What Gets Measured Gets Managed: Investment and the Cost of Capital*

Zhiguo He Guanmin Liao Baolian Wang

January 24, 2023

Abstract

We study the impact of government-led incentive systems by examining a staggered reform in the Chinese state-owned enterprise (SOE) performance evaluation policy. To improve capital allocative efficiency, starting in 2010, regulators evaluating SOE performance switched from using return on equity (ROE) to economic value added (EVA). This EVA policy adopts a one-size-fits-all approach by stipulating a fixed cost of capital for virtually all SOEs, ignoring the potential heterogeneity of firm-specific costs of capital. We show that SOEs indeed responded to the performance evaluation reform by altering their investment decisions, more so when the actual borrowing rate was further away from the stipulated cost of capital. Our paper provides causal evidence that incentive schemes affect real investment and sheds new light on challenges faced by economic reforms in China.

JEL Classification: G31, G34, M12, M52, P31

Keywords: CEO compensation, Capital budgeting, Cost of Capital, Corporate governance, Economic reform, Transition economy

*He: Booth School of Business, University of Chicago and NBER, zhiguo.he@chicagobooth.edu; Liao: School of Business, Renmin University of China, liaoguanmin@rmbs.ruc.edu.cn; Wang: Warrington College of Business, University of Florida, baolian.wang@warrington.ufl.edu. We thank Chong-en Bai, Allen Berger, Gary Biddle, Loren Brandt, Hui Chen, Chang-Tai Hsieh, Jay Ritter, Zheng Michael Song, Kjetil Storesletten, Bernard Yeung, Weilong Zhang, and seminar participants at the 2019 Macroeconomy and Finance in China Conference, Capital Market Development: China and Asia (ABFER and BFI Chicago), the 2022 China Financial Research Conference, the 2022 CICF, Dongbei University of Finance and Economics, Hong Kong Polytechnic University, Peking University, University of Florida, University of Nevada, Las Vegas, University of South Carolina, and Fanhai International School of Finance at Fudan University for valuable comments. We also thank Xin Wang for his input on the group company level data. Zhiguo He acknowledges financial support from the John E. Jeuck Endowment at the University of Chicago Booth School of Business. All errors are our own.

1 Introduction

Incentives are everywhere, whether they are productive or counterproductive. As pointed out in "On the Folly of Rewarding A, while Hoping for B" by Kerr (1975), an *Academy of Management Classic* reprinted in 1995, "*numerous examples exist of reward systems that are fouled up in that the types of behavior rewarded are those which the rewarder is trying to discourage, while the behavior desired is not being rewarded at all.*" Though the potential pitfalls of poorly designed incentive systems have been widely acknowledged, empirical researchers face mounting challenges to study this issue in a rigorous way. To name one of these obstacles, because incentive arrangements are arguably an endogenous outcome of a complex process, comparing behaviors between firms with different managerial incentive arrangements may not necessarily reflect managerial incentives themselves.

By exploiting a staggered policy adoption experiment in China, this paper conducts an empirical analysis that directly speaks to the relationship between managerial incentives and firm behaviors, shedding light on Kerr (1975). Since 2004, the Chinese government, through State-owned Assets Supervision and Administration Commissions (SASACs), has used formula-based schemes to evaluate state-owned enterprises (SOEs). One key input in the evaluation scheme was return on equity (ROE), which was later replaced by economic value added (EVA) starting in 2010. Because EVA includes a charge for the cost of all capital employed by a firm, it has been applauded as a measure of *economic* profit and is fundamentally more sound than ROE, which only captures accounting profit (Rogerson, 1997).

This EVA reform was launched in order to improve capital allocative efficiency in the Chinese economy (Stern, 2011). The root cause of capital allocative inefficiency in China is a well-known policy distortion wherein Chinese SOEs have access to cheaper credit and hence overinvest relative to their private peers (e.g., Song, Storesletten, and Zilibotti (2011); Brandt, Tombe, and Zhu (2013)). Primarily motivated to urge SOEs to manage their capital more efficiently, the EVA reform may correct this policy distortion without getting to the root cause itself. In other words, by modifying the performance evaluation metric, the EVA reform could discourage SOEs from overinvestment without changing their preferential credit access.

However, as has been typical in reforms conducted in any transition economy worldwide, the devil is in the details. Instead of using firm-specific costs of capital as a full-blown risk-based theory would suggest, the Chinese central SASAC—which lacks knowledge of local information a la Hayek (1945) and Huang, Li, Ma, and Xu (2017)—set the after-tax cost of capital at 5.5% for virtually all the SOEs under its control.[1] In other words, the implementation of EVA reform ignores the potential heterogeneity of firm-specific cost of capital.

During our sample period, listed firms faced tight regulations on external equity financing in China. Our theoretical framework in Section 3 hence assumes that firms adjust their financing margin through debt at their firm-specific borrowing interest rates. Before the EVA policy, a firm invests until its marginal operating profit equals its actual marginal cost of debt, while after the EVA policy the firm invests until it hits the stipulated 5.5% cost of capital. Assuming a decreasing return to scale, we expect that the higher the marginal cost of debt a firm had before the EVA adoption, the more the firm's investment will increase in the post-EVA period.

Our empirical analysis—which directly speaks to the question "Do incentives matter?"—starts by studying how adopting the EVA policy affected the investment of Chinese-listed SOEs with different interest rates. From 2010 to 2015, the central SASAC and fourteen provincial SASACs adopted the same EVA policy in different years. To tease out the sole effect of the EVA policy, we not only rely on the staggered adoption of the EVA policy but also exploit an important institutional feature to address the potential endogeneity issue regarding EVA adoption decisions.

The following example illustrates our identification strategy, which is essentially a difference-in-differences-in-differences (DDD) approach. The Beijing SASAC (treatment group) adopted the EVA policy in 2010, after which firms under the Beijing SASAC with high interest rates increased their investment more than firms under the Beijing SASAC with low interest rates. This gives us a difference-in-differences (DD) estimation, but there is a concern: Firms with different interest rates were not the same, and regardless of the EVA policy adoption, investment opportunities might have changed in 2010 in a way that affected Beijing SOEs with high interest rates differently from those

[1] The reason that the central SASAC chose 5.5% as the cost of capital was never disclosed. In 2009, benchmark interest rates for bank loans with maturity between one to three years (the most popular maturity range) ranged from 5.31% to 5.40%. Vice Director of the SASAC Huang Shuhe said, "The capital returns have to be higher than the bank loan interest rate." (Adfaith, 2005). This seems to suggest that 5.5% was chosen to equal the bank loan interest rate. However, the 5.5% stipulated cost of capital is after tax, while the bank loan interest rate is before tax.

with low interest rates. To address this concern, we compare the DD estimation of the SOEs under the Beijing SASAC with a similarly calculated DD estimation of the SOEs controlled by other SASACs without an EVA adoption in 2010, such as Shanghai (control group). If the investment difference between firms with high and low interest rates was affected by the similar investment opportunity change in 2010 regardless of their SASAC affiliations, the DD estimation of Shanghai provides a counterfactual to Beijing's DD, yielding the desired estimate of the effect of the EVA policy.

One remaining concern about the DDD strategy is the potential endogeneity of the EVA policy adoption, as there may be business cycle factors that coincided with or even led to the EVA policy's adoption, giving rise to changing economic conditions specific to the EVA-passing SASACs. We believe such a concern is unlikely to drive our results. Empirically the EVA policy adoption's timing does not seem to be correlated with many provincial-level factors. As we discuss in the institutional background in detail, a SASAC can decide whether to adopt the EVA policy, but its ability to choose a certain year is limited; and since most of the EVA effects occur in the adoption year, such a sharp reaction mitigates the concern. Furthermore, we directly address this concern by exploiting a unique feature of the EVA policy adoption. EVA adoption by a SASAC affects all the firms under its control, independent of the firms' locations. For instance, central SOEs are located all over the country; for local SOEs, while most of them and their SASACs are located in the same province, some are in other provinces. This allows us to include province-year fixed effects to control for time-varying provincial-level factors.[2]

Following the above DDD methodology, we show that firms with a higher interest rate increased their investment more than firms with a lower interest rate in the post-EVA period, consistent with our prediction. A standard deviation (3.3 percentage points) increase in the interest rate leads to about a 0.6 percentage point increase in a firm's investment, measured as capital expenditure divided by lagged total assets. The effect is economically sizable as the median firm investment was 4.6%. Based on dynamic treatment effect estimation, we also confirm the parallel trends assumption for both the treatment and control groups in the pre-EVA period, lending support to

[2]We exploit another variation in the data that can address this concern by treating non-SOEs as placebos since they were not subject to the EVA policy. In the placebo test, we assign a provincial SASAC's EVA adoption year to the non-SOEs located in that province. Among the non-SOEs, we find no significant change in the investment difference between the low and high interest rate firms.

a causal interpretation of our results.

The EVA policy has implications on firm performance from the shareholders' perspective; we discuss the welfare implication from the planner's perspective shortly. For firms with an interest rate higher (lower) than the stipulated one, the EVA policy encouraged them to raise (cut) their investment, giving rise to overinvestment (underinvestment) that is detrimental to shareholder value. Our theory in Section 3 predicts that the EVA policy lowers a firm's ROE as long as its actual interest rate differs from the stipulated cost of capital, and that ROE decreases more when the interest rate is further away from—either above or below—this threshold. Our empirical results confirm this prediction; for instance, firms with an interest rate below 2.5% or higher than 10.5% had a ROE reduction of about 4–6 percentage points.

We conduct our main analysis based on the listed SOE firms for data quality issues, but our results are robust to using group-level data. We further explore the underlying economic mechanisms at work in the EVA reform. The EVA adoption strengthens the relationship between a firm's EVA performance and its forced executive turnover (i.e., demotions), but not executive compensation; this result points to a unique feature of managerial incentives in Chinese SOEs wherein managers are more like government officials. With respect to potential heterogeneous effects concerning manager characteristics, we find that managers with little equity ownership or managers with government experience were more likely to comply with the EVA rules.

In the last part of the paper, we study whether the EVA policy improves the capital allocative efficiency from a social perspective, both theoretically and empirically. Returning to the opening quote in Kerr (1975), Chinese authorities are hoping for "capital allocative efficiency" by "EVA-based rewarding" that uses a uniformly stipulated cost of capital. Although the EVA policy hurts individual firms' performances (from the shareholders' perspective), it may improve aggregate capital productivity by mitigating capital misallocation, either within SOEs (say, moving the capital from less efficient SOEs to more efficient ones), or from SOEs to more productive non-SOEs.[3]

We base our welfare discussion on a framework where risk plays an important role in determining the firm's cost of capital and hence the economy-wide capital allocative efficiency. Risk is not highlighted in the literature pioneered by Hsieh and Klenow (2009), but is central to the finance

[3] There is an extensive literature on capital allocative efficiency; see Restuccia and Rogerson (2013) and Syverson (2011) for more details.

literature (say, the classic capital asset pricing model [CAPM] by Sharpe (1964) and Lintner (1965)). The EVA's welfare implication crucially depends on whether the *true* cost of capital, which reflects the fair market-based risk compensation, is equal across firms. Intuitively, the observed dispersion in interest rates could either be driven by policy distortions—so a "bad" dispersion—or could also be driven by heterogeneous risk premia—so a "good" dispersion. A "one-size-fits-all" EVA policy could kill both bad and good dispersions, and, therefore, potentially do more harm than good to the social welfare.

In our empirical investigation, we first study the capital allocative efficiency within the SOE sector. After constructing a measure for the *true* cost of capital based on the pre-EVA data, we document that, in response to the EVA policy, industries with a higher true cost of capital increased their investment more than industries with a lower true cost of capital. Under the assumption that SOEs in the same industry share the same cost of capital,[4] this hints at a negative welfare impact of the one-size-fits-all EVA policy. A further variance decomposition exercise shows that, in our data, only about half of the cross-SOE variations in their *actual* costs of capital (i.e., including policy distortions) are within-industry variations. Since within-industry variations represent "bad" dispersion under the premise of equal cost of capital within any industry, this result constitutes a warning that the EVA policy could kill a significant amount of good dispersion present in the *actual* costs of capital. Overall, we offer preliminary but mixed evidence as to whether the EVA reform improves the overall allocative efficiency within SOEs, and we await future research on this important question.

As for the second question of capital reallocation from SOEs to non-SOEs, we find no evidence that non-SOEs increased their investment more than SOEs after the EVA policy, suggesting no improvement on this front. This is consistent with the criticism that the cost of capital stipulated by SASACs was not high enough (Stern, 2011).[5]

Our study thus contributes to the literature on SOE reforms in China.[6] By the early 2000s,

[4]As we explain in Section 5.2, this is a common assumption in the finance literature (e.g., Krüger, Landier, and Thesmar (2015)) and has been widely used among industry practitioners (Berk and DeMarzo (2017)). We classify firms into 60 industries based on three-digit industry classification codes provided by the Guidelines for the Industry Classification of Listed Companies (2012) of the Chinese Securities Regulatory Commission.

[5]The average after-tax interest rate of our sampled publicly listed SOEs was 4.4%, which is 1.1% below the 5.5% stipulated cost of capital. Our study suggests that a margin of 1.1% is not significant enough to push capital flow from SOEs to non-SOEs.

[6]The Chinese government has adopted several methods to reform the SOE sector, including shifting the responsibility for firm decisions to firms in the 1980s (Groves, Hong, McMillan, and Naughton, 1994), delegating firm

most small SOEs had been privatized. SASACs were established in 2003 to monitor the remaining big SOEs (Naughton, 2008, 2015; Li and Zhang, 2021). Instead of continuing to privatize SOEs, SASACs focused their monitoring on setting up manager evaluation rules, and the EVA reform was one of the most significant reforms since then. Our paper shows that the EVA policy reform did manage to influence the real activities of SOEs by changing the hurdle rates for capital budgeting;[7] and we stress that it should not be taken for granted that economic incentives matter for the business operation of SOEs.

From this perspective, our findings that "SOE reforms do matter" serve as a positive sign for China's future, as many researchers consider Chinese SOEs—especially central SOEs—to be run like political bureaucracies, with a significant number of them operating beyond the control of the SASACs. What is more, our analysis shows that if the EVA policy can be implemented based on firm-specific "local knowledge" a la Hayek (1945), such a reform could potentially bring a significant welfare improvement. Perhaps because they are aware of the potential pitfalls of the fixed stipulation in the cost of capital, the Chinese central SASAC has switched to using the firm-specific cost of capital for their EVA evaluations since 2016 (though it did not disclose how the cost of capital is calculated).

Literature Review. This paper contributes to the literature studying whether and how manager incentives affect firm operation and performance, both in China and beyond. Although an extensive literature exists on the relation between manager incentives and firm behaviors, the endogenous nature of managerial incentives poses significant challenges for studies on this issue (e.g., Frydman and Jenter, 2010; Edmans, Gabaix, and Jenter, 2017).[8] For clean identification, this literature often relies on certain institutional details with arguably "exogenous" compensation arrangements (e.g., restricted stocks or stock options vesting).[9] By exploiting a Chinese policy reform aimed directly

monitoring to lower-level governments (Huang, Li, Ma, and Xu, 2017), and privatization in the 1990s (Hsieh and Song, 2015). For a recent review on the topics of SOE reform and financial market development in China, see He and Wei (2022).

[7]This echoes Brandt and Li (2003), who show that bank managers' economic incentives in China's state-owned financial institutions alleviated their discrimination against private firms.

[8]Most studies in the United States have focused on how CEO pay structure (e.g., pay-performance sensitivity, option grants, deferred compensation) correlates with firm policy and performance. However, as compensation arrangements are endogenous, it is hard to interpret these correlations as causal. Murphy (1999, 2013), Frydman and Jenter (2010), and Edmans, Gabaix, and Jenter (2017) provide extensive surveys of this literature.

[9]For instance, Edmans, Fang, and Lewellen (2017) study how CEOs' equity vesting affects their firms' real investment decisions, and Shue and Townsend (2017) study how exogenous CEO option grants affect firm risk-taking. Based on a regression discontinuity framework, Flammer and Bansal (2017) find that narrowly passed shareholder

at managerial performance evaluations, we present clean causal evidence on the role of incentives by utilizing the EVA policy as a "natural experiment."[10]

There is an accounting literature studying the effects of *voluntary* EVA-based compensation plans on adopters' investment and performance, but this literature has mixed findings (Wallace, 1997; Hogan and Lewis, 2005; Balachandran, 2006). Wallace (1997) reports that, compared to control firms, EVA adopters cut investment and performance improves. Hogan and Lewis (2005) criticize Wallace (1997) by pointing out that EVA adopters are relatively poor performers before the EVA adoption, and matched non-EVA adopters show similar changes as Wallace (1997) had documented. There are two critical differences between these studies and ours. First, in these studies, firms use their actual costs of debt to calculate EVA, and the equity cost is also firm-specific (say, based on the CAPM model). They do not have the one-size-fits-all feature of the EVA reform we study, a feature that is our focus. Second, in these studies, the EVA adoptions are voluntary and endogenous, limiting any causal interpretation of the outcomes.

The EVA policy is directly aimed at improving the capital allocative efficiency in China. Capital misallocation can lower aggregate productivity (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Midrigan and Xu, 2014). Regulations, property rights, trade and competition, and financial and informational frictions are all causes of capital misallocation (Restuccia and Rogerson, 2017). Studies on policy distortion caused by SOEs' cheaper access to credit are most relevant to ours. Brandt and Li (2003) show that private firms face discrimination from banks in China, but that this discrimination diminishes with proper managerial incentives in banks. In Song, Storesletten, and Zilibotti (2011), the misallocation of resources between SOEs and non-SOEs is a key source of productivity loss, which has gained increasing attention over the years after China's four-trillion RMB stimulus package in 2009 (Bai, Hsieh, and Song, 2016; Chen, He, and Liu, 2020). Dollar and Wei (2007) find that SOEs have significantly lower returns to capital than non-SOEs.[11] More recently, Geng and Pan (2021) study the time-variation of implicit guarantees and discrimination

proposals granting executives long-term incentives increase firm value.

[10]Apparently, we are not the first to document that incentive schemes can have unintended consequences. For example, see Dranove, Kessler, McClellan, and Satterthwaite (2003), who document that health care report cards – public disclosure of patient health outcomes at the level of the individual physician or hospital or both—give doctors and hospitals incentives to decline to treat more difficult, severely ill patients.

[11]Brandt, Tombe, and Zhu (2013) find that resource misallocation between SOEs and non-SOEs in China reduces non-agricultural productivity by an average of 20%, and Bai, Lu, and Tian (2018) incorporate savings in a model with financial frictions and find the aggregate TFP loss to be about 12%. Finally, Li, Wang, and Zhou (2021) study the effect of the anti-corruption campaign on credit reallocation between SOEs and non-SOEs.

against non-SOEs in China's fast-growing corporate bond market.[12] In contrast, our study takes a more reduced-form approach and provides direct evidence that policy regulation of the cost of capital has a first-order impact on capital allocation.

Our study is useful for thinking about policy distorted credit activities worldwide. SOEs or organizations with similar natures exist around the world, as governments often provide implicit or explicit guarantees to too-big-to-fail financial institutions and nonfinancial firms (Lucas, 2014). While we do not advocate a simple EVA policy for all these institutions, such an approach may help them recognize any cost of government guarantees in their decision making, especially when removing such guarantees is not an option.

This paper proceeds as follows. Section 2 describes the regulations of Chinese SOEs and the details of the EVA policy. In Section 3, we develop a simple framework and develop our predictions. Section 4 describes the data, explains our methodology, and reports the main empirical results. Analysis on the capital allocative efficiency is presented in Section 5, and Section 6 concludes.

2 Chinese SOEs and the EVA Reform

We provide institutional background in this section.

2.1 The SOE System in China and the SASAC

The SOE system in China has undergone significant reforms over the last four decades. Before 1978, SOEs were directly under the management of the Chinese government. Reforms gave them increasing autonomy (Groves, Hong, McMillan, and Naughton, 1994; Mengistae and Xu, 2004) so that, by the 1990s, many SOEs had become independent production and management entities.

To monitor these SOEs, the Chinese government established the SASAC system in March 2003. The SASACs were set up simultaneously at the central and local government levels. The SASACs represent the government authority as the legal owner of the SOEs and is designed to monitor SOEs and ensure that they advance the government's interests. The SASACs accomplish this by appointing auditors and boards of directors, establishing procedures for appointing managers,

[12] Amstad and He (2020) provide an overview of the institutional background of the Chinese corporate bond market. For the most recent studies on this market, see Chen, Chen, He, Liu, and Xie (2022) and Ding, Xiong, and Zhang (2022), among others.

approving major business decisions (say, mergers and new strategic initiatives), and reporting SOEs' performance to the appropriate level of government. Most relevant to our study, the SASACs conduct annual performance evaluations of SOE managers, based on which the SASACs make their remuneration and personnel decisions concerning SOE managers.[13]

SOEs are controlled by different levels of the Chinese government; some are controlled by the central government and others by provincial or lower-level governments. An SOE is under the watch of the SASAC at the appropriate level of government that controls it. The majority of local SASACs adopt monitoring rules similar to the central SASAC. Next, we discuss the rules adopted by the central SASAC.

2.2 Performance Evaluation Procedures

The SASAC bases its performance score on a formula that uses several objective performance measures, two of which are mandatory.[14] From 2004 to 2009, the two mandatory measures were earnings before tax and extraordinary items (EBT) and return on equity (ROE, net income divided by equity). Starting from 2010, ROE was replaced by economic value added (EVA); we will explain the definition of EVA shortly.

The formula assigns points to SOEs based on whether they exceed or fall short of performance targets. Performance targets are negotiated with SOE managers at the end of the previous performance period and are subject to stringent guidelines. For example, performance targets generally will be above the average of the last three years' performance and are heavily influenced by a firm's industry performance and GDP growth objectives.[15] Finally, based on the final points of each SOE, the SASAC assigns one of five rating categories, A to E, to each SOE, based on certain cutoff scores. A rating of "C" or above is considered acceptable, and SOE executives in D- and E-rated firms may be asked to step down. According to publicly disclosed rules, the ratings directly determine the executives' incentive pays as well as their promotion/demotion outcomes.

[13]In some cases, the Organizational Department of the Chinese Communist Party makes the personnel decisions. Based on our conversations with officials from both the SASACs and the Organizational Department, even in these cases, the SASAC evaluations are important factors that the Organizational Department considers in making their decisions.

[14]The SASAC also chooses other supplementary measures based on industry and firm characteristics. Common measures include inventory turnover, accounts receivable turnover, and sales growth.

[15]A firm's industry performance and the Chinese government's GDP growth objectives are largely out of any individual firm's control. Based on interviews with SASAC officials, Du, Erkens, Young, and Tang (2018) conclude that subjectivity does not play a significant role in setting target levels.

