Incentives and Firm Investment: Evidence from China's Reform*

Zhiguo He Guanmin Liao Baolian Wang

March 24, 2021

Abstract

We study how managerial incentives affect firm behavior by studying a staggered reform in the Chinese state-owned enterprise (SOE) performance evaluation policy. To improve capital allocation efficiency, starting in 2010, Chinese regulators switched from using the return on equity (ROE) to economic value added (EVA) when evaluating SOE performance. This EVA policy adopts a one-size-fits-all approach by stipulating a fixed cost of capital for virtually all SOEs. We show that SOEs did respond 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 on the impact of incentive schemes on 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

*Preliminary and incomplete, please do not distribute. 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 Allen Berger, Chang-Tai Hsieh, Jay Ritter, Zheng Michael Song, and seminar participants at the Macroeconomy and Finance in China Conference, University of Florida, University of South Carolina for valuable comments. All errors are our own.

1 Introduction

The endogenous nature of manager incentives has limited our understanding of even the most basic questions about them (e.g., Frydman and Jenter, 2010; Edmans, Gabaix, and Jenter, 2017). Managerial incentive arrangements are the endogenous outcome of a complex process involving the managers, the firm, and the managerial labor market. As a result, comparing behaviors between firms with different managerial incentive arrangements may capture the effects of these observable and unobservable firm, industry, and manager characteristics rather than the effect of managerial incentives.

In this article, by exploiting a staggered policy adoption experiment in China, we conduct an empirical analysis that directly speaks to the relationship between managerial incentives and firm behaviors. Since 2004, the Chinese governments, both at the central and local levels, through the State-Owned Assets Supervision and Administration Commissions (SASACs), have been using formula-based schemes to evaluate state-owned enterprises (SOEs). The schemes are based on four accounting measures, one of which was initially return on equity (ROE) initially until it was later replaced by economic value added (EVA) starting in 2010. EVA, which has been applauded as a measure of *economic* profit, is fundamentally more sound than ROE, which captures accounting profit only (Rogerson, 1997). Essentially, by including a charge for the cost of all capital employed by a firm, EVA directly measures the net present value created by the firm.

This EVA reform was launched to improve capital allocation efficiency in Chinese economy (Stern, 2011). It is well known that firms in the Chinese state-owned sector 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), and this policy distortion favoring SOEs is the root cause of the capital allocation efficiency. The EVA reform, with the primary motivation of urging SOEs to manage their capital more efficiently, has the potential to correct this policy distortion without touching the root cause directly. In other words, by modifying the performance evaluation metric, the EVA reform could discourage SOEs from overinvestment without changing their preferential credit access. However, 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 à la Hayek (1945)—set the after-tax cost of capital at 5.5% for virtually all the SOEs under its control.[1] Most local SASACs, if they decided to adopt, also chose to follow this one-size-fits-all EVA policy, albeit in different years.

During our sample period, China had strong regulations on external equity financing. Based on this fact, we develop a theoretical framework in Section 3 under which firms adjust their financing margin via debt at their firm-specific borrowing interest rate.[2] Under the ROE policy, a firm could invest until its marginal operating profit equals its actual marginal cost of debt, while under the EVA policy, the firm can invest until its marginal operating profit equals the fixed 5.5% cost of capital stipulated by the SASACs. Assuming a decreasing return to scale, we expect that the higher a firm's marginal cost of debt before the EVA policy, the greater the increase of investment in the post-EVA period.

We first investigate whether the SOE firms changed their investment in response to the EVA policy. This analysis directly speaks to the question of "Do incentives matter?" Our analysis of the EVA policy focuses on how the EVA policy adoption affected the investment of firms with different interest rates, using a panel of 638 SOEs listed on either the Shanghai or the Shenzhen Stock Exchanges. From 2010 to 2015, the central SASAC and fourteen provincial SASACs adopted the same EVA policy. The staggered adoption of the EVA policy provides a set of counterfactuals for how firm investment would have evolved in the absence of the EVA policy, allowing researchers to tease out the sole effect of the EVA policy. We also exploit an important institutional feature to address the potential endogeneity issue regarding adoption decisions of the EVA policy.

A simple example illustrates our identification strategy, which essentially is a difference-in-differences-in-differences (DDD) approach. The Beijing SASAC (treatment group) adopted the EVA policy in 2010. Following the EVA policy adoption, within the SOEs controlled by the Beijing SASAC, firms with high interest rates increased their investment more than firms with low interest rates. The response difference between the two groups of firms gives us a difference-in-differences

[1] The reason that the SASAC chose 5.5% as the cost of capital was never publicly disclosed. According to Adfaith (2005), Shuhe Huang, the Vice Director of the SASAC at that time, said, "The capital returns have to be higher than bank loan interest rate." In 2009, the benchmark interest rates for bank loans with maturity between one to three years (the most popular maturity range) were from 5.31% to 5.40%. Note, the 5.5% stipulated cost of capital is after-tax; translating to pre-tax terms, it is about 7.3%, which is indeed higher than bank loan interest rates that are quoted in pre-tax.

[2] We provide more discussions on the external equity financing regulation in Section 4.6.3.

(DD) estimation. One concern of this DD estimation is that firms with different interest rates were not the same, and investment opportunities might have changed in 2010 in a way that affected Beijing SOEs with high interest rates differently from those with low interest rates, regardless of the EVA adoption. To control for such possible contemporaneous developments, 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, say Shanghai (the control group). To the extent that the difference in the investments between firms with high and low interest rates was similarly affected by the investment opportunity change in 2010 regardless of their SASAC affiliations, the DD estimation of Shanghai provides a counterfactual of Beijing's DD. Hence, the DDD gives the desired estimate of the effect of the EVA policy.

Following the above methodology, we find 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 (3.2 percentage points) of difference in interest rates leads to about a 0.5 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 about 4.6%. Among the treatment SASACs, in the pre-EVA period, SOEs with interest rates below the sample median (the low group) invested 3–5% higher than SOEs with interest rates above the sample median (the high group), while the difference in investment between these two groups shrank below 1% in the post-EVA period. We also confirm the parallel trends assumption for both treatment and control groups in the pre-EVA period, which lends support to the causal interpretation of the results.

One remaining concern about the above DDD strategy is the potential endogeneity of the EVA policy adoption, as there may be political economy or business cycle factors that coincided with or even led to the EVA policy's adoption. Although empirically the EVA policy adoption's timing does not seem to be correlated with many provincial-level factors, we address the concern of changing economic conditions specific to the EVA passing SASACs by exploiting a unique feature of EVA policy adoption in China. The EVA adoption by a SASAC affects all the firms under the control of this SASAC, independent of the firms' locations. Although most SOEs and their SASAC are located in the same province, some firms are located in other provinces. Central SOEs are located around the country. Therefore, we can include province-year fixed effects to control for time-varying provincial-level factors.[3] Our estimation is essentially unchanged under this specification.[4]

The EVA policy also has implications on firm performance. The EVA policy leads firms to deviate from using their actual borrowing cost toward the stipulated cost of capital. For firms with an interest rate higher (lower) than the stipulated cost of capital, the EVA policy has encouraged them to increase (decrease) their investment. From shareholders' perspective, the increase (decrease) in firm investment leads to over- (under)investment, and hence the EVA policy is detrimental to shareholders. More specifically, our theory in Section 3 predicts that the EVA policy lowers a firm's ROE as long as its interest rate deviates from 7.3%, which is the stipulated cost of capital adjusted by the tax rate. What is more, ROE decreases more when the interest rate is further away from—either above or below— this threshold. Our empirical results lend strong support to this prediction. After the EVA policy adoption, ROE decreases more if a firm's interest rate is further away from 7.3%, for both firms with an interest rate higher and lower than 7.3%; for example, firms with an interest rate below 3.5% or higher than 9.5% had a ROE reduction of about 3-4 percentage points.

We further explore the underlying economic mechanisms at work in the EVA reform. We first show that the adoption of the EVA policy strengthens the relationship between a firm's EVA performance and its executive forced turnover (i.e., demotions), but not executive compensation; this points to the unique feature of managerial incentives in Chinese SOEs where SOE managers are more like government officials. We also investigate the heterogeneous effects concerning manager characteristics. We hypothesize that managers with equity ownership were less likely to adhere to the EVA policy, but managers who had government experience were more likely to comply. As explained, the EVA policy is likely to be harmful to minority shareholders who would be simply equity-value maximizers. Therefore, managers with equity ownership should be more aligned with small shareholders, while managers with government experience should be more aligned with the government. Our empirical results indeed confirm the theoretical prediction: the impact of the EVA policy was weaker for firms where managers had equity ownership and stronger for firms

[3] When studying the effect of state-level antitakeover law, Bertrand and Mullainathan (2003) exploit a similar feature of their data.

[4] 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 shrinkage in the investment difference between the low and high interest rate firms.

where managers had government experience.

In the last part of the paper, we investigate whether the EVA policy improves the capital allocation efficiency from a social perspective, both theoretically and empirically. Although the EVA policy hurts individual firms' performance (from the shareholders' perspective), it may improve aggregate capital productivity by mitigating the capital misallocation caused by financial frictions or policy subsidies. Indeed, the capital allocative efficiency literature à la (Hsieh and Klenow, 2009) offers the insight that efficiency requires each firm to invest up to the point where its marginal revenue product of capital ($MRPK$) equals its true cost of capital. The EVA policy may improve capital allocation efficiency either because it reallocates capital within SOEs (from less efficient SOEs with greater policy subsidies to more efficient SOEs with less subsidies), or from SOEs to non-SOEs that are widely considered to be more productive of capital (Song, Storesletten, and Zilibotti, 2011; Brandt, Tombe, and Zhu, 2013). Of course, if the observed dispersion interest rates are driven by the heterogeneity of risk premia and hence the true costs of capital of individual firms, then the "one-size-fits-all" EVA policy might do more harm than good to the general welfare.

In our empirical investigation, we first study whether capital allocative efficiency improves with the SOE sector following the EVA policy adoption. Due to data limitations, we follow Chen and Song (2013) to measure $MRPK$ based on the financial statements of listed companies. Conceptually, interest rate, which is the marginal cost of investment, should equal $MRPK$ which gives the marginal benefit of investment; and if one treats the interest rate as a better measurement of the "shadow" $MRPK$, then our empirical findings suggest an improvement of allocative efficiency within the SOE sector. But we face a serious measurement issue for $MRPK$; in fact, in our sample of SOEs, interest rates and our measured $MRPK$'s were largely uncorrelated. Perhaps because of this measurement issue, the industry-adjusted dispersion of the measured $MRPK$, which is an inverse measure of capital allocation efficiency (Hsieh and Klenow, 2009), does not change following the EVA policy. Overall, our evidence offers some preliminary supporting evidence that EVA reform improves allocative efficiency within the SOE system, and we await future research to offer more evidence on this important question.

Second, we find no evidence that non-SOEs increased their investment more than SOEs after the EVA policy adoption, suggesting no capital reallocation from SOEs to non-SOEs. This second result is consistent with the criticism that the stipulated cost of capital was not high enough (Stern, 2011). Based on our estimation, the average after-tax interest rate of our sampled publicly listed SOEs was 4.4%. Although the stipulated cost of capital 5.5% was indeed higher, out study suggests that this margin of 1.1% is not significant enough to push capital flow from SOEs to non-SOEs. [5]

It is intellectually intriguing to mention the famous article "On the Folly of Rewarding A, while Hoping for B" by Kerr (1975). As the *Academy of Management Classic* reprinted in 1995, Kerr (1975) wrote that "*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.*" In the EVA reform, Chinese authorities were hoping for "capital allocation efficiency" by rewarding "EVA" based on uniformly stipulated cost of capital. Our empirical study shows that the Chinese SOEs are actively responding to the direct reward "A" (i.e., what gets measured gets managed), but it remains a question whether the regulator achieves the ultimate goal of "B."

Literature Review. This paper contributes to the literature studying whether and how manager incentives affect firm operation and performance, both in China and beyond. Though 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). 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; but as compensation arrangements are endogenous, it is hard to interpret these correlations as causal.[6] To meet the bar for clean identification, this literature then exploits certain intriguing institutional details on arguably "exogenous" compensation arrangements (e.g., restricted stocks or stock options vesting).[7] By exploiting one of China's policy reforms that aimed directly at managerial performance evaluations, we present

[5] A caveat exists for interpreting this result on comparing SOEs and non-SOEs. SOEs and non-SOEs exhibit different investment patterns. In other words, the parallel trends assumption do not hold. In particular, in our sample period, to mitigate the effect of the 2007-2008 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 had decreased its investment due to the EVA policy, had the 2007-09 financial crisis never happened.

[6] Murphy (1999, 2013), Frydman and Jenter (2010), and Edmans, Gabaix, and Jenter (2017) provide extensive surveys of this literature.

[7] 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 proposals granting executives long-term incentives increase firm value.

clean causal evidence on the role of incentives by utilizing the EVA policy as a "quasi-natural experiment."

