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

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Abstract

We study how managerial incentive affects firm behavior by studying a staggered reform in the Chinese state-owned enterprise (SOE) performance evaluation policy. To encourage a more efficient allocation of capital, starting 2010 Chinese regulators switched from using return on equity (ROE) to economic value added (EVA) when evaluating SOE performance. However, the new EVA policy stipulated a fixed cost of capital for virtually all the SOEs. We show that SOEs responded to the managerial performance evaluation reform by altering their investment decisions. This behavior reduced shareholder values, and more so when the actual cost of capital was further away from the stipulated one. Our study provides causal evidence of the importance of incentive schemes in corporate governance.

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

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> What gets measured gets managed – even when it's pointless to measure and manage it, and even if it harms the purpose of the organization to do so.
>
> – Typically credited to Peter Drucker

1 Introduction

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

In this article, we present causal evidence on the relationship between managerial incentives and firm behaviors by exploiting a staggered policy adoption experiment. 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 them was return on equity (ROE) initially, and later was replaced by economic value added (EVA) starting 2010. EVA is a measure of economic profit; it is is supposed to be a better performance measure than ROE, which captures accounting profit (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, and this reform should help improve the capital allocation efficiency in Chinese economy.

However, as typical in reforms conducted in transition and developing economies, the devil is always in the details. Instead of using firm-specific costs of capital as theory suggests, the Chinese central SASAC—who lacks the knowledge of these local knowledge a 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,

[1]The reason that the SASAC chose 5.5% as the cost of capital was never disclosed. 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%. The Vice Director of the SASAC, Shuhe Huang, said, "The capital returns have to be higher than bank loan interest rate." (Adfaith, 2005). This seems to suggest that 5.5% was chosen to equal the bank loan interest rate. However, the 5.5% stipulated cost of capital is after-tax, while the bank loan interest rate is before tax.

if decided to adopt the EVA policy, also chose to follow, albeit in different years. SOEs has long been criticized for overinvestment because of their preferential credit access (Brandt and Li (2003); Song, Storesletten, and Zilibotti (2011)). The EVA policy's primary motivation was to urge SOE managers to manage capital more efficiently (Stern, 2011). Based on our estimation, the average after-tax interest rates of our sampled publicly-listed SOEs were 4.4%. Although the stipulated cost of capital 5.5% was indeed higher, it is not by a significant margin, let alone the fact that the the implementation of EVA reform ignores the potential heterogeneity of firm-specific cost of capital.

The first question is whether firms changed their investment in response to the EVA policy, as the cost of capital is at the core of capital budgeting. During our sample period, China had strong regulations on external equity financing, and we hence assume that firms adjust their financing margin via debt at their firm-specific borrowing interest rate.[2] Under the ROE policy, a firm invests until its marginal operating profit equals its actual marginal cost of debt, while under the EVA policy the firm invests until its marginal revenue equals the fixed 5.5% cost of capital stipulated by the SASACs. Assuming a decreasing return to scale, we expect that the higher the marginal cost of debt a firm had before the EVA adoption, the more the firm investment will increase in the post-EVA period.

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 Exchange. From 2010 to 2015, the central SASAC and 14 provincial SASACs adopted the same EVA policy. The staggered nature of the EVA policy adoption provides a set of counterfactuals for how firm investment would have evolved in the absence of the EVA policy and allows us to disentangle the effect of the EVA policy.

A simple empirical example serves to illustrate our identification strategy, which essentially is a difference-in-differences-in-differences (DDD) approach. The Beijing SASAC (treatment group) adopted the EVA policy in 2012. Following the EVA 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 (DD) estimation. One concern of the DD estimation is that firms with different

[2]We provide more discussions on the external equity financing regulation in Section 5.4.2.

interest rates are different, and investment opportunities may have changed in 2010 in a way that affected Beijing SOEs with different interest rates differently, regardless of the EVA adoption. To control such possible contemporaneous developments, we compare the DD estimation of the SOEs controlled by the Beijing SASAC with a similarly calculated DD estimation of the SOEs controlled by other SASACs without an EVA adoption in 2012, say Shanghai (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 2012 regardless of their SASACs, the DD estimation of Shanghai provides a counterfactual of Beijing's DD. 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) increase in a firm's interest rate 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 investment is 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. For both the treatment and the control SASACs, in the pre-EVA period, the investment of the high and low interest rate SOEs exhibit parallel trends. In the treatment group, the shrinkage in the investment difference between the high and low interest rate groups mainly occurred in the first year when the EVA became effective; in contrast, the shrinkage of the control group is much smaller, and spread out over several years. The different patterns in the shrinkage strengthen the causal interpretation of the results.