2.3 The EVA Reform

In 2010, the central SASAC replaced ROE with EVA in the performance evaluation system. EVA is a measure of operating income that, by including a charge for the cost of all capital employed by a firm, provides a measure of economic profit. EVA measures value creation for investors; conceptually it is a better performance measure than ROE, which measures accounting profit (Rogerson, 1997).[16] More specifically, define Adjusted Capital to be[17]

$$\text{Adjusted Capital} = \text{Equity} + \text{Liabilities} - \text{Adjustment},$$

and Net Operating Profits after Tax (NOPAT) to be

$$\text{NOPAT} = \text{Net Income} + 0.75 \times \left(\text{Interest Expenses} + \text{R\&D Expenses} - \frac{\text{Nonrecurring Income}}{2}\right), \tag{1}$$

where the factor of 0.75 in Eq. (1) is to adjust for tax, as the running tax rate at that time in China was 25%. Then, Economic Value Added (EVA) is calculated as

$$\text{EVA} = \text{NOPAT} - \text{Adjusted Capital} \times \text{Cost of Capital}. \tag{2}$$

The EVA formula adopted by Chinese authorities adds after-tax interest expenses back to net income and, more importantly, fixes the "Cost of Capital" in Eq. (2) at 5.5%. Adjusting for the tax factor 0.75, it is as if the new policy stipulates a 5.5% after-tax cost of capital on the firm or 7.3% (5.5%/0.75) on a pre-tax basis. In Section 3, we develop our hypotheses on how the EVA policy affects firm investment and valuation.[18]

The stipulated 5.5% cost of capital of applies to virtually all SOEs, though there are a few exceptions. One such exception is for firms that are too levered; specifically, industrial firms with

[16] Despite its theoretical superiority, whether EVA beats earnings empirically is less conclusive due to the difficulty in accurately measuring firms' cost of capital (and hence EVA). For example, Biddle, Bowen, and Wallace (1997) report that earnings outperforms EVA (the version of EVA advocated by the consulting company Stern Stewart & Company) as earnings is more related with stock returns than EVA.

[17] Here, the "Adjustment" includes interest-free current liabilities and construction in process.

[18] Besides the above change, the EVA policy adds back R&D expenses and half of the nonrecurring income. These adjustments may have changed firms' policies. For example, they may have increased firms' incentive to invest in R&D (which was one of the SASAC's goals). However, these two adjustments are unrelated to a firm's interest rate. In Section 4.6.3, we confirm that the EVA policy did increase firms' R&D expenses, providing additional evidence that the EVA policy had affected SOEs' behaviors.

debt/asset ratios higher than 75% or nonindustrial firms with debt/asset ratios higher than 80% have a 6% cost of capital. We exclude these firms, which account for about 8% of our sample, from our analysis. Our empirical results are robust to whether we include them or not.[19]

Although the majority of the local SASACs adopted the same rules as the central SASAC, some provincial SASACs adopted different rules for calculating the cost of capital. In Hebei and Gansu, the actual cost of debt is considered in EVA calculations. Hebei also uses the actual cost of equity (however, it did not disclose how the cost of equity is calculated). Gansu sets the cost of equity at 7%. Anhui sets the cost of capital at 4.5% instead of 5.5%. Shaanxi sets a firm's cost of capital as the average return on assets of its industry peers. For consistency of our empirical analysis, we exclude these four provincial SASACs, which account for about 9% of our final sample, from our analysis. We also exclude Tibet SASAC due to lack of data.

2.4 The Staggered Adoption of the EVA Policy

SASACs typically decide whether to revise their evaluation policy at the beginning of three-year cycles. The beginning of the three-year cycles varies across SASACs largely as a result of when a SASAC was established to evaluate SOEs. For example, the central SASAC was established in 2003 and started to evaluate SOEs in 2004. Hence, the 2010-2012 period is the third three-year cycle. Because different SASACs started their initial evaluation in different years, their three-year cycles do not perfectly overlap. Partially because of this heterogeneity, the EVA adoption was staggered across SASACs.

We manually collected information on the details of the EVA policy for each province.[20] We primarily rely on the performance evaluation reports or announcements available on the SASAC websites and occasionally on our direct contact with SASAC officials. We end our sample in 2015 because the central SASAC revised the EVA policy but did not disclose the details of the new performance evaluation policy.

In our final sample, besides the central SASAC, we have fourteen provincial SASACs that also

[19] Other exceptions are firms with significant policy burdens and high asset specificity, say military service–related firms. Their cost of capital is stipulated to be 4.1%. Most of these firms are not publicly listed and therefore not in our sample.

[20] Different levels (provincial, prefectural, or county) of the Chinese government have their own SASACs. In this paper, we focus on the provincial-level SASACs. First, a majority of the SOEs in our sample (firms listed on the Shanghai and Shenzhen Stock Exchanges) are controlled either by the central SASAC or the provincial SASACs. Second, information on local EVA policy adoption for lower-level governments is extremely difficult to collect.

adopted the EVA policy, in a staggered fashion. Figure 1 presents the year of the EVA policy adoption for each SASAC. Figure 1 does not reveal any clear pattern on the timing of the EVA policy. For example, the Beijing SASAC adopted the EVA in 2010, while Tianjin and Shanghai did not adopt it by the end of our sample period. In Table 1, we conduct a more formal test. Table 1 presents results on how province-level characteristics affect the timing of the EVA policy adoption. The unit of analysis is province-year. The dependent variable is one if a province adopted the EVA policy in that year and zero otherwise. Province-year observations after a province adopted the EVA are excluded. All the independent variables are lagged by one year.

We consider both economic and political factors: GDP growth, GDP per capita, age and tenure of Party secretary, the proportion of SOE assets among all industrial enterprises (*% of SOE Assets*), and an index measuring the province's marketization level. Data on province marketization levels are from the China Provincial Market Index Database (https://cmi.ssap.com.cn/) and data on province Party secretaries are from the Chinese Research Data Services Platform (CNRDS). All other data are from the China Stock Market & Accounting Research (CSMAR) Database. The results show that the only variable significant at the 5% level is *% of SOE Assets*, suggesting that provinces with a higher fraction of assets under SOEs' control are more likely to adopt the EVA policy than other provinces. However, when we put all the variables into one regression, its statistical significance disappears. Broadly speaking, the EVA policy adoption timing is not strongly correlated with any of these variables. Later in the paper, we design tests to mitigate further the concern that the EVA policy adoption may be endogenous.

Finally, before the formal adoption of the EVA policy in 2010, the central SASAC had encouraged central SOEs to use the EVA formula to calculate their performance, and some SOEs had started to report their EVA to the SASAC. However, EVA was never used in actual evaluation until 2010. We argue that the partial anticipation of the EVA policy should not have an effect on our estimation because firms did not have incentives to maximize their EVA until it became effective (Hennessy and Strebulaev, 2020).

One concern of the DDD strategy is that the EVA-adoption timing may coincide with political economy or business cycle factors. Table 1 shows that the timing is not associated with many observables and hence mitigates this concern. However, it is impossible to take all possible factors into account, especially unobservables.

We address this concern by exploiting a unique institutional feature in the context of China's SOE reform. Although most SOEs controlled by one provincial SASAC are located in the same province, a number of them are located elsewhere, and the central SASAC controls SOEs located across the country. For example, Yaxing Coach, a bus manufacturer based in Jiangsu province, is controlled by Shandong SASAC. These firms and the central SASAC firms enable us to add province×year fixed effects to control for time-varying province-level factors. The last column of Table 3 reports the results of this specification. Our results are robust. The magnitude of the estimate is also similar to that without province×year fixed effects. These results show that time-varying province-level factors have minimal impact on our finding, mitigating the concern that the EVA adoption timing may be endogenous.

3 A Theoretical Framework

We offer a simple model to guide our empirical analyses in Section 4. This theoretical framework also provides foundation for our welfare discussion in Section 5.

3.1 The Setting

Consider a model in which an SOE chooses the capital scale of $K = D + E$, where D denotes debt and E denotes equity. We assume a standard production function $F(K) = F(D + E)$ with usual regularity conditions $F'(K) > 0$ and $F''(K) < 0$. This SOE receives the following cash flows

$$\Pi(K) = \Pi(D + E) = (1 - \tau_Y) F(D + E). \tag{3}$$

Here, τ_Y, which could be firm specific, captures the so-called output wedge following the capital allocative efficiency literature (e.g., Hsieh and Klenow, 2009) and includes the standard corporate taxes (with a rate of π) as well as government subsidies (excluding indirect subsidies via lower interest rates, which will be discussed soon).[21] We allow for any general π_Y to ensure that our main empirical methodology is robust to this dimension of heterogeneity in the data.

Following Hsieh and Klenow (2009) we implicitly define the capital cost wedge τ_K, which cap-

[21] Note that in the standard corporate finance literature, when $\tau_Y = \pi$, $F(K)$ represents the earnings before interest and taxes (EBIT) of the firm, and $\Pi(K)$ is the earnings before interest after tax (EBIAT).

tures the difference between the SOE's actual interest rate r_D and the economy-wide equilibrium interest rate r:

$$r_D = (1 + \tau_K)\, r. \tag{4}$$

The capital cost wedge τ_K can also be firm specific, which, similar to τ_Y, distorts the firm's investment decision as well. It could capture the government's cost of capital subsidy; the cheaper the credit access, the smaller (more negative) the τ_K is and hence the lower the expected financial cost. Importantly, in our data, we observe r_D directly.

We highlight two conceptual points of our framework. We do not analyze risk in the baseline model here; it is clear that the analysis is robust to idiosyncratic risk. However, aggregate risk does play an important role in our welfare discussion later in Section 5. We therefore offer a simple model with aggregate risk in Appendix Section A.1. There, we illustrate that the key empirical predictions in Section 3.3 are robust to the presence of aggregate risk.[22]

Aggregate risk matters for our welfare discussion later because it carries risk premium; with risk premium, the "right" discount rate r could be firm specific, as opposed to a single economy-wide equilibrium interest rate r. This possibility is implicitly assumed away by the standard capital allocative efficiency literature (e.g., Hsieh and Klenow, 2009), but it is widely acknowledged by the finance literature dating back to Modigliani and Miller (1958), which says that the appropriate discount rate should include the "risk premium" based on the risk profile of the firm's cash flows. This important conceptual difference matters little in most parts of our paper, which is mainly concerned with the *positive* implications of the EVA policy reform. However, it plays a key role when we discuss the *normative* implications later in Section 5.

3.2 Assumptions and Discussions

Throughout the paper, we assume that debt, rather than equity, is the financing margin to adjust for the firm's investment. Section 4.6.3 provides empirical evidence for this premise, which reflects the unique regulatory environment in China. During our sample period, external equity financing activities of Chinese listed firms were strictly regulated;[23] Appendix Section A.2 shows that less

[22] For most analyses, we can place the model in a risk-neutral setting and treat $F(K)$ and r_D as expected cash flows and interest rate under the risk-neutral measure (as opposed to the physical measure).

[23] For instance, concerning poor corporate governance, the China Securities Regulatory Commission (CSRC) required a firm to have positive earnings and at least 20% dividend payout ratio over the past three years to qualify

than 1.5% of listed firms conducted public seasoned equity offerings; dividend payments were low and strongly persistent, and repurchases were almost nonexistent. Since 2006, virtually all external equity was issued via private equity placements, which, however, could serve a different purpose than financing investment.[24] We hence assume that equity adjustment cost is prohibitive and debt is the margin to finance investment.[25] Our results are robust to the sample excluding firms that conducted external equity financing, as shown in Section 4.6.3.

There is another assumption behind Eq. (4): the borrowing rate r_D is independent of the firm's leverage D. Note, r_D should be the expected interest expense, as opposed to the quoted (or promised) interest rate; and r_D should equal the economy-wide risk-free rate (i.e., independent of firm leverage) if default is idiosyncratic. Aggregate risk would bring about a positive relationship between the expected borrowing cost r_D and leverage D, but the nature of risk matters. In the simple setting given in Appendix Section A.1, default is driven by an aggregate disaster state, leading to an equilibrium borrowing rate that is independent of firm-specific leverage again.[26] Finally, empirically neither the levels of r_D and leverage nor their changes are correlated in our SOE sample, as SOE default is extremely rare during our sample period 2009–2015.[27]

3.3 Model Implications

This section provides empirical predictions regarding the firm's investment responses to the EVA policy adoption. Before the EVA policy, the SOE manager maximizes the firm's ROE:

$$\max_D ROE = \frac{\text{Net Income}}{E} = \frac{\Pi\left(D+E\right) - \text{After-tax Interest Expense}}{E}, \tag{5}$$

$$= \frac{\left(1-\tau_Y\right) F\left(D+E\right) - \left(1-\pi\right) r_D D}{E}, \tag{6}$$

for public seasoned equity offerings.

[24]Private equity placements, which require neither positive earnings nor a certain dividend payout, typically involve either a change of controlling shareholders or the addition of new large shareholders. Consistent with this view, we find that the average private placement's issuance amount is large (conditional on conducting a private placement, the new issuance was 42.6% of the existing equity base), and about 70% of investors are either enterprises or private equities during our sample period.

[25]In Appendix Section A.2, we report the analyses on external equity financing. Specifically, Appendix Table A.1 reports the summary statistics on our sample firms' external financing activities. In Table A.2, we report results if we exclude firms that conducted external equity issuance.

[26]In Appendix Section A.1, we modify the setting slightly in Section 3.1 to incorporate aggregate risk. There, the probability of project failure is driven by an aggregate event in which the project yields zero cash flows and triggers default. We derive the equilibrium interest rate, which is independent of firm leverage.

[27]We report the correlation of the levels of r_D and leverage, which is only 3.2%, in Panel B, Table 2. The annual changes in leverage and r_D have an even lower correlation of 2.5%, which is insignificant at the 5% level.

where π denotes the corporate tax rate. (Note that τ_Y includes the corporate tax rate π.) The first-order condition with respect to D (and equivalently, with respect to K) reads

$$F'\left(K_{ROE}\right) = \frac{1-\pi}{1-\tau_Y} r_D. \tag{7}$$

Under the EVA policy, the SOE manager maximizes its EVA, which is given by:[28]

$$\text{EVA} = \text{Net Income} + 0.75 \times r_D D - 5.5\% \times (D+E).$$

Plugging in Net Income from Eq. (5), which equals $(1-\tau_Y) F(D+E) - (1-\pi) r_D D$, the SOE manager now solves

$$\max_D \, (1-\tau_Y) F(D+E) - (0.25-\pi) r_D D - 5.5\% (D+E).$$

The optimal capital level under the EVA policy satisfies the following first-order condition:

$$F'\left(K_{EVA}\right) = \frac{(0.25-\pi) r_D + 5.5\%}{1-\tau_Y}. \tag{8}$$

Denote by ROE^* and ROE_{EVA} the ROE before and after the EVA adoption, respectively. The following proposition forms the basis of our empirical analysis.

Proposition 1. *Suppose that $\pi = 0.25$, which is the running corporate tax rate in China. All else equal, we have:*

1. *$K_{EVA} - K_{ROE}$ increases with r_D; that is to say, relative to the ROE policy, the change in an SOE's investment under the EVA policy is greater when its borrowing cost r_D is higher.*
2. *$ROE_{EVA} - ROE^*$ is hump shaped in r_D, and reaches its maximum when $r_D = 7.3\%$.*

Proof. When $\pi = 0.25$, $F'\left(K_{EVA}\right) = \frac{5.5\%}{1-\tau_Y}$ is independent of r_D while $F'\left(K_{ROE}\right) = \frac{1-\pi}{1-\tau_Y} r_D$ increases with r_D. This proves the first claim. The second claim, which does not rely on $\pi = 0.25$,

[28] Here we can ignore the adjustment of R&D expenses and nonrecurring incomes in Eq. (1) for a cleaner analysis as they can be viewed as some constant adjustment in the objective.

follows from the fact that

$$F'(K_{EVA}) - F'(K_{ROE}) = \frac{5.5\% - 0.75 r_D}{1 - \tau_Y} = \frac{7.3\% - r_D}{\frac{4}{3}(1 - \tau_Y)},$$

so that K_{EVA} coincides with K_{ROE} when $r_D = 7.3\%$. □

Our first result, which concerns how the EVA policy changes the SOE's investment, is immediate given the concavity of F. More specifically, the lower the borrowing cost r_D (which might be caused by a greater subsidy), the lower the change of investment following the EVA adoption. One also test a perhaps sharper prediction that $K_{EVA} - K_{ROE} > 0$ ($K_{EVA} - K_{ROE} < 0$) for firms with $r_D > 5.5\%$ ($r_D < 5.5\%$); however, as explained in footnote 41, this alternative difference-in-differences (DD) approach requires a different parallel-trend assumption compared to our main DDD approach, with the latter receiving a much stronger empirical support.

Our second result implies that from the perspective of shareholders, the EVA policy is value-destroying because the manager no longer maximizes shareholder values. (We return to the EVA's welfare implication in Section 5.) Essentially, the EVA policy leads firms with interest rates higher than 7.3% to overinvest (relative to K_{ROE}, which optimizes ROE), leads firms with interest rates lower than 7.3% to underinvest, and has no impact on firms with $r_D = 7.3\%$.

4 Empirical Results

After describing the data, we present our main empirical results, both the raw data pattern and regression analysis.

4.1 Data

The SASACs evaluate their SOEs at the level of "group company." Most of these group companies are unlisted. This paper focuses on studying the listed SOEs because we have better information about them. Most of these listed SOEs are subsidiaries of group companies. Theoretically, maximizing EVA at the group company–level is always equivalent to maximizing EVA for every subsidiary. Further, if debt is the only financing margin, which is our running assumption, then without any other financial constraints maximizing ROE at the group company–level is also equivalent to maximizing ROE for every subsidiary (to see this point, see Eq. (6)). For these listed firms, accounting data and stock price data are from China Stock Market & Accounting Research (CSMAR) Database, which covers all firms listed on China's two stock exchanges.

The sample period is from 2004 to 2015. We start the sample from 2004 because the central and also most provincial SASACs started to evaluate SOEs in 2004. We end the sample in 2015 because the EVA policy for the centrally controlled SOEs was revised then, but the details were not disclosed.[29]

We begin with 11,236 firm-year observations (1,196 unique firms) of nonfinancial SOEs.[30] We classify a firm as an SOE if its ultimate controlling party is the state. We manually collected the identity of firms' controlling shareholders.[31] We exclude SOEs controlled by the Tibet SASAC (24 observations), by government agencies other than SASACs, and by lower-than-province level SASACs (4,860 observations); they are excluded because we cannot find information as to whether they adopted the EVA policy or not.[32] In addition, as explained in detail toward the end of Section 2.3, we further exclude 1) SOEs controlled by the SASACs of Hebei, Gansu, Anhui, and Shaanxi (426 observations) as they do not set the cost of capital at 5.5% in their EVA policy; and 2) SOEs that are too levered (393 observations), as the EVA policy mandates them to have a stipulated cost of capital of 6%.[33] Including them does not have any material impact on our results. Finally,

[29]There are two alternative data sources. The first one is the Chinese Annual Survey of Industrial Firms, which is collected by the National Bureau of Statistics in China. This dataset includes all SOEs. Unfortunately, it is widely accepted that the data during our post-EVA sample have serious quality issues (e.g., Brandt, Van Biesebroeck, and Zhang, 2014). This data set has total debt but not interest-bearing debt. As a result, it does not allow researchers to calculate interest rates accurately. We discuss this issue in detail later this section. The second alternative data source is the Annual Tax Survey Database, an annual survey administrated by the Ministry of Finance and the State Administration of Taxation of China (Chen, Jiang, Liu, Serrato, and Xu, 2021; Chen, Liu, Serrato, and Xu, 2021). Unfortunately, like the Annual Survey of Industrial Firms database, this database does not have information on interest-bearing debt. We hence conduct our study based on listed firm sample.

[30]The firms listed on ChiNext, a NASDAQ-style subsidiary of the Shenzhen Stock Exchange, are not included, as the first batch of firms started trading on ChiNext on October 30, 2009, which was right before the first wave of EVA adoption.

[31]Chinese listed firms are required by law to disclose their ultimate controlling parties in their annual financial reports. The state is the ultimate controlling party of a firm if (i) the state controls directly or indirectly over 50% of total shares outstanding, (ii) the state controls directly or indirectly over 30% of total voting rights, (iii) the voting rights of the state allow it to elect over 50% of board directors, or (iv) the state has a significant influence on decisions made in shareholder meetings. Many existing studies have used the same definition (Allen, Qian, and Qian, 2005; Fan, Wong, and Zhang, 2007).

[32]The CSMAR dataset classifies whether a listed firm is under the control of the central SASAC or a local SASAC. Unfortunately, we find this field has many errors, and we manually double-checked this data field by using information from a firm's or their group's reports and websites.

[33]These four SASACs account for about 9% of our final sample, and firms that are too levered (industrial firms with debt/asset ratios above 75% or non-industrial firms with debt/asset ratios above 80%) account for about 8%. The high-leverage filter is based on the leverage of the group companies. For listed firms for which we do not have data on their group company, the high leverage filter is based on the listed firm's leverage. Our results are very

we also exclude 817 observations with missing capital expenditure, lagged interest rates, or lagged *Tobin's Q*. Our final sample contains 4,716 observations and 638 unique firms.[34]

We define *InterestRate* as interest expenses divided by the average of a firm's interest-bearing debts at the beginning of the year and the end of each of four quarters. We use quarterly data to better calculate the average amount of debt used over a year period. Total interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. This method has been widely used in the accounting and finance literature to calculate interest rates using the U.S. listed firm sample (e.g., Francis, LaFond, Olsson, and Schipper, 2005; Frank and Shen, 2016).[35]

Table 2 reports the summary statistics. To mitigate the effect of outliers, we winsorize all the continuous variables at the 1% and 99% levels. Panel A reports the mean, median, standard deviation, and the 25th and 75th percentiles of the variables used in our analysis. Panel B reports the correlation matrix. Here, *Capex* is capital expenditure divided by lagged total assets; *Tobin's Q* is defined as the sum of the market value of equity and book value of the liabilities, divided by the book value of total assets; *CashFlow* is cash flow from operating activities, scaled by lagged total assets; *Log*(*Assets*) is the natural logarithm of total assets; *Leverage* is defined as total liabilities divided by total assets; *CEOOwnership* is the average fraction of shares held by a firm's general manager and board chair, multiplied by 100.[36] *PoliticalConnection* is a dummy variable

similar if we keep these firms.

[34] A firm's controlling shareholder can change in various ways: between two governments (which could involve different levels of governments and/or the same level) or between the state (various levels of governments) and a nonstate shareholder. Hsieh and Song (2015), Huang, Li, Ma, and Xu (2017), and Gan, Guo, and Xu (2018) study some aspects of these ownership changes. Our data selection is at the firm-year level. In other words, a firm-year is included in our sample if the firm satisfies our data requirement in that year. This firm may not satisfy our data requirement in other years, and those firm-years will be excluded.

[35] We highlight several points regarding the measurement of the interest rate. First, in theory r_D should be the marginal interest rate, while our empirical measure is the average interest rate given the data limitation. Second, in our theoretical framework, r_D should be the expected interest rate, not the promised/quoted interest rate (e.g., loan rate); they could differ if there are renegotiations or defaults, and therefore our measurement is closer to our theory than quoted loan rates. (During our sample period, defaults were extremely rare but renegotiations occurred often.) Third, the denominator should have interest-bearing debt only; including other non-interest-bearing debt (e.g., accounts payable) may lead to a severe underestimation. To give a concrete example, the Chinese Annual Survey of Industrial Firms dataset has information on total debt but not on interest-bearing debt. Based on that dataset, Bai, Lu, and Tian (2018) measure interest rate as the ratio of interest expenses to total debt, and obtain a mean (median) interest rate as 3% (1–2%) that is much lower than ours (in fact, even below the government bond yield). Fourth, although some of the interest expenses can be capitalized, the EVA formula specifically states that the interest expense should exclude capitalized interest expenses. We hence follow this definition and exclude the capitalized interest expenses in our estimation (though our results are robust to this treatment).