The EVA policy is directly aimed at improving the capital allocation efficiency in China. Capital misallocation can lower aggregate productivity (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009). 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 credit access 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). 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 fricitons and find the aggregate TFP loss to be about 12%. More recently, Geng and Pan (2021) study the time-varitaion of implicit guarantee and descrimation against non-SOEs in the China's fast growing corporate bond market.[8] 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 paper is also useful for thinking about policy distorted credit activities. SOEs or organizations with similar natures exist around the world, including in the U.S. One such example is the Tennessee Valley Authority (TVA), which is wholly owned by the federal government and enjoys an implicit federal government guarantee of its debt. Throughout the world, governments provide implicit or explicit guarantees to too-big-to-fail financial institutions and nonfinancial firms, transferring risk from these firms to taxpayers (Lucas, 2014). However, most of these firms do not include the cost of risk borne by taxpayers into their cost of capital calculation. 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

[8] Amstad and He (2019) provide an overview for the institutional background of Cihnese corporate bond market. For the most recent studies on this market, see Chen, Chen, He, Liu, and Xie (2020) and Ding, Xiong, and Zhang (2020) among others.

not an option.

Our study is closely related to the literature on SOE reforms, especially the SASAC, in China.[9] The Chinese government has adopted several methods to reform the SOE sector. These methods include shifting the responsibility for firm decisions from the government to the firms in the 1980's (Groves, Hong, McMillan, and Naughton, 1994), delegating firm monitoring to lower-level governments (Huang, Li, Ma, and Xu, 2017), and privatization in the 1990's (Hsieh and Song, 2015). These methods are largely proven to be successful; for instance, Groves, Hong, McMillan, and Naughton (1994) document that firm autonomy and profit retention in the SOE reforms during the 1980's led managers to strengthen workers' incentives and improve workers' productivity.

By the early 2000s, most small SOEs had been privatized. SASACs were established in 2003 to monitor the remaining big SOEs (Naughton, 2008, 2015; Li and Zhang, 2020). 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. We show that the EVA policy reform did manage to influence the real activities of SOEs by changing the hurdle rates for capital budgeting, echoing Brandt and Li (2003) who show that bank managers' economic incentives in China's state-owned financial institutions alleviated their discrimination against private firms. However, that economic incentives matter for the business operation of SOEs should not be taken as granted, and could serve a positive sign for the future of economic reform, as many researchers consider SOEs—especially central SOEs—to be run like political bureaucracies, with a significant number of them being beyond the control of SASACs.

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 allocation efficiency is presented in Section 5. Section 6 concludes.

2 Chinese SOEs and the EVA Reform

We provide institutional background in this section.

[9] Most studies have documented beneficial effects of SOE (partial) privatization. To name a few, Groves, Hong, McMillan, and Naughton (1994, 1995), Hsieh and Song (2015), and Gan, Guo, and Xu (2018).

2.1 The SOE System in China and the SASAC

The SOE system in China has undergone significant reforms in 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 in March 2003. This body was set up simultaneously at the central and local government levels. The SASAC represents the government authority as the legal owner of the SOEs and is designed to monitor the SOEs and ensure that they advance the government's interests. The SASAC accomplishes this by appointing auditors and boards of directors, establishing procedures for appointing managers, approving major decisions including mergers, bankruptcies, the issuance of stocks, and major new strategic initiatives, and reporting on SOEs' performance to the appropriate level of government. Most relevant to our study, the SASAC conducts annual performance evaluations of SOE managers.[10] The SASAC makes their rewards or punishment and personnel decisions of SOE managers based on these evaluations.[11]

SOEs are controlled by different levels of the Chinese government. Some are controlled by the central government, and others are controlled 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 very 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 these measures are mandatory across all SOEs. The SASAC also chooses other suplementary measures based on industry and firm characteristics. Common measures include

[10] Besides annual performance, the SASAC also considers performance over the past three years. For the three-year performance evaluation, they mainly consider average sales growth and average growth of firm equity (after considering external equity financing and dividend payments).

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

inventory turnover, accounts receivable turnover, and sales growth. From 2004 to 2009, the two mandatory measures were earnings before tax and extraordinary items (EBT) and return on equity (ROE). Starting from 2010, ROE was replaced by economic value added (EVA). EBT has base points of 30, ROE (and later EVA) has 40, and the suplementary measures have 30 in total.

The formula assigns points to SOEs based on whether they exceed or fall short of performance targets. Achieving above-target performance increases the points earned, and below-target performance decreases the points earned (capped and floored at ±20%). For example, every 0.4% increase in an SOE's realized ROE leads to an extra point, capped at 8.

Performance targets are negotiated with SOE managers at the end of the previous performance period and are subject to stringent guidelines. For example, they generally cannot be lower than the average of the last three years' performance and are heavily influenced by a firm's industry performance and the Chinese government's GDP growth objectives.[12] 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.

If one performance measure of an SOE is higher than the target, the SASAC will adjust the raw score by a factor (between 1 and 1.15) that reflects the degree of operational difficulty. The degree of operational difficulty is a subjectively determined parameter based on assets, revenue, total profit, return on equity, number of employees, and the ratio of retired employees to total employees. The SASAC indicates that they deduct punishment points if an SOE has severe safety incidents or has been involved in financial fraud or other scandals. They get extra points if they have acquired financially distressed SOEs. These adjustments cannot be more than 2 points.

After collecting all the data, the SASAC determines cutoff scores to assign each SOE to one of five rating categories, A to E. A score of "C" or above is considered acceptable, and SOE executives in D- and E-ranked firms may be asked to step down. According to the publicly disclosed rules, executive incentive pay and promotion/demotion decisions are a direct function of the rating they get.

[12] A concern of the effectiveness of a target-based performance evaluation scheme is the ratchet effect (Weitzman, 1980; Freixas, Guesnerie, and Tirole, 1985). A firm's industry performance and the Chinese government's GDP growth objectives are largely out of any individual firm's control. Linking the target to the past three years' performance also mitigates the ratchet effect, as the average manager tenure is 2.5 years.

2.3 The EVA Reform

In 2010, the central SASAC replaced ROE (net income divided by average equity) 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.[13] EVA measures value creation for shareholders, and theoretically, it is a better performance measure than ROE, which measures accounting profit (Rogerson, 1997). More specifically, define Adjusted Capital to be[14]

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

and Net Operating Profits after Tax (NOPAT) to be

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

and 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 adds after-tax interest expenses back to net income and fixes the "Cost of Capital" in Eq. (2) at 5.5%. The factor of 0.75 is to adjust tax, as the running tax rate at that time in China was 25%. As a result, 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) at the pre-tax basis. In Section 3, we develop our hypotheses on how the EVA policy affects firm investment and valuation.[15]

The stipulated cost of capital of 5.5% applies to virtually all SOEs, though with a few exceptions.[16] One such exception is for firms that are too levered; specifically, industrial firms with debt/asset ratios higher than 75% or non-industrial firms with debt/asset ratios higher than 80%

[13] Some authors have called it "residual income" (Kaplan, 1982; Horngren and Foster, 1987).

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

[15] 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 into R&D (this was one of the motivations of the SASAC). 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.

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

have a cost of capital at 6%. These firms account for about 8% of our sample. We exclude them from our analysis. Our empirical results are robust to whether we include them or not.

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. These four SASACs account for about 9% of our final sample. We exclude these four provincial SASACs from our analysis. We also exclude Tibet SASAC because its information is missing.

2.4 The Staggered Adoption of the EVA Policy

We manually collected the information on the details of the EVA policy for each province.[17] 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 adopted the EVA policy, in a staggered fassion. 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 by the end of our sample period. In Table 1, we conduct a more formal test. Table 1 presents the 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. They are GDP growth, GDP per capita,

[17] 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 very difficult to collect.

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 of province marketization level are from Fan, Wang, and Zhu (2010) and Wang, Fan, and Hu (2019), data of 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 significant variable 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 affected our estimation, because firms did not have incentives to maximize their EVA until it became effective (Hennessy and Strebulaev, 2020).

3 A Theoretical Framework

In this section, we develop a theoretical framework on how the EVA policy affects firm investment and performance.

3.1 The Setting

Consider a model where an SOE firm 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 $F''(K) < 0$.

We assume that this SOE firm receives the following cash flows from its production

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

Here, τ_Y, which could be firm specific, captures the so-called output wedge following the capital allocation efficiency literature (e.g., Hsieh and Klenow, 2009). The output wedge τ_Y includes the standard corporate taxes (with a rate of π), as well as government subsidies (excluding indirect subsidies via lower costs of capital) to Chinese SOEs; the latter enters τ_Y negatively. The output wedge potentially distorts the firm's investment decision and will play an important role when we analyze the socially optimal capital allocation. 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).

Denote by r the equilibrium discount rate for this firm, which we take as exogenously given. Following the capital allocation efficiency literature, we assume that the SOE firm is able to borrow at a rate of

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

The capital cost wedge τ_K can also be firm specific, which, similar to τ_Y, distorts the firm's investment decision as well. The firm-specific parameter τ_K, if it is negative, could capture 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.

3.2 Assumptions and Discussions

Throughout the model, we assume that debt, rather than equity, is the margin to adjust for investment financing. External equity financing activities of Chinese listed firms were strictly regulated and needed supervisory approval. During our sample period, the China Securities Regulatory Commission (CSRC), the gatekeeper of China's stock market, 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. The underlying driver for tight regulation in China is rooted in potential adverse selection and poor corporate governance (protection of minority shareholders), which is linked to the celebrated pecking order theory where debt minimizes the external financing cost given information asymmetry. In Table A.1 in the Appendix, we show that, in most of the years during our sample, less than 0.5% of listed firms conducted public seasoned equity offerings. Since 2006, virtually all external equity was issued via private equity placements. Private equity placements also needed regulatory approval, but they required neither positive earnings, nor a certain dividend payout. As a result, more firms were eligible and it was relatively easier to get approval. However, we find that the average private placement's issuance amount was huge. Conditional on conducting a private placement, the new issuance was 45.63% of the existing equity base. Given that the number of investors in the private equity placement was typically small, these private placements were almost always partial mergers that involved either a change of controlling shareholders or addition of new big shareholders. Dividend payments were low and strongly persistent, and repurchases were almost nonexistent. As a result, we observe that the equity adjustment cost is high, and assume that the debt is the margin to adjust for investment financing.[18]

There is another key implication behind the competitive borrowing rate (4) in our model. Eq. (4) implies that the equilibrium borrowing rate r_D is independent of the leverage D.[19] Empirically, we find that, in our sample, r_D and leverage are indeed uncorrelated. As we find later in this paper, in response to the EVA policy, firms changed their investment and debt financing significantly. Although the changes are economically large, they are probably not large enough to have a major impact on r_D. Empirically, the annual change in leverage and the annual change in r_D is almost uncorrelated—their correlation coefficient is 0.025, which is statistically indistinguishable from zero.

Last, but perhaps most importantly from a conceptual perspective, we allow for the possibility that the "right" discount rate r could be firm specific. This possibility is implicitly assumed away by the standard capital allocation efficiency literature (e.g., Hsieh and Klenow, 2009), but it is widely acknowledged by the finance literature dated back to Modigliani and Miller, which says that the appropriate discount rate should include the "risk premium" based on the risk profile of the firm's cash flows. This conceptual difference plays little role in Section 3.3, which concerns the *positive* implication of the EVA policy reform. However, it matters quite a bit when we discuss the *normative* implications later in Section 5.1.

[18] Table A.1 in the Appendix 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.

[19] Although it is partially driven by our simplified assumption of no default, we emphasize that there are models where firms default but the equilibrium borrowing rates are independent of leverage D. Consider the following setting where each period the firm fails with probability p, in which event the project yields zero cash flows afterwards and hence the firm defaults. Given the context of Chinese SOE in our model, we envision a sufficiently small default probability $p \simeq 0$ during our sample period 2009-2015. If the cashflows $F(K)$ given success is sufficiently high, this implies that the one-period debt is repaid with probability $1-p$. As a result, the break-even interest rate charged the lenders, which is also the firm's competitive borrowing rate, is $r_D = \frac{1+r}{1-p} - 1 = \frac{r+p}{1-p} > 0$ which is again leverage independent. It is straightforward to introduce capital wedge in this context.

3.3 Model Implications

In this section we analyze the model. We focus on the empirical predictions regarding firm policy responses to the EVA policy adoption; these are positive analysis in their nature. We will come back to the model later in Section 5 to discuss the normative implications of the model regarding capital allocation efficiency.

Before the EVA policy, the SOE manager maximizes the firm's ROE:

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

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

where π denotes the corporate tax rate. (Note that τ_Y includes the corporate tax rate π.) As a result, the first-order condition reads

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

which gives the optimal ROE^*.

Under the EVA policy, the SOE manager maximizes its EVA, which is given by[20]

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

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

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

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

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

Denote by ROE_{EVA} the ROE under the new optimal EVA investment.

[20] 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.

By comparing the investment policies (7) and (8) under the two regimes, we have the following proposition, which 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 the following results.*

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 level when $r_D = 7.3\%$.*

Proof. When $\pi = 0.25$, $F'(K_{EVA}) = \frac{5.5\%}{1-\tau_Y}$ is independent of r_D while $F'(K_{ROE}) = \frac{1-\pi}{1-\tau_Y} r_D$ increases with r_D. This proves the first claim. The second claim, which does not rely on $\pi = 0.25$, 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, because only K_{ROE} (not K_{EVA}) in (7) is affected by the interest rate r_D. More specifically, the lower the borrowing cost r_D (which might caused by a greater subsidy), the lower the change of investment following the EVA adoption. Our second result implies that from the perspective of shareholders, the EVA policy is value destroying because the manager no longer maximizes shareholder values. Essentially, the EVA policy leads firms with interest rates higher than 7.3% to overinvest—relative to K_{ROE}, which optimizes ROE—and firms with interest rates lower than 7.3% to underinvest, and has no impact on firms with $r_D = 7.3\%$.