One remaining concern of the above DDD strategy is the potential endogeneity of the EVA policy adoption. 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 timing does not seem to be correlated with many provincial-level factors. Nevertheless, we fully 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 of a SASAC affects all the firms under the control of this SASAC, independent of firms' location. Although most SOEs and their

SASAC locate in the same province, some firms locate in other provinces. The central SOEs locate 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]

After establishing the results that the EVA policy affected firm investment, we 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. The EVA policy's primary motivation was to reduce SOEs' overinvestment problem due to their preferential credit access, without changing the preferential credit access. To maximize valuation, a firm should use its actual interest rate instead of the policy-stipulated one. The EVA policy represented the government's will, i.e., the controlling shareholder, but not necessarily that of the small shareholders. The managers with equity ownership had a more aligned incentive with the small shareholders, but the managers with government experience had a more aligned incentive with the government. Our results show that the EVA policy's impact was weaker for firms where managers had equity ownership and stronger for firms where managers had government experience.

The EVA policy also had implications on firm performance. The EVA policy leads firms to deviate from using their actual borrowing cost toward the stipulated interest rate. For firms with an interest rate higher than the stipulated one, the EVA policy encouraged them to increase their investment, leading to overinvestment. For firms with an interest rate lower than the stipulated one, the EVA policy discouraged them from increasing their investment, leading to underinvestment. Both are value-destroying. We expect a firm's performance decreased more when its interest rate was further away from, either above or below, the stipulated one. Our results confirm this prediction. When we measure firm performance using the market-to-book ratio, our estimation suggests that the market-to-book ratio of an average firm decreased by around 0.09 due to the EVA policy. On average, such a decrease was associated with a lost market capitalization of RMB 0.94 billion ($0.13 billion) per firm and RMB 602 billion ($86 billion) in aggregate.

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

[4] We explore another variation in the data that can address this concern, by treating non-SOEs as placebo as 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.

In the last part of the paper, we investigate the EVA policy's aggregate capital allocation effect. Although the EVA policy hurts individual firms' performance, it may improve aggregate capital productivity if it mitigated the capital misallocation problem caused by policy-distorted interest rates. Capital allocation efficient may increase either because the EVA policy reallocated capital within SOEs (from less efficient SOEs to more efficient SOEs), or from SOEs to non-SOEs that are widely considered more capital productive (Song, Storesletten, and Zilibotti, 2011; Brandt, Tombe, and Zhu, 2013).

Our results show no evidence that the aggregate capital allocation efficiency had improved due to the EVA policy. Theory predicts that the aggregate capital productivity is the highest when the marginal product of capital equalizes across firms (Hsieh and Klenow, 2009). Following the macroeconomic literature (Hsieh and Klenow, 2009; Chen and Song, 2013), we use the dispersion of the marginal revenue product of capital (MRPK) as an inverse measure of capital allocation efficiency and find no significant change in the dispersion of MRPK. We find no evidence that the EVA policy reallocated capital from low MRPK SOEs to high MRPK SOEs. This result may not be surprising because the EVA policy reallocated capital from low interest rate SOEs to high interest rate SOEs, and interest rates and capital efficiency were uncorrelated in our sample. We find no evidence that the non-SOEs increased their investment more than the SOEs after the EVA adoption, suggesting no capital reallocation from SOEs to non-SOEs, consistent with the criticism that the stipulated cost of capital was not high enough (Stern, 2011).[5]

Literature Review. This paper contributes to the literature studying whether and how manager incentives affect firm operation and performance, both in China and beyond. Its primary contribution is to present clean evidence using a natural experiment. Groves, Hong, McMillan, and Naughton (1994) study Chinese SOE reforms of the 1980s when the responsibility for firm decisions was shifted from the government to the firm and when firms were allowed to retain more profits. They find that firm autonomy and profit retention led managers to strengthen workers' incentives and increase workers' productivity. In the US, most studies have focused on how CEO pay struc-

[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 financial crisis never happened.

ture (e.g., pay-performance sensitivity, option grants, and deferred compensation) correlates with firm policy and performance.[6] As compensation arrangements are endogenous, it is hard to interpret these correlations as causal (Frydman and Jenter, 2010; Edmans, Gabaix, and Jenter, 2017). Notable exceptions are Edmans, Fang, and Lewellen (2017) that study how CEOs' equity vesting affects their firms' real investment decision, Edmans, Goncalves-Pinto, Groen-Xu, and Wang (2018) that study how equity vesting affects firms' strategic news release, Shue and Townsend (2017) that study how exogenous CEO option grants affect firm risk-taking, and Flammer and Bansal (2017) use a regression discontinuity framework and find the narrowly passed shareholder proposals that grant executives long-term incentives increases firm value.