[36] We consider both the general manager (often with the title of CEO) and the board chair to be company executives. In China, many board chairs are the ultimate decision makers who really perform the duty of CEO, as understood in the terms of the western economy (Jiang and Kim, 2020).

that equals one if either the general manager or the board chair was previously employed as a government bureaucrat (either central or local). Finally, ROE is net income divided by the lagged equity.

The mean (median) of $Capex$ is 7.1% (4.6%) of total assets, while the mean (median) of $InterestRate$ is 5.8% (5.4%). There are large variations for both variables. The 25th and the 75th percentiles of $Capex$ are 1.8% and 9.4%, respectively, and they are 4.2% and 6.6% for $InterestRate$. Consistent with the U.S. data (e.g., Frank and Shen, 2016), $Capex$ and $InterestRate$ are strongly negatively correlated. Also, larger firms, lower *Tobin's Q* firms, and higher ROE firms have lower interest rates. Firms with political connections also have lower interest rates, consistent with the existing literature (Li, Meng, Wang, and Zhou, 2008).

Finally, in Section 4.4.1, we conduct a robustness analysis based on group-level data. We collect the data of a sample of "group-level" companies from several sources. Some group companies that issued corporate bonds or commercial papers need to disclose their financial statements from the past three years, and we collect their accounting information from the RESSET Database. RESSET has a much more comprehensive coverage of these firms than the CSMAR database. However, since RESSET does not have information on ownership, industry, or location, we obtain such information from the Chinese Research Data Services Platform (CNRDS) and supplement with information from these firms' websites and public internet searches. Both RESSET and CNRDS are widely used databases for obtaining Chinese data (Calomiris, Fisman, and Wang, 2010; Chen, Ma, Martin, and Michaely, 2022).

4.2 Empirical Pattern: The Raw Data

Figure 2 presents the evolution of $Capex$ for different interest rate groups in the raw data; it can serve as a preliminary test of the parallel trends assumption, which we formally test later.[37] Panel A reports the results of the treatment SASACs, and Panel B reports the results of the control SASACs. For treated SASACs that adopted the EVA policy in year t, we use the SASACs that never adopted the EVA in our sample as controls. Specifically, we sort firms into high and low

[37] An SOE's controlling shareholder may change from one SASAC to another. If the two SASACs adopt the EVA policy in different years, an SOE subject to the EVA policy this year may switch back in a later year. In our sample, there are 24 such changes. Due to the difficulty of defining the event year, we exclude these 24 firms from this analysis. Our results are almost identical if we use the first time an SOE became subject to the EVA policy and ignore the following controlling shareholder changes.

InterestRate groups by the sample median in each EVA adoption year based on the interest rate at the last year before the EVA adoption. We report the mean of firm investment (with 95% confidence intervals) from four years before ($t-4$) to four years after ($t+3$) the EVA adoption. Year 0 is the first year that the EVA policy became effective. We do this separately for the treated and the control firms.

There is an overall trend in decreasing investment across all the SOEs, coinciding with a decreasing GDP growth rate in China during this period. More important is that the investment levels of the two groups of firms are parallel before the policy adoption, for both the treated and the control. Among the treated firms, the investment gap between the high and low interest rate groups shrinks from a pre-EVA-adoption level of 3–5% to almost zero. Most of the shrinkage occurs in the EVA adoption year (year 0). Among the control firms, the investment gap between the high and low interest rate groups shrinks from a pre-EVA-adoption level of 2% to 1%. The shrinkage is much smaller, and the shrinkage spreads out over the years, rather than being concentrated in year 0. Overall, these patterns in the raw data provide evidence for the validity of our DDD strategy.

4.3 Baseline Empirical Results

4.3.1 Baseline regressions

The main empirical prediction (the first prediction of our proposition) is that firms with a higher cost of debt will increase their investment after the EVA policy adoption relative to firms with a lower cost of debt. Specifically, we run the following baseline model for our DDD strategy:

$$CAPEX_{i,t} = \beta_1 InterestRate_{i,t-1} + \beta_2 Post_{i,t} + \beta_3 Post_{i,t} \times InterestRate_{i,t-1} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t}. \quad (9)$$

Here, i and t index firms and years, respectively; $CAPEX_{i,t}$ is firm i's capital expenditure divided by lagged total assets in year t; $InterestRate_{i,t}$ is the interest rate on a firm's borrowing; $Post_{i,t}$ is a dummy equal to one if firm i is subject to the EVA policy in year t and zero otherwise; $\boldsymbol{X}_{i,t}$ is a set of control variables, including *Tobin's Q*, *CashFlow*, *Log*(*Assets*), and *Leverage*. All the control variables are lagged by one year except *CashFlow*, which is measured contemporaneously.[38]

[38]Some of these control variables may also be affected by the EVA policy. Our results are similar if we do not include any controls. See Table A.3 in Appendix.

Depending on the specification, we include firm fixed effects, year fixed effects, industry×year fixed effects, and SASAC×year fixed effects. These two interactive fixed effects control for the time-varying SASAC-level and industry-level factors.[39] We double-cluster standard errors by SASAC and year.[40] We classify firms into 19 industries based on the industry classification codes provided by the Guidelines for the Industry Classification of Listed Companies (2001) of the Chinese Securities Regulatory Commission, with two-digit (one-digit) industry codes for (non)manufacturers.[41]

The main prediction of Proposition 1 is that $\beta_3 > 0$. Column 1 of Table 3 reports the result without any control variables or fixed effects. We add more control variables and fixed effects from column 2 to column 5. The coefficient of the interaction term is similar across different specifications, and the statistical significance with more stringent controls is even stronger relative to the simplest model in column 1.

The magnitude of the coefficient of the interaction term is large. In column 1, the coefficient of $InterestRate$ is -0.368 ($t = -4.16$). This suggests that, before the EVA adoption, a 1% increase in $InterestRate$ is associated with a 0.368% decrease in $Capex$. In the post-EVA period, a 1% increase in $InterestRate$ is associated with a 0.112% decrease in $Capex$ ($-0.368 + 0.256$). The sensitivity decreases by close to 70%.[42] Overall, these results support the first prediction of our proposition.

Finally, as explained in Section 2.4, one concern of the DDD strategy is that the EVA-adoption timing may coincide with political economy or business cycle factors. We address this concern by exploiting a unique institutional feature in the context of China's SOE reform. Although most

[39] The standard difference-in-differences estimate based on staggered events may be biased (De Chaisemartin and D'Haultfoeuille, 2020; Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021). De Chaisemartin and D'Haultfoeuille (2020) propose to use the never-treated sample as the control group, an approach that we follow later in Figure 2 in Section 4.3.2. We also report the regression results based on this approach in Appendix Section A.3 and find similar estimates.

[40] Occasionally, the t-statistics of the coefficient of $Post \times InterestRate$ are significantly higher than most of the estimates. This is likely due to the small sample property of the double-clustered standard errors (Petersen, 2009). For these cases (columns 3 and 4 of Table 3), instead of reporting the double-clustered t-statistics, we report the more conservative t-statistics clustered by SASAC.

[41] Besides the prediction that $K_{EVA} - K_{ROE}$ increases with r_D, our theoretical model also predicts that $K_{EVA} - K_{ROE} > 0$ if $r_D > 5.5\%$ and $K_{EVA} - K_{ROE} < 0$ if $r_D < 5.5\%$. We conduct the test using a difference-in-differences (DD) approach by comparing treatment and control SOEs with similar interest rates, which requires parallel trends between investments by these two groups. However, as shown in Figure (2), this parallel-trend assumption does not hold in the data, as Panel A (treatment group) has a different trend from Panel B (control group). (Note, our DDD approach requires the high-low investment difference to exhibit parallel trends between treatment and control SOEs, which largely holds in Figure (2).)

[42] In Table A.2, we exclude firms that have done any external equity financing during the seven years around the EVA policy adoption and find similar results.

SOEs controlled by one provincial SASAC are located in the same province, a number of them are located elsewhere, and the central SASAC controls SOEs located across the country. For example, Yaxing Coach, a bus manufacturer based in Jiangsu province, is controlled by Shandong SASAC. These firms and the central SASAC firms enable us to add province×year fixed effects to control for time-varying province-level factors. The last column of Table 3 reports the results of this specification; we observe a similar coefficient of $Post \times InterestRate$ as in column 6, which shows that time-varying province-level factors have minimal impact on our finding, mitigating the concern that the EVA adoption timing may be endogenous.

4.3.2 Dynamic estimations

Figure 2 presents the parallel trends with the raw data; we now present the effect of the EVA policy in a dynamic regression framework. Figure 3 plots the coefficients $\{\beta_{3s}\}$ from the following regression:

$$CAPEX_{i,t} = \beta_1 \cdot InterestRate_{i,t} + \sum_{s \neq -1} \beta_{2s} \cdot Post_{i,t,s} + \sum_{s \neq -1} \beta_{3s} \cdot InterestRate_{i,t} \times Post_{i,t,s} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t}.$$

Here, s indicates the year relative to the EVA adoption, so for firm i in year t, $Post_{i,t,s} = 1$ if firm i's SASAC adopted the EVA policy in year $t - s$. We use the year before the EVA adoption ($s = -1$) as the base year and estimate the coefficients of $Post \times InterestRate$ for each event year relative to the base year. The t-statistics are calculated by clustering at both the SASAC level and the year level. Panel A presents the results without including the province×year fixed effects (corresponding to column 5 in Table 3). Panel B presents the results with the province×year fixed effects (corresponding to column 6 in Table 3). The results show that the $\{\beta_{3s}\}$ coefficients are around zero in the pre-EVA-adoption period and become positive in the post-EVA period, consistent with the findings in Figure 2.

4.4 Robustness Tests

4.4.1 Empirical results based on group-level data

Even though maximizing EVA at the group company level is equivalent to maximizing EVA for every subsidiary, one potential concern is that listed firms may not be representative of all group companies. We repeat the same exercise using the group company data. From the RESSET Database, we obtain data for 426 state-owned nonfinancial group companies (3,563 firm-year observations) that are either controlled by the central SASAC or by any provincial SASAC. Unlike listed firms, these group firms do not report interest expenses; rather they report net interest expenses, which are defined as interest expenses minus interest income. As most interest income is generated by bank deposits or other short-term debt investment, we proxy the amount of interest income as cash holding multiplied by the benchmark one-year deposit rate,[43] and back out interest expenses by adding the proxied interest expenses to the reported net interest expenses. Similar to the listed firm sample, we remove groups controlled by the SASACs of Hebei, Gansu, Anhui, Shaanxi, or Tibet (46 firm-years), groups with high leverage (163 firm-years), and 893 firm-year observations with missing $Capex$ or $InterestRate$. Our final sample has 2,461 firm-year observations and 384 unique group companies.

Table 4 reports the baseline regression results for this sample. As most of these group companies are not public, we do not include *Tobin's Q* as a control. The coefficient of the interaction term is statistically significant either at the 1% level or at the 5% level. The magnitude is between 0.204 to 0.261, which is comparable to the estimates from Table 3. We report the dynamic estimation results in Appendix Section A.4 and find that they are similar to the estimation in Figure 3. These results mitigate the concern that the listed firm sample may not be representative.

4.4.2 A placebo test using non-SOEs

The EVA policy should have affected SOEs only. We hence use non-SOEs as a placebo sample by examining whether the EVA policy adopted by a provincial SASAC affected the non-SOEs located in the same province. In Table 5, we estimate the baseline regressions reported in Table 3 but using the non-SOE sample. We report the summary statistics of this sample in Appendix Section A.5. We also replace the SASAC×year fixed effects with the Province×year fixed effects, as non-SOEs are not under the control of any SASAC. Table 5 shows that the coefficient of $Post \times InterestRate$ is negative (contrary to the findings for the SOEs), although never statistically significant after the proper fixed effects are included. These findings provide further evidence that our results

[43] Our results are robust to using the benchmark term deposit rate of three or six months, or the benchmark demand deposit rate.

are unlikely driven by factors coinciding with the EVA adoption, [44] as otherwise non-SOEs with different interest rates—like SOEs—should have changed their investments as well.

4.4.3 Other robustness tests

Appendix Section A.6 conducts two additional robustness tests. In Panel A, we drop the firms controlled by the central SASAC (about half of the sample) and find similar results as the baseline. In Panel B, we trim the sample based on $InterestRate$, as extremely low or high $InterestRate$ values are likely to have measurement errors. We drop those interest rate observations either below the 5^{th}-percentile (1.9%) or above the 95^{th} percentile (10.8%), and we find the coefficients become slightly larger.

4.5 The Impact on ROE

In Table 6, we test the second prediction and examine the impact of the EVA policy on firm performance. The idea is that, from individual firms' perspectives, the EVA policy leads to distortion in their investment decisions. As discussed in Section 3, a firm with a pre-tax cost of borrowing at 7.3% is unaffected. Firms with interest rates higher than 7.3% will overinvest, and firms with interest rates lower than 7.3% will underinvest. In both cases, the firm performance in terms of ROE should deteriorate.

To quantify the nonmonotone impact of the EVA policy on firm performance, we group all firms into six groups by $InterestRate$. Specifically, we classify firms with $InterestRate$ below 2.5%, between 2.5% and 4.5%, between 4.5% and 6.5%, between 6.5% and 8.5%, between 8.5% and 10.5%, and higher than 10.5%, as groups indexed by $g = 1, 2, ...,$ and 6, respectively. The range of $InterestRate$ is wider for *groups* 1 and 6 because the density of firms in the tails is lower.[45]

As discussed in Proposition 1 in Section 3, a firm with a pre-tax cost of borrowing at 7.3% is unaffected; note that 7.3% lies at the middle of group 4. We hence run the regression with the

[44] Interestingly, the coefficient of $InterestRate$ is negative but not statistically significant, suggesting that non-SOEs may face credit rationing.

[45] The numbers of observations for six groups are 376, 1,018, 2,059, 802, 215, and 246, respectively.

following specification:

$$ROE_{it} = \sum_{g=1}^{6} \beta_g \cdot \mathbf{1}^g_{i,t-1} \cdot Post_{i,t} + \alpha_i + y_t + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t}, \tag{10}$$

where $ROE_{i,t}$ is firm i's ROE in year t, and α_i and y_t are firm- and year- fixed effects, respectively; $\mathbf{1}^g_{i,t-1}$ is the dummy that indicates the firm i's $InterestRate$ at time t belongs to group g as discussed above. The $\{\beta_g\}$ coefficients capture the impacts of the EVA policy on ROE for firms in various $InterestRate$ groups, relative to the control firms. We expect β_g to increase from $g = 1$ to 4, and then decrease from $g = 4$ to 6. We also expect β_4 in Eq. (10) to be close to zero, as their investment decisions should not be affected.

The results in Table 6 are consistent with our theoretical predictions. In column 1, $\hat{\beta}_4 = 0.02$ with $t = 1.90$, which is only marginally significant at the 10% level (our theory predicts $\hat{\beta}_4 = 0$). The $\left\{\hat{\beta}_g\right\}$ coefficients become more negative for both lower and higher $InterestRate$ groups. In other columns, we add different interactive fixed effects, including the SASAC×year, industry×year, and province×year fixed effects. Once the SASAC×year fixed effects are added, we cannot identify all $\left\{\hat{\beta}_g\right\}$ coefficients anymore. Therefore in columns 2–4 we use group 4 as the base case and report the other coefficients, which capture the differential EVA policy impact on other firm groups relative to β_4. The results in these columns show that the EVA policy affected firms in group 4 the least, and other firms more negatively. Figure 4 further displays the relation between $InterestRate$ groups and change in firm performance graphically based on the estimation results in Table 6, confirming that EVA policy-induced ROE reduction grows with the gap between a firm's interest rate and the policy-stipulated one, in both directions.

The economic magnitudes of these effects are sizable. Based on the estimation in column 4 of Table 6, we find that, relative to the firms with $InterestRate$ between 6.5% and 8.5%, firms with $InterestRate$ lower than 2.5% (group 1) had a 4.2% reduction in ROE, and firms with $InterestRate$ higher than 10.5% (group 6) had a 6.1% reduction in ROE. Overall, these results support result 2 in Proposition 1.

4.6 Potential Economic Mechanisms and Supporting Evidence

We now investigate the economic mechanisms behind our findings, arguing that the EVA policy affects firm investment via the channel of managerial incentives. We provide further supporting evidence by studying other firm behaviors.

4.6.1 Executive turnover versus executive compensation

We study two standard mechanisms through which managerial incentives work: executive turnover and executive compensation. Through the lens of the EVA reform, our results shed light on how managerial incentives work in Chinese SOEs.

We first examine the relationship between firm performance and CEO turnover with demotion. We expect that after the adoption of the EVA policy, an SOE's EVA performance should become a stronger negative predictor for executive turnovers with demotion, while its ROE performance should become a weaker predictor. As before we consider both the general manager and the board chair as company executives. We define turnovers with demotion to be turnovers excluding promotions where the executive under consideration becomes a government official or moves to the group company with a chief position.[46]

Panel A of Table 7 reports the regression results on the relationship between executive turnover and lagged performance measures. The dependent variable equals one if a company executive experiences a turnover with demotion, and zero otherwise. We calculate EVA following the EVA rule as in Eq. (2). To make the EVA measure comparable across firms, we scale the dollar EVA by average firm assets. $Post$ is a dummy equal to one if a firm is subject to the EVA policy in a year and zero otherwise. All the independent variables are lagged by one year.[47]

The results show that the coefficient of $Post \times EVA$ is significantly negative, consistent with the hypothesis that after the EVA adoption, firms' EVA becomes more important in affecting executive turnover. The coefficient of ROE is negative and significant (-0.366, column 4), suggesting that before the EVA, firms with higher ROE are less likely to have a departing executive. This negative

[46] Out of all the turnovers, about 85% are demotions. The results are similar if we include promotions but define the value of the dependent variable of these observations as -1 (in the specification of column 4 of Table 7, the coefficient of $Post \times EVA$ becomes -1.615 and $t = -2.79$).

[47] For a firm-year to enter our sample, we require both the general manager and the chair to have started their current position at least a year prior. We also exclude observations where their departure is driven by retirement, personal health, or involvement in legal cases. Our results are robust to these treatments.

effect is completely eliminated after EVA: the coefficient of $Post \times ROE$ is positive with a point estimate of 0.663 (column 4), suggesting that the effect of ROE on executive turnover becomes weaker after the EVA adoption. Overall, the results on both the EVA and ROE are as predicted, confirming that the SASAC used the EVA measure to evaluate SOE managers.

We also conduct the analysis for executive compensation. The regression is the same as in Panel A except for two differences. First, we replace the dependent variable with the natural logarithm of one plus the average compensation of the general manager and the board chair. If one executive's compensation information is missing, we only use the other executive's compensation. Second, $Post$, EVA, and ROE are measured in the same year as the compensation. We measure EVA and ROE in the same year as the compensation to reflect the fact that compensation in year t is typically based on the performance in year t. As shown in columns 5–8, the coefficient of $Post \times EVA$ is positive, and the coefficient of $Post \times ROE$ is negative, suggesting that after the policy adoption EVA (ROE) becomes more (less) important in determining executive compensation. However, the coefficient of $Post \times ROE$ is never statistically significant, while the coefficient of $Post \times EVA$ is only marginally significant in column 8. The weaker results on executive compensation are consistent with the unique feature of managerial incentives in Chinese SOEs where SOE managers are more like government officials who potentially care more about their political career as opposed to salary remuneration.

4.6.2 Heterogeneity tests

In Table 8, we test firm heterogeneity. We hypothesize that the effect should be stronger if the manager was a former government official or if manager ownership is lower.

First, former government officials are less likely to be hired as professional managers and are more likely to be incentivized by their political careers. Former government officials, therefore, are more likely to adhere to the SASAC rules and less likely to take the nonstate shareholders' interests into account. We construct $PoliticalConnection$, which is a dummy variable that equals one if one of the company executives was previously a government official and zero otherwise. In our sample, the average value of $PoliticalConnection$ is 33.5%.

Second, generally speaking, the EVA policy is against the simple equity-value maximization. From this perspective, managers with higher equity ownership should be less likely to comply with the EVA rule. We calculate $CEOOwnership$ as the average fraction of shares held by a firm's company executives. In 31.8% of our sample firms, executives have positive equity ownership; and the average $CEOOwnership$ is 0.15% conditional on positive executive ownership.

We test these two predictions by adding two triple interaction terms—$Post \times InterestRate \times PoliticalConnection$ or $Post \times InterestRate \times CEOOwnership$—into our baseline specification (9). We expect the coefficient of $Post \times InterestRate \times PoliticalConnection$ to be positive, while that of $Post \times InterestRate \times CEOOwnership$ to be negative. The results in Table 8, with the first four columns for political connection and the next four columns for executive ownership, confirm these two predictions.

4.6.3 Other firm behaviors

We provide two additional pieces of further empirical evidence in this section, one on the implication of debt financing as the investment margin and the other on R&D investment, which is another component of the EVA policy.

External financing As discussed in Section 3, our model rests on the assumption that firms adjust their investment by issuing or retiring debt. In fact, our results are robust to the sample excluding firms that conducted external equity financing around the EVA policy adoption (see Appendix Section A.2).

We further test this assumption in Table 9. Specifically, we examine how the EVA policy affects firms' financing policies, and for debt financing, we consider both short-term debt and long-term debt. Long-term debt financing is the change in long-term debt (including long-term loans, bonds payable, long-term payables, and long-term liabilities due within one year) from year $t-1$ to t, scaled by lagged total assets. Short-term debt financing is the change in short-term debt (i.e., short-term loans) from year $t-1$ to t, scaled by lagged total assets. External equity financing is the sum of rights issues and seasoned equity offerings (both public equity issuance and private equity placements), scaled by lagged total assets.

The results in Table 9 show that the EVA policy has a different impact on firms' debt financing depending on their cost of debt, but not on their equity financing. The coefficient of $Post \times InterestRate$ is close to zero for external equity financing regressions and short-term debt financing regressions and is significantly positive in the regressions of long-term debt financing, suggesting that after the EVA policy adoption, firms with a higher cost of borrowing increase their debt borrowing and mainly long-term debt. These results are consistent with our premise that external equity financing is strictly regulated, and firms rely on debt to fund their investment (as we have shown in the baseline empirical result in Section 4.3.1).

R&D Investment Besides the change in the cost of capital stipulation, the EVA policy adds back R&D expenses and half of the nonrecurring income; we have not analyzed them because these two adjustments are unrelated to a firm's cost of capital. They, however, should have boosted SOE's incentives to invest in R&D, which is indeed one of the SASAC's policy goals. To investigate the impact of the EVA policy on firms' R&D expenses, we include firm fixed effects that absorb the SASAC fixed effects. As the impact on R&D does not depend on the firm's cost of capital, our focus is on the coefficient of $Post$ as opposed to that of $Post \times InterestRate$. Note, $Post$ is a SASAC-year level variable so we also exclude the SASAC×year fixed effect in the regression.