Finally, as explained in Section 3.2, our analysis is built on the assumption that debt is the relevant margin to adjust when SOEs adjust their investment upon EVA adoption. We show our results are robust to the sample excluding firms that conducted external equity financing around the EVA policy adoption, but one straightforward test of this assumption is whether they adjusted investment following the EVA adoption by issuing debt, which is supported by the data as shown in Section 4.6.3.

4 Main Empirical Results

We first describe our data in this section, and then present our main empirical results.

4.1 Data

Firm-level accounting data and stock price data are from the China Stock Market & Accounting Research (CSMAR) Database. CSMAR covers all firms listed on China's two stock exchanges – the Shanghai Stock Exchange and the Shenzhen Stock Exchange.[21] The sample period is from 2004 to 2015. We start the sample from 2004 because the central and most provincial SASACs started to evaluate SOEs from 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.[22]

We begin with 11,236 firm-year observations (1,196 unique firms) for non-financial SOEs.[23] We classify a firm as an SOE if its ultimate controlling party is the state. We manually collected the identity of firms' controlling shareholders.[24] We exclude SOEs controlled by the Tibet SASAC (27 observations), SOEs controlled by government agencies other than SASACs, and SOEs controlled by lower-than-province level SASACs (4,878 observations). We exclude them because we cannot find the information on whether they adopted the EVA policy or not. As explained in detail toward the end of Section 2.3, we 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) firms with too high leverage (397 observations), as the EVA policy mandates them to have

[21] The SASACs evaluate their SOEs at the "group company" level, which applies to the EVA policy reform. Unfortunately, we do not have their accounting data for these state-owned group companies as most of them are unlisted. In this paper we study listed SOEs who are subsidiaries of these group companies and conduct our test at the listed company level. Theoretically, maximizing EVA at the holding 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 maximizing ROE at the holding company level is also equivalent to maximizing ROE for every subsidiary (to see this point, check Eq. (6)).

[22] An alternative data source is the Chinese Annual Survey of Industrial Firms, which are collected by the National Bureau of Statistics in China. This dataset includes all SOEs. Unfortunately, it is widely accepted that the data in the post-2008 period have serious quality issues (e.g., see Brandt, Van Biesebroeck, and Zhang (2014)) and we hence conduct our study based on listed firm sample.

[23] 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.

[24] 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 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).

a stipulated cost of capital of 6%.[25] Including them does not have any material impact on our results. We also exclude 841 observations with missing capital expenditure, lagged interest rates, or lagged *Tobin's Q*. Our final sample contains 4,667 observations and 638 unique firms.[26]

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. 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 in calculating interest rates using the U.S. listed firm sample (e.g., Francis, LaFond, Olsson, and Schipper, 2005; Frank and Shen, 2016).

It is worth emphasizing one should use the interest-bearing debt only in the denominator when estimating firm-level interest rate; including other non-interest-bearing debt (e.g., accounts payable) may lead to a severe underestimation of the interest rate. To give a concrete example, the Chinese Annual Survey of Industrial Firms data set has information on total debt but not information on interest-bearing debt. Using the Chinese Annual Survey of Industrial Firms data, Bai, Lu, and Tian (2018) measure firm-level interest rate as the ratio of interest expenses to total debt. They report that, for SOEs, the mean interest rate is 0.03 and the median interest rate is 0.01-0.02, much lower than ours. This is likely due to their inclusion of non-interest-bearing debt in the denominator and hence resulting underestimation.

Panal A of Table 2 reports the summary statistics of the SOE sample. Panel A1 reports the mean, median, standard deviation, and the 25th and 75th percentiles of the variables used in our analysis. Panel A2 reports the correlation matrix. *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. To deal with the effect of outliers, we set the value of *Tobin's Q* as missing if it is higher than 10. *Cash Flow* is cash flow from operating activities, scaled by average total assets. *Log*(*Assets*) is the natural logarithm of total assets.

[25]These four SASACs account for about 9% of our final sample, and firms with too high leverage (industrial firms with debt/asset ratios above 75% or non-industrial firms with debt/asset ratios above 80%) account for about 8%.

[26]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 non-state 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.

Leverage is defined as total liabilities divided by total assets. *CEOOwnership* is the fraction of shares held by a firm's CEO, multiplied by 100. *PoliticalConnection* is a dummy variable that equals one if the CEO was previously employed as a bureaucrat by the central government or a local government.

The mean *Capex* is 7.1% (median is 4.6%) of total assets. The mean *InterestRate* is 5.7% (median is 5.4%). There are large variations for both variables. The 25th and the 75th percentiles of *Capex* are 1.9% and 9.4%, respectively; and they are 4.2% and 6.6% for *InterestRate*. *Capex* and *InterestRate* are strongly negatively correlated, consistent with the U.S. data (e.g., Frank and Shen, 2016). Also, larger firms, lower *Tobin's Q* firms, more profitable firms, and firms with higher CEO ownership have lower interest rates. Firms with political connections also have lower interest rates, consistent with the existing literature (Li, Meng, Wang, and Zhou, 2008).

Panel B of Table 2 reports the summary statistics of the listed non-SOE sample. Although we focus 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 are with a higher financing cost: the average *InterestRate* among non-SOEs is 6.4%, which is 0.7% higher than the average *InterestRate* of SOEs.[27] 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 are with higher *Tobin's Q* in general.

4.2 Empirical Pattern: Raw Data

Figure 2 presents the test of the parallel trends assumption.[28] Panel A reports the results of the treatment SASACs, and Panel B reports the results of the control SASACs. For treated SASACs

[27] 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.

[28] An SOE's controlling shareholder may change from one SASAC to another. As a result, 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 ever and ignore the following controlling shareholder changes.

that adopted the EVA policy in year t, we use the SASACs that either adopted the EVA before $t-4$ or after $t+3$ as controls. Specifically, we sort firms into high and low *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 the 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.

There is an overall trend in decreasing investment across all the SOEs, coinciding with decreasing in the 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 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 and not concentrates in year 0. Overall, these tests provide evidence on the validity of our DDD strategy.

4.3 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:

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

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 $Tobin's\ Q$, $Cash\ Flow$, $Log(Assets)$, and $Leverage$. All the control variables are lagged by one year except $Cash\ Flow$ that is measured contemporaneously.[29] Depending on the specification, we include firm fixed effects, year fixed effects, industry×year fixed

[29]Some of these control variables may also be affected by the EVA policy. Our results are similar if we do not include them as controls.

effects, and SASAC×year fixed effects. The main prediction is that $\beta_3 > 0$. We double-cluster standard errors by SASAC and year.[30]

Table 3 reports the results of the baseline regressions. Column 1 reports the result without any control variables or fixed effects. The coefficient of the interaction term is 0.225 ($t = 2.56$), consistent with the first prediction of our proposition. After the EVA adoption, firms with a higher borrowing cost increase their investment relative to firms with a lower borrowing cost. We add more control variables and fixed effects from column 2 to column 6. We add *Tobin's Q* and *Cash Flow* in column 2, *Log*(*Assets*) and *Leverage* in column 3, and firm and year fixed effects in column 4.

In columns 5 and 6, we further add SASAC×year and industry×year fixed effects, respectively. These two interactive fixed effects control for the time-varying SASAC-level and industry-level factors. Note that we eliminate the *Post* dummy because the SASAC×year dummies fully absorb the *Post* dummy. 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 −0.359 ($t = -4.02$). This suggests that, before the EVA adoption, a 1% increase in *InterestRate* is associated with a 0.359% decrease in *Capex*. In the post-EVA period, a 1% increase in *InterestRate* is associated with a 0.134% decrease in *Capex* (−0.359 + 0.225). The sensitivity decreases by more than 60%.[31] Overall, these results support the first prediction of our proposition.

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. Not all firms controlled by one SASAC locate in the same province, and the central

[30] 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 4 and 5 of Table 3, and columns 1 and 2 of Table 9), instead of reporting the double-clustered t-statistics, we report the more conservative t-statistics clustered by SASAC.

[31] 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.

SASAC SOEs locate across the country. Although most SOEs controlled by one provincial SASAC locate in the same province, a number of them locate elsewhere. 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 coefficient of $Post \times InterestRate$ is also similar to that from column 6. 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.

4.4 Robustness Tests

4.4.1 Dynamic estimations

Figure 2 presents the parallel trends with the raw data. In Figure 3 , we present the effect of the EVA policy in a dynamic regression framework. Specifically, Figure 3 presents the β_{3s} coefficients from the following regression:

$$CAPEX^j_{i,t} = \beta_1 \cdot InterestRate^j_{i,t} + \sum_{s \neq -1} \beta_{2s} \cdot Post^j_{i,t,s} + \sum_{s \neq -1} \beta_{3s} \cdot InterestRate^j_{i,t} \times Post^j_{i,t,s} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t}$$

Here, s indicates the year relative to the EVA adoption, so for firm i in year t, $Post^j_{i,t,s} = 1$ 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. Panel A presents the results without including the $province \times year$ fixed effects (corresponding to column 6 in Table 3). Panel B presents the results with the Province×Year fixed effects (corresponding to column 7 in Table 3). The results show that the β_{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.

4.4.2 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. Suppose that the EVA adoption coincided with political economy or business cycle factors that had different impacts on firms with different interest rates. In that case, we should expect that non-SOEs with different interest rates changed their investments accordingly, similar to those SOEs that we have studied.

In Table 4, we estimate the baseline regressions reported in Table 3 but using the non-SOE sample. 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 4 shows that the coefficient of $Post \times InterestRate$ is negative (contrary to the findings for the SOEs), although never statistically significant at the 5% level. These findings provide further evidence that our results are unlikely driven by factors coinciding with the EVA adoption.

4.4.3 Other robustness test

In Table 5, 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 $InterestRate$. Extremely small or high $InterestRate$ values are likely to have measurement errors. Specifically, we drop the extreme values that are either lower than the 5th percentile (1.9%) or higher than the 95th percentile (10.5%). The estimations from Panels A are similar to the full sample results. In Panel B, after we drop the interest rates that are more likely to contain measurement errors, the coefficients become higher. Overall, our results are robust to these alternative specifications.

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' perspective, 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 will deteriorate. We measure ROE as net income divided by average total equity.

To quantify the non-monotonic impact of the EVA policy on firm performance, we group all firms into six groups by their $InterestRate$. Specifically, we classify firms with $InterestRate$ below 3.5%, between 3.5% and 5%, between 5% and 6.5%, between 6.5% and 8%, between 8% and 9.5%, and higher than 9.5%, as *Group* 1, *Group* 2, ..., and *Group* 6, respectively. The range of $InterestRate$ is wider for *Groups* 1 and 6 because the density of firms in the tails is lower.

As discussed in Proposition 1 in Section 3, a firm with a pre-tax cost of borrowing at 7.3% is unaffected; and 7.3% lies about the middle of *Group* 4. We hence run the regression with the following specification:

$$ROE_{it} = \sum_{Group=1}^{6} \beta_{Group} Group_{i,t-1} \times Post_{i,t} + \alpha_i + y_t + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t} \tag{10}$$

where $ROE_{i,t}$ is firm i's ROE in year t, and α_i and $y_t$are firm fixed effects and year fixed effects, respectively. $Group_{i,t}$ indicates the firms with the $InterestRate$ in any of the six groups as discussed above. The β_{Group} coefficient captures the impact of the EVA policy on ROE of firms in an $InterestRate$ group relative to control firms. We expect that β_{Group} to increase from $Group = 1$ to 4, and then decrease from $Group = 4$ to 6. We also expect $\beta_{Group=4}$ in Equation (10) to be close to zero, as their investment decisions were least affected.

The results in Table 6 are consistent with the above predictions. In column 1, $\hat{\beta}_4 = 0.018$ with $t = 1.38$, which is statistically indistinguishable from zero. The $\{\beta_{Group}\}$ coefficients become more negative for lower $InterestRate$ groups and also for higher $InterestRate$ groups. In other columns, we add different interactive fixed effects, including the $SASAC \times year$, $Industry \times year$, and $province \times year$ fixed effects. Once the $SASAC \times year$ fixed effects are added, we cannot identify all the β_{Group}coefficients anymore. In these cases, we use $\beta_{Group=4}$ as the base case, and report the other coefficients. The β_{Group} coefficients in columns 2-4 can be explained as the difference of the EVA policy impact on firms with different $InterestRate$. The results are evident that the EVA policy affected firms in *Group* 4 the least, and other firms were affected more negatively.

Figure 4 displays the relation between $InterestRate$ groups and change in firm performance graphically based on the estimation results of Table 6. The results based on column 3 (Panel A) and column 4 (Panel B) reveal that the EVA policy-induced firm performance reduction is the lowest for the fourth interest rate group, i.e, when $InterestRates$ is between 6.5% and 8%. The EVA policy-induced firm performance reduction increases with the gap between a firm's interest rate and the policy-stipulated one, and 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 $InterestRates$ between 6.5% and 8%, firms with $InterestRates$ lower than 3.5% (group 1) had a 3.5% higher reduction in ROE, and firms with $InterestRates$ higher than 9.5% (group 6) had a 4.2% higher reduction in ROE. Overall, these results support result 2 in Proposition 1.

