,996	336,471	336,471

Notes: This table estimates the treatment effect of privatization (equation (1)) on firm performance measures with the sample restricted to SOEs and former SOEs. Firm and year fixed effects are controlled for but not reported. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Differences in Firm Performance between Former SOEs and Always-POEs

	Return on Assets	Patent Probability	Number of Patents
Former SOEs	-0.0729***	-0.4892	-1.4634
	(0.0012)	(1.3743)	(2.7859)
Observations	2,477,112	2,479,762	2,479,762

Notes: This table estimates differences between former SOEs and always-POEs (equation (2)) in their performance measures with the sample restricted to former SOEs and always-POEs. Sector and year fixed effects are controlled for but not reported. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6A: Impact of Privatization on Total Factor Productivity Growth: All Specifications Allow for Establishment Level Fixed Effects and Year Fixed Effects

	SOEs and Privatizing Establishments Only			Private Enterprises and Privatizing Establishments Only		
Privatization	0.024	0.024	0.027	0.022	0.016	0.017
	(0.004)***	(0.004)***	(0.005)***	(0.004)***	(0.004)***	(0.005)***
Subsidy Dummy		0.010	0.010		0.008	0.008
		(0.003)***	(0.003)***		(0.001)***	(0.001)***
Tax Break Dummy		0.045	0.045		0.021	0.021
		(0.002)***	(0.002)***		(0.001)***	(0.001)***
Interest Rate Dummy		-0.006	-0.006		-0.013	-0.013
		(0.002)**	(0.002)**		(0.001)***	(0.001)***
Lead Dummy (=1 Year prior to Privatization)			0.007			0.003
			(0.003)**			(0.003)
R^2	0.12	0.15	0.15	0.15	0.18	0.18
N	199,120	194,672	194,672	1,059,911	1,026,965	1,026,965

Notes: All specifications allow for firm fixed effects. A * indicates $p<0.1$; ** $p<0.05$; *** $p< 0.01$. Other controls not reported here include year fixed effects, vertical and horizontal tariffs, and sector-level horizontal and vertical FDI as well as sectoral export shares.

Table 6B: Impact of Privatization on Total Factor Productivity Growth:

Exploring the Importance of SOE Share Ownership versus Registration Definition

All Specifications Allow for Establishment Level Fixed Effects and Year Fixed Effects

	SOEs and Privatizing Establishments			Private and Privatizing Enterprises		
Registration Measure of SOE	-0.023	-0.021	-0.023	-0.027	-0.026	-0.026
	(0.004)***	(0.004)***	(0.004)***	(0.005)***	(0.005)***	(0.005)***
Share SOE Ownership	-0.016	-0.017	-0.020	-0.006	-0.003	-0.005
	(0.003)***	(0.003)***	(0.003)***	(0.004)	(0.004)	(0.005)
R^2	0.12	0.15	0.15	0.15	0.18	0.18
N	199,120	194,672	194,672	1,059,911	1,026,965	1,026,965

Notes: All specifications allow for firm fixed effects. A * indicates $p<0.1$; ** $p<0.05$; *** $p< 0.01$. Other controls not reported here include year fixed effects, vertical and horizontal tariffs, and sector-level horizontal and vertical FDI as well as sectoral export shares.

Table 7: Impact of Privatization, Accounting for 2004 Reforms

	SOEs and Privatizing Establishments Only		
Privatization	0.031	0.030	0.033
	(0.004)***	(0.004)***	(0.005)***
SOE* SASAC	0.016	0.016	0.015
	(0.005)***	(0.005)***	(0.005)***
Subsidy Dummy		0.010	0.010
		(0.003)***	(0.003)***
Tax Break Dummy		0.045	0.045
		(0.002)***	(0.002)***
Interest Rate Dummy		-0.006	-0.006
		(0.002)***	(0.002)***
Lead Dummy (=1 Year prior to Privatization)			0.005
			(0.003)
Constant	1.905	2.092	2.091
	(0.005)***	(0.035)***	(0.035)***
R^2	0.12	0.15	0.15
N	199,120	194,672	194,672

Notes: All specifications allow for firm fixed effects. A * indicates $p<0.1$; ** $p<0.05$; *** $p< 0.01$. Other controls not reported here include year fixed effects, vertical and horizontal tariffs, and sector-level horizontal and vertical FDI as well as sectoral export shares.