Table 10 reports the regression results with the dependent variable as R&D intensity. Following the convention in the literature (Audretsch and Feldman, 1996; Chen, Liu, Serrato, and Xu, 2021), we define R&D intensity as R&D expenses scaled by sales. The coefficient of $Post$ varies from 0.003 to 0.015, suggesting that in the post-EVA period, firms increased their R&D/Sales ratio by 0.003 to 0.015. This is economically significant relative to the average R&D/Sales ratio in the data, which is 0.009. R&D investment thus provides additional evidence that the SASAC policies had significant impact on SOEs' behaviors.[48]

5 Does the EVA Policy Improve Capital Allocation?

We have presented a collection of strong evidence that Chinese SOEs have reacted to the stipulated cost of capital since the EVA reform was implemented. This section takes this point one step further to make an attempt to evaluate the welfare consequence of the EVA policy, under the premise that the EVA policy is implemented at its full scale.

[48] Firms can relabel expenses as R&D. Chen, Liu, Serrato, and Xu (2021) estimate that relabeling accounts for about a quarter of the reported R&D in China. Firms have stronger incentives to relabel under the ROE rule than the EVA rule. Hence, our estimation should be considered to be a lower bound.

The primary motivation for SASACs to conduct the EVA reform was to urge SOEs to manage capital more efficiently (Adfaith, 2005). From the perspective of allocative efficiency, there are potentially two layers to achieve this policy goal: the first concerns the allocative efficiency among SOEs, and the second concerns the allocative efficiency between SOEs and non-SOEs. But before delving into these two parts, we first provide a conceptual framework that lays out the key elements of the discussion.

5.1 EVA and Capital Allocative Efficiency: Theory and Discussion

Following Hsieh and Klenow (2009), we study the welfare implications of the EVA policy reform through the lens of comparing Eq. (7) and Eq. (8). We bring back the firm index i, and define firm i's marginal revenue product of capital ($MRPK$, normalizing the product price to 1) to be $MRPK_i \equiv F'(K_i)$. Under the ROE policy, using $r_{Di} = (1+\tau_{Ki})\, r_i$ in Eq. (4) we can rewrite Eq. (7) to be $F'(K_i) = \frac{1+\tau_{Ki}}{1-\tau_{Yi}}(1-\pi)\, r_i$, which implies that

$$MRPK_i^{ROE} = \frac{1+\tau_{Ki}}{1-\tau_{Yi}}(1-\pi)\, r_i. \tag{11}$$

In contrast, under the EVA policy, Eq. (8) implies that

$$MRPK_i^{EVA} = \frac{(0.25-\pi)(1+\tau_{Ki})\, r_i + 5.5\%}{1-\tau_{Yi}}. \tag{12}$$

To facilitate discussion, we further assume $1-\tau_{Yi} = 1-\pi = 0.75$.[49] Then we have

$$MRPK_i^{ROE} = (1+\tau_{Ki})\, r_i \text{ and } MRPK_i^{EVA} = \frac{5.5\%}{0.75} = 7.33\%. \tag{13}$$

As hinted in the last point from Section 3.2, the impact of EVA adoption on allocative efficiency crucially depends on whether the true cost of capital r_i, which reflects the fair market-based compensation of the risk of the project, is equal across firms. This answer is a solid "no" from the classic perspective in the finance literature dating back to the capital asset pricing model (CAPM, Sharpe, 1964, Lintner, 1965): the required rate of return, or the cost of capital, should include both

[49] For most of our sample firms, we have the corporate tax rate as $\pi = 0.25$. We discuss the implication of the potential heterogeneity in τ_{Yi} in Section 5.3 when we empirically measure $MRPK$ for each firm.

the risk-free rate and the compensation for risk—more precisely, the aggregate risk that requires a risk premium.

More specifically, the CAPM model, which is widely used in corporate finance (e.g., Berk and DeMarzo (2017)), says

$$\text{Cost of Capital} = \text{Risk-free Rate} + \beta_A \times \text{Market Risk Premium}, \tag{14}$$

where β_A stands for β of "Asset" which captures the quantity of aggregate risk of this asset's cash flows (for instance, the entire market portfolio has $\beta = 1$). In practice, the cost of capital is calculated as follows:

$$\text{Cost of Equity} \times (1 - \text{Leverage Ratio}) + \text{Cost of Debt} \times \text{Leverage Ratio}, \tag{15}$$

where the cost of equity is estimated as

$$\text{Cost of Equity} = \text{Risk-free Rate} + \beta_{equity} \times \text{Market Risk Premium}, \tag{16}$$

with β_{equity} defined as the covariance between the firm's equity return and market return, divided by the variance of the market return, and the leverage ratio defined as the book value of debt divided by the sum of the market value of equity and the book value of debt.

Our efficiency discussion will take heterogeneous costs of capital across firms with different risk profiles as given. One could easily introduce cash-flow risk in our setting outlined in Section 3.1; we choose not to model risk explicitly—but discuss the potentially heterogeneous cost of capital—for the ease of exposition.

5.1.1 Within-group allocative efficiency with equal cost of capital

We start our discussion by considering firms within a group with the same true cost of capital; in principle they share a similar risk profile β_A and hence require the same risk premium. In our empirical analysis later, we take these groups to be industries.

Comparing (11) and (12), we observe that the EVA policy effectively eliminates the dispersion of actual costs of capital faced by firms, implying a welfare gain (Hsieh and Klenow, 2009). This point is most evident when the firms' true cost of capital just equals the EVA stipulated cost of capital, i.e., $r_i = r = 7.33\%$. In this case, Eq. (13) implies that $MRPK_i^{EVA} = r$ under the EVA policy, reaching the highest allocative efficiency.

Intuitively, in the absence of any policy subsidy, all the SOEs' (before-tax) cost of capital would have been 7.33%, but various policy distortions/subsidies drive the observed heterogeneity in interest rates (i.e., wedge τ_{Ki}). The EVA policy then would have increased capital allocative efficiency by incentivizing firms not to make capital budgeting decisions based on their distorted "actual" costs of capital. In other words, the one-size-fits-all EVA policy corrects various policy distortions and would kill the "bad" dispersion of $MRPK$ (or the actual cost of capital).

5.1.2 Across-group allocative efficiency with different costs of capital

For firms with heterogeneous costs of capital, the simple one-size-fits-all EVA policy typically leads to welfare loss. To illustrate this point, we take a polar assumption that $\tau_{Ki} = 0$ but r_i differs; in words, firms are free from any policy distortion but face heterogeneous costs of capital due to the different risk profiles of their business operations. Eq. (13) then becomes

$$MRPK_i^{ROE} = r_i \text{ and } MRPK_i^{EVA} = 7.33\%. \tag{17}$$

As is evident from Eq. (17), the one-size-fits-all EVA policy now kills the "good" dispersion reflected in the true costs of capital r_i.

5.1.3 The level of the EVA cost of capital: Allocative efficiency between SOEs and non-SOEs

Finally, the stipulated cost of capital by the EVA policy has natural implications on allocative efficiency between SOEs and non-SOEs. If the average true cost of capital of the SOE sector is greater (less) than 7.33%, then a successful implementation of the EVA policy will cause overinvestment (underinvestment) in the SOE sector. Indeed, because SOEs enjoy cheaper access to bank loans thanks to the implicit government guarantee, it has been widely documented that the misallocation between SOEs and non-SOEs is responsible for low aggregate productivity in China (Dollar and Wei 2007; Hsieh and Klenow 2009; Song, Storesletten, and Zilibotti 2011; Brandt, Tombe, and Zhu

2013). The EVA policy, by stipulating the hurdle rate for the entire SOE sector, can affect the allocative efficiency in aggregate. We empirically test this hypothesis in Section 5.2.3.

5.2 Empirical Analysis on Allocative Efficiency

The above discussion provides a conceptual framework to empirically investigate the overall welfare impact of the EVA reform. The empirical exercises conducted in this section, due to data limitations, are noisy and only suggestive; this is an important research topic for future exploration.

Throughout this subsection, we assume that firms in the same industry share the same cost of capital. Put differently, we deem that firms in the same industry have the same asset beta, i.e., β_A in Eq. (14), and therefore industries serve as the equal-cost-of-capital groups in Section 5.1.1. This is a satisfactory assumption for at least two reasons in our context. First, such a treatment has been widely used in the finance literature (e.g., Krüger, Landier, and Thesmar (2015)); in fact, it is a common practice to use the industry asset beta when practitioners estimate a project's cost of capital (Section 12.5, Berk and DeMarzo (2017)), with the underlying assumption that firms in the same industry share a similar line of business.[50] Second, this assumption echoes Hsieh and Klenow (2009) who have focused on the within-industry $MRPK$ dispersion as a measure of misallocation. In Hsieh and Klenow (2009), there is no aggregate risk in the production function. But once we introduce aggregate risk to that framework, for within-industry $MRPK$ dispersion to measure capital misallocation (within the same industry), researchers need to implicitly assume that firms in the same industry have the same cost of capital.

The capital allocative literature advocates for using finely classified industries. Hence, in this analysis, we classify firms into 60 industries based on three-digit industry classification codes provided by the Guidelines for the Industry Classification of Listed Companies (2012) of the Chinese Securities Regulatory Commission. We provide the list of industries (their codes and short description), and the number of observations of each industry in Appendix Section A.7.

[50]Based on data for U.S. department stores in mid-2009, *Example* 12.7 in Berk and DeMarzo (2017) shows that while there exist significant differences in the firms' β_{equity} (due to differences in leverage), the firms' β_A are similar, suggesting that the underlying businesses in this industry have similar market risk.

5.2.1 The impact of EVA: SOE investment across industries

Section 5.1 points out that the one-size-fits-all policy ignores the heterogeneity in the true costs of capital and hence could have negative welfare implications. It is difficult to measure the true costs of capital precisely. Given our stand that various industries should have different true costs of capital, we first check whether SOE investment across industries exhibits a similar pattern as in Figure 2 after the EVA reform. That is, do industries with a lower true cost of capital cut their investment relatively more than their higher-cost-of-capital peers?

To calculate the industry-level cost of capital, we first calculate the firm-level cost of capital based on Eq. (15) and Eq. (16), and then take the average within each industry. To mitigate potential subsidy on cost of debt, our calculation uses the risk-free rate, which is the one-year rate of China Development Bank (CDB) bonds,[51] instead of each firm's actual interest rate. Regarding cost of equity, we compute β_{equity} based on the firm's stock returns from the past 48 months. Since β_{equity} is constructed from the second moment of equity prices, it is unlikely to be affected by policy subsidies.

Figure 5 then sorts firms into high and low cost of capital industry groups and tracks their average investment (similar to Panel A of Figure 2). This method is particularly attractive because the ranking of industry average cost of capital—upon which Figure 5 is based—does not depend on the choices of macroeconomic parameters (i.e., risk-free rate and market risk premium).[52]

Figure 5 shows that, in response to the EVA policy, industries with a relatively lower cost of capital reduced their investment more than industries with a relatively higher cost of capital. In fact, industries with a lower cost of capital invested more in the pre-EVA period, but in the post-EVA period, their investment became similar to industries with a higher cost of capital. Such convergence in investment kills the "good" dispersion in the true cost of capital and hence reduces welfare, suggesting that EVA policy should have unclear overall welfare implications.

[51] We use the rate of CDB bonds instead of the Chinese Treasury bonds because CDB bonds have better liquidity, receive zero risk-weight for commercial banks, have the same tax treatment as other non-Treasury bonds, and are widely accepted as the risk-free benchmark in practice (Amstad and He, 2020).

[52] This irrelevance result always holds when we set the cost of debt (of all firms) to be the risk-free rate, which is what we do in this exercise. This assumption is reasonable because, during our sample period, the default probability of SOE firms is negligible across different industries. Nevertheless, the irrelevance of ranking regarding the macroeconomic parameters also holds in the parameter range that is empirically reasonable.

5.2.2 The impact of EVA: A variance decomposition exercise in the SOE sector

Denote the *actual* cost of capital for firm i in industry j, before EVA, by $\hat{r}_{ij}$; it is the cost of capital faced by the firm subject to the contamination of subsidies before the EVA period. After the EVA policy, firms use 7.33% as the hurdle rate for their capital budgeting. Under the assumption that firms in any industry share the same true cost of capital, what is the aggregate welfare effect of this one-size-fits-all policy?

A complete answer to this question requires a structural general equilibrium model and hence is beyond the scope of this paper. Here, we perform a nonstructural variance decomposition exercise, whose result offers a preliminary quantitative gauge to this important question. The following total variance decomposition is straightforward:

$$\underbrace{\mathbb{E}\left[\left(\hat{r}_{ij}-7.33\%\right)^2\right]}_{\text{Total Effect}} = \underbrace{\mathbb{E}\left[\left(\hat{r}_{ij}-\mathbb{E}_j\left(\hat{r}_{ij}\right)\right)^2\right]}_{\text{Within-industry Disperson}} + \underbrace{\mathbb{E}\left[\left(\mathbb{E}_j\left(\hat{r}_{ij}\right)-\mathbb{E}\left(\hat{r}_{ij}\right)\right)^2\right]}_{\text{Across-industry Disperson}} + \underbrace{\left(\mathbb{E}\left(\hat{r}_{ij}\right)-7.33\%\right)^2}_{\text{Wedge b/w EVA policy rate \& }\mathbb{E}(\hat{r}_{ij})}, \tag{18}$$

where $\mathbb{E}_j$ is the average operator within the industry j and $\mathbb{E}$ is the average operator across the entire sample.

We consider two alternative measures for the actual cost of capital $\hat{r}_{ij}$ before the EVA policy. The first one is based on Eq. (15) which, in addition to the interest rates observed in the data, uses the cost of equity given by (16). The second is the firm's interest rate that we used in previous sections, as explained in 4.1. The first proxy requires an input of market risk premium; we entertain five values ranging from 5% to 8% as an accurate estimate of market risk premium does not exist.[53] Because our main focus is on cross-sectional dispersion, we perform the decomposition year by year and then average across years. Our decomposition is based on the pre-EVA firm-year observations only; note that this exercise loses its meaning for the post-EVA period (as firms were no longer using the actual cost of capital for their capital budgeting).

[53] Liu, Stambaugh, and Yuan (2019) report an average monthly market return in excess of the one-year benchmark deposit rate of 0.66%, implying an annualized rate of 7.9%. In our sample period, the one-year benchmark deposit rate is about 0.6% lower than the one-year CDB bond rate. If calculated relative to the CBD bond rate, the market risk premium is about 7.3%. The estimates of the market risk premium in the US have a big range, from about 7% based on the realized equity returns over the past several decades to 3–4% implied from fundamentals (Claus and Thomas, 2001; Fama and French, 2002). The survey conducted by Welch (2000) and the follow-up update shows that the average expected market risk premium by finance and economics professors varies over time from about 3% to 7%. We choose a slightly higher range because the Chinese equity market may be riskier than the United States.

Table 11 reports the total variance decomposition results; Appendix Section A.8 shows the decomposition for each year for both proxies of the actual cost of capital. Among the three variance components (within-industry variation, cross-industry variation, and wedge between the average actual cost of capital and the stipulated one), the within-industry variation accounts for about 31.5–49.9% of the total variance using Eq. (15) (Panel A), or 51.7% using interest rate (Panel B). Because the within-industry variations represent distortive subsidies under our assumption of equal cost of capital within any industry, there seems to be considerable scope for the EVA policy to kill the "bad" dispersion.

For the remaining two components, cross-industry variations explain about 16.6–26.3% of the total variance, while the wedge between the average actual cost of capital and 7.33% explains 23.84–52.9%. We acknowledge that it is challenging to clearly tag these variations as "good" or "bad." Although the cross-industry variation likely represents a "good" dispersion under our assumption that firms in the same industry share the same β_A, the empirically measured cross-industry dispersion might be contaminated by China's heavy industrial policies and hence could be labeled as "bad." For the third component, it is even more challenging to gauge whether 7.33% is above or below the average true cost of capital for the whole economy. Overall, our result warns that the EVA policy may kill a significant portion of "good" dispersion as well.

A final point is noteworthy: although we can use a similar technique as Hsieh and Klenow (2009) to translate the within-industry dispersion in the cost of capital to aggregate productivity by assuming that firms operate at their first-order condition (when the marginal cost of capital equals the marginal revenue of product of capital), providing an overall welfare evaluation of the EVA policy requires a full-blown equilibrium framework to integrate this "bad" dispersion with the other two dispersions. We await future research for this challenging question.

5.2.3 The impact of EVA: SOE and Non-SOE

As hinted by the third part in Eq. (18), if the stipulated cost of capital is higher (lower) than the actual cost of capital of SOEs, then SOEs as a whole should cut (raise) investment in response to the EVA policy, potentially favoring (hurting) non-SOE investment in general equilibrium. In this way, the EVA policy could improve allocative efficiency by reallocating capital from SOEs to non-SOEs.

Our sample of publicly listed SOEs has an average before-tax interest rate of 5.8%, which is below 7.33% but not by a significant margin. It thus remains an empirical question whether this wedge is sufficient to push SOEs to cut back investment relative to their non-SOE peers. In Table 12, we run a difference-in-differences test that includes non-SOEs, with the main variable of interest being $Post \times SOE$. Our regression allows for province-year fixed effects, and the coefficient of $Post \times SOE$ picks up the additional investment changes of SOEs compared to those of non-SOEs, around the EVA policy for a given (provincial) SASAC in a given year. We exclude the central SASAC from this analysis due to the difficulty in defining its non-SOE peer group.

We also introduce an additional dummy variable $High$ that indicates firms with a high interest rate (above sample median). In column 5 of Table 12, the coefficient of $Post \times SOE$ captures the change of investment in SOEs with a low interest rate following the EVA adoption, relative to that in the corresponding non-SOE sample; and the coefficient of $Post \times SOE \times High$ captures the additional investment of SOEs with a high interest rate relative to SOEs with a low interest rate. The estimation results confirm a significant difference between high and low interest rate SOE groups, consistent with our findings in Section 4.3.1. In other words, our key empirical results are robust to use non-SOEs in the same province-year as the control group.

However, in all columns in Table 12, we find that the estimated coefficient of $Post \times SOE$ is statistically insignificant. Though only suggestive, this result indicates that the 7.33% EVA-stipulated (before) cost of capital—which is not far from the average before-tax interest rate of 5.8% for our sample of SOEs—is not high enough to persuade the entire SOE sector to downsize.

Of course, there exists another caveat for interpreting this result for the comparison of SOEs and non-SOEs: SOEs and non-SOEs exhibit different investment patterns (e.g., Brandt and Zhu, 2000; Li, Liu, and Wang, 2015). In other words, the parallel trends assumption might not hold. In particular, in our sample period, to mitigate the effect of the 2007–2009 financial crisis, the Chinese government encouraged SOEs to invest (Deng, Morck, Wu, and Yeung, 2015; Cong, Gao, Ponticelli, and Yang, 2019). Hence, it is possible that an average SOE would have decreased its investment due to the EVA policy, had the 2007–09 financial crisis never happened.

5.3 Measurement of $MRPK$ and the Impact of the EVA Policy

Our paper shares a similar framework with that in Hsieh and Klenow (2009), though we do not measure the firms' $MRPK$ because we are able to directly measure the actual interest rate faced by firms. In contrast, Hsieh and Klenow (2009) and other more macroeconomic-oriented studies (e.g., Chen and Song (2013)) need to invoke the standard Cobb-Douglas production function and measure $MRPK$ from the production side.

For completeness, this section repeats the same exercise following the methodology in Hsieh and Klenow (2009) and Chen and Song (2013). Given our data limitations, we adopt the $MRPK$ measure used by Chen and Song (2013), which is calculated as the natural logarithm of the ratio between operating profit and lagged fixed assets.[54] We always adjust $MRPK$ by industry means and also report the results by restricting to manufacturing firms (for better comparison to the literature).

We are interested in whether the EVA reform leads to a reduction of industry-adjusted $MRPK$ dispersion. Our dependent variable is $MRPK$ dispersion at the SASAC-year level, which is calculated as the standard deviation of the industry-adjusted $MRPK$ across firms controlled by that SASAC in that year. In Table 13, column 1 reports the results for manufacturing firms, and column 3 for all firms; columns 2 and 4 include average firm size and average leverage as control, respectively. In all specifications, the coefficients of the dummy $Post$, which captures the EVA's impact on the treated SASAC's $MRPK$ dispersion, are indistinguishable from zero, suggesting no improvement in allocative efficiency within the SOE sector.

This negative result in Table 13 seems to contradict our main findings in Section 4, where we show that SOEs with a high interest rate cut their investment relative to their low–interest rate peers in response to EVA policies. Measurement error of $MRPK$ is perhaps the leading candidate for the discrepancy between these two findings.[55] First, as explained above, the method in Chen

[54] Operating profit (before tax) is sales minus costs of goods sold and selling, general and administrative expenses, plus depreciation. The literature provides various approaches to measure capital productivity (Hsieh and Klenow, 2009; Bai, Lu, and Tian, 2018); most measures, however, require data on firm-level industrial value-added, which our sample firms (publicly listed SOEs) do not report.

[55] Conceptually, the interest rate, which is the marginal cost of investment, should equal $MRPK$, which, theoretically, gives the marginal benefit of investment. But this does not hold in our data: in our sample of SOEs, interest rates and our measured $MRPK$'s were largely uncorrelated. Their correlation coefficients are 0.027 and 0.025 among the manufacturing firms and for all firms, respectively. Neither is statistically distinguishable from zero. We also directly test whether the EVA policy increased the investment of firms with a higher measured $MRPK$ more than firms with a lower measured $MRPK$. We conduct the test using a model similar to Eq. (9). Specifically, we replace

and Song (2013), which measures $MRPK$ simply by the logarithm of the ratio between operating profit and lagged fixed assets based on standard financial statement data for listed companies, is quite crude. What is more, it is challenging to back out the true output $F(K_i)$ of any firm i; to estimate $F(K_i)$, we simply take $(1-\tau_{Yi})F(K_i)$ observed in the data and adjust taxes and subsidies recorded in financial statements. This may introduce serious measurement errors in our $MRPK$ calculation if other subsidies enter firms' operating profits directly.[56]

6 Conclusion

The Chinese SOEs' EVA reform provides us with a laboratory to study the real consequences of managerial incentives. The reform stipulated a fixed cost of capital to virtually all SOEs and was adopted in a staggered way across different regulators. We find that, under the EVA rule, SOEs deviated from using their actual cost of capital to the stipulated one as the hurdle rates for their investment decisions. Because SOEs' actual cost of capital may be distorted by policy subsidies, the EVA policy may have mitigated some of these policy distortions. However, the EVA policy ignored the legitimate heterogeneity in the costs of capital due to risks, and such imperfection could be welfare reducing. Relatedly, we do not find that capital moved from the SOE sector to the non-SOE sector in response to the EVA reform.

Although we cannot reach a conclusion as to whether the EVA policy improved capital allocative efficiency, our evidence shows that the current EVA policy has great room for improvement. For instance, Chinese authorities who have been "hoping" for capital allocative efficiency could at least fine-tune the "reward" system to account for industry heterogeneity. Perhaps aware of the potential weakness of the one-size-fits-all stipulation of the cost of capital, the Chinese central SASAC changed to use the firm-specific cost of capital in their EVA evaluation in 2016. Unfortunately, how the cost of capital is calculated now has not been disclosed to the public.