4.6 Potential Economic Mechanisms and Supporting Evidence

We present further evidence to show that the effect of EVA reform on firm behaviors is via the channel of the managerial incentives.

4.6.1 Executive turnover versus executive compensation

This subsection studies two standard mechanisms via which managerial incentives are working: executive turnover and executive compensation. Through the lens of EVA reform, our results shed light on how managerial incentives are working 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 the opposite holds for its ROE performance. In our empirical analysis, for each listed company, we consider both the general manager (often, with the title of CEO) and the board chair as the company executives. In China, many board chairs are the ultimate decision makers who are performing the real duty as CEOs in western economy (Jiang and Kim, 2020). We define turnovers with demotion to be turnovers but exclude promotions where the executive under consideration becomes a government official or moves to the group company with a chief position.

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 either the general manager or the board chair experiences a turnover with demotion, and zero otherwise. EVA is calculated following the EVA rule as in Eq. (8). 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. *ROE* is net income divided by average equity. All the independent variables are lagged by one year.[32]

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. *ROE* has a negative and significant coefficient (-0.44, column 4), suggesting that before the EVA, firms with higher ROE are less likely to have a departing executive. This negative effect is completely eliminated after EVA: the coefficient of $Post \times ROE$ is positive with a point of estimate of 0.73 (column 4), suggesting that the effect of *ROE* on affecting executive turnover becomes weaker after the EVA adoption.

We also conduct the analysis for executive compensation. The regression is the same as in Panel A except two differences. First, we replace the dependent variable by the natural logarithm of one plus the average compensation of the general manager and the board chair. If one'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. 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 adoption of the EVA policy, EVA becomes more important in determing executive compensation, and *ROE* becomes less important. However, the coefficient of $Post \times ROE$ is never statistically significant and the coefficient of $Post \times EVA$ is only marginally significant in columns 7 and 8. The weaker results on executive compensation is 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. Former government officials are less likely to be hired as professional managers and are more likely to be incentivized

[32]For a firm-year to enter our sample, we require that both the general manager and the chair started their current position at least a year ago. We also exclude the observations where their departure is driven by retirement, personal health, or involvement in legal cases. Our results are qualitatively similar if we require that either the general manager and the chair started their current position at least a year ago, or include the above discussed departures.

by promotion within the government system. They are more likely to adhere to the SASAC rules and less likely to take the non-state shareholders' interests into account. $PoliticalConnection$ is a dummy variable that equals one if the CEO was previously a government official and zero otherwise. Managers are more likely to care about firm value when they have higher ownership. We calculate $CEOOwnership$ as the fraction of a CEO's equity ownership. In our sample, 11.1% of CEOs were former government officials. In 25.1% of our sample firms, CEOs have positive equity ownership. Conditional on positive CEO ownership, the average $CEOOwnership$ is 0.3%, with a market value of RMB 24.57 million, which is about 44 times of the average annual compensation.

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 first four columns of Table 8 report the results on political connection, and the next four columns report the results on CEO ownership. The results in Table 8 confirm these two predictions.

4.6.3 Other firm behaviors

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 Table A.2 in the Appendix).

We can further test this assumption in Table 9. Specifically, we examine how the EVA policy affects firms' debt financing and equity financing, 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. Specifically, after the EVA policy adoption, firms with a higher cost of borrowing increase their debt borrowing and mainly long-term debt. 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. These results are consistent with the fact that external equity financing is strictly regulated, and firms rely on debt to fund their investment, providing support to the assumption discussed in Section 3.2.

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. Although these two adjustments are unrelated to a firm's interest rate, these adjustments may have changed firms' policy. For example, they may have increased firms' incentive to invest into R&D. In fact, encouraging SOEs to invest into R&D activities was one of the motivations of the SASAC. We investigate the impact of the EVA policy on firms' R&D expenses. In the regression we include firm fixed effects which absorb SASAC fix effects. Because the impact on R&D does not depend on the firm's interest rate, we focus 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 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. The average R&D/Sales ratio is 0.009, suggesting that the EVA policy had a significant impact on firms' R&D expenses. These results, besides confirming that the EVA policy did increase firms' R&D expenses, provide additional evidence that the SASAC policies had significant impact on SOEs' behaviors.

5 Does EVA Policy Improve Capital Allocation?

In this section, we attempt to evaluate the welfare consequence of the EVA policy, i.e., whether the EVA adoption improved the aggregate capital allocation efficiency. Our results, due to data limitations, are noisy and only suggestive; this is an important research topic for future explorations.

The primary motivation of SASAC to conduce the EVA reform is to urge SOE managers 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 is about the allocative efficiency between SOEs and non-SOEs. This perspective helps us organize our discussion in Section 5.1, which is based on the framework we have developed in Section 3.

5.1 EVA and Capital Allocation Efficiency: Theory

Following the allocative efficiency literature ((Hsieh and Klenow, 2009)), we study the welfare implication of EVA policy reform through the lens of comparing Equations (7) and (8). As expected, the EVA policy's effect on aggregate capital productivity critically depends on what caused different SOEs to have different costs of capital.

To facilitate discussion, we follow the capital allocation efficiency literature by specifying the production function to be Cobb-Douglas, i.e., for firm i we have

$$F_i\left(K_i\right) = A_i K^{\alpha_i} \text{ with } F_i'\left(K_i\right) = \frac{\alpha_i F\left(K_i\right)}{K_i}. \tag{11}$$

We also assume away the labor margin for simplicity. The firm's marginal revenue product of capital ($MRPK$) is defined, normalizing the product price to 1, as

$$MRPK_i \equiv F'\left(K_i\right).$$

Under the ROE policy, using $r_{Di} = \left(1+\tau_{Ki}\right) r_i$ in (4) we can rewrite Eq. (7) as $F'\left(K_i\right) = \frac{1+\tau_{Ki}}{1-\tau_{Yi}}\left(1-\pi\right) r_i$, which implies that

$$MRPK_i^{ROE} = \frac{1+\tau_{Ki}}{1-\tau_{Yi}}\left(1-\pi\right) r_i. \tag{12}$$

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

$$MRPK_i^{EVA} = \frac{\left(0.25-\pi\right)\left(1+\tau_{Ki}\right) r_i + 5.5\%}{1-\tau_{Yi}}. \tag{13}$$

Finally, equation (12) holds for non-SOEs in our economy.

5.1.1 Allocative efficiency within SOEs

We now discuss the impact of EVA adoption on allocative efficiency within SOEs. The result crucially depends on whether the required costs of capital r_i's are equal across firms. From the classic perspective in the finance literature, the required rate of return (or cost of capital) includes both the risk-free rate and the compensation for risk—more precisely, aggregate risk that requires a risk premium. 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 ease of exposition.

Constant cost of capital $r_i = r$ Conceptually, this is the right benchmark if we think the firms under consideration have a similar risk profile and hence require the same risk premium. Under this assumption, efficient capital allocation requires that

$$MRPK_i = constant,$$

and a similar exercise as in Hsieh and Klenow (2009) implies that the aggregate welfare is decreasing in the $MRPK$ dispersion among firms.

Comparing (12) and (13), we observe that EVA essentially reduces the dispersion caused by heterogeneous borrowing costs. We will show shortly in Section 4 the EVA reform indeed affected the SOE investment as our theory suggests. Then, to the extent that the borrowing cost is either positively correlated with, or roughly independent of the output wedge τ_{Yi},[33] the EVA reform should reduce the $MRPK$ dispersion within the SOE sector and hence bring a welfare gain. This point is most evident when we take the extreme case where we set $1 - \tau_{Yi} = 1 - \pi = 0.75$ (so that $\pi = 0.25$ which holds for most of sample firms) and impose $r_i = r = \frac{5.5\%}{0.75} = 7.33\%$:

$$MRPK_i^{ROE} = (1 + \tau_{Ki})\, r \text{ and } MRPK_i^{EVA} = \frac{5.5\%}{1 - \tau_{Yi}} = r. \tag{14}$$

This says that in the absence of any policy subsidy, all the SOEs' (after-tax) cost of capital would have been 5.5%, and the observed heterogeneity of interest rates is entirely driven by the wedge

[33] We follow the literature by specifying the signs of the output wedge τ_Y and financing wedge τ_D so that both measure the "tax" to the firm.

τ_{Ki} which captures various policy subsidies. The EVA policy then would have increased capital allocation efficiency by incentivizing firms not to make capital budgeting decisions based on their actual but rather on their distorted interest rates.

The real challenge is whether we can directly measure the change of the $MRPK$ dispersion in our sample of listed firms by following the capital allocative efficiency literature. The Cobb-Douglas technology implies that one can measure a firm's $MRPK$ by its output-to-capital ratio, thanks to Eq. (5):

$$MRPK_i = \frac{\alpha_i F\left(K_i\right)}{K_i}, \tag{15}$$

Under the further assumption that α_i is the same for firms within the same industry, one can infer the change of the $MRPK$ dispersion by analyzing the dispersion of the industry-adjusted $MRPK$, before and after the EVA policy adoption.

Heterogeneous cost of capital $r_i \neq r$ Once we recognize that the true cost of capital might be heterogeneous across firms—or at least industries—then it is immediate that the simple EVA policy does not necessarily lead to welfare gain. Now even if we assume $1 - \tau_{Yi} = 1 - \tau_Y$ as a constant across industries, (14) becomes

$$MRPK_i^{ROE} = \frac{1-\pi}{1-\tau_Y}\left(1+\tau_{Ki}\right) r_i \text{ and } MRPK_i^{EVA} = \frac{5.5\%}{1-\tau_Y}. \tag{16}$$

As is evident from (16), a successful EVA reform, given its one-size-fits-all nature, can fix the "bad" divergence caused by $1 + \tau_{Ki}$ but necessarily will kill the good "divergence" rooted in the heterogeneity among the true costs of capital, r_i. Of course, it is even more challenging to measure and quantify the latter negative welfare impact of the EVA reform, a topic we discuss further in Section 5.

Now consider the other extreme that the actual interest rates that our firms face are free from any policy distortion but entirely due to different risk profiles of their business operations. In this scenario, the EVA policy would increase capital misallocation.

5.1.2 Allocative efficiency between SOEs and non-SOEs

It has been widely documented that misallocation between SOEs and non-SOEs is responsible for low aggregate productivity in China (Song, Storesletten, and Zilibotti 2011; Brandt, Tombe, and Zhu 2013; Hsieh and Klenow 2009) because SOEs have cheaper access to capital thanks to the implicit government guarantee. It is possible that the SASAC, via the EVA policy, increases the SOEs' hurdle rates for capital budgeting and therefore curbs their investment, without changing their actual cost of capital or removing the implicit government guarantee. In other words, the EVA policy can affect SOEs' investment through the extensive margin.

This crucially depends on whether the stipulated cost of capital (5.5%) was higher than the actual cost of capital of SOEs, i.e., whether on average $MRPK_i^{EVA} > MRPK_i^{ROE}$ holds in (16). In our sample of publicly listed SOEs, the average after-tax interest rate was about 4.4%; this is indeed lower than the stipulated (after) cost of capital 5.5%, but not by a significant margin. It remains an empirical question on whether this wedge is sufficient to push SOEs to cut back investment on the whole after the EVA adoption relative to their non-SOE peers.

5.2 Empirical Results

We conduct two tests in this section. The first test is guided by Section 5.1.1 which concerns $MRPK$ dispersion at the SASAC-year level, while the second is guided by Section 5.1.2 which concerns investment at the firm-year level.

5.2.1 Impact of EVA policy on $MRPK$ dispersion within SOEs

We adopt the marginal revenue product of capital ($MRPK$) measure used by Chen and Song (2013); the advantage of their approach is that it does not need data on firms' industrial value-added, which unfortunately our sample firms do not report.[34] More specifically, $MRPK$ is calculated as the natural logarithm of the ratio between operating profit and lagged fixed assets. Operating profit (before tax) is sales minus costs of goods sold and selling, general and administrative expenses, plus depreciation. To control for cross-industry differences, we adjust $MRPK$ by industry means. Since

[34]The literature provides various approaches to measure capital productivity (Hsieh and Klenow, 2009; Bai, Lu, and Tian, 2018). Most measures require the data on firm-level industrial value-added, which our sample firms, which are publicly listed SOEs, do not report.

most of the studies in this literature restrict the sample to manufacturing firms (Hsieh and Klenow, 2009), we also report the results by restricting to the manufacturing firms besides the results based on the full sample.

Table 11 reports the results. Our unit of observation is SASAC-year, and the dependent variable is $MRPK$ disperson, which is calculated as the standard deviation of the industry-adjusted $MRPK$ across firms controlled by that SASAC in that year (we require at least five firms within each unit of observation). *Post* equals one after a SASAC adopted the EVA policy and zero otherwise. In other words, we are employing a difference-in-differences design in that we are comparing the change of SASACs that have adopted EVA policies to the change of other SASACs who have not adopted yet. Colomn 1 is for manufacturing firms and column 3 for all firms; and in column 2 and 4 we include average firm size and average leverage in any SASAC-year unit of observation as control, respectively. In all specifications, the coefficients of *Post* are indistinguishable from zero at the 5% level.