Table 8:Effect of Privatization on Government Policies (Staggered DiD)

	Interest Rate	Loan Size	Subsidy Amount
Privatization	0.0024***	-0.0487***	-0.0003
	(0.0009)	(0.0129)	(0.0004)
Observations	198,396	288,778	272,459

Notes: This table estimates the treatment effect of privatization on the government support firms receive with the sample restricted to SOEs and former SOEs using a staggered difference-in-differences design (Callaway and Sant'Anna, 2021). The model is conditional on logged firm size and province and sector fixed effects. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Effect of Privatization on Firm Performance (Staggered DiD)

	Return on Assets	Patent Probability	Number of Patents	TFPG vs SOEs	TFPG vs POEs
Privatization	0.0137***	-0.0948	-0.4717	0.0085**	0.0069*
	(0.0018)	(0.1555)	(0.5450)	(0.0041)	(0.0036)
Observations	308,327	308,810	308,810	175,857	949,993

Notes: Columns 1-3 present estimates of the treatment effect of privatization on firm performance measures with the sample restricted to SOEs and former SOEs using a staggered difference-in-differences design (Callaway and Sant'Anna, 2021). The model is conditional on logged firm size and province and sector fixed effects. Columns 4-5 use SOEs and always-POEs as controls, respectively, and are also estimated by a staggered difference-in-differences model conditional on firm size and province and sector fixed effects. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Differences in Government Policies between Former SOEs and Always-POEs (PSM)

	Interest Rate	Loan Size	Subsidy Amount
Former SOEs	-0.0114***	0.1918***	0.0009***
	(0.0006)	(0.006)	(0.0002)
Balance test for firm size:			
% Bias	-1.2	0.3	0.3
t-stat	-1.57	0.47	0.39
p value	0.117	0.636	0.694
Observations	1,527,133	2,430,173	1,764,054

Notes: This table estimates differences between former SOEs and always-POEs in the government support they receive with the sample restricted to former SOEs and always-POEs using Propensity Score Matching. The first stage propensity scores are constructed from a Probit model of logged firm size and province, sector and year fixed effects. Standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 11: Differences in Firm Performance between Former SOEs and Always-POEs (PSM)

	Return on Assets	Patent Probability	Number of Patents
Former SOEs	-0.0465***	-0.0102	-1.0405*
	(0.0011)	(0.0659)	(0.5881)
Balance test for firm size:			
% Bias	-0.4	-0.2	-0.2
t-stat	-0.62	-0.33	-0.33
p value	0.535	0.739	0.739
Observations	2,477,112	2,479,762	2,479,762

Notes: This table estimates differences between former SOEs and always-POEs in their performance measures with the sample restricted to former SOEs and always-POEs using Propensity Score Matching. The first stage propensity scores are constructed from a Probit model of logged firm size and province, sector and year fixed effects. Standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 12: Decomposing the Effects of Ownership and Environment on Firm Performance

Return on Assets:	Effect of Privatization	Former SOEs vs Always-POEs
Privatization / Former SOE	0.0165***	-0.0381***
	(0.0011)	(0.0016)
Interest Rate	0.0128**	0.4234***
	(0.0056)	(0.0027)
Loan Size	-0.0052***	-0.0699***
	(0.0003)	(0.0004)
Subsidy Amount	0.0001	-0.2280***
	(0.0087)	(0.0178)
Observations	150,031	864,052

Notes: This table estimates the effect of privatization on ROA (equation (1)) and differences between former SOEs and always-POEs in ROA (equation (2)) controlling for lagged environment variables of effective interest rate, loan size, and subsidy amount. In column 1, the sample is restricted to SOEs and former SOEs, and firm and year fixed effects are controlled for but not reported. In column 2, the sample is restricted to former SOEs and always-POEs, and sector and year fixed effects are controlled for but not reported. Standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 13: Closing the Performance Gap in ROA Associated with Government Support

	Effects of Privatization			Remaining Gap vs. Always POEs		
	Coefficient of impact on ROA (Table 12)	Difference in policies (Table 8)	Total impact	Coefficient of impact on ROA (Table 12)	Difference in policies (Table 10)	Total impact
Privatization	0.0165		1.65%			
Interest Rate	0.0128	0.0024	0.003%	0.4234	-0.0114	-0.48%
Loan Size	-0.0052	-0.0487	0.025%	-0.0699	0.1918	-1.34%
Subsidy Amount	0.0001	-0.0003	~0	-0.2280	0.0009	-0.02%
Total impact on ROA: Gains from further environmental changes relative to privatization			1.68%			-1.84%

Notes: This table illustrates the effects of privatization on firms' ROA as well as potential further gains by closing the soft budget constraints gap between former SOEs and always-POEs. Coefficients of policies' impact on ROA between different types of firms correspond to those in Table 8. The estimated differences in firms' policy environments correspond to Table 8 (former SOEs vs. SOEs using staggered DiD) and Table 10 (former SOEs vs. always-POEs using PSM).