In many countries around the world, governments provide subsidies to various institutions, leading to a lower capital allocative efficiency. Although we do not advocate a simple EVA policy for

the independent variable $InterestRate$ with industry-adjusted $MRPK$. Appendix Section A.9 reports the results. The coefficient of $MRPK \times Post$ is insignificant in all the specifications except in column 6.

[56] We measure τ_{Yi} by dividing the sum of the direct subsidies a firm receives from the government and the tax savings from having a tax rate lower than the statutory tax rate with operating profit. Our results show that τ_{Yi} and r_{Di} (both industry-adjusted) are largely uncorrelated with a correlation coefficient of 0.014 ($p = 0.249$), implying that our null result is unlikely driven by the heterogeneity in τ_{Yi}.

all these institutions, such an approach may help them recognize any cost of government subsidies in their decision making, especially when removing such subsidies is politically difficult or infeasible. If the hurdle rates were stipulated properly (ideally with firm-specific information to take risk into account), such a policy could play a positive role, and we await future research along this direction.

References

Adfaith, 2005, A simulated EVA evaluation of central SOEs, *CEIBS Business Review* 24, 3–12.

Allen, Franklin, Jun Qian, and Meijun Qian, 2005, Law, finance, and economic growth in China, *Journal of Financial Economics* 77, 57–116.

Amstad, Marlene, and Zhiguo He, 2020, Chinese bond market and interbank market, in *The Handbook of the China's Financial System* (Princeton University Press).

Audretsch, David B, and Maryann P Feldman, 1996, R&D spillovers and the geography of innovation and production, *American Economic Review* 86, 630–640.

Bai, Chong-En, Chang-Tai Hsieh, and Michael Zheng Song, 2016, The long shadow of a fiscal expansion, *Brookings Papers on Economic Activity* 47, 129–181.

Bai, Yan, Dan Lu, and Xu Tian, 2018, Do financial frictions explain Chinese firms' saving and misallocation?, *working paper*.

Balachandran, Sudhakar V, 2006, How does residual income affect investment? the role of prior performance measures, *Management Science* 52, 383–394.

Berk, Jonathan, and Peter DeMarzo, 2017, *Corporate Finance: Global Edition* (Pearson).

Biddle, Gary C., Robert M. Bowen, and James S. Wallace, 1997, Does EVA® beat earnings? Evidence on associations with stock returns and firm values, *Journal of Accounting and Economics* 24, 301–336.

Brandt, Loren, and Hongbin Li, 2003, Bank discrimination in transition economies: ideology, information, or incentives?, *Journal of Comparative Economics* 31, 387–413.

Brandt, Loren, Trevor Tombe, and Xiaodong Zhu, 2013, Factor market distortions across time, space and sectors in China, *Review of Economic Dynamics* 16, 39–58.

Brandt, Loren, Johannes Van Biesebroeck, and Yifan Zhang, 2014, Challenges of working with the Chinese NBS firm-level data, *China Economic Review* 30, 339–352.

Brandt, Loren, and Xiaodong Zhu, 2000, Redistribution in a decentralized economy: Growth and inflation in China under reform, *Journal of Political Economy* 108, 422–439.

Callaway, Brantly, and Pedro HC Sant'Anna, 2021, Difference-in-differences with multiple time periods, *Journal of Econometrics* 225, 200–230.

Calomiris, Charles W, Raymond Fisman, and Yongxiang Wang, 2010, Profiting from government stakes in a command economy: Evidence from Chinese asset sales, *Journal of Financial Economics* 96, 399–412.

Chen, Deqiu, Yujing Ma, Xiumin Martin, and Roni Michaely, 2022, On the fast track: Information acquisition costs and information production, *Journal of Financial Economics* 143, 794–823.

Chen, Hui, Zhuo Chen, Zhiguo He, Jinyu Liu, and Rengming Xie, 2022, Pledgeability and asset prices: Evidence from the Chinese corporate bond markets, *Journal of Finance forthcoming.*

Chen, Kaiji, and Zheng Song, 2013, Financial frictions on capital allocation: A transmission mechanism of TFP fluctuations, *Journal of Monetary Economics* 60, 683–703.

Chen, Zhuo, Zhiguo He, and Chun Liu, 2020, The financing of local government in China: Stimulus loan wanes and shadow banking waxes, *Journal of Financial Economics* 137, 42–71.

Chen, Zhao, Xian Jiang, Zhikuo Liu, Juan Carlos Suárez Serrato, and Daniel Xu, 2021, Tax policy and lumpy investment behavior: Evidence from China's VAT reform, *Review of Economic Studies forthcoming.*

Chen, Zhao, Zhikuo Liu, Juan Carlos Suárez Serrato, and Daniel Yi Xu, 2021, Notching R&D investment with corporate income tax cuts in China, *American Economic Review* 111, 2065–2100.

Claus, James, and Jacob Thomas, 2001, Equity premia as low as three percent? Evidence from analysts' earnings forecasts for domestic and international stock markets, *Journal of Finance* 56, 1629–1666.

Cong, Lin William, Haoyu Gao, Jacopo Ponticelli, and Xiaoguang Yang, 2019, Credit allocation under economic stimulus: Evidence from China, *Review of Financial Studies* 32, 3412–3460.

De Chaisemartin, Clément, and Xavier D'Haultfoeuille, 2020, Two-way fixed effects estimators with heterogeneous treatment effects, *American Economic Review* 110, 2964–96.

Deng, Yongheng, Randall Morck, Jing Wu, and Bernard Yeung, 2015, China's pseudo-monetary policy, *Review of Finance* 19, 55–93.

Ding, Yi, Wei Xiong, and Jinfan Zhang, 2022, Issuance overpricing of China's corporate debt securities, *Journal of Financial Economics* 144, 328–346.

Dollar, David, and Shang-Jin Wei, 2007, Das (wasted) kapital: firm ownership and investment efficiency in China, *working paper.*

Dranove, David, Daniel Kessler, Mark McClellan, and Mark Satterthwaite, 2003, Is more information better? the effects of "report cards" on health care providers, *Journal of political Economy* 111, 555–588.

Du, Fei, David H Erkens, S Mark Young, and Guliang Tang, 2018, How adopting new performance measures affects subjective performance evaluations: Evidence from EVA adoption by Chinese state-owned enterprises, *The Accounting Review* 93, 161–185.

Edmans, Alex, Vivian W Fang, and Katharina A Lewellen, 2017, Equity vesting and investment, *Review of Financial Studies* 30, 2229–2271.

Edmans, Alex, Xavier Gabaix, and Dirk Jenter, 2017, Executive compensation: A survey of theory and evidence, in *The Handbook of the Economics of Corporate Governance*, vol. 1 . pp. 383–539 (Elsevier).

Fama, Eugene F, and Kenneth R French, 2002, The equity premium, *Journal of Finance* 57, 637–659.

Fan, Joseph PH, Tak Jun Wong, and Tianyu Zhang, 2007, Politically connected CEOs, corporate governance, and post-IPO performance of China's newly partially privatized firms, *Journal of Financial Economics* 84, 330–357.

Flammer, Caroline, and Pratima Bansal, 2017, Does a long-term orientation create value? Evidence from a regression discontinuity, *Strategic Management Journal* 38, 1827–1847.

Francis, Jennifer, Ryan LaFond, Per Olsson, and Katherine Schipper, 2005, The market pricing of accruals quality, *Journal of Accounting and Economics* 39, 295–327.

Frank, Murray Z, and Tao Shen, 2016, Investment and the weighted average cost of capital, *Journal of Financial Economics* 119, 300–315.

Frydman, Carola, and Dirk Jenter, 2010, CEO compensation, *Annual Review of Financial Economics* 2, 75–102.

Gan, Jie, Yan Guo, and Chenggang Xu, 2018, Decentralized privatization and change of control rights in China, *Review of Financial Studies* 31, 3854–3894.

Geng, Zhe, and Jun Pan, 2021, The SOE premium and government support in China's credit market, *working paper*.

Goodman-Bacon, Andrew, 2021, Difference-in-differences with variation in treatment timing, *Journal of Econometrics* 225, 254–277.

Groves, Theodore, Yongmiao Hong, John McMillan, and Barry Naughton, 1994, Autonomy and incentives in Chinese state enterprises, *Quarterly Journal of Economics* 109, 183–209.

Hayek, F. A., 1945, The use of knowledge in society, *American Economic Review* 35, 519–530.

He, Zhiguo, and Wei Wei, 2022, China's financial system and economy: A review, *NBER working paper w30324*.

Hennessy, Christopher A, and Ilya A Strebulaev, 2020, Beyond random assignment: credible inference and extrapolation in dynamic economies, *Journal of Finance* 75, 825–866.

Hogan, Chris E, and Craig M Lewis, 2005, Long-run investment decisions, operating performance, and shareholder value creation of firms adopting compensation plans based on economic profits, *Journal of Financial and Quantitative Analysis* 40, 721–745.

Hsieh, Chang-Tai, and Peter J Klenow, 2009, Misallocation and manufacturing TFP in China and India, *Quarterly Journal of Economics* 124, 1403–1448.

Hsieh, Chang-Tai, and Zheng Michael Song, 2015, Grasp the large, let go of the small: the transformation of the state sector in China, *Brookings Papers on Economic Activity* pp. 295–346.

Huang, Zhangkai, Lixing Li, Guangrong Ma, and Lixin Colin Xu, 2017, Hayek, local information, and commanding heights: Decentralizing state-owned enterprises in China, *American Economic Review* 107, 2455–78.

Jiang, Fuxiu, and Kenneth A Kim, 2020, Corporate Governance in China: A Survey, *Review of Finance* 24, 733–772.

Kerr, Steven, 1975, On the folly of rewarding A, while hoping for B, *Academy of Management Journal* 18, 769–783.

Krüger, Philipp, Augustin Landier, and David Thesmar, 2015, The WACC fallacy: The real effects of using a unique discount rate, *Journal of Finance* 70, 1253–1285.

Li, Bo, Zhengwei Wang, and Hao Zhou, 2021, China's anti-corruption campaign and credit reallocation from SOEs to non-SOEs, *PBCSF-NIFR Research Paper*.

Li, Hongbin, Lingsheng Meng, Qian Wang, and Li-An Zhou, 2008, Political connections, financing and firm performance: Evidence from Chinese private firms, *Journal of Development Economics* 87, 283 – 299.

Li, Shengyu, and Hongsong Zhang, 2021, Does external monitoring improve the performance of state-owned enterprises?, *Economic Journal forthcoming*.

Li, Xi, Xuewen Liu, and Yong Wang, 2015, A model of China's state capitalism, *working paper*.

Lintner, John, 1965, The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets, *Review of Economics and Statistics* 47, 13–37.

Liu, Jianan, Robert F Stambaugh, and Yu Yuan, 2019, Size and value in china, *Journal of Financial Economics* 134, 48–69.

Lucas, Deborah, 2014, Evaluating the cost of government credit support: the OECD context, *Economic Policy* 29, 553–597.

Mengistae, Taye, and Lixin Colin Xu, 2004, Agency theory and executive compensation: The case of Chinese state-owned enterprises, *Journal of Labor Economics* 22, 615–637.

Midrigan, Virgiliu, and Daniel Yi Xu, 2014, Finance and misallocation: Evidence from plant-level data, *American Economic Review* 104, 422–58.

Modigliani, Franco, and Merton H Miller, 1958, The cost of capital, corporation finance and the theory of investment, *American Economic Review* 48, 261–297.

Murphy, Kevin J, 1999, Executive Compensation, *Handbook of Labor Economics* 3, 2485–2563.

——— , 2013, Executive compensation: Where we are, and how we got there, in *Handbook of the Economics of Finance*, vol. 2 . pp. 211–356 (Elsevier).

Naughton, Barry, 2008, SASAC and rising corporate power in China, *China Leadership Monitor* 24, 1–9.

——— , 2015, The transformation of the state sector: SASAC, the market economy, and the new national champions, *State Capitalism, Institutional Adaptation, and the Chinese Miracle* pp. 46–71.

Petersen, Mitchell A., 2009, Estimating standard errors in finance panel data sets: Comparing approaches, *Review of Financial Studies* 22, 435–480.

Restuccia, Diego, and Richard Rogerson, 2008, Policy distortions and aggregate productivity with heterogeneous establishments, *Review of Economic Dynamics* 11, 707–720.

——— , 2013, Misallocation and productivity, *Review of Economic dynamics* 16, 1–10.

——— , 2017, The causes and costs of misallocation, *Journal of Economic Perspectives* 31, 151–74.

Rogerson, William P, 1997, Intertemporal cost allocation and managerial investment incentives: A theory explaining the use of economic value added as a performance measure, *Journal of Political Economy* 105, 770–795.

Sharpe, William F, 1964, Capital asset prices: A theory of market equilibrium under conditions of risk, *Journal of Finance* 19, 425–442.

Shue, Kelly, and Richard R Townsend, 2017, How do quasi-random option grants affect CEO risk-taking?, *Journal of Finance* 72, 2551–2588.

Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti, 2011, Growing like China, *American Economic Review* 101, 196–233.

Stern, Erik, 2011, China adopts EVA: An essential step in the Great Leap Forward, *Journal of Applied Corporate Finance* 23, 57–62.

Sun, Liyang, and Sarah Abraham, 2021, Estimating dynamic treatment effects in event studies with heterogeneous treatment effects, *Journal of Econometrics* 225, 175–199.

Syverson, Chad, 2011, What determines productivity?, *Journal of Economic Literature* 49, 326–65.

Wallace, James S, 1997, Adopting residual income-based compensation plans: Do you get what you pay for?, *Journal of Accounting and Economics* 24, 275–300.

Welch, Ivo, 2000, Views of financial economists on the equity premium and on professional controversies, *Journal of Business* 73, 501–537.

Table 1: Determinants of the EVA policy adoption

This table presents the regression results on how province characteristics affect the timing of the EVA policy adoption. The unit of analysis is province-year. The dependent variable is one if a province adopts the EVA policy in that year, and zero otherwise. Province-years after the EVA adoption are excluded from the analysis. *Age* $\geq$ 65 is a dummy variable that equals one if the age of the secretary of the provincial Communist Party committee is equal to or greater than 65 years, and zero otherwise. *Tenure* is the natural log of one plus the number of years that the party secretary has been in office. *% of SOE Assets* is the proportion of SOE assets among all the industrial enterprises of the province. *SOE Investment Growth* is the average growth rate of capital expenditure of all SOEs controlled by a provincial SASAC, calculated over the past three years. *Marketization* is the Marketization index from the China Provincial Market Index Database (https://cmi.ssap.com.cn/), measuring the importance of the market in resource allocation. The sample period is 2004-2015. All the independent variables are lagged by one year. T-statistics computed with standard errors clustered at the province and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP Growth	1.116*							1.134
	(1.71)							(1.46)
GDP per capita		-0.001						0.032
		(-0.06)						(0.79)
Age $\geq$ *65*			0.043					0.059
			(0.57)					(0.70)
Tenure				-0.018				-0.028
				(-1.32)				(-1.55)
% of SOE Assets					0.116**			0.108
					(2.24)			(0.82)
SOE Investment Growth						0.006		0.005
						(0.58)		(0.42)
Marketization							-0.008	-0.009
							(-1.17)	(-0.47)
Observations	272	272	272	272	272	267	272	267
R-squared	0.087	0.078	0.079	0.081	0.087	0.080	0.082	0.109
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2: Summary Statistics

This table reports the summary statistics: Panel A for mean, median, standard deviation, and percentiles and Panel B for correlations. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. *CEOOwnership* is the average fraction of shares held by a firm's general manager and board chair, multiplied by 100. *PoliticalConnection* is a dummy variable that equals one if either the general manager or the board chair was previously employed as a bureaucrat by the central government or a local government. *ROE* is net income divided by the lagged equity. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Mean, median, standard deviation, and percentiles

	N	Mean	Median	Std. Dev.	P25	P75
Capex	4716	0.071	0.046	0.080	0.018	0.094
InterestRate	4716	0.058	0.054	0.033	0.042	0.066
Tobin's Q	4716	1.976	1.597	1.239	1.206	2.268
CashFlow	4716	0.056	0.051	0.097	0.006	0.102
Log(Assets)	4716	22.256	22.03	1.416	21.222	23.099
Leverage	4716	0.530	0.533	0.192	0.390	0.662
CEOOwnership (%)	4698	0.046	0	0.527	0	0.001
PoliticalConnection	4716	0.335	0	0.472	0	1
ROE	4664	0.075	0.071	0.186	0.021	0.137

Panel B: Correlations

	Capex	*InterestRate*	*Tobin's Q*	*CashFlow*	*Log(Assets)*	*Leverage*	*CEOOwnership* (%)	*PoliticalConnection*	*ROE*
Capex	1								
InterestRate	-0.110***	1							
Tobin's Q	0.056***	0.125***	1						
CashFlow	0.295***	-0.023	0.083***	1					
Log(Assets)	0.056***	-0.173***	-0.329***	0.047***	1				
Leverage	-0.126***	0.032**	-0.186***	-0.154***	0.221***	1			
CEOOwnership (%)	0.065***	-0.02	0.029**	-0.028*	-0.023	0	1		
PoliticalConnection	0.075***	-0.054***	-0.046***	0.076***	0.115***	0.026*	-0.047***	1	
ROE	0.221***	-0.037**	0.163***	0.352***	0.055***	-0.073***	-0.007	0.038***	1

Table 3: Baseline regressions

This table reports the results of the baseline regressions. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. SASAC*Year, Industry*Year, and Province*Year are three interactive fixed effects. In all columns except columns (3) and (4), t-statistics are calculated by clustering at the SASAC and year levels. In columns (3) and (4), t-statistics are calculated by clustering at the SASAC level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Post × InterestRate	0.256***	0.240**	0.186***	0.175***	0.179***	0.190***
	(2.71)	(2.62)	(4.13)	(4.31)	(3.37)	(3.17)
Post	-0.032***	-0.030**	-0.005			
	(-3.13)	(-2.54)	(-0.99)			
InterestRate	-0.368***	-0.321***	-0.196***	-0.156***	-0.183***	-0.170***
	(-4.16)	(-4.60)	(-4.46)	(-2.92)	(-3.90)	(-2.88)
Tobin's Q		0.004***	0.007***	0.006***	0.005***	0.004**
		(4.27)	(4.21)	(3.77)	(2.93)	(2.24)
CashFlow		0.215***	0.106***	0.101**	0.087**	0.078***
		(7.63)	(5.57)	(5.32)	(7.29)	(6.77)
Log(Assets)		0.005*	-0.016***	-0.017**	-0.021**	-0.027***
		(1.84)	(-2.82)	(-2.76)	(-2.02)	(-2.83)
Leverage		-0.036**	-0.058**	-0.048**	-0.039*	-0.028
		(-2.46)	(-3.13)	(-2.53)	(-2.14)	(-1.73)
Observations	4,716	4,716	4,682	4,646	4,628	4,616
R-squared	0.025	0.118	0.471	0.514	0.549	0.591
Firm FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	NO	NO	YES	YES	YES
Industry*Year FE	NO	NO	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	NO	NO	YES

Table 4: Results using the group company sample

This table reports the results of the baseline regressions using the group company sample. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of the year. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. Province×Year and Industry×Year are two interactive fixed effects; we do not include SASAC×year because for non-SOE sample this dummy coincides with Province×Year exactly). T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Post × *InterestRate*	0.261***	0.228**	0.204**	0.213**
	(3.35)	(2.79)	(2.29)	(2.40)
Post	-0.014			
	(-1.71)			
InterestRate	-0.037	-0.018	-0.000	0.018
	(-0.68)	(-0.30)	(-0.00)	(0.26)
CashFlow	0.068**	0.077**	0.069**	0.059**
	(2.80)	(3.08)	(3.24)	(2.87)
Log(*Assets*)	-0.017	-0.021*	-0.028**	-0.026*
	(-1.77)	(-1.96)	(-2.35)	(-2.17)
Leverage	-0.102**	-0.104**	-0.089*	-0.104**
	(-3.05)	(-2.80)	(-2.15)	(-2.63)
Observations	2,439	2,418	2,397	2,384
R-squared	0.636	0.692	0.723	0.734
Firm FE	YES	YES	YES	YES
Year FE	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES

Table 5: Non-state owned enterprises as a placebo group

This table reports the results of the baseline regressions on non-SOEs. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. Province×Year and Industry×Year are two interactive fixed effects; we do not include SASAC×year because for non-SOE sample this dummy coincides with Province×Year exactly). T-statistics computed with standard errors clustered at the province and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Post × *InterestRate*	-0.086	-0.112**	-0.049	-0.029	-0.040
	(-1.57)	(-2.01)	(-1.12)	(-0.75)	(-0.96)
Post	0.005	0.006	0.001		
	(0.61)	(0.82)	(0.11)		
InterestRate	-0.057	-0.064	-0.008	-0.012	-0.014
	(-1.19)	(-1.57)	(-0.23)	(-0.38)	(-0.52)
Tobin's Q		0.005***	0.005**	0.005**	0.005**
		(4.29)	(2.76)	(2.75)	(2.70)
CashFlow		0.136***	0.059**	0.061**	0.057**
		(9.98)	(2.95)	(2.96)	(2.88)
Log(Assets)		0.001	-0.017***	-0.018***	-0.021***
		(0.22)	(-4.01)	(-3.95)	(-5.01)
Leverage		-0.030***	-0.024**	-0.024**	-0.022**
		(-4.34)	(-2.84)	(-2.84)	(-2.89)
Observations	6,459	6,459	6,343	6,334	6,326
R-squared	0.003	0.073	0.486	0.533	0.566
Firm FE	NO	NO	YES	YES	YES
Year FE	NO	NO	YES	NO	NO
Province*Year FE	NO	NO	NO	YES	YES
Industry*Year FE	NO	NO	NO	NO	YES

Table 6: Firm performance

This table reports the results on how the EVA policy affected firm performance as measured with *ROE*. *ROE* is net income divided by lagged equity. Firms are sorted into six groups by lagged interest rates. We classify firms with *InterestRate* below 2.5%, between 2.5% and 4.5%, between 4.5% and 6.5%, between 6.5% and 8.5%, between 8.5% and 10.5%, and higher than 10.5%, as group 1, group 2, ..., and group 6, respectively. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the variables are lagged by one year. SASAC×Year, Industry×Year, and Province×Year are three interactive fixed effects. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Post × Group1	-0.012	-0.035**	-0.048***	-0.042***
	(-0.53)	(-2.72)	(-4.85)	(-3.56)
Post × Group2	-0.030	-0.046**	-0.047***	-0.049**
	(-1.57)	(-2.40)	(-3.16)	(-2.77)
Post × Group3	0.019	-0.003	-0.009	-0.005
	(1.50)	(-0.33)	(-1.22)	(-0.44)
Post × Group4	0.020*			
	(1.90)			
Post × Group5	-0.012	-0.040	-0.045*	-0.025
	(-0.43)	(-1.52)	(-2.14)	(-1.20)
Post × Group6	-0.036	-0.053	-0.079	-0.061**
	(-0.98)	(-1.31)	(-1.72)	(-2.28)
Log(*Assets*)	-0.053**	-0.053**	-0.056**	-0.065**
	(-2.70)	(-2.62)	(-2.90)	(-3.05)
Leverage	0.089	0.116	0.133	0.152*
	(1.04)	(1.43)	(1.71)	(1.93)
Observations	4,624	4,586	4,567	4,554
R-squared	0.375	0.439	0.486	0.565
Firm FE	YES	YES	YES	YES
Year FE	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES

Table 7: EVA, executive turnover, and compensation

This table reports the OLS regression results on the relationship between EVA and forced executive turnover (Panel A) and the relationship between EVA and executive compensation (Panel B). In Panel A, the dependent variable equals one if either the general manager or the board chair departs and zero otherwise. In Panel B, the dependent variable is the Log (1 + the average compensation of the general manager and the board chair). *EVA* is calculated following the SASAC report as in Eq. (2). To make the EVA measure comparable across firms, we scale the dollar EVA by average firm assets. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *ROE* is net income divided by the lagged equity. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. We also control for the age and tenure of the general manager and the board chair. In Panel A, all the variables are lagged by one year. In Panel B, *Post*, *EVA*, and *ROE* are contemporaneous with compensation and all other variables are lagged by one year. SASAC×Year, Industry×Year, and Province×Year are three interactive fixed effects. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Panel A. Turnover				Panel B. Compensation			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × EVA	-0.999*	-1.272**	-0.919*	-1.469**	-0.092	0.176	1.244	4.455*
	(-1.83)	(-2.39)	(-2.03)	(-2.67)	(-0.03)	(0.05)	(0.39)	(1.79)
Post	-0.043				-0.391			
	(-1.28)				(-1.14)			
EVA	-0.029	0.264	0.138	0.408	0.604	0.647	-0.450	-1.514
	(-0.08)	(0.55)	(0.27)	(0.86)	(0.18)	(0.18)	(-0.17)	(-0.58)
Post × ROE	0.478**	0.568***	0.530***	0.663***	0.026	0.215	-0.094	-1.686
	(2.99)	(5.19)	(5.27)	(3.28)	(0.02)	(0.13)	(-0.06)	(-1.46)
ROE	-0.270**	-0.368**	-0.323**	-0.366**	-0.012	-0.149	0.040	1.025
	(-2.28)	(-2.74)	(-2.30)	(-2.26)	(-0.01)	(-0.10)	(0.04)	(1.05)
Tobin's Q	-0.005	-0.006	-0.009	-0.018	-0.103	-0.100	-0.125*	-0.177*
	(-0.30)	(-0.28)	(-0.41)	(-0.86)	(-1.18)	(-1.36)	(-1.92)	(-1.81)
Log(Assets)	-0.074**	-0.072***	-0.082***	-0.109***	0.278	0.287	0.187	0.228
	(-2.75)	(-3.80)	(-3.61)	(-4.13)	(1.36)	(1.16)	(0.86)	(0.83)
Leverage	0.255***	0.320***	0.305***	0.259**	-0.726	-0.162	-0.166	-0.590
	(3.24)	(3.83)	(3.12)	(2.53)	(-0.62)	(-0.14)	(-0.15)	(-0.56)
Log (Age of	0.319***	0.378***	0.352***	0.327**	-1.946**	-1.645**	-1.793**	-1.851*
general manager)	(4.00)	(5.28)	(3.37)	(2.30)	(-3.08)	(-2.60)	(-2.31)	(-2.06)
Log (1 + tenure of	0.136***	0.139***	0.137***	0.128***	3.066***	3.175***	3.179***	3.166***
general manager)	(6.44)	(8.18)	(12.74)	(11.07)	(11.52)	(12.85)	(14.24)	(15.05)
Log (Age of	0.049	0.041	0.055	0.106	2.208*	1.900	1.981*	2.267*
chair)	(0.52)	(0.47)	(0.55)	(1.04)	(2.19)	(1.71)	(2.06)	(2.20)
Log (1 + tenure of	0.136***	0.143***	0.145***	0.146***	-0.837***	-0.824***	-0.855***	-0.861***
chair)	(6.09)	(6.56)	(8.77)	(6.71)	(-8.03)	(-8.29)	(-9.27)	(-7.41)
Observations	3,637	3,594	3,561	3,537	3,675	3,630	3,602	3,577
R-squared	0.248	0.311	0.348	0.426	0.594	0.625	0.646	0.682
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	NO	NO	NO
SASAC * Year FE	YES	YES	YES	YES	NO	YES	YES	YES
Industry * Year FE	NO	NO	YES	YES	NO	NO	YES	YES
Province * Year FE	NO	NO	NO	YES	NO	NO	NO	YES

Table 8: Firm heterogeneity

This table reports results on firm heterogeneity: Panel A on political connection and Panel B on CEO ownership. *PoliticalConnection* is a dummy variable that equals one if either the general manager or the board chair was previously employed as a bureaucrat by the central government or a local government. *CEOOwnership* is the average fraction of shares held by a firm's general manager and board chair, multiplied by 100. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. SASAC*Year, Industry*Year, and Province*Year are three interactive fixed effects. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Political connection				Panel B. CEO ownership			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × InterestRate	0.075	0.065	0.093	0.122	0.185***	0.175***	0.179***	0.195***
	(1.28)	(1.20)	(1.28)	(1.42)	(10.74)	(6.24)	(3.58)	(3.25)
Post × Interest Rate × PoliticalConnection	0.327**	0.330**	0.249**	0.197*				
	(2.84)	(2.76)	(2.30)	(1.68)				
Post × PoliticalConnection	-0.026**	-0.025**	-0.020*	-0.017				
	(-2.38)	(-2.38)	(-2.06)	(-1.56)				
InterestRate × PoliticalConnection	-0.192*	-0.170*	-0.134	-0.103				
	(-2.19)	(-1.85)	(-1.41)	(-0.88)				
Post × InterestRate × CEOOwnership					-0.242	-0.242**	-0.383**	-0.468**
					(-1.38)	(-2.35)	(-2.59)	(-2.77)
Post × CEOOwnership					0.001	0.000	0.001	0.003
					(0.07)	(0.00)	(0.19)	(0.39)
Interest Rate × CEOOwnership					-0.050	-0.075	-0.098	-0.087
					(-0.36)	(-0.60)	(-1.01)	(-0.92)
Post	0.003				-0.005			
	(0.51)				(-0.98)			
InterestRate	-0.124*	-0.090	-0.129	-0.127	-0.191***	-0.150***	-0.175**	-0.165**
	(-2.09)	(-1.24)	(-1.55)	(-1.51)	(-5.42)	(-3.75)	(-2.98)	(-2.89)
PoliticalConnection	0.023**	0.021**	0.020**	0.017**				
	(3.05)	(2.67)	(2.83)	(2.31)				
CEOOwnership					0.019	0.021*	0.023**	0.022**
					(1.57)	(2.02)	(2.52)	(2.45)
Tobin's Q	0.007**	0.006**	0.005**	0.004*	0.007*	0.006*	0.005*	0.004
	(2.84)	(2.83)	(2.40)	(1.81)	(2.13)	(1.95)	(2.06)	(1.64)
Cash Flow	0.105***	0.101***	0.087***	0.078***	0.105***	0.100***	0.087***	0.078***
	(6.56)	(6.16)	(6.31)	(6.27)	(6.66)	(6.30)	(7.43)	(6.85)
Log(Assets)	-0.016*	-0.017*	-0.021*	-0.027**	-0.015	-0.017	-0.020*	-0.026**
	(-1.98)	(-1.80)	(-2.05)	(-2.81)	(-1.51)	(-1.48)	(-1.81)	(-2.42)
Leverage	-0.058**	-0.048**	-0.039*	-0.028	-0.056**	-0.046*	-0.038	-0.027
	(-2.86)	(-2.35)	(-1.91)	(-1.53)	(-2.79)	(-1.88)	(-1.79)	(-1.48)
Observations	4,682	4,648	4,628	4,616	4,665	4,630	4,610	4,598
R-squared	0.473	0.516	0.551	0.592	0.472	0.515	0.550	0.591
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES	NO	NO	NO	YES

Table 9: External financing

This table reports the results of external financing. The dependent variable is *Long-term Debt Financing* in columns (1)-(4), *Short-term Debt Financing* in (5)-(8), and *External Equity Financing* in columns (9)-(12). *Long-term Debt Financing* is the change in Long-term debt (including long-term loans, bonds payable, long-term payables, and long-term liabilities due within one year) from year t-1 to t, scaled by lagged total assets. *Short-term Debt Financing* is the change in short-term debt (i.e., short-term loans) from year t-1 to t, scaled by lagged total assets. *External Equity Financing* is the sum of rights issues and secondary equity offerings, scaled by lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. SASAC×Year and Industry×Year are two interactive fixed effects. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A. Long-term Debt Financing				Panel B: Short-term Debt Financing				Panel C: External Equity Financing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post × InterestRate	0.128***	0.139***	0.141***	0.170***	-0.017	-0.037	-0.009	-0.031	0.076	0.085	-0.026	0.125
	(3.46)	(5.08)	(4.48)	(3.46)	(-0.23)	(-0.49)	(-0.14)	(-0.41)	(0.52)	(0.50)	(-0.12)	(0.69)
Post	-0.011				-0.000				-0.004			
	(-1.13)				(-0.02)				(-0.33)			
InterestRate	-0.115**	-0.091	-0.075	-0.086*	0.128***	0.131***	0.137***	0.163***	-0.198	-0.204*	-0.147	-0.215*
	(-2.31)	(-1.66)	(-1.44)	(-1.93)	(3.47)	(3.71)	(3.90)	(6.53)	(-1.79)	(-2.07)	(-1.26)	(-2.01)
Tobin's Q	0.000	-0.001	-0.001	-0.001	0.006***	0.006***	0.006*	0.005	0.027***	0.028***	0.030***	0.029***
	(0.13)	(-0.34)	(-0.11)	(-0.24)	(3.86)	(3.56)	(2.16)	(1.45)	(6.06)	(5.67)	(4.17)	(5.07)
CashFlow	0.003	-0.001	0.008	-0.010	-0.183***	-0.189***	-0.193***	-0.200***	0.251***	0.236***	0.232***	0.226***
	(0.10)	(-0.04)	(0.29)	(-0.47)	(-5.72)	(-5.62)	(-5.39)	(-5.73)	(3.37)	(3.30)	(3.56)	(3.31)
Log(Assets)	-0.033*	-0.035*	-0.040*	-0.047**	-0.022**	-0.024**	-0.027*	-0.033**	-0.067**	-0.073**	-0.080**	-0.094**
	(-2.13)	(-2.07)	(-1.95)	(-2.39)	(-2.54)	(-2.37)	(-1.88)	(-2.85)	(-2.73)	(-2.79)	(-2.85)	(-2.94)
Leverage	-0.078**	-0.082**	-0.073**	-0.060**	-0.125***	-0.125***	-0.121***	-0.112***	0.150***	0.165***	0.173***	0.188***
	(-2.38)	(-2.84)	(-2.67)	(-2.46)	(-5.03)	(-5.50)	(-5.72)	(-5.97)	(4.71)	(5.18)	(5.42)	(5.00)
Observations	4,682	4,648	4,628	4,616	4,682	4,648	4,628	4,616	4,682	4,648	4,628	4,616
R-squared	0.208	0.278	0.318	0.370	0.243	0.293	0.328	0.395	0.204	0.263	0.302	0.355
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES

Table 10: R&D expenses

This table reports the difference-in-differences tests on how the EVA policy affected firms' R&D expenses. The dependent variable is *R&D*. *R&D* is R&D expenses scaled by sales. Missing R&D values are treated as zero. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *InterestRate* is a firm's interest expenses divided by the average of its total debts at the beginning of the year and the end of each quarter. The total debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. Industrym×Year are interactive fixed effects. Data of R&D expenses are hand collected for 2004-2006 and are from CSMAR for 2007 onward. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.015***	0.015***	0.015***	0.005**	0.007**	0.003**
	(6.03)	(6.19)	(5.60)	(2.69)	(2.60)	(2.47)
InterestRate		0.017	0.017	-0.030***	-0.015	-0.007
		(1.22)	(1.61)	(-3.85)	(-1.45)	(-1.22)
Tobin's Q		0.001*	0.001	0.001**	0.000	-0.000
		(1.82)	(1.38)	(2.48)	(0.43)	(-0.40)
CashFlow		-0.008**	-0.010**	-0.001	-0.001	-0.003**
		(-1.98)	(-2.03)	(-0.68)	(-0.36)	(-2.30)
Log(Assets)			-0.001	-0.001***	-0.002*	-0.001
			(-1.01)	(-7.77)	(-2.10)	(-1.78)
Leverage			-0.011***	-0.007***	-0.004	-0.004**
			(-3.61)	(-3.50)	(-1.25)	(-2.36)
Observations	4,714	4,714	4,714	4,714	4,679	4,659
R-squared	0.135	0.144	0.158	0.386	0.599	0.698
Industry FE	NO	NO	NO	YES	NO	NO
Firm FE	NO	NO	NO	NO	YES	YES
Year FE	NO	NO	NO	YES	YES	NO
Industry*Year FE	NO	NO	NO	NO	NO	YES

Table 11: Cost of capital decomposition

In this table, we decompose the firm-level cost of capital into three components: within-in-industry dispersion, across-industry dispersion, and wedge between the EVA policy rate and the sample average. Panel A analyzes the cost of capital by accounting both the cost of debt and the cost of equity, and Panel B analyzes interest rate. We do the decomposition year by year. The reported fractions are the fractions of variations explained by each component, averaged across the sample years. In Panel A, each row represents the analysis of one choice of the market risk premium, from 5% to 8%. We only include the pre-EVA firm-year observations.

	Within-industry	Across-industry	Wedge b/w EVA rate and sample mean
Panel A. Cost of capital			
market risk premium = 5%	0.499	0.263	0.238
market risk premium = 6%	0.474	0.248	0.279
market risk premium = 6.5%	0.435	0.228	0.336
market risk premium = 7%	0.389	0.206	0.405
market risk premium = 8%	0.305	0.166	0.529
Panel B. Interest rate			
	0.517	0.224	0.259

Table 12: Capital reallocation between SOEs and non-SOEs

In this table, we examine how the EVA policy affected capital reallocation between SOEs and non-SOEs. The sample contains all SOEs from the SASACs that adopted the EVA (except the central SASAC) and non-SOEs from these provinces. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by lagged total assets. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *SOE* equals one for SOEs and zero for non-SOEs. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. *High* equals one for SOEs with an interest rate higher than the median of SOEs and zero otherwise. We do not include the *SOE*dummy in the model because it is absorbed by firm fixed effects. In column 5, *High*, *SOE*High*, and *Post*High* are included but unreported. All the control variables are lagged by one year except *CashFlow*. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Post × SOE	-0.004	0.004	0.009	0.009	-0.001
	(-0.49)	(0.32)	(1.01)	(0.98)	(-0.07)
Post	0.004				
	(0.76)				
Post × SOE × High					0.018***
					(5.42)
Tobin's Q	0.008***	0.008***	0.008***	0.008***	0.008***
	(5.47)	(5.04)	(5.56)	(5.33)	(5.21)
CashFlow	0.060***	0.055***	0.048**	0.048**	0.048**
	(3.30)	(3.21)	(2.89)	(2.81)	(2.64)
Log(Assets)	-0.015*	-0.018**	-0.020**	-0.019**	-0.019**
	(-2.20)	(-2.36)	(-2.75)	(-2.60)	(-2.59)
Leverage	-0.012	-0.015	-0.013	-0.014	-0.013
	(-1.44)	(-1.62)	(-1.52)	(-1.64)	(-1.57)
Observations	3,198	3,198	3,166	3,141	3,141
R-squared	0.517	0.556	0.603	0.608	0.609
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES	YES
Province*Year FE	NO	NO	NO	YES	YES

Table 13: Aggregate capital productivity: Evidence based on $MRPK$ dispersion

This table reports the results on aggregate capital productivity. In columns (1) and (2), we only keep manufacturing firms in the analysis. In columns (3) and (4), we keep all the firms. We measure aggregate capital productivity using the dispersion of marginal revenue product of capital ($MRPK$) and examine how the EVA policy affects the dispersion. The unit of analysis is SASAC-year. The dependent variable is the dispersion of industry-adjusted $MRPK$ across all the SOEs under the control of a SASAC. We require at least five firms within each unit of observation at the SASAC-year level. $MRPK$ is the natural logarithm of the ratio between operating profit and lagged fixed assets. Operating profit is sales minus costs of goods sold and selling, general and administrative expenses, plus depreciation. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Average Log(Assets)* is the mean of lagged log total assets among firms controlled by a SASAC. *Average Leverage* is the mean of lagged leverage among firms controlled by a SASAC. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Manufacturing Firms		All Firms	
	(1)	(2)	(3)	(4)
Post	0.009	-0.079	-0.027	-0.024
	(0.10)	(-0.56)	(-0.28)	(-0.24)
Average Log(Assets)		-0.246**		-0.141
		(-2.85)		(-1.24)
Average Leverage		1.360*		-0.270
		(2.11)		(-0.40)
Observations	120	120	198	198
R-squared	0.397	0.452	0.305	0.316
SASAC FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Figure 1: Year of EVA policy adoptiont

This figure reports the year of the EVA policy adoption. "Year of adoption" is the first year when the policy was effective. Hebei and Gansu consider the actual cost of capital in their EVA policies. Anhui sets the cost of capital at 4.5% instead of 5.5%. Shaanxi sets a firm's cost of capital as the average return-on-assets of its industry peers. They are included in the figure but are excluded from our analysis. Tibet is excluded because its information is missing. Hong Kong, Macao, and Taiwan are also excluded as they do not have SASACs. "No EVA Adoption" indicates that the EVA has not been adopted by 2015.

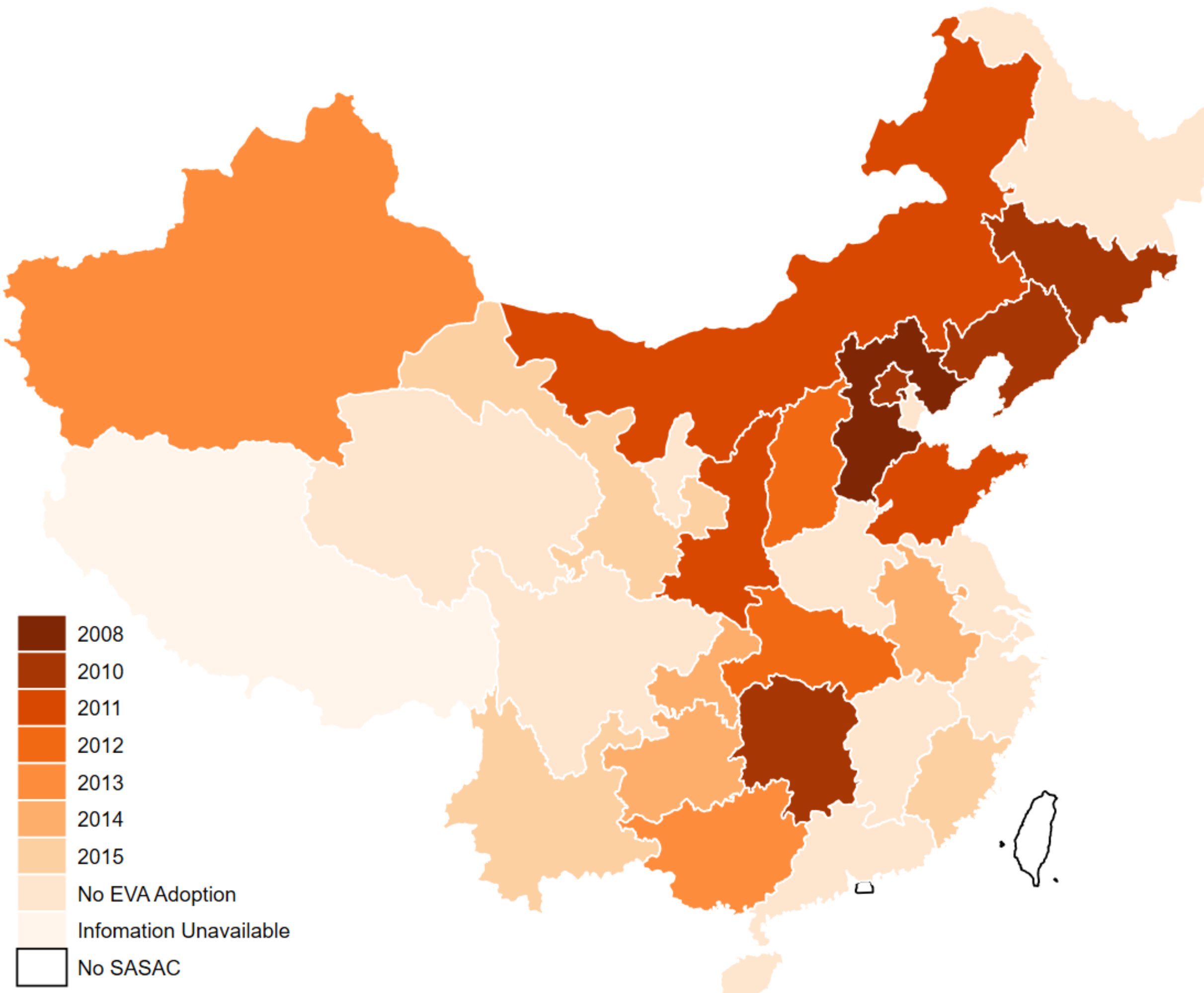
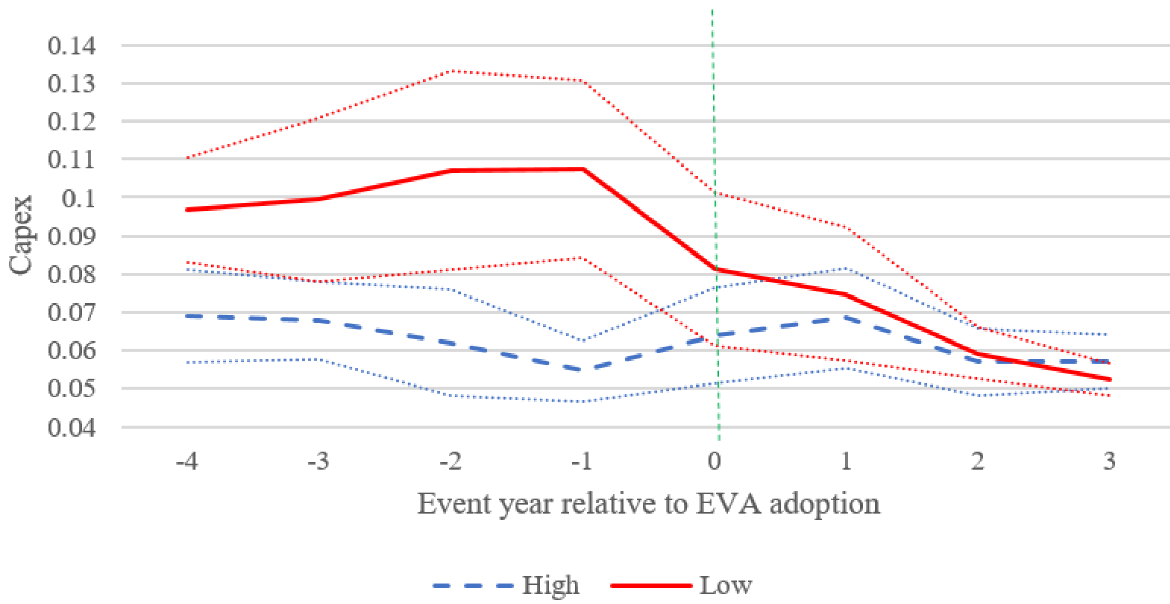


Figure 2: Empirical Pattern: Raw Data

This figure presents the average *Capex* (the y-axis) for firms with high and low *InterestRate* by event year (the x-axis) from four years before to three years after the EVA adoption. Panel A reports the results of the treated SASACs, and Panel B reports the results of the control SASACs. We sort firms into High and Low *InterestRate* groups by the sample median based on the interest rate at the last year before EVA adoption. The solid red line represents the Low group, and the blue dashed line represents the High group. The dotted lines are the 95% confidence intervals. The dashed vertical line indicates the first year that the EVA policy was adopted.