We interpret the industry-adjusted $MRPK$ dispersion as a (negative) measure of aggregate capital productivity (Hsieh and Klenow, 2009). As discussed in Section 5.1.1, under the assumption that $r_i = r$ and hence the differences in the costs of capital across firms in the same industry are driven solely by frictions (policy distortions or financial constraints), then theory predicts that the aggregate capital productivity is highest when the marginal capital productivity equalizes across firms with an industry. To the extent that industry is perhaps the most important determinant of the firm's true cost of capital r_i (which is pinned down by the profile of the aggregate risk of its cash flows, see, e.g., the MBA-level book Berk and DeMarzo (2017)), it is not implausible to assume that $r_i = r$ for all firms in the same industry and hence that the $MRPK$ disperson (inversly) measures the aggregate capital productivity.

Therefore an insignificant estimate of coefficients of *Post* in Table 11 suggests no improvement in allocative efficiency within the SOE sector. This 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. Conceptually, the interest rate, which is the marginal cost of investment, should equal $MRPK$ which, theoretically, gives the margnial 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 manufaturing firms and for all firms, respectively. Neither is statistically distinguishable from zero. [35]

So what can explain the difference? Although it is worth another full paper to answer this important question, measurement error of $MRPK$ is perhaps the leading candidate for the discrepancy of our findings. First of all, as explained in the beginning of this section, the method of Chen and Song (2013) which measures $MRPK$ simply by the logarithm of the ratio between operating profit and lagged fixed assets is rather crude. We have only standard financial statement data for listed companies, as opposed to plant-level data; this prevents us from using a more fine-tuned methodology.

Second, another challenging part of the exercise is to back out the true output $F(K_i)$ while we only observe $(1-\tau_{Yi})\,F(K_i)$. To obtain an estimate of $F(K_i)$, we simply add back taxes and exclude subsidies recorded in financial statements. It is likely that some subsidies enter firms' operating profits but do not show up separately on firms' accounting statements, hence will lead to measurement error in our $MRPK$ calculation.

5.2.2 Impact of EVA policy between SOEs and non-SOEs

From the perspective of the whole economy, the EVA policy can still improve capital allocation efficiency by relocating capital from SOEs to non-SOEs, as there exists ample evidence that the latter are more productive than the former.

To empirically test this hypothesis, we expand our sample to include non-SOEs during our sample period to serve as controls. More specifically, we run a difference-in-differences test in our panel regression in Table 12, with the main variable of interest being $Post \times SOE$. Essentially, this methodology allows for province-year specific trends, 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 adoption for a given (provincial) SASAC at a given year. We exclude the central SASAC from this analysis due to the difficulty in defining its controls. We also introduce an additional dummy variable $SOE \times High$ that indicates SOEs with high interest rate (above median) into the

[35] 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 the independent variable $InterestRate$ with industry-adjusted $MRPK$. Table A.3in Appendix reports the results. The coefficient of $MRPK \times Post$ is insignificant in all the specifications except in column 6.

regression and report these results in column 5. In these columns, the coefficient of the dummy $Post \times SOE$ captures the change of investment in SOEs with low interest rate following the EVA adoption, relative to that in the corresponding non-SOE firms as a control group; and the coefficient of the dummy $Post \times SOE \times High$ captures the additional investment of SOEs with high interest rate relative to SOEs with low interest rate.

Table 12 reports our results with various sets of controls and fixed effects. Column 5 confirms that that there is a significant difference between high and low interest rate groups, consistent with our findings in Section 4.3; and the EVA policy leads SOEs with low interest rate to cut investment (-0.4%) while those with low interest rate to increase investment ($1.2\% = -0.004 + 0.016$). However, column 5 shows that the estimated coefficient of $Post \times SOE$ is negative but statistically insignificant, suggesting no evidence of capital reallocation from SOEs to non-SOEs. This suggests that the 5.5% EVA-stipulated (after) cost of capital—which is not far from the average after-tax interest rate of 4.4% for our sample of SOEs—is too low. Though intellectually intriguing, it is beyond the scope of this paper to explore the optimal stipulated cost of capital in the EVA policy.

6 Conclusion

The Chinese SOEs' EVA reform provides us 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 borrowing to the stipulated one as the hurdle rates used for their capital budgeting and investment decisions, suggesting an improved capital allocative efficiency within the SOE sector. We, however, do not find capital moved from the SOE sector to the non-SOE sector in response to the EVA reform.

In many countries around the world, governments provide subsidies to various institutions, leading to a lower capital allocation efficiency. Although we do not advocate a simple EVA policy for 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, 2019, Chinese bond market and interbank market, Discussion paper National Bureau of Economic Research.

Bai, Chong-En, Chang-Tai Hsieh, and Zheng Michael Song, 2016, The long shadow of a fiscal expansion, Discussion paper National Bureau of Economic Research.

Bai, Yan, Dan Lu, and Xu Tian, 2018, Do financial frictions explain chinese firms' saving and misallocation?, Discussion paper National Bureau of Economic Research.

Berk, Jonathan, and Peter DeMarzo, 2017, Corporate finance (; global ed.), .

Bertrand, Marianne, and Sendhil Mullainathan, 2003, Enjoying the quiet life? corporate governance and managerial preferences, *Journal of political Economy* 111, 1043–1075.

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.

Chen, Hui, Zhuo Chen, Zhiguo He, Jinyu Liu, and Rengming Xie, 2020, Pledgeability and asset prices: Evidence from the chinese corporate bond markets, Discussion paper National Bureau of Economic Research.

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*.

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

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, 2020, Overpricing in china's corporate bond market, Discussion paper National Bureau of Economic Research.

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, *The 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).

Fan, Gang, Xiaolu Wang, and Hengpeng Zhu, 2010, Neri index of marketization of China's provinces 2009 report, .

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.

Freixas, Xavier, Roger Guesnerie, and Jean Tirole, 1985, Planning under incomplete information and the ratchet effect, *The review of economic studies* 52, 173–191.

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, *The Review of Financial Studies* 31, 3854–3894.

Geng, Zhe, and Jun Pan, 2021, The soe premium and government support in china's credit market, Discussion paper National Bureau of Economic Research.

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

——— , 1995, China's evolving managerial labor market, *Journal of political economy* 103, 873–892.

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

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

Horngren, Charles, and George Foster, 1987, *Cost accounting: A managerial emphasis, 6/e* (Prentice-Hall).

Hsieh, Chang-Tai, and Peter J Klenow, 2009, Misallocation and manufacturing TFP in China and India, *The 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, Discussion paper.

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.

Kaplan, Robert, 1982, *Advanced Management Accounting* (Prentice-Hall).

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

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, 2020, Does external monitoring improve the performance of state-owned enterprises?, *working paper*.

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.

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, *The 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.

——— , 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.

Shue, Kelly, and Richard R Townsend, 2017, How do quasi-random option grants affect ceo risk-taking?, *The 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.

Wang, Xiaolu, Gang Fan, and Lipeng Hu, 2019, Marketization index of China's provinces: Neri report 2018, .

Weitzman, Martin L, 1980, The" ratchet principle" and performance incentives, *The Bell Journal of Economics* pp. 302–308.

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 equal to 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 Fan, Wang, and Zhu (2010) and Wang, Fan, and Hu (2019), 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*							1.138
	(1.71)							(1.45)
GDP per capita		-0.001						0.028
		(-0.06)						(0.58)
Age $\geq$ *65*			0.043					0.060
			(0.57)					(0.71)
Tenure				-0.018				-0.028
				(-1.32)				(-1.54)
% of SOE Assets					0.116**			0.121
					(2.24)			(0.93)
SOE Investment Growth						0.010		0.009
						(0.82)		(0.65)
Marketization							-0.007	-0.006
							(-1.13)	(-0.31)
Observations	272	272	272	272	272	267	272	267
R-squared	0.087	0.078	0.079	0.081	0.087	0.081	0.081	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 SOEs and Panel B for non-SOEs. *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 average total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is total liabilities divided by total assets. *CEOOwnership* is the fraction of shares held by a firm's CEO, multiplied by 100. *PoliticalConnection* is a dummy variable equals to one if the CEO was previously employed as a bureaucrat by the central government or a local government. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A1: Mean, median, standard deviation, and percentiles of SOEs

	N	Mean	Median	Std. Dev.	P25	P75
Capex	4667	0.071	0.046	0.08	0.019	0.094
InterestRate	4667	0.057	0.054	0.032	0.042	0.066
Tobin's Q	4667	1.931	1.592	1.092	1.205	2.249
CashFlow	4667	0.051	0.048	0.081	0.006	0.096
Log(Assets)	4667	22.27	22.05	1.411	21.232	23.11
Leverage	4667	0.528	0.532	0.189	0.389	0.66
CEOOwnership (%)	4650	0.08	0	1.008	0	0
PoliticalConnection	4650	0.111	0	0.314	0	0

Panel A2: Correlations of SOEs

	Capex	*InterestRate*	*Tobin's Q*	*CashFlow*	*Log(Assets)*	*Leverage*	*CEO-Ownership*	*Political-Connection*
Capex	1							
InterestRate	-0.109***	1						
Tobin's Q	0.053***	0.139***	1					
CashFlow	0.242***	-0.025*	0.058***	1				
Log(Assets)	0.057***	-0.184***	-0.327***	0.067***	1			
Leverage	-0.117***	0.012	-0.218***	-0.161***	0.238***	1		
CEOOwnership	0.075***	-0.027*	0.025*	-0.023	-0.027*	0.003	1	
PoliticalConnection	0.055***	-0.062***	-0.041***	0.031**	0.077***	0.006	-0.018	1

Table 2: Summary Statistics (Continued)

Panel B1: Mean, median, standard deviation, and percentiles of non-SOEs

	N	Mean	Median	Std. Dev.	P25	P75
Capex	6359	0.070	0.045	0.077	0.017	0.096
InterestRate	6359	0.064	0.060	0.041	0.047	0.072
Tobin's Q	6359	2.374	1.935	1.362	1.433	2.841
CashFlow	6359	0.040	0.040	0.084	-0.004	0.088
Log(Assets)	6359	21.411	21.338	1.031	20.701	22.063
Leverage	6359	0.480	0.464	0.275	0.309	0.617

Panel B2: Correlations of non-SOEs

	Capex	*InterestRate*	*Tobin's Q*	*CashFlow*	*Log(Assets)*	*Leverage*
Capex	1					
InterestRate	-0.050***	1				
Tobin's Q	0.134***	0.111***	1			
CashFlow	0.150***	0.011	0.030**	1		
Log(Assets)	-0.026**	-0.134***	-0.393***	0.024*	1	
Leverage	-0.197***	0.007	-0.083***	-0.075***	0.070***	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 average 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 (4) and (5), t-statistics are calculated by clustering at the SASAC and year levels. In columns (4) and (5), 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)	(7)
Post × InterestRate	0.225**	0.205**	0.214**	0.177***	0.174***	0.170***	0.154***
	(2.56)	(2.49)	(2.42)	(3.81)	(4.44)	(6.10)	(5.58)
Post	-0.030***	-0.025**	-0.030**	-0.003			
	(-2.87)	(-2.58)	(-2.34)	(-0.73)			
InterestRate	-0.359***	-0.357***	-0.321***	-0.196***	-0.151***	-0.186***	-0.172***
	(-4.02)	(-4.20)	(-4.56)	(-5.76)	(-4.17)	(-3.28)	(-3.21)
Tobin's Q		0.004***	0.005***	0.009***	0.008***	0.007***	0.007**
		(3.62)	(5.00)	(4.02)	(4.05)	(3.18)	(2.88)
CashFlow		0.223***	0.200***	0.057***	0.050**	0.032**	0.021
		(10.19)	(6.78)	(3.79)	(3.08)	(2.40)	(1.64)
Log(*Assets*)			0.006*	-0.017	-0.019*	-0.021*	-0.027**
			(1.84)	(-1.67)	(-2.00)	(-1.86)	(-2.95)
Leverage			-0.036**	-0.054**	-0.044**	-0.035*	-0.025
			(-2.35)	(-2.84)	(-2.22)	(-2.09)	(-1.70)
Observations	4,667	4,667	4,667	4,631	4,598	4,576	4,563
R-squared	0.024	0.080	0.092	0.465	0.510	0.544	0.590
Firm FE	NO	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	NO	NO	NO	YES	YES	YES
Industry*Year FE	NO	NO	NO	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	NO	NO	NO	YES

Table 4: 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 average 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)	(6)
Post × InterestRate	-0.063	-0.093	-0.097*	-0.052	-0.048	-0.042
	(-1.25)	(-1.63)	(-1.67)	(-1.09)	(-1.07)	(-0.90)
Post	0.004	0.007	0.004	0.002		
	(0.50)	(0.81)	(0.57)	(0.19)		
InterestRate	-0.079*	-0.103**	-0.090**	-0.034	-0.036	-0.035
	(-1.91)	(-2.39)	(-2.43)	(-0.99)	(-1.14)	(-1.33)
Tobin's Q		0.008***	0.008***	0.013***	0.012***	0.012***
		(4.77)	(4.18)	(11.45)	(12.33)	(9.41)
CashFlow		0.136***	0.122***	0.030**	0.032**	0.028**
		(6.57)	(6.46)	(2.50)	(2.64)	(2.37)
Log(*Assets*)			0.002	-0.008***	-0.009***	-0.012***
			(0.79)	(-3.50)	(-3.38)	(-5.09)
Leverage			-0.050***	-0.044***	-0.042***	-0.039***
			(-6.06)	(-4.76)	(-5.00)	(-5.62)
Observations	6,359	6,359	6,359	6,241	6,231	6,226
R-squared	0.003	0.044	0.076	0.499	0.545	0.578
Firm FE	NO	NO	NO	YES	YES	YES
Year FE	NO	NO	NO	YES	NO	NO
Province*Year FE	NO	NO	NO	NO	YES	YES
Industry*Year FE	NO	NO	NO	NO	NO	YES