This paper also contributes to the literature on capital allocation efficiency. 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). Most relevant to ours are studies on policy distortion caused by SOEs' cheaper credit access. 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 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%.

Our study provides direct evidence that policy regulation of the cost of capital has a first-order impact on capital allocation. Our study also contributes to the literature on SOE reforms. Most studies have documented beneficial effects of SOE (partial) privatization (Groves, Hong, McMillan, and Naughton, 1994, 1995; Hsieh and Song, 2015; Gan, Guo, and Xu, 2018). Starting from the early 2000s, most small SOEs had been privatized. SASACs were established to monitor the remaining big SOEs (Naughton, 2008, 2015; Li and Zhang, 2020). Instead of continuing the privatization, SASACs focused their monitoring on setting up manager evaluation rules. The EVA reform was one of the most significant reforms since then. Our evidence shows that it was not very successful. From a positive perspective, our results show that the EVA policy changed firms' investments by

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

changing the hurdle rates used for capital budgeting. If the hurdle rates were stipulated properly, such a policy might play a positive role.

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 US. One such example is the Tennessee Valley Authority (TVA), which is wholly owned by the federal government and enjoys the implicit federal government guarantee of its debt. Throughout the world, governments provide implicit or explicit guarantees to too-big-to-fail financial institutions and non-financial firms, transferring risks 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 guarantee in their decision making, especially when removing such guarantees is not an option.

This paper proceeds as follows. Section 2 describes the regulations of the Chinese SOEs and the details of the EVA policy. In Section 3, we develop a simple framework and develop our hypotheses. Section 4 describes the data. Methodology and results on firm investment and performance are in Section 4. Results on the aggregate capital allocation efficiency are in Section 5. Section 6 concludes.

2 Chinese SOEs and the EVA Reform

We provide institutional background in this section.

2.1 The SOE System in China and the SASAC

The SOE system in China had 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 November 2002. 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 board 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.[7] The SASAC makes their rewards or punishment and personnel decisions of SOE managers based on these evaluations.[8]

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 monitoring of the SASAC of 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 four objective performance measures. Two of these measures are mandatory across all SOEs. Each SOE must also choose two of the following three other measures: inventory turnover, accounts receivable turnover, and sales growth. From 2004 to 2009, the two mandatory measures are 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 40, ROE (and later EVA) has 40, and each of the other two non-mandatory measures has 15.

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 $\pm 20\%$). 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

[7] 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).

[8] 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.

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.[9] 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. Executive incentive pay is a direct function of the rating they get.

2.3 The EVA Reform

In 2010, the central SASAC replaced ROE (net income before non-recurrent 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.[10] EVA measures value creation for shareholders, and theoretically, it is a better performance measure than ROE that measures accounting profit (Rogerson, 1997). More specifically, define Adjusted Capital to be[11]

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

[9] 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. By linking the target to past three years' performance also mitigate the ratchet effect, as the average manager tenure is 2.5 years.

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

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

and Net Operating Profits after Tax (NOPAT) to be

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

then Economic Value Added (EVA) can be calculated as

$$\text{EVA} = \text{NOPAT} - \text{Adjusted Capital} \times \text{Cost of Capital}. \tag{1}$$

The EVA formula adds after-tax interest expenses back to net income and fixes the "Cost of Capital" in Eq. (1) at 5.5%. The factor of 0.75 is to adjust tax, as the running tax rate at that time in China is 25%. As a result, it is as if the new policy stipulates a 5.5% after-tax interest rate on the firm, with a pre-tax interest rate of 7.3% (5.5%/0.75). In Section 3, we develop our hypotheses on how the EVA policy affects firm investment and valuation.[12]

The stipulated cost of capital of 5.5% applies to virtually all the SOEs, with some exceptions.[13] One such exception is for firms with too high leverage; specifically, industrial firms with debt/asset ratios higher than 75% or non-industrial firms with debt/asset ratios higher than 80% 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 (Section 5.2.1).