Panel A: The treated SASACs



Panel B: The control SASACs

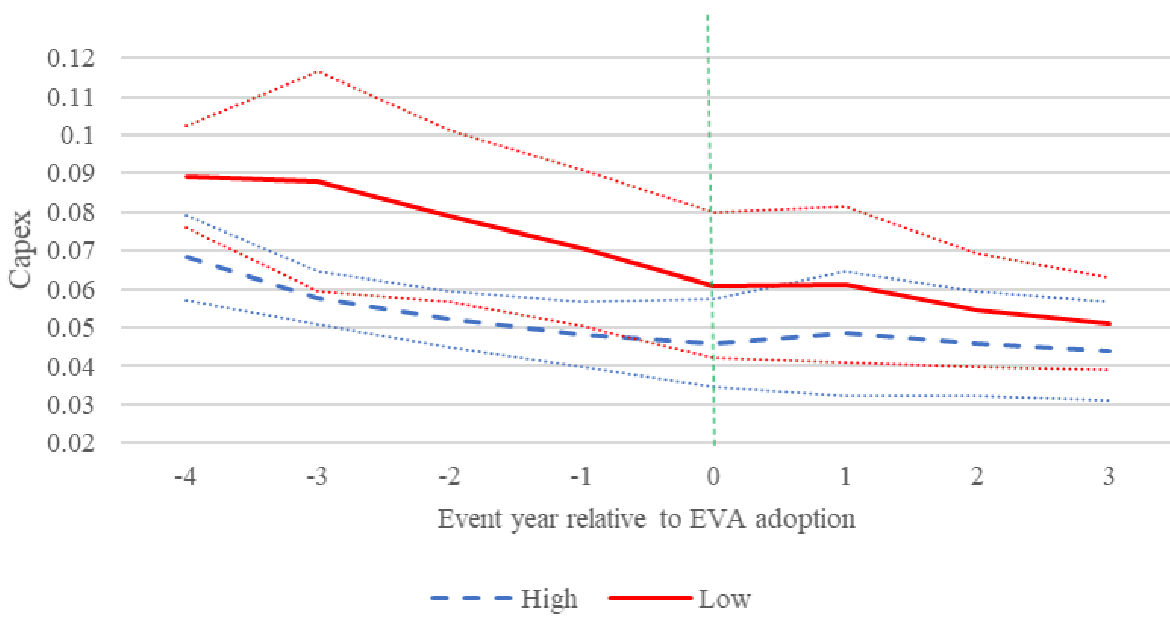
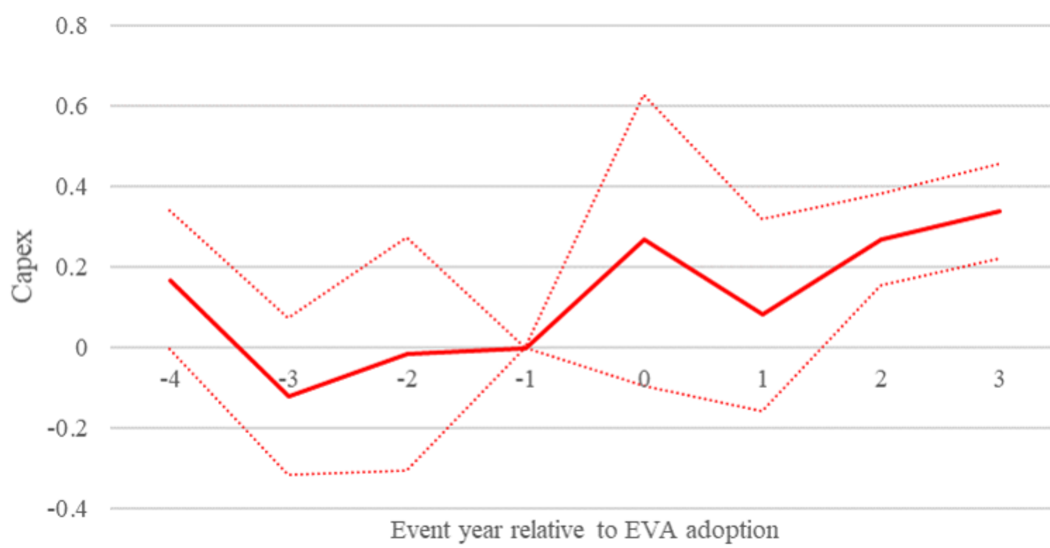


Figure 3: Dynamic regression coefficients

This figure reports the $\beta_{3,s}$ coefficients from the following regressions. In Panel A, we include firm fixed effects, SASAC×year fixed effects, and the industry×year fixed effects. In Panel B, we further add the province×year fixed effects. The t-statistics are calculated by clustering by SASAC and year.

$$CAPEX_{i,t} = \beta_1 InterestRate_{i,t} + \sum_{s \neq -1} \beta_{2,s} Post_{i,t,s} + \sum_{s \neq -1} \beta_{3,s} InterestRate_{i,t} \times Post_{i,t,s} + \gamma' X_{i,t} + \epsilon_{i,t}$$

Panel A: Without the province × year fixed effects



Panel B: With the province*year fixed effects

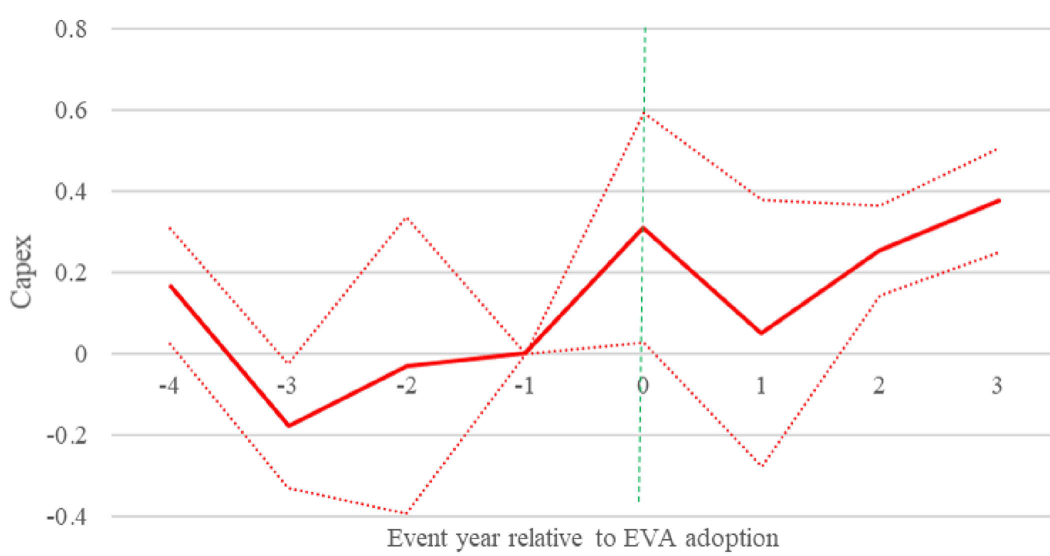
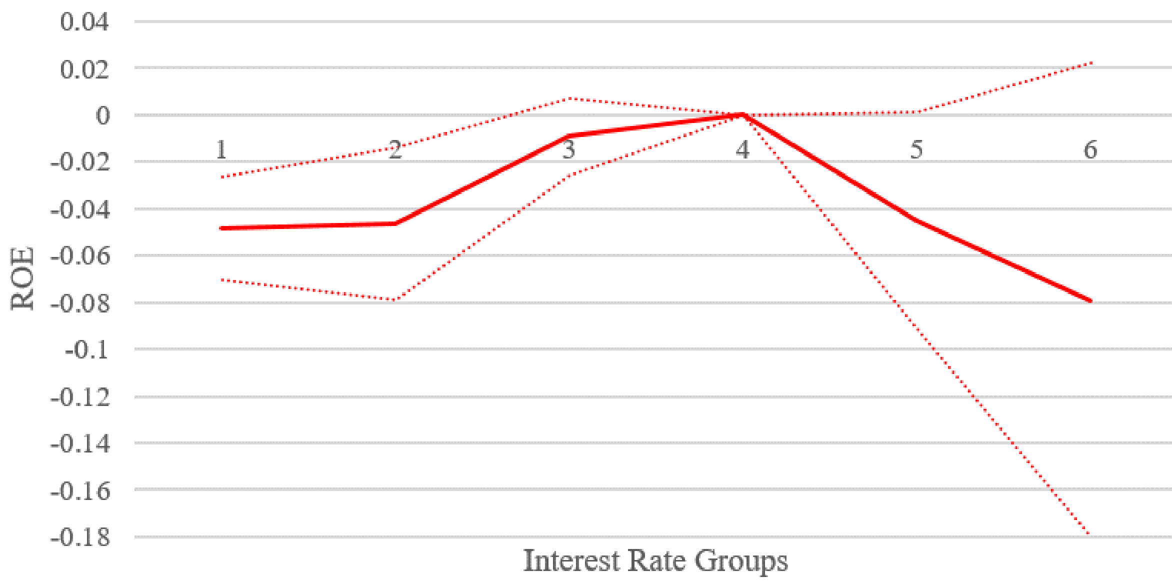


Figure 4: EVA and firm performance

This figure displays the change in firm performance (measured with ROE) by the level of interest rates. Firms are sorted into six groups by lagged interest rates. We classify firms with *InterestRate* below 2.5%, between 2.5% and 4.5%, between 4.5% and 6.5%, between 6.5% and 8.5%, between 8.5% and 10.5%, and higher than 10.5%, as group 1, group 2, ..., and group 6, respectively. Panel A displays the β_g coefficients of column 3 of Table 6, and Panel B displays the β_g coefficients of column 4 of Table 6.

Panel A: without the province*year fixed effects



Panel B: with the province*year fixed effects

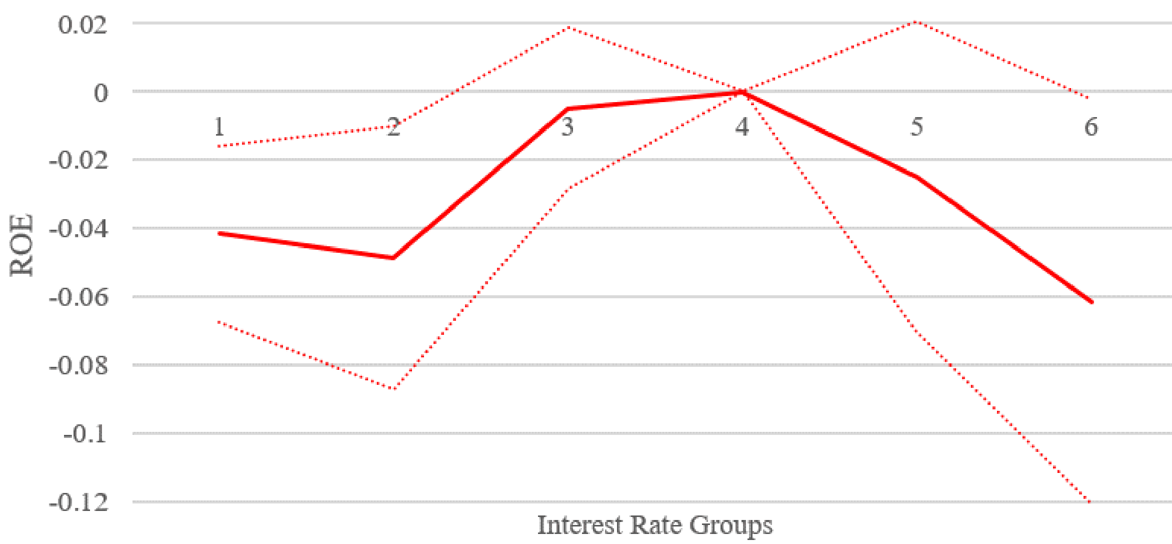
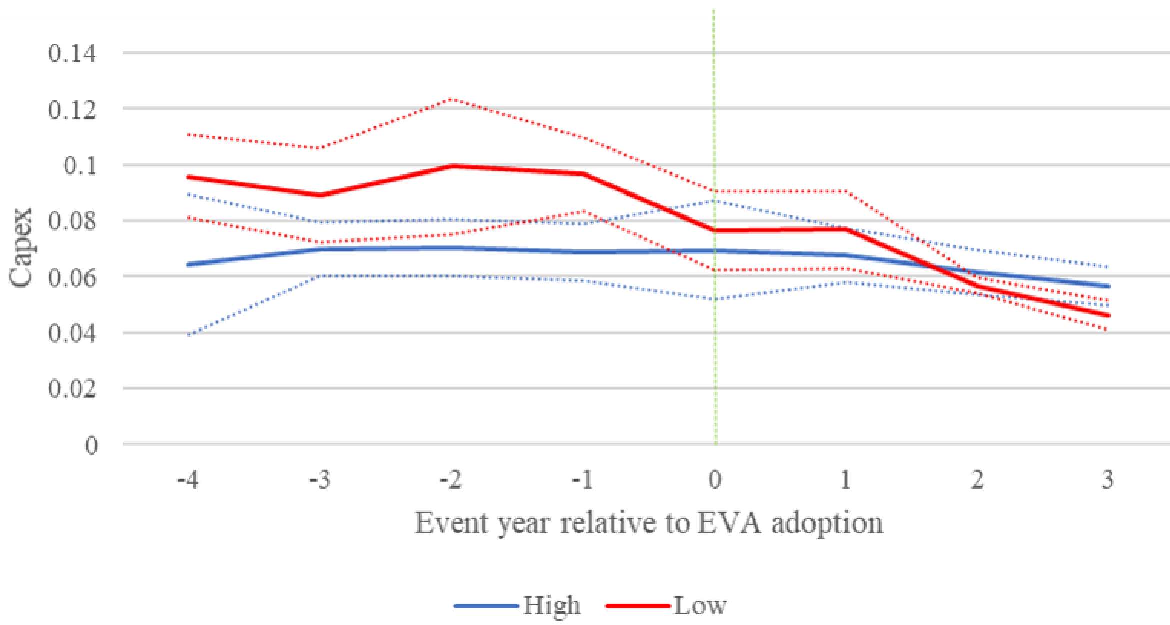


Figure 5: EVA and firm investment based on industry average cost of capital

This figure presents the average *Capex* (the y-axis) for firms with high and low industry average cost of capital by event year (the x-axis) from four years before to three years after the EVA adoption. The sample includes the firms controlled by all the treated SASACs. We sort firms into High and Low cost of capital groups by the sample median based on the industry average cost of capital at the last year before EVA adoption. The solid red line represents the Low group, and the blue dashed line represents the High group. The dotted lines are the 95% confidence intervals. The dashed vertical line indicates the first year that the EVA policy was adopted.



A Appendix

A.1 An Example of a Project with Aggregate Risk

Consider a one-period setting where an SOE firm operates with a production function $F(K) = F(D+E)$, such that $F'(K) > 0$ and $F''(K) < 0$. Here, K is the capital that the SOE employs, with the accounting identity $K = D+E$ so that the physical capital asset (K) is financed via either debt (D) or equity (E). Recall $F(K)$ is the firm's earnings before interests and taxes. Throughout, our analysis assumes that debt is the only margin to adjust; we, therefore, do not take a stand on the potential benefit of debt or the bankruptcy cost.

As explained in Section 3.1, the risk-neutral analysis we conduct in the main model goes through if the project involves idiosyncratic risk only. Now suppose that with probability $p \in (0,1)$ the project succeeds and generates a cash flow of $\tilde{Y} = \frac{F(K)}{p}$, while with probability $1-p$ it fails with zero output $\tilde{Y} = 0$; this implies the expected output is still $F(K)$. The "failure" state is an aggregate state with a higher risk-adjusted price; say that the Arrow-Debrew price of the "failure" state is $\theta > 1$. In this example, for simplicity, we set the output after failure to be zero, which implies that the expected cash flows (under measure $\mathbb{P}$) are equal to the market value of the cash flows (under measure $\mathbb{Q}$); but our conclusion does not depend on this simplifying assumption. Finally, suppose that the time discount rate for deterministic cash flow streams is $\rho > 1$.

We now derive the borrowing cost of the firm. Because the debt holders of this project receive nothing in the failure state, the equilibrium "quoted" interest rate should be

$$\frac{p(1+r_D)}{\rho} = 1 \Rightarrow r_D = \frac{\rho}{p} - 1.$$

Because the lenders are fairly compensated for the aggregate risk (i.e., they lose the principal and interest in the failure state), r_D is the right cost of capital that enters the firm's optimization decision.[57] In fact, we can also solve for the implied risk-free rate in this economy, denoted by r, as

$$\frac{p(1+r)+(1-p)\,\theta(1+r)}{\rho}=1\Rightarrow r=\frac{\rho}{p+(1-p)\,\theta}-1. \tag{19}$$

The credit spread, which is defined as the difference between the quoted interest rate and the risk-free rate, is

$$r_D-r=\frac{\rho}{p}-\frac{\rho}{p+(1-p)\,\theta}=\frac{(1-p)\,\rho\theta}{p\,(p+(1-p)\,\theta)}>0.$$

This example also offers a theoretical framework where the equilibrium interest rate r_D is independent of leverage D, which is the running assumption in Eq. (4) as discussed extensively in Section 3.2. We emphasize that here p captures the aggregate risk, and this framework is appealing in the context of Chinese SOEs whose default is extremely rare during our sample period 2009–2015.

A.2 External Equity Financing

During our sample period, external equity financing activities of Chinese listed firms were strictly regulated; for instance, concerning poor corporate governance, the China Securities Regulatory Commission (CSRC) required a firm to have positive earnings and at least 20% dividend payout ratio over the past three years to qualify for public seasoned equity offerings.

In Table A.1, we show that in most of the years during our sample, less than 0.5% of listed firms conducted public seasoned equity offerings; dividend payments were low and strongly persistent, and repurchases were almost nonexistent. Since 2006, virtually all external equity was issued via private equity placements. Private equity placements required neither positive earnings, nor a certain dividend payout; hence, it was relatively easier for them to get approval. However, these private placements could serve a different purpose than financing investment as they typically involve either a change of controlling shareholders or the addition of new large shareholders. Consistent with the view of potential control change, we find that the average private placement's issuance amount is large (conditional on conducting a private placement, the new issuance was 42.6% of the existing

[57] More specifically, the firm who is taking into account of the aggregate risk is maximizing

$$p\cdot\underbrace{\left[\frac{F\,(D+E)}{p}-r_D\cdot D\right]}_{\text{success}}+(1-p)\cdot\underbrace{0}_{\text{failure}}=F\,(D+E)-(1+\rho)\,D,$$

and we use Eq. (19) to get the second equation. In fact, $F\,(D+E)$ is the market value of the cash flows $\tilde{Y}$ (evaluated at time 1) while the market value of investment (via debt) is $(1+\rho)\,D$.

equity base), and about 70% of investors are either enterprises or private equities during our sample period. As a result, we assume that equity adjustment cost is prohibitive and assume that the debt is the margin to adjust for investment financing.

In Table A.2, we report that our results are robust if we exclude firms that conducted external equity financing around the EVA policy adoption.

A.3 Using Never-Treated Sample as the Control

We report the main regression results using the never-treated as the control in Table A.4. The control group is constructed in the same way as in Figure 2. The coefficient of of $Post \times InterestRate \times Treat$ measures the difference-in-differences-in-differences effect.

A.4 Dynamic Estimation for Group Companies

We report the dynamic estimation results of the group company sample in Figure A.1. Specifically, Figure A.1 presents the β_{3s} coefficients from the following regression:

$$CAPEX_{i,t} = \beta_1 \cdot InterestRate_{i,t} + \sum_{s \neq -1} \beta_{2s} \cdot Post_{i,t,s} + \sum_{s \neq -1} \beta_{3s} \cdot InterestRate_{i,t} \times Post_{i,t,s} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t}.$$

Here, s indicates the year relative to the EVA adoption, so for firm i in year t, $Post_{i,t,s} = 1$ if firm i's SASAC j adopted the EVA policy in year $t - s$. We use the year before the EVA adoption ($s = -1$) as the base year and estimate the coefficients of $Post \times InterestRate$ for each event year relative to the base year. The t-statistics are calculated by clustering at both the SASAC level and the year level.

A.5 Summary Statistics of Non-SOEs

Table A.5 reports the summary statistics of the listed non-SOE sample. Although we focus on SOEs in our analysis, we also use the non-SOE sample in some regressions. The results show that the non-SOEs and SOEs have similar *Capex*—both the level and the distribution. Consistent with the literature on misallocation of resources between SOEs and non-SOEs in China (e.g., Song, Storesletten, and Zilibotti, 2011; Brandt, Tombe, and Zhu, 2013), in our sample of listed firms, non-SOEs have a higher financing cost: the average *InterestRate* among non-SOEs is 6.5%, which is 0.7% higher than the average *InterestRate* of SOEs. Based on the issuance yields of corporate bonds by listed firms in Chinese stock markets, Geng and Pan (2021) document a similar difference between SOEs and non-SOEs for their cost of debt. Like the SOE sample, $Capex$ and $InterestRate$ are strongly negatively correlated in the non-SOE sample, although the correlation coefficient is lower. The most distinct difference between SOEs and non-SOEs is perhaps their average size—on average, SOEs are much bigger than non-SOEs. Finally, it is not surprising to see that non-SOEs have higher *Tobin's Q* in general.

A.6 Other Robustness Tests

In Table A.6, we conduct two robustness tests. In Panel A, we drop the firms controlled by the central SASAC (about half of the sample). In Panel B, we trim the sample based on $InterestRate$. Overall, our results are robust to these alternative specifications.

A.7 Industry List

The capital allocative literature advocates for using finely classified industries. Hence, in this analysis, we classify firms into 60 industries based on three-digit industry classification codes provided by the Guidelines for the Industry Classification of Listed Companies (2012) of the Chinese Securities Regulatory Commission. We provide the list of industries (their codes and short description), and the number of observations of each industry in Table A.7.

A.8 Cost of Capital Decomposition by Year

Table A.8 shows the cost of capital decomposition for each year for both proxies of the actual cost of capital. See 5.2 for the detail.