Table 5: Robustness

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 (10.5%). 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 average 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 province 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	0.168**	0.194**	0.180*	0.181*	0.384***	0.295**	0.230**	0.178**
	(2.26)	(3.02)	(1.95)	(1.81)	(3.79)	(2.82)	(2.98)	(2.24)
Post	-0.004				-0.011			
	(-0.58)				(-1.27)			
InterestRate	-0.188***	-0.111**	-0.114**	-0.116**	-0.526***	-0.359***	-0.371***	-0.327***
	(-3.42)	(-2.79)	(-2.76)	(-2.58)	(-17.56)	(-17.69)	(-25.84)	(-9.37)
Tobin's Q	0.008**	0.007*	0.004	0.005	0.009***	0.009**	0.007*	0.006
	(2.28)	(1.82)	(1.37)	(1.43)	(3.15)	(2.83)	(2.11)	(1.50)
CashFlow	0.042	0.024	0.015	0.017	0.063**	0.054	0.038	0.022
	(1.31)	(0.78)	(0.45)	(0.47)	(2.73)	(1.51)	(1.42)	(1.42)
Log(Assets)	-0.024**	-0.027**	-0.032*	-0.032*	-0.021**	-0.021	-0.024*	-0.030***
	(-2.61)	(-2.39)	(-1.94)	(-1.87)	(-2.24)	(-1.49)	(-1.83)	(-3.33)
Leverage	-0.049	-0.024	-0.017	-0.017	-0.051**	-0.043*	-0.037	-0.024
	(-1.52)	(-0.75)	(-0.61)	(-0.59)	(-2.51)	(-1.87)	(-1.47)	(-1.27)
Observations	2,488	2,453	2,433	2,429	4,159	4,120	4,099	4,082
R-squared	0.470	0.543	0.588	0.597	0.472	0.522	0.558	0.608
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 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 average equity. Firms are sorted into six groups by lagged interest rates. We classify firms with *InterestRate* below 3.5%, between 3.5% and 5%, between 5% and 6.5%, between 6.5% and 8%, between 8% and 9.5%, and higher than 9.5%, 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*	-0.014	-0.039**	-0.043***	-0.035***
	(-0.65)	(-2.34)	(-4.21)	(-3.12)
Post × *Group2*	-0.009	-0.027	-0.033**	-0.019
	(-0.69)	(-1.71)	(-2.65)	(-1.64)
Post × *Group3*	0.007	-0.011	-0.016	-0.001
	(0.59)	(-0.85)	(-1.44)	(-0.06)
Post × *Group4*	0.018			
	(1.38)			
Post × *Group5*	-0.007	-0.023	-0.036	-0.011
	(-0.22)	(-0.59)	(-1.03)	(-0.31)
Post × *Group6*	-0.016	-0.026*	-0.046***	-0.042***
	(-0.93)	(-1.84)	(-3.64)	(-3.28)
Log(*Assets*)	-0.020	-0.015	-0.014	-0.022*
	(-1.63)	(-1.56)	(-1.25)	(-1.81)
Leverage	-0.015	0.001	0.016	0.049
	(-0.32)	(0.01)	(0.31)	(1.06)
Observations	4,631	4,598	4,576	4,563
R-squared	0.465	0.510	0.544	0.590
Group FE	YES	YES	YES	YES
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 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 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 average 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	-1.865***	-2.013***	-1.693***	-2.006***	5.150	3.247	5.256*	4.813*
	(-5.69)	(-6.61)	(-6.27)	(-6.28)	(1.36)	(1.14)	(1.83)	(1.72)
Post	-0.065*				-0.372			
	(-1.90)				(-1.20)			
EVA	0.281	0.591*	0.559	0.660*	-2.830	-2.255	-4.010	-2.792
	(1.02)	(1.90)	(1.66)	(1.85)	(-0.70)	(-0.53)	(-0.93)	(-0.64)
Post × ROE	0.746***	0.767***	0.735***	0.734***	-0.992	-0.369	-0.721	-0.861
	(6.83)	(9.07)	(7.87)	(5.23)	(-0.83)	(-0.32)	(-0.66)	(-0.69)
ROE	-0.404***	-0.498***	-0.480***	-0.438***	1.510	1.225	1.529	1.662
	(-3.61)	(-5.39)	(-7.28)	(-3.68)	(1.13)	(0.79)	(1.09)	(1.18)
Tobin's Q	-0.011	-0.016	-0.014	-0.024	-0.157	-0.140	-0.198*	-0.259*
	(-0.56)	(-0.65)	(-0.71)	(-1.07)	(-1.49)	(-1.42)	(-1.95)	(-2.11)
Log(Assets)	-0.062*	-0.056**	-0.069**	-0.102**	0.318	0.335*	0.179	0.148
	(-2.03)	(-2.34)	(-2.29)	(-2.84)	(1.77)	(1.83)	(0.84)	(0.56)
Leverage	0.177**	0.218***	0.200*	0.182*	-0.537	-0.069	-0.059	-0.229
	(2.99)	(3.14)	(2.06)	(1.94)	(-0.50)	(-0.07)	(-0.05)	(-0.19)
Log (Age of	0.324***	0.392***	0.379***	0.361***	-1.855**	-1.661**	-1.900*	-2.026
general manager)	(3.91)	(3.88)	(3.62)	(3.74)	(-2.32)	(-2.29)	(-2.01)	(-1.75)
Log (1 + tenure of	0.144***	0.149***	0.147***	0.140***	3.101***	3.214***	3.225***	3.220***
general manager)	(5.23)	(6.33)	(9.43)	(9.06)	(10.59)	(10.44)	(13.28)	(14.32)
Log (Age of	0.120	0.138	0.161	0.204*	2.022	1.899	2.027	2.581**
chair)	(1.20)	(1.23)	(1.61)	(1.93)	(1.67)	(1.57)	(1.72)	(2.24)
Log (1 + tenure of	0.127***	0.136***	0.134***	0.133***	-0.822***	-0.816***	-0.862***	-0.879***
chair)	(5.18)	(6.48)	(7.14)	(7.80)	(-6.74)	(-5.92)	(-8.09)	(-7.69)
Observations	3,556	3,508	3,474	3,448	3,481	3,437	3,406	3,383
R-squared	0.252	0.316	0.361	0.436	0.491	0.531	0.557	0.604
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 8: Firm heterogeneity

This table reports results on firm heterogeneity: Panel A on political connection and Panel B on CEO ownership. *PoliticalConnection* equals one if a firm's CEO was a former government official and zero otherwise. *CEOOwnership* is the CEO's fraction of equity ownership. 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 average 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	0.122**	0.124**	0.133**	0.116**	0.179***	0.178***	0.172***	0.159***
	(3.07)	(2.81)	(2.96)	(2.59)	(14.89)	(14.20)	(6.42)	(4.94)
Post × Interest Rate × PoliticalConnection	0.554**	0.498**	0.366	0.347				
	(2.66)	(2.29)	(1.67)	(1.45)				
Post × PoliticalConnection	-0.050**	-0.047**	-0.036*	-0.037*				
	(-3.01)	(-2.76)	(-1.93)	(-1.81)				
InterestRate × PoliticalConnection	-0.528**	-0.496**	-0.391*	-0.430*				
	(-2.66)	(-2.47)	(-2.14)	(-2.18)				
Post × InterestRate × CEOOwnership					-0.302**	-0.313**	-0.343**	-0.368**
					(-2.37)	(-2.34)	(-2.70)	(-2.59)
Post × CEOOwnership					0.005	0.005	0.006	0.006
					(0.63)	(0.61)	(0.75)	(0.74)
Interest Rate × CEOOwnership					0.014	0.012	0.010	0.013
					(0.11)	(0.09)	(0.08)	(0.10)
Post	0.002				-0.003			
	(0.26)				(-0.72)			
InterestRate	-0.149***	-0.107**	-0.148**	-0.131**	-0.192***	-0.147***	-0.179***	-0.168***
	(-4.37)	(-2.49)	(-2.76)	(-2.71)	(-5.72)	(-4.39)	(-3.50)	(-3.32)
PoliticalConnection	0.041***	0.036***	0.032**	0.037**				
	(3.36)	(3.18)	(2.57)	(2.73)				
CEOOwnership					0.009	0.009	0.009	0.009
					(1.12)	(1.07)	(1.13)	(1.12)
Tobin's Q	0.009***	0.008***	0.007**	0.006**	0.009**	0.009***	0.007**	0.007**
	(4.48)	(3.89)	(2.66)	(2.65)	(3.02)	(3.87)	(2.98)	(2.68)
Cash Flow	0.057***	0.051**	0.033*	0.021	0.057***	0.050**	0.032**	0.020
	(3.38)	(2.56)	(2.14)	(1.37)	(3.82)	(2.99)	(2.34)	(1.51)
Log(Assets)	-0.018	-0.019	-0.022	-0.027**	-0.017	-0.018*	-0.021*	-0.027**
	(-1.38)	(-1.68)	(-1.78)	(-2.96)	(-1.65)	(-1.92)	(-2.07)	(-2.87)
Leverage	-0.054**	-0.044**	-0.035*	-0.024	-0.053**	-0.042*	-0.033	-0.022
	(-2.79)	(-2.21)	(-1.91)	(-1.48)	(-2.66)	(-2.02)	(-1.58)	(-1.29)
Observations	4,615	4,581	4,560	4,547	4,615	4,581	4,560	4,547
R-squared	0.468	0.512	0.545	0.592	0.469	0.513	0.547	0.593
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 average 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 are reported in the parentheses. In columns (1) and (2), t-statistics are clustered by SASAC. In other columns, t-statistics are clustered by SASAC and year. ***, **, 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	0.106*	0.128**	0.123***	0.135***	-0.025	-0.045	-0.026	-0.063	0.014	0.040	-0.071	0.043
	(1.84)	(2.21)	(9.65)	(5.15)	(-0.43)	(-0.65)	(-0.39)	(-0.73)	(0.15)	(0.30)	(-0.45)	(0.29)
Post	-0.011				0.002				0.001			
	(-1.40)				(0.49)				(0.06)			
InterestRate	-0.119*	-0.089	-0.078	-0.093*	0.124***	0.125**	0.128***	0.156***	-0.184	-0.183	-0.148	-0.190
	(-2.03)	(-1.30)	(-1.50)	(-2.04)	(3.23)	(2.75)	(3.32)	(4.54)	(-1.35)	(-1.53)	(-1.08)	(-1.40)
Tobin's Q	-0.001	-0.003	-0.002	-0.003	0.007***	0.007***	0.007***	0.006**	0.023***	0.024***	0.024***	0.025***
	(-0.33)	(-0.73)	(-0.65)	(-0.57)	(5.77)	(4.56)	(3.39)	(2.60)	(5.38)	(5.50)	(3.73)	(4.28)
CashFlow	-0.136***	-0.144***	-0.138***	-0.161***	-0.308***	-0.314***	-0.319***	-0.326***	0.027	0.013	0.018	0.005
	(-4.37)	(-4.15)	(-5.40)	(-9.39)	(-10.68)	(-10.72)	(-10.94)	(-11.09)	(0.62)	(0.38)	(0.46)	(0.12)
Log(Assets)	-0.033***	-0.034***	-0.039*	-0.046**	-0.022**	-0.023**	-0.025**	-0.031***	-0.063**	-0.067**	-0.071***	-0.081***
	(-4.21)	(-4.17)	(-2.07)	(-2.35)	(-2.60)	(-2.40)	(-2.21)	(-3.16)	(-2.93)	(-3.02)	(-3.16)	(-3.14)
Leverage	-0.070**	-0.072**	-0.062**	-0.051**	-0.120***	-0.124***	-0.120***	-0.108***	0.171***	0.186***	0.183***	0.190***
	(-2.43)	(-2.77)	(-2.51)	(-2.38)	(-4.80)	(-5.44)	(-5.35)	(-6.47)	(4.19)	(4.79)	(4.54)	(4.01)
Observations	4,631	4,598	4,576	4,563	4,631	4,598	4,576	4,563	4,631	4,598	4,576	4,563
R-squared	0.215	0.285	0.325	0.383	0.265	0.314	0.348	0.412	0.172	0.236	0.280	0.342
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 average 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**
	(6.14)	(6.27)	(5.61)	(2.69)	(2.66)	(2.63)
InterestRate		0.019	0.019*	-0.027**	-0.014	-0.008
		(1.32)	(1.67)	(-2.80)	(-1.25)	(-1.24)
Tobin's Q		0.002*	0.001	0.001*	0.001	0.000
		(1.78)	(1.33)	(1.85)	(1.23)	(0.16)
CashFlow		-0.007**	-0.010*	0.001	-0.000	-0.003*
		(-2.01)	(-1.94)	(0.23)	(-0.17)	(-1.80)
Log(Assets)			-0.001	-0.001***	-0.001*	-0.001*
			(-0.85)	(-8.18)	(-1.94)	(-1.80)
Leverage			-0.011***	-0.007***	-0.005	-0.005**
			(-3.58)	(-3.29)	(-1.70)	(-2.44)
Observations	4,666	4,666	4,666	4,666	4,630	4,608
R-squared	0.143	0.154	0.167	0.396	0.615	0.711
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: 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. *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)	(5)	(6)
Post	0.195*	0.095	-0.030	-0.025
	(1.88)	(0.65)	(-0.30)	(-0.26)
Average Log(Assets)		-0.133**		-0.142
		(-2.21)		(-1.12)
Average Leverage		1.896**		-0.289
		(2.96)		(-0.43)
Observations	106	106	198	198
R-squared	0.436	0.509	0.268	0.279
SASAC FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

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 average 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	-0.002	-0.007	0.000	0.006	-0.004
	(-0.18)	(-0.69)	(0.02)	(0.31)	(-0.18)
Post	0.007				
	(1.21)				
Post × SOE × High					0.016***
					(3.79)
Tobin's Q	0.012***	0.010***	0.011***	0.012***	0.012***
	(4.60)	(4.05)	(5.43)	(5.16)	(4.83)
CashFlow	0.037*	0.035*	0.033	0.031	0.030
	(1.84)	(1.82)	(1.32)	(1.10)	(1.06)
Log(Assets)	-0.013**	-0.019**	-0.020**	-0.019**	-0.019**
	(-2.40)	(-3.07)	(-2.61)	(-2.45)	(-2.22)
Leverage	-0.050***	-0.051***	-0.048***	-0.048***	-0.048***
	(-4.83)	(-3.78)	(-3.71)	(-3.56)	(-3.52)
Observations	3,168	3,154	3,138	3,112	3,112
R-squared	0.515	0.573	0.623	0.630	0.632
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

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.