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 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 was effective (Hennessy and Strebulaev, 2020).

[12] Besides the above change, the EVA policy adds back R&D expenses and half of the nonrecurring income. These adjustments may have changed firms' policy. 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 5.4.3, we confirm that the EVA policy did increase firms' R&D expenses, providing evidence that the EVA policy had affected SOEs' behaviors.

[13] 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.

2.4 The Staggered Adoption of the EVA Policy

We manually collected the information on the details of the EVA policy of each province.[14] We primarily rely on the performance evaluation reports or announcements available at the SASAC websites and occasionally on our direct contact with SASAC officials. We end our sample in 2015 because the government revised the EVA policy but did not disclose the details of the new performance evaluation policy.

Although the majority of the local SASACs adopted the same rules as the central SASAC, some provincial SASACs adopted different rules in calculating the cost of capital. Hebei and Gansu consider the actual cost of debt in their EVA calculation. 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. We exclude these four provincial SASACs from our main analysis. The four SASACs account for about 9% of our final sample. Including them does not have any material impact on our results. We also exclude Tibet SASAC because its information is missing. In our final sample, besides the central SASAC, we have 14 provincial SASACs that also adopted the EVA policy.

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, 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, 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

[14] 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, 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, the information on local EVA policy adoption for lower level governments is very difficult.

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. Largely 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.

3 A Theoretical Framework

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

3.1 The Setting

Consider an SOE firm with the following project. Conditional on survival at the end of period $t-1$, the firm chooses the capital scale of K_t which is financed by (one-period) debt D_t and equity E_t. During period t, the firm generates cash-flows of

$$F(K_t) = F(D_t + E_t);$$

with usual regularity conditions $F'(K) > 0$ and $F''(K) < 0$. At the end of period t, with probability p the firm fails, which yields zero cash-flows afterwards and hence the firm defaults on its short-term debt. The default probability p conditional on survival corresponds to hazard rate in other contexts.

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. Also, because our model is cast in a stationary setting, we omit the time index from now on.

In our model, conditional on survival $F(K)$ is the firm's earnings before interests and taxes

(EBIT). We assume that the cash-flows $F(K)$ given success is sufficiently high, which implies that the one-period debt is repaid with probability $1-p$. Given a risk-free rate of r, the break-even interest rate charged the lenders, which is also the firm's competitive borrowing rate, is

$$r_D = \frac{1+r}{1-p} - 1 = \frac{r+p}{1-p} > 0. \tag{2}$$

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 gate keeper of China's stock market, requires a firm having 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 A2 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 issuances were done by private equity placements. Private equity placements also needed regulatory approval, but they did not require positive earnings nor any requirements on dividend payout. As a result, they were relatively easier to get approval. However, we find that the average private placement's issuance amount is huge. Conditional conducting a private placement, the new issuance is 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 non-existent. As a result, we view that the equity adjustment cost is high, and assume that the debt is the margin to adjust for investment financing.[15]

There is another key implication behind the competitive borrowing rate (2) in our model.

[15]Table A2 in the Appendix reports the summary statistics on our sample firms' external financing activities. In Table A3, we report results if we exclude firms that conducted external equity issuance.

Eq. (2) implies that the equilibrium borrowing rate r_D is not a function of D (i.e., leverage). 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. It is also possible that firms may game the new rule by increasing risk-taking. We do not find such evidence.

For our application of SOE reform, we also allow r_D to depend on some other economic variables, say government subsidy. $r_D(\theta)$, which takes the following form

$$r_D(\theta) \equiv \frac{1+\theta r}{1-p} - 1$$

which essentially scales the risk-free rate. As a result the expected interest rate expense is

$$\mathbb{E}[InterestRate] = (1 + r_D(\theta))(1-p) - 1 = \theta r \tag{3}$$

3.3 Model Implications

We now derive the main model implications.