A.9 Capital Reallocation across SOEs

In Table A.9, we test whether the EVA policy increased the investment of firms with a higher measured $MRPK$ more than firms with a lower measured $MRPK$. We conduct the test using a model similar to Eq. (9). Specifically, we replace the independent variable $InterestRate$ with industry-adjusted $MRPK$. The coefficient of $MRPK \times Post$ is insignificant in all the specifications except in column 6.

Table A.1: Summary of external equity financing

This table reports the summary statistics of the external equity financing of our sample firms. External equity financing includes rights issuance, non-rights public equity issuance, and private equity placements. We also consider cash dividends and stock repurchases.

Panel A: Fraction of firms with each type of external financing activity and the amount relative to existing share base

Year	Fraction of Firms with External Equity Financing	Fraction of Firms with Private equity placements	Fraction of Firms with Right issuance	Fraction of Firms with non-rights public equity offerings	Fraction of Firms with public equity offerings	Private Equity Placements/ Existing Share Base conditional on being an issuer	Rights Issuance/ Existing Share Base conditional on being an issuer	Non-rights public equity offerings/ Existing Share Base conditional on being an issuer	Public equity offerings/ Existing Share Base conditional on being an issuer	Fraction of Firms with cash dividend payment	Fraction of firms with repurchases
2004	2.66%	0.00%	1.60%	1.06%	2.66%	0.00%	6.91%	13.02%	19.93%	57.98%	0.00%
2005	0.51%	0.00%	0.00%	0.51%	0.51%	0.00%	0.00%	40.28%	40.28%	60.71%	0.00%
2006	5.65%	4.91%	0.00%	0.74%	0.74%	55.38%	0.00%	3.09%	3.09%	55.77%	2.70%
2007	11.22%	9.27%	0.73%	1.22%	1.95%	47.40%	1.92%	1.08%	3.00%	58.29%	0.24%
2008	10.92%	7.76%	1.15%	2.01%	3.16%	21.51%	2.26%	3.78%	6.04%	59.20%	0.00%
2009	10.23%	8.70%	0.77%	0.77%	1.53%	50.48%	2.17%	1.57%	3.74%	59.34%	0.00%
2010	11.11%	10.00%	0.74%	0.37%	1.11%	41.83%	1.26%	0.30%	1.57%	64.07%	0.37%
2011	10.75%	9.11%	1.17%	0.47%	1.64%	51.87%	2.64%	0.72%	3.36%	64.72%	0.00%
2012	9.58%	8.18%	0.93%	0.47%	1.40%	47.15%	2.65%	1.05%	3.70%	66.59%	0.00%
2013	14.49%	12.62%	1.40%	0.47%	1.87%	41.06%	2.70%	0.61%	3.31%	67.99%	1.17%
2014	12.06%	11.35%	0.71%	0.00%	0.71%	38.54%	1.22%	0.00%	1.22%	70.92%	1.65%
2015	17.59%	17.59%	0.00%	0.00%	0.00%	45.41%	0.00%	0.00%	0.00%	70.60%	1.45%
Mean	9.80%	8.38%	0.76%	0.66%	1.42%	42.62%	1.79%	1.43%	3.22%	63.17%	0.66%

Panel B: Financing activity scaled by lagged assets

Year	External Equity Financing / Lagged Assets	Rights Issues / Lagged Assets	Private Equity Placements/ Lagged Assets	Non-rights public equity offerings / Lagged Assets	Cash Dividends/ Lagged Assets	Stock Repurchases/ Lagged Assets	Change in Debt/ Lagged Assets	| Change in Debt | / Lagged Assets
2004	0.42%	0.19%	0.00%	0.11%	1.28%	0.00%	4.54%	8.72%
2005	0.00%	0.00%	0.00%	0.00%	1.49%	0.00%	1.84%	6.68%
2006	1.48%	0.00%	1.40%	0.00%	1.33%	0.27%	3.15%	10.09%
2007	5.59%	0.00%	4.93%	0.09%	1.27%	0.00%	8.21%	12.35%
2008	3.99%	0.12%	3.46%	0.23%	1.27%	0.00%	6.92%	11.41%
2009	4.40%	0.00%	4.06%	0.00%	0.96%	0.00%	6.57%	10.61%
2010	2.85%	0.00%	2.63%	0.00%	0.99%	0.00%	4.84%	8.49%
2011	6.16%	0.13%	5.93%	0.00%	0.95%	0.00%	6.93%	9.10%
2012	3.47%	0.00%	3.22%	0.00%	0.92%	0.00%	5.03%	8.09%
2013	3.94%	0.25%	3.54%	0.00%	0.87%	0.00%	3.69%	7.61%
2014	4.28%	0.00%	4.16%	0.00%	0.80%	0.00%	2.90%	7.54%
2015	5.85%	0.00%	5.85%	0.00%	0.82%	0.00%	2.90%	7.18%
Mean	3.60%	0.06%	3.33%	0.03%	1.08%	0.02%	4.77%	8.96%

Table A.2: Excluding firms with external equity financing

This table reports the results of how the EVA policy affected firm investment. We only include the firm-years from three years before to three years after the EVA policy adoption. In this table, we exclude firms with external equity financing during the sample period. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. SASAC×Year, Industry×Year, and Province×Year are three interactive fixed effects. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Post × InterestRate	0.192***	0.229***	0.188***	0.149***	0.117***	0.101
	(2.93)	(3.89)	(6.19)	(4.02)	(4.24)	(1.48)
Post	-0.025***	-0.029***	-0.016*			
	(-3.23)	(-3.84)	(-2.29)			
InterestRate	-0.358***	-0.292***	-0.112**	-0.081**	-0.086*	-0.072
	(-4.02)	(-5.06)	(-2.97)	(-2.90)	(-2.30)	(-1.34)
Tobin's Q		0.000	-0.000	0.000	-0.002	-0.000
		(0.29)	(-0.13)	(0.09)	(-0.96)	(-0.03)
CashFlow		0.153***	0.094***	0.101***	0.071***	0.051***
		(5.58)	(3.63)	(3.85)	(5.43)	(4.09)
Log(Assets)		0.009***	-0.013*	-0.012*	-0.027***	-0.043***
		(4.65)	(-2.08)	(-2.02)	(-4.23)	(-4.20)
Leverage		-0.052***	-0.080*	-0.076*	-0.048	0.003
		(-5.09)	(-2.12)	(-1.97)	(-1.45)	(0.06)
Observations	1,003	1,003	962	944	919	869
R-squared	0.033	0.157	0.593	0.607	0.686	0.761
Firm FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	NO	NO	YES	YES	YES
Industry*Year FE	NO	NO	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	NO	NO	YES

Table A.3: Baseline regressions – No control variables

This table reports the results of the baseline regressions without any control variables. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. SASAC*Year, Industry*Year, and Province*Year are three interactive fixed effects. In all columns, t-statistics are calculated by clustering at the SASAC and year levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Post × InterestRate × Treat	0.446***	0.401***	0.145*	0.252***	0.289***	0.295***
	(6.14)	(10.59)	(1.94)	(3.54)	(3.58)	(3.51)
Post × Treat	-0.025***	-0.023***	-0.003			
	(-2.64)	(-3.26)	(-0.38)			
InterestRate × Treat	-0.405***	-0.375***	-0.134	-0.281***	-0.349***	-0.340***
	(-3.43)	(-3.77)	(-1.54)	(-4.29)	(-4.39)	(-5.84)
Post × InterestRate	-0.021	0.004	0.017	-0.023	-0.041	-0.043
	(-0.25)	(0.07)	(0.34)	(-0.62)	(-1.04)	(-1.05)
Treat	0.035**	0.032**	-0.002	0.016***	0.020***	0.020***
	(2.16)	(2.14)	(-0.15)	(3.72)	(3.41)	(5.39)
Post	-0.017*	-0.014	-0.002	0.001	0.002	0.003
	(-1.74)	(-1.56)	(-0.45)	(0.61)	(1.03)	(1.05)
InterestRate	-0.136	-0.148	-0.050	0.066	0.057	0.054
	(-1.23)	(-1.58)	(-0.63)	(1.33)	(1.46)	(1.64)
Tobin's Q		0.005**	0.005	0.005	0.003	0.003
		(2.35)	(0.89)	(1.18)	(0.75)	(0.63)
CashFlow		0.229***	0.092***	0.097***	0.086***	0.081***
		(6.42)	(3.82)	(4.26)	(4.02)	(3.43)
Log(Assets)		0.001	-0.036**	-0.036**	-0.043**	-0.047**
		(0.33)	(-2.63)	(-2.92)	(-2.52)	(-2.46)
Leverage		-0.009	-0.050*	-0.034	-0.022	-0.015
		(-0.47)	(-1.91)	(-1.14)	(-0.88)	(-0.55)
Observations	6,909	6,909	6,866	6,849	6,841	6,831
R-squared	0.029	0.122	0.547	0.596	0.641	0.667
Firm FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	NO	NO	YES	YES	YES
Industry*Year FE	NO	NO	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	NO	NO	YES

Table A.4: Baseline regressions – Using never-treated as the controls

This table reports the results of the baseline regressions using the never-treated firms as the controls. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. SASAC*Year, Industry*Year, and Province*Year are three interactive fixed effects. In all columns except columns (3) and (4), t-statistics are calculated by clustering at the SASAC and year levels. In columns (3) and (4), t-statistics are calculated by clustering at the SASAC level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Post × InterestRate	0.240***	0.231***	0.214***	0.218***
	(7.32)	(9.68)	(3.40)	(3.55)
Post	-0.012**			
	(-2.59)			
InterestRate	-0.187**	-0.142*	-0.169*	-0.143
	(-2.88)	(-1.82)	(-1.85)	(-1.73)
Observations	4,682	4,648	4,628	4,616
R-squared	0.434	0.483	0.523	0.565
Firm FE	YES	YES	YES	YES
Year FE	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES

Table A.5: Summary Statistics for Non-SOEs

This table reports the summary statistics for non-SOEs: Panel A for mean, median, standard deviation, and percentiles and Panel B for correlations. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Mean, median, standard deviation, and percentiles

	N	Mean	Median	Std. Dev.	P25	P75
Capex	6459	0.070	0.045	0.079	0.016	0.096
InterestRate	6459	0.065	0.060	0.045	0.047	0.072
Tobin's Q	6459	2.618	1.959	3.158	1.437	2.912
CashFlow	6459	0.043	0.042	0.099	-0.005	0.095
Log(Assets)	6459	21.375	21.319	1.071	20.663	22.05
Leverage	6459	0.517	0.466	0.569	0.309	0.620

Panel B: Correlations

	Capex	*InterestRate*	*Tobin's Q*	*CashFlow*	*Log(Assets)*	*Leverage*
Capex	1					
InterestRate	-0.046***	1				
Tobin's Q	0.077***	0.118***	1			
CashFlow	0.185***	-0.011	-0.013	1		
Log(Assets)	-0.024*	-0.146***	-0.372***	0.029**	1	
Leverage	-0.106***	0.066***	0.583***	-0.076***	-0.166***	1

Table A.6: Other Robustness Tests

This table reports two robustness tests. In Panel A, we check whether the results are driven by firms controlled by the central SASAC. In Panel B, we drop the observations where *InterestRate* is extreme. Specifically, we drop the extreme values that are either lower than the 5th percentile (1.9%) or higher than then 95th percentile (10.8%). The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the lagged total assets. *InterestRate* is a firm's interest expenses divided by the average of its interest-bearing debts at the beginning of the year and the end of each of the four quarters. The interest-bearing debts include short-term loans, long-term liabilities due within one year, long-term loans, bonds payable, and long-term payables. *Post* is a dummy equal to one if a firm is subject to the EVA policy in year t and zero otherwise. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. SASAC×Year, Industry×Year, and Province×Year are three interactive fixed effects. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A. Dropping central SASAC firms				Panel B: Dropping extreme *InterestRate*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × InterestRate	0.226**	0.209***	0.184*	0.185**	0.382***	0.270**	0.235**	0.225**
	(2.93)	(3.34)	(2.17)	(2.15)	(4.62)	(2.62)	(2.66)	(2.50)
Post	-0.009				-0.013			
	(-1.18)				(-1.48)			
InterestRate	-0.179***	-0.109***	-0.108**	-0.110**	-0.509***	-0.349***	-0.356***	-0.314***
	(-3.57)	(-3.15)	(-2.53)	(-2.43)	(-27.32)	(-15.05)	(-59.40)	(-10.20)
Tobin's Q	0.007**	0.006	0.004	0.005	0.007***	0.007***	0.005	0.005
	(2.27)	(1.54)	(1.19)	(1.21)	(3.48)	(3.28)	(1.75)	(1.75)
CashFlow	0.094**	0.084**	0.075*	0.078**	0.117***	0.110***	0.098***	0.084***
	(2.97)	(2.58)	(2.15)	(2.26)	(6.03)	(4.77)	(6.27)	(5.99)
Log(Assets)	-0.025**	-0.028**	-0.034*	-0.033*	-0.018*	-0.019	-0.022*	-0.029***
	(-2.68)	(-2.23)	(-2.06)	(-1.91)	(-1.87)	(-1.42)	(-1.85)	(-3.23)
Leverage	-0.050	-0.028	-0.017	-0.019	-0.056**	-0.047*	-0.042	-0.030
	(-1.56)	(-0.88)	(-0.59)	(-0.61)	(-2.86)	(-1.95)	(-1.65)	(-1.48)
Observations	2,504	2,468	2,447	2,442	4,209	4,169	4,149	4,130
R-squared	0.479	0.550	0.594	0.602	0.478	0.527	0.563	0.609
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES	NO	NO	NO	YES

Table A.7: Industry List

This table reports the list of industries in our sample: industry code, industry name, and the number of observations in our sample.

Number	Industry Code	Industry Name	# of obs.
1	A01	Agriculture	15
2	A02	Forestry	9
3	A03	Animal husbandry	5
4	A04	Fishery	13
5	B06	Coal mining and dressing industry	132
6	B07	Oil and natural gas exploitation industry	29
7	B08	Ferrous metal ore mining and dressing industry	4
8	B09	Non-ferrous metal ore mining and dressing industry	63
9	B11	Exploitation auxiliary activities	25
10	C13	Agricultural and sideline food processing industry	29
11	C14	Food manufacturing	61
12	C15	Alcohol, beverage and refined tea manufacturing	70
13	C17	Textile industry	48
14	C18	Textile garment and apparel industry	10
15	C22	Papermaking and paper product industry	38
16	C23	Printing and recording media reproduction industry	11
17	C25	Industries of petroleum processing, coking, and nuclear fuel processing	69
18	C26	Manufacturing of chemical raw materials and chemical products	296
19	C27	Pharmaceutical industry	172
20	C28	Chemical fiber manufacturing	16
21	C29	Industry of rubber and plastic products	22
22	C30	Industry of non-metallic mineral products	109
23	C31	Industry of ferrous metal smelting and rolling processing	191
24	C32	Industry of non-ferrous metal smelting and rolling processing	176
25	C33	Metal product industry	46
26	C34	General equipment manufacturing	94
27	C35	Special-purpose equipment manufacturing	195
28	C36	Automobile manufacturing	240
29	C37	Manufacturing of railways, ships, aircrafts, spacecrafts and other transportation equipment	171
30	C38	Electric machinery and equipment manufacturing	91
31	C39	Manufacturing of computers, communications and other electronic equipment	354
32	C40	Instrument and meter manufacturing	10
33	C41	Other manufacturing industries	7
34	C42	Industry of comprehensive utilization of waste resources	2
35	D44	Industry of electric power and heat production and supply	276
36	D45	Gas production and supply industry	4
37	D46	Water production and supply industry	31
38	E48	Civil engineering construction industry	159
39	E49	Construction installation industry	12
40	E50	Architectural decoration and other construction industries	11
41	F51	Wholesale industry	258
42	F52	Retail industry	140
43	G54	Road transport industry	133
44	G55	Waterway transport industry	116
45	G56	Air transport industry	60
46	G58	Industry of loading/unloading	16
47	G59	Storage industry	12
48	H61	Accommodation industry	42
49	H62	Catering industry	7
50	I63	Telecommunications, radio and television and satellite transmission services	23
51	I64	Internet and related services	15
52	I65	Industry of software and information technology services	129
53	K70	Real estate industry	333
54	L72	Commercial service industry	29
55	M74	Professional technical service industry	18
56	N77	Ecological protection and environmental governance industry	7
57	N78	Public facility management industry	15
58	Q83	Health	14
59	R85	Press and publishing industry	19
60	S90	Diversified industries	14

Table A.8: Cost of capital decomposition by year

In this table, we decompose the firm-level cost of capital into three components: within-in-industry dispersion, across-industry dispersion, and the wedge between the EVA policy rate and the sample average. Panel A analyzes interest rate, and Panel B considers the cost of capital by accounting both the cost of debt and the cost of equity. We do the decomposition year by year. The reported fractions are the fractions of variations explained by each component, averaged across the sample years. In Panel B, we report the analysis of one choice of the market risk premium, 6.5%. We only include the pre-EVA firm-year observations.

Market risk premium	Year	Within-industry	Across-industry	Wedge b/w EVA rate and sample mean
Panel A. Interest rate				
N/A	2004	0.473	0.092	0.435
N/A	2005	0.535	0.169	0.296
N/A	2006	0.652	0.144	0.204
N/A	2007	0.633	0.236	0.131
N/A	2008	0.716	0.247	0.037
N/A	2009	0.324	0.128	0.548
N/A	2010	0.317	0.255	0.427
N/A	2011	0.549	0.369	0.082
N/A	2012	0.516	0.451	0.033
N/A	2013	0.541	0.188	0.270
N/A	2014	0.654	0.242	0.104
N/A	2015	0.293	0.167	0.540
Panel B. Considering the cost of equity				
6.5%	2004	0.426	0.150	0.424
6.5%	2005	0.725	0.274	0.001
6.5%	2006	0.536	0.263	0.201
6.5%	2007	0.197	0.106	0.697
6.5%	2008	0.716	0.284	0.000
6.5%	2009	0.587	0.252	0.161
6.5%	2010	0.225	0.198	0.577
6.5%	2011	0.316	0.263	0.421
6.5%	2012	0.338	0.273	0.389
6.5%	2013	0.254	0.121	0.625
6.5%	2014	0.301	0.173	0.527
6.5%	2015	0.603	0.384	0.013

Table A.9: Capital reallocation across SOEs

In this table, we examine how the EVA policy affected capital reallocation across SOEs with different *MRPK*. This table has the same sample as in our baseline analysis with the requirement that we can calculate *MRPK*. *Capex* is capital expenditure scaled by lagged total assets. *MRPK* is the natural logarithm of the ratio between operating profit and lagged fixed assets. Operating profit is sales minus costs of goods sold and selling, general and administrative expenses, plus depreciation. *MRPK* is industry-adjusted. *SOE* equals one for SOEs and zero for non-SOEs. *Tobin's Q* is measured as the sum of the market value of equity and book value of total liabilities, divided by the book value of total assets. *CashFlow* is cash flow from operating activities, scaled by the lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. All the control variables are lagged by one year except *CashFlow*. SASAC×Year, Industry×Year, and Province×Year are three interactive fixed effects. In columns (1) - (4), we only keep manufacturing firms in the analysis. T-statistics computed with standard errors clustered at the SASAC and year levels are reported in the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

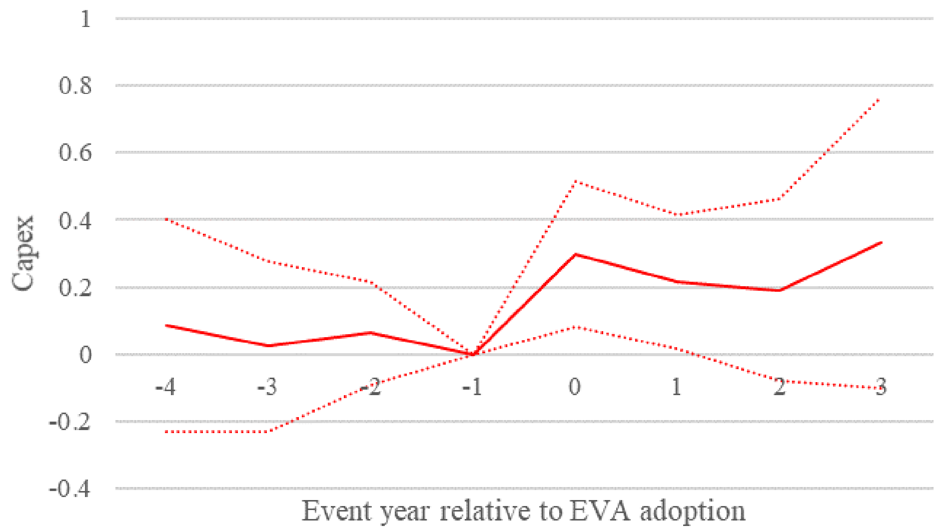
	Manufacturing Firms				All Firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × MRPK	0.002	0.002	-0.001	-0.000	0.005	0.005*	0.002	0.005
	(0.54)	(0.39)	(-0.33)	(-0.01)	(1.55)	(1.85)	(0.74)	(1.09)
Post	0.012				0.006			
	(1.64)				(1.12)			
MRPK	0.015***	0.016***	0.017***	0.018***	0.009***	0.009***	0.009***	0.007***
	(3.98)	(4.94)	(5.40)	(4.73)	(4.83)	(5.31)	(5.19)	(4.10)
Tobin's Q	0.001	0.001	0.001	0.001	0.006***	0.005***	0.005***	0.004**
	(0.25)	(0.28)	(0.29)	(0.24)	(3.77)	(3.87)	(3.22)	(2.63)
CashFlow	0.092***	0.103***	0.102***	0.080***	0.096***	0.090***	0.078***	0.067***
	(5.35)	(5.16)	(5.43)	(3.83)	(8.23)	(6.75)	(6.55)	(4.83)
Log(Assets)	-0.025**	-0.026**	-0.027**	-0.035***	-0.022**	-0.024**	-0.025**	-0.031***
	(-2.82)	(-2.73)	(-2.84)	(-4.17)	(-2.82)	(-3.07)	(-2.91)	(-3.59)
Leverage	-0.051	-0.039	-0.033	-0.013	-0.049*	-0.033	-0.033	-0.029
	(-1.75)	(-1.31)	(-1.16)	(-0.33)	(-1.94)	(-1.43)	(-1.62)	(-1.27)
Observations	1,929	1,873	1,863	1,834	4,028	3,987	3,963	3,946
R-squared	0.473	0.556	0.580	0.649	0.489	0.537	0.569	0.615
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES	NO	NO	NO	YES

Figure A.1: Dynamic regression coefficients of group companies

This figure reports the $\beta_{2,s}$ coefficients from the following regressions based on the group company sample. In Panel A, we include firm fixed effects, SASAC×year fixed effects, and the industry×year fixed effects. In Panel B, we further add the province×year fixed effects. The t-statistics are calculated by clustering at both the SASAC level and the year level.

$$CAPEX_{i,t} = \beta_1 InterestRate_{i,t} + \sum_{s \neq -1} \beta_{2,s} Post_{i,t,s} + \sum_{s \neq -1} \beta_{3,s} InterestRate_{i,t} \times Post_{i,t,s} + \gamma' X_{i,t} + \epsilon_{i,t}$$

Panel A: Without the province × year fixed effects



Panel B: With the province*year fixed effects