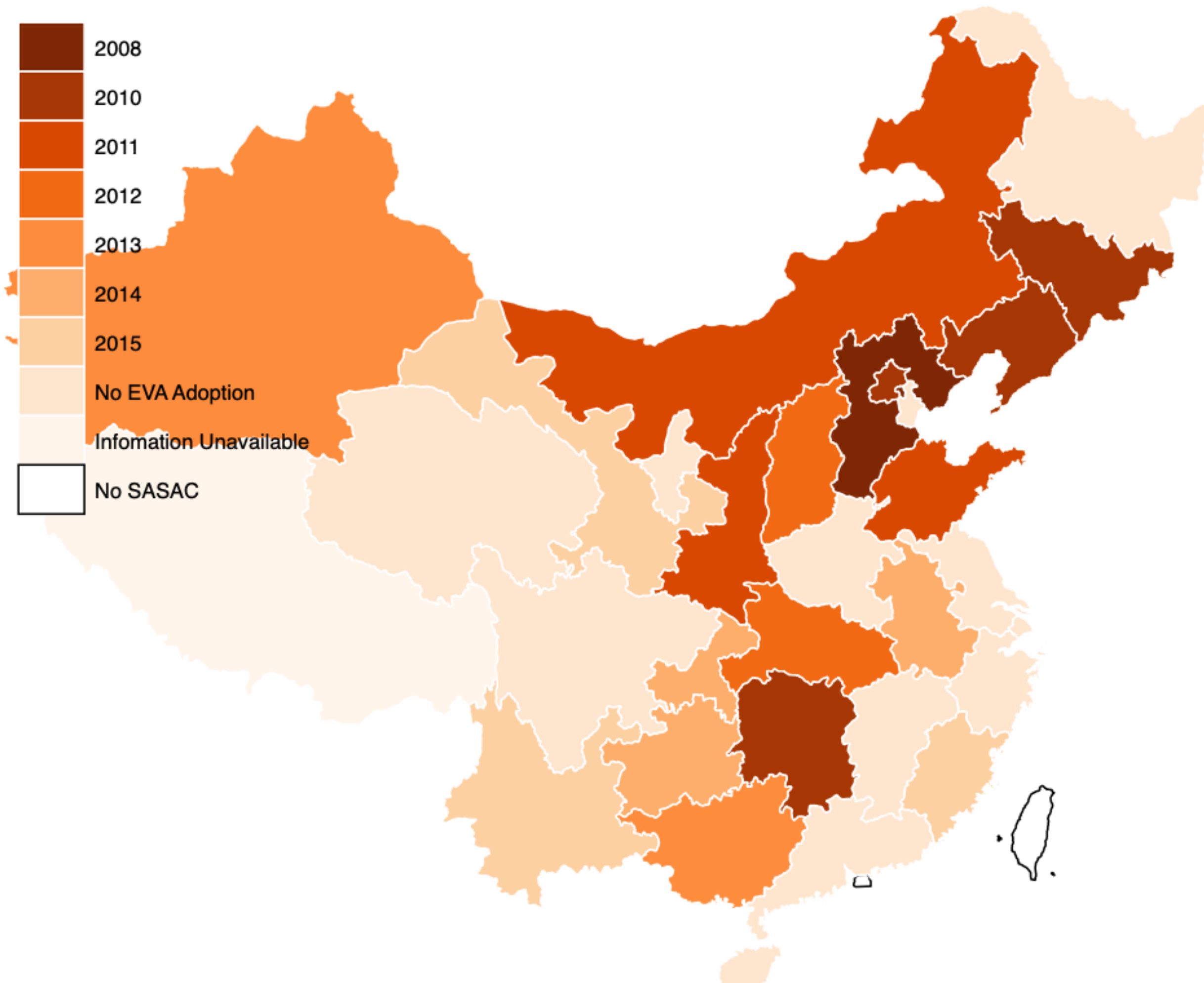
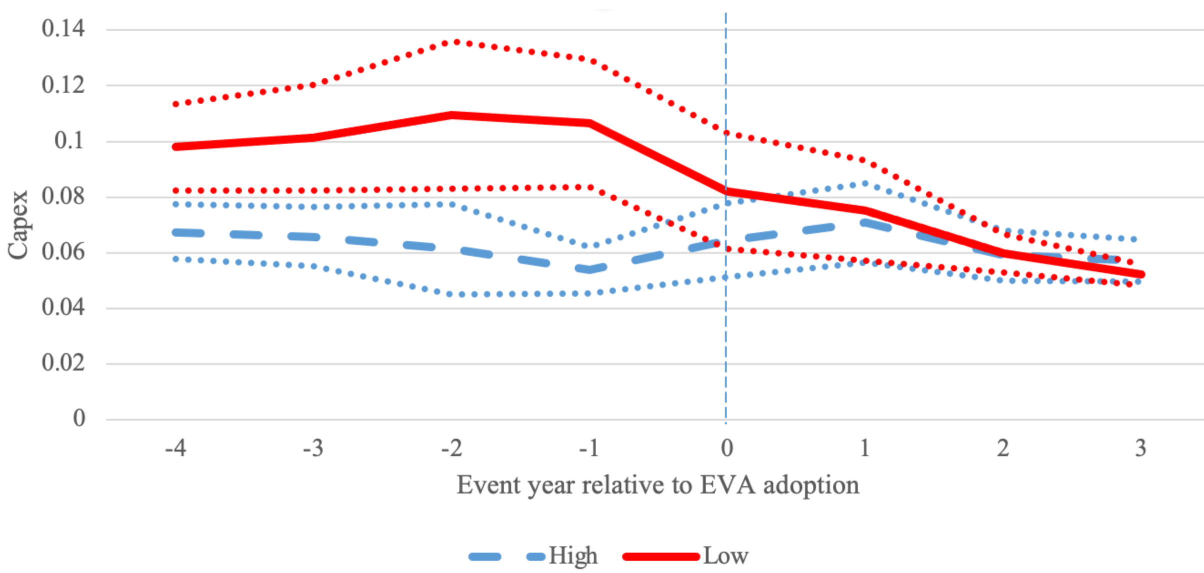


Figure 2: Parallel trends assumption

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

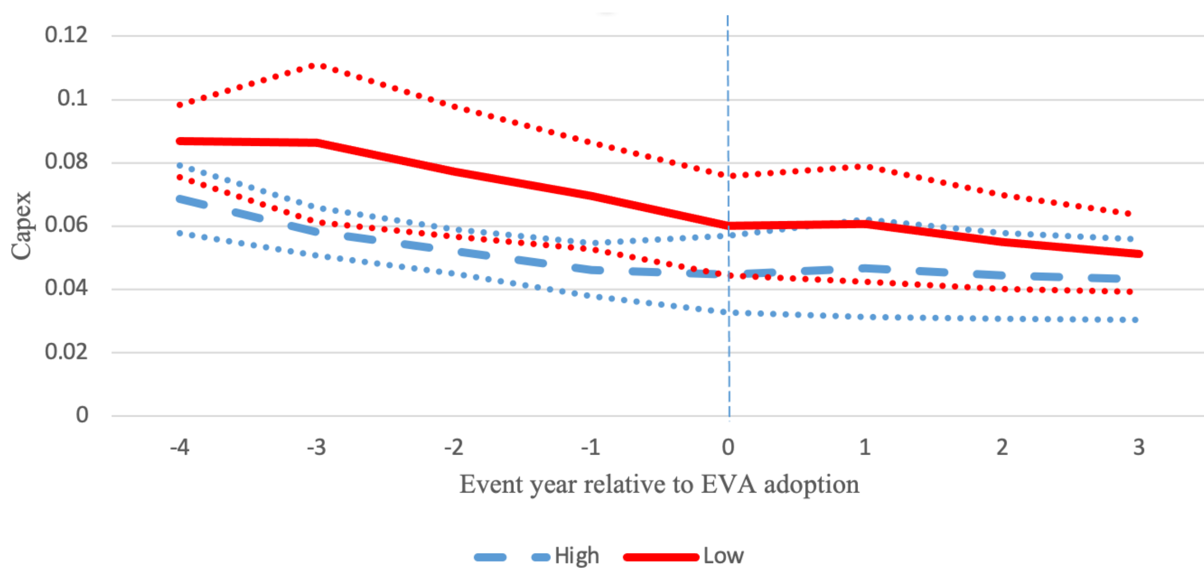
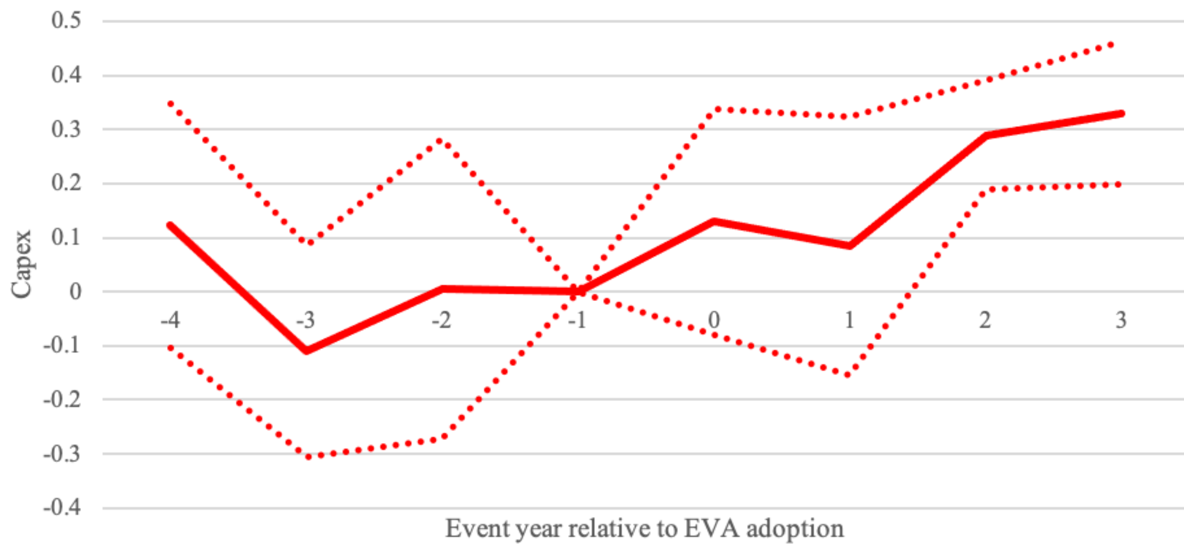


Figure 3: Dynamic regression coefficients

This figure reports the $\beta_{2,s}$ 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 at both the SASAC level and the year level.

$$CAPEX^j_{i,t} = \beta_1 InterestRate^j_{i,t} + \sum_{s\neq-1} \beta_{2,s} Post^j_{i,t,s} + \sum_{s\neq-1} \beta_{3,s} InterestRate^j_{i,t} \times Post^j_{i,t,s} + \gamma' X_{i,t} + \epsilon_{i,t}$$