Before the EVA policy, the SOE manager maximizes the firm's ROE (using (3)):

$$\max_D ROE = (1-\tau)\frac{\mathbb{E}[EBIT - InterestRate \cdot D]}{E}, \tag{4}$$

$$= (1-\tau)\frac{F(D+E) - ((1-p)r_D(\theta) - p)D}{E} \tag{5}$$

where τ denotes the tax rate (i.e., 25%). As a result, the first-order condition reads

$$F'(K_{ROE}) = (1-p)r_D(\theta) - p = \theta r, \tag{6}$$

which gives the optimal ROE^*. The resulting market-to-book (MB), which is defined as the equity value (conditional on survival) per unit of equity book value, can be calculated as

$$MB_{ROE} = \frac{MV_{equity}}{E} = \frac{1}{E}\frac{(1-\tau)\mathbb{E}[EBIT - InterestRate \cdot D]}{r+p} = \frac{ROE^*}{r+p}. \tag{7}$$

Under the EVA policy, the SOE manager maximizes its EVA defined as

$$\max_{D} EVA = \left[(1-\tau) F(D+E) - 5.5\% \times (D+E)\right]. \tag{8}$$

As a result, the SOE's first-order condition is (with $\tau = 25\%$)

$$F'(K_{EVA}) = \frac{5.5\%}{1-\tau} \simeq 7.3\%. \tag{9}$$

And under EVA the market-to-book can be derived similarly as

$$MB_{EVA} = \frac{ROE_{EVA}}{r+p}. \tag{10}$$

By comparing the investment policies and valuations under the two regimes, we have the following proposition which forms the basis of our empirical analysis.

Proposition 1. *Suppose that the default probability $p \simeq 0$. Our model have the following predictions.*

1. *$K_{EVA} - K_{ROE}$ increases with $r_D(\theta)$: Relative to the ROE policy, under the EVA policy, an SOE increased their investment more when its cost of borrowing was higher.*

2. *Both $ROE_{EVA} - ROE^*$ and $MB_{EVA} - MB_{ROE}$ are hump shaped in r_D, and reach their maximum levels when $r_D = 7.3\%$. Relative to the ROE policy, under the EVA policy, an SOE's ROE and the market-to-book ratio decrease more if the difference between its interest rate and 7.3% became larger.*

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 (6) is affected by the interest rate $r_D(\theta)$. More specifically, the greater the subsidy (i.e., the smaller the θ), the lower the interest rate $r_D(\theta)$, the greater the increase of the investment after the EVA adoption. Our second result says that from the perspective of individual shareholders, the EVA policy is value-destroying; and note that the market-to-book ratio and ROE is one-to-one in light of Eq. (6) and (10). 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 $r_D = 7.3\%$.

Equations (6) and (9) also deliver an important implication of EVA adoption on capital allocation efficiency.

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. One straightforward test of this assumption is whether their investment adjustment following the EVA adoption is by issuing debt. We will provide supporting evidence for this prediction. Our results are also robust if we exclude firms that conducted external equity financing around the EVA policy adoption (see Table A.3 in the Appendix).

4 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 – Shanghai Stock Exchange and Shenzhen Stock Exchange.[16] 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.

We begin with 11,236 firm-year observations (1,196 unique firms) for non-financial SOEs.[17] We classify a firm as an SOE if its ultimate controlling party is the state. We manually collected the identity of firms' controlling shareholders.[18] 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

[16] 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, the data for the post-2008 period are not available to researchers, and therefore cannot be use for our study.

[17] 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.

[18] 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).

find the information on whether they adopted the EVA policy. We exclude SOEs controlled by the SASACs of Hebei, Gansu, Anhui, and Shaanxi (426 observations) because they do not set the cost of capital at 5.5% in their EVA policy. [19] Based on the EVA policy, firms with too high leverage have a stipulated cost of capital of 6%. Based on this, we exclude 397 observations. 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. [20]

Table 2 reports the summary statistics of the sample. Panel A reports the mean, median, standard deviation, and the 25^{th} and 75^{th} percentiles of the variables used in our analysis. Panel B reports the correlation matrix. *Capex* is capital expenditure divided by lagged total assets. *InterestRate* is proxied by 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. Total 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 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 lagged total assets. *Log(Assets)* is the natural logarithm of total assets. *Leverage* is defined as total liabilities divided by total assets. $CEOOwnership$ is the 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.

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

[19] These four SASACs are interesting by themselves. However, the number of firms is so much to warrant any statistical analysis.

[20] A firm's controlling shareholder can change in various ways: between two governments (between different levels of governments, or from one provincial government to another provincial government, and so on), 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.

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)).

5 Main Empirical Results

5.1 Empirical pattern from raw data

Figure 2 presents the test on parallel trends assumption.[21] Panel A reports the results of the treatment SASACs, and Panel B reports the results of the control SASACs. For treated SASACs that adopted the EVA policy in year t, we use the SASACs that 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 was 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 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 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.

5.2 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

[21] An SOE's controlling shareholder may change from one SASAC to another. As a result, an SOE subject to the EVA policy may become not subject to the EVA policy in a later year. In our sample, there are 27 such changes. Due to the difficulty of defining the event year, we exclude these 27 firms from this analysis. Our results are very similar if we use the first time an SOE became subject to the EVA policy and ignore the following controlling shareholder change.

lower cost of debt. Specifically, we run the below baseline model for our DDD strategy:

$$CAPEX^j_{i,t} = \beta_1 InterestRate^j_{i,t-1} + \beta_2 Post^j_{i,t} + \beta_3 Post^j_{i,t} \times InterestRate^j_{i,t-1} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t}. \quad (11)$$

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. Depending on the specification, we include firm fixed effects, year fixed effects, industry×year fixed effects, and SASAC×year fixed effects. The main prediction is that $\beta_3 > 0$. We double-cluster standard errors by SASAC and year.[22]

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 $Tobin'sQ$ 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 time-varying SASAC-level and industry-level factors. The coefficient of the interaction term is similar across different specifications, and the statistical significance is even higher 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 EVA adoption, a 1% increase in InterestRate is associated with a 0.359% decrease in $Capex$. In the post-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%.[23] 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

[22] 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), instead of reporting the double-clustered t-statistics, we report the more conservative t-statistics clustered by SASAC.

[23] In Table A3, we exclude firms that have done any external equity financing during the seven years around the EVA policy adoption and find similar results.

observables and hence mitigate this concern. However, it is impossible to take all possible factors into account, especially unobservables.

To provide further evidence, we take advantage of the fact that not all firms controlled by one SASAC locate in the same province, and the central SASAC SOEs locate around 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.

5.2.1 Robustness Tests

Dynamic estimations Table 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* × *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.

Placebo test using non-SOEs The EVA policy only affected SOEs. We use the non-SOEs as a placebo sample. In this placebo test, we examine whether the EVA policy adopted by a provincial SASAC affected the non-SOEs located in this province. Suppose 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 the non-SOEs with different interest rates changed their investments differently, similar to the SOEs.

In Table 4, we estimate the baseline regressions reported in Table 3 but using the non-SOE sample. We also replace the $SASAC \times year$ fixed effects with the $province \times year$ 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.

Other robustness test In Table 5, we conduct three 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 (11.0%). In Panel C, we drop firms with leverage higher than 75% because the SASACs set their cost of capital at 6%, which is 0.5% higher than other firms. The estimations from Panels A and C 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 three alternative specifications.

5.3 The Impact on ROE and Equity Valuation

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 underinvest, and firms with interest rates lower than 7.3% will overinvest. In both cases, the firm value will decrease.

We adopt two firm performance measures: the market-to-book ratio as a stock-market based

performance measure and ROE as an accounting measure. The market-to-book ratio is calculated as the market value of equity divided by the book value of equity. ROE is income before extraordinary items divided by lagged total equity.

To quantify the impact of the EVA policy on firm performance, we estimate the below model

$$Y_{it} = \beta_1 Gap_{i,t-1} + \beta_2 Post_{i,t} + \beta_3 Gap_{i,t-1} \times Post_{i,t} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t} \tag{12}$$

where $Y_{i,t}$ is firm i's performance in year t, either the market-to-book ratio or ROE. $Gap_{i,t}$ is the absolute difference between a firm's $InterestRate$ and 7.3%. We expect that β_3 in Equation (12) to be negative.

We also run Eq. (13) to examine whether the results are driven by firms with interest rates higher or lower than 7.3% or both. $High_{i,t-1}$ ($Low_{i,t-1}$) are two dummy variables that are equal to one if $InterestRate$ is higher (lower) than 7.3%. We expect both λ_1 and λ_2 are negative.

$$\begin{aligned} Y_{i,t} =& \lambda_1 Gap_{i,t-1} \times Post_{i,t} \times High_{i,t-1} + \lambda_2 Post_{i,t} \times High_{i,t-1} + \lambda_3 Gap_{i,t-1} \times High_{i,t-1} \\ & \lambda_4 Gap_{i,t-1} \times Post_{i,t} \times Low_{i,t-1} + \lambda_5 Post_{i,t} \times Low_{i,t-1} + \lambda_6 Gap_{i,t-1} \times Low_{i,t-1} + \boldsymbol{\gamma}' \boldsymbol{X_{i,t}} + \epsilon_{i,t} \end{aligned} \tag{13}$$

The results in the first four columns of Panel A of Table 6 show that, after the EVA, the market-to-book ratio decreases more if a firm's $InterestRate$ is further away from 7.3%. In the last four columns, both λ_1 and λ_2 are negative (although not always statistically significant), showing that the market-to-book ratio decreases more if a firm's $InterestRate$ is further away from 7.3%, for both firms with $InterestRate$ higher and lower than 7.3%. The results in Panel B of Table 6 show similar results for ROE.

Figure 4 displays the relation between $InterestRate$ and change in firm performance graphically. We sort all the firms into five groups by $InterestRates$. Group 1 contains firms with an interest rate lower than 2.5%. Groups 2 contains firms with an interest rate between 2.5% and 5%. Other groups are similarly defined. Groups 5 contains the firms with an interest rate higher than 10%. For each of the five groups, we calculate the change in the performance of the treatment firms relative to the control firms in the same interest rate group. The results of the market-to-book ratio (Panel A) and ROE (Panel B) reveal that the EVA policy-induced firm performance reduction

is the lowest for the third interest rate group, i.e, when $InterestRates$ is between 5% and 7.5%. 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 1 of Panel A, we find that a 1% deviation of interest rate from 7.3% is associated with a 0.0343 decrease in the market-to-book ratio. The average Gap is 2.71%. Hence, the EVA policy decreases the market-to-book ratio by 0.093 for an average firm. The mean book value of equity is RMB 10.13 billion ($1.45 billion). A 0.093 decrease in the market-to-book ratio is RMB 0.94 billion ($0.19 billion). There are 638 SOEs in our sample. In aggregate, this is a 602 billion ($122 billion) loss, which is economically huge. The effect on ROE is also sizable. Based on the estimation in column 1 of Panel B, a 1% deviation of interest rate from 7.3% is associated with a 0.38% decrease in ROE. Overall, these results support point 2 in Proposition 1.

5.4 Potential economic mechanisms and further supporting evidence

5.4.1 Heterogeneity tests

In Table 7, 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 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— $Post \times InterestRate \times PoliticalConnection$ and $Post \times InterestRate \times CEOOwnership$—into our baseline specification (11). 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 7 report the results on political connection, and the next four columns report the results on CEO ownership. The results in Table 7 confirm these two predictions.

5.4.2 Other firm economic behaviors

External financing As discussed in Section 3, we expect that firms adjust their investment by issuing or retiring debt. We test this prediction in Table 8. 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 placements), scaled by lagged total assets.

The results in Table 8 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 the magnitude of the coefficient of $Post \times InterestRate$ in the regressions of long-term debt financing is similar to that in the investment regressions in Table 3. 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.

One maintained assumption is that firms do not game the EVA rule by increase risk-taking. They may do so as under the EVA rule, the cost of capital is not adjusted if risk gets higher and borrowing cost increases. This predicts that all EVA firms will increase their debt financing. The results in Table 8 reveal no such evidence. If we multiply the coefficient of $Post \times InterestRate$ with the average $InterestRate$ (5.7%), and plus the coefficient of $Post$, we get the average effect of the EVA policy on firms' financing. It is clear that the EVA policy did not have a significant effect on firms preference over debt or equity.

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. In Table 9, we investigate the impact of the EVA policy on firms' R&D expenses. Because the impact on R&D is not a function of a firm's interest rate, in the regressions, instead of estimating the coefficient of $Post \times InterestRate$, we estimate the coefficient of $Post$. The dependent variable is 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 evidence that the SASAC policies had significant impact on SOEs' behaviors.

6 Does EVA Policy Improve Capital Allocation?

In this section, we evaluate whether the EVA policy improved the aggregate capital allocation efficiency. The primary motivation of the EVA policy was to urge SOE managers to manage capital more efficiently. SOEs have cheaper access to capital due to the implicit government guarantee. The government tried, via the EVA policy, to increase their hurdle rates without changing their actual cost of capital or removing the implicit government guarantee. The main rationale was that the stipulated 5.5% cost of capital was higher than the actual cost of capital of SOEs, and SOEs will reduce their investment. Based on our estimation, the average after-tax interest rates of our sampled publicly-listed SOEs were 