Panel A: Without the province × year fixed effects



Panel B: With the province*year fixed effects

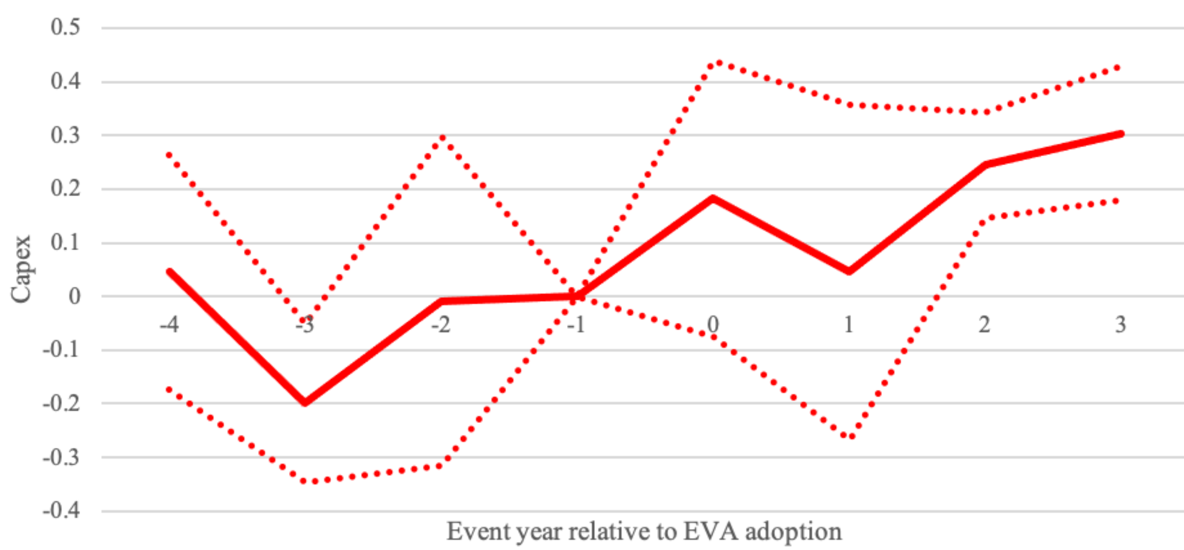
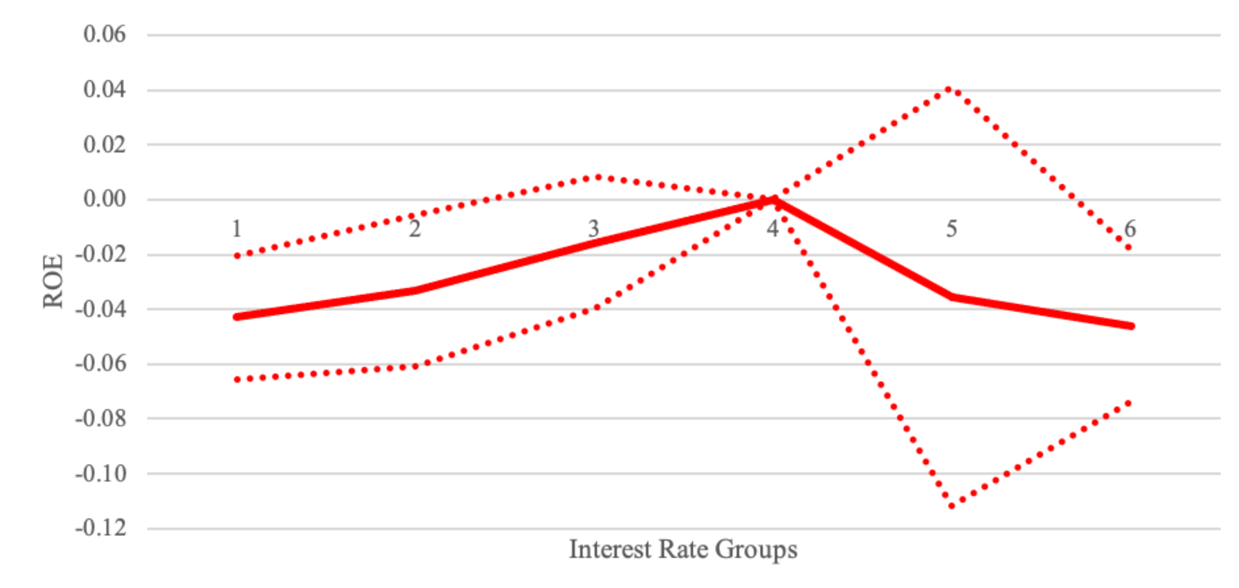


Figure 4: EVA and firm performance

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 3.5%, between 3.5% and 5%, between 5% and 6.5%, between 6.5% and 8%, between 8% and 9.5%, and higher than 9.5%, as group 1, group 2, ..., and group 6, respectively. Panel A displays the β_{Group} coefficients of column 3 of Table 6, and Panel B displays the β_{Group} coefficients of column 4 of Table 6.

Panel A: without the province*year fixed effects



Panel B: with the province*year fixed effects

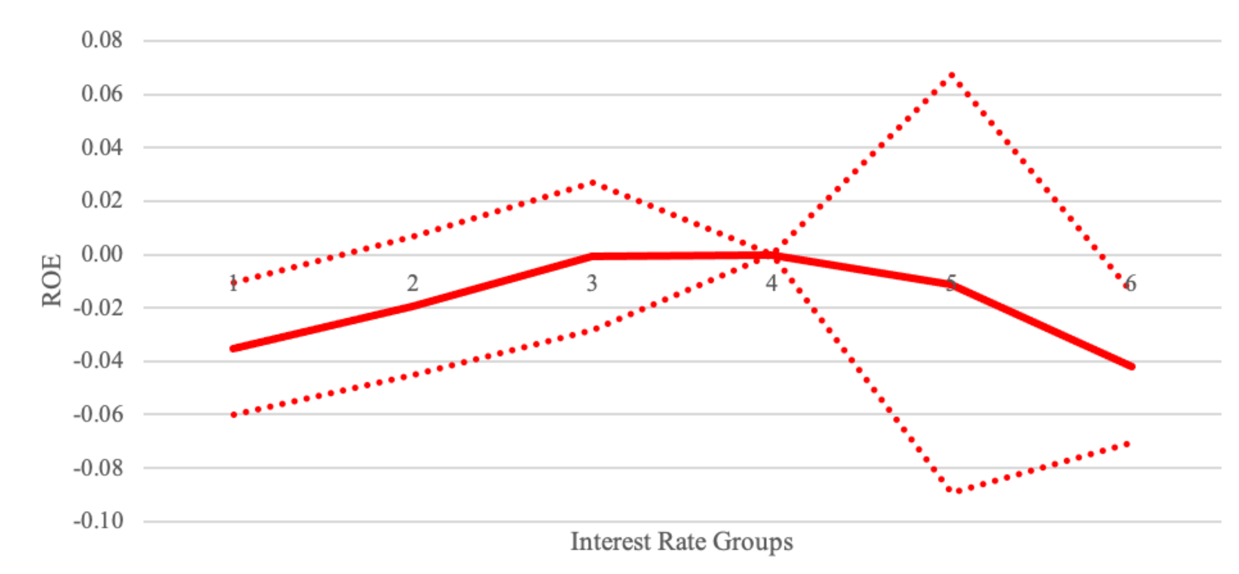


Table A.1: Summary of external equity financing

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 dividend 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	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	Fraction of Firms with cash dividend payment	Fraction of firms with repurchases
2004	2.67%	0.00%	1.60%	1.07%	0.00%	6.91%	13.02%	58.02%	0.00%
2005	0.52%	0.00%	0.00%	0.52%	0.00%	0.00%	40.28%	61.08%	0.00%
2006	5.65%	4.91%	0.00%	0.74%	55.38%	0.00%	3.09%	55.77%	2.70%
2007	11.25%	9.29%	0.73%	1.22%	47.40%	1.92%	1.08%	58.44%	0.24%
2008	10.95%	7.69%	1.18%	2.07%	21.79%	2.32%	3.88%	60.06%	0.00%
2009	10.28%	8.74%	0.77%	0.77%	50.48%	2.17%	1.57%	59.64%	0.00%
2010	11.36%	10.23%	0.76%	0.38%	41.83%	1.26%	0.30%	64.77%	0.38%
2011	9.90%	8.21%	1.21%	0.48%	40.49%	2.97%	0.81%	65.94%	0.00%
2012	9.55%	8.11%	0.95%	0.48%	38.01%	2.71%	1.08%	68.02%	0.00%
2013	14.59%	12.47%	1.65%	0.47%	40.33%	3.15%	0.61%	68.94%	1.18%
2014	12.50%	11.79%	0.71%	0.00%	37.79%	1.18%	0.00%	72.17%	1.65%
2015	17.31%	17.31%	0.00%	0.00%	46.26%	0.00%	0.00%	71.63%	1.68%
Mean	9.77%	8.31%	0.79%	0.66%	40.68%	1.88%	1.45%	63.87%	0.69%

Panel B: Financing activity scaled by lagged assets

Year	External Equity Financing / Lagged Assets	Private Equity Placements/ Lagged Assets	Rights Issues / Lagged Assets	Non-rights public equity offerings / Lagged Assets	Cash Dividends/ Lagged Assets	Stock Repurchases/ Lagged Assets
2004	0.75%	0.00%	0.26%	0.49%	1.30%	0.00%
2005	0.28%	0.00%	0.00%	0.28%	1.51%	0.00%
2006	1.94%	1.86%	0.00%	0.08%	1.37%	0.34%
2007	10.57%	9.91%	0.39%	0.28%	1.30%	0.01%
2008	4.67%	4.13%	0.24%	0.30%	1.29%	0.00%
2009	6.12%	5.78%	0.14%	0.20%	0.99%	0.00%
2010	3.76%	3.53%	0.20%	0.03%	1.02%	0.00%
2011	5.78%	5.54%	0.20%	0.03%	0.99%	0.00%
2012	4.44%	4.18%	0.19%	0.07%	0.96%	0.00%
2013	7.19%	6.76%	0.38%	0.04%	0.89%	0.01%
2014	5.36%	5.24%	0.12%	0.00%	0.83%	0.15%
2015	7.57%	7.57%	0.00%	0.00%	0.85%	0.00%
Mean	4.97%	4.65%	0.18%	0.15%	1.10%	0.05%

Table A.2: Excluding firms with external equity financing

This table reports the results of how the EVA policy affected firm investment. In this table, we exclude firms with any external equity financing from three years before to three years after the EVA policy adoption. We only include the firm-years from three years before to three years after the EVA policy adoption. 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 average 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)	(7)
Post × InterestRate	0.192***	0.203***	0.229***	0.175***	0.136***	0.106***	0.118**
	(3.05)	(5.14)	(3.97)	(4.16)	(3.52)	(5.70)	(2.67)
Post	-0.022***	-0.020***	-0.028***	-0.013*			
	(-2.89)	(-3.10)	(-3.51)	(-2.00)			
InterestRate	-0.354***	-0.330***	-0.296***	-0.086**	-0.054**	-0.070**	-0.094
	(-4.06)	(-5.73)	(-5.50)	(-2.66)	(-3.15)	(-2.42)	(-1.42)
Tobin's Q		0.000	0.002	0.002	0.002	-0.000	0.004
		(0.06)	(1.14)	(1.20)	(1.17)	(-0.08)	(1.29)
CashFlow		0.221***	0.163***	0.071***	0.079***	0.044***	0.019*
		(8.33)	(7.92)	(3.52)	(3.68)	(3.90)	(1.86)
Log(Assets)			0.010***	-0.013	-0.012	-0.025**	-0.038***
			(5.10)	(-1.52)	(-1.59)	(-3.23)	(-3.39)
Leverage			-0.046***	-0.067*	-0.066	-0.037	0.015
			(-4.49)	(-1.88)	(-1.81)	(-1.21)	(0.37)
Observations	993	993	993	950	931	905	863
R-squared	0.029	0.098	0.149	0.609	0.622	0.700	0.773
Firm FE	NO	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	NO	NO	NO	YES	YES	YES
Industry*Year FE	NO	NO	NO	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	NO	NO	NO	YES

Table A.3: 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 average 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	0.003	0.003	-0.000	0.001	0.006	0.006**	0.003	0.005
	(0.58)	(0.64)	(-0.07)	(0.19)	(1.60)	(2.26)	(0.96)	(1.25)
Post	0.015*				0.008			
	(2.01)				(1.47)			
MRPK	0.015***	0.015***	0.017***	0.018***	0.008***	0.008***	0.009***	0.006***
	(3.68)	(5.07)	(5.57)	(4.59)	(4.41)	(5.09)	(4.54)	(3.38)
Tobin's Q	0.001	0.002	0.001	0.001	0.007***	0.007***	0.006**	0.006**
	(0.40)	(0.39)	(0.35)	(0.14)	(4.06)	(4.17)	(2.62)	(2.37)
CashFlow	0.026	0.040	0.039	-0.003	0.042***	0.035***	0.022***	0.008
	(0.98)	(1.29)	(1.25)	(-0.10)	(6.83)	(4.18)	(5.91)	(0.76)
Log(*Assets*)	-0.029**	-0.029**	-0.030**	-0.037***	-0.024**	-0.025***	-0.026***	-0.031***
	(-3.05)	(-2.96)	(-2.90)	(-3.64)	(-3.01)	(-3.27)	(-3.18)	(-3.64)
Leverage	-0.047	-0.038	-0.032	-0.009	-0.045	-0.032	-0.032	-0.026
	(-1.52)	(-1.17)	(-1.04)	(-0.23)	(-1.75)	(-1.33)	(-1.57)	(-1.19)
Observations	1,926	1,877	1,865	1,837	4,067	4,026	4,005	3,989
R-squared	0.489	0.565	0.587	0.663	0.499	0.545	0.577	0.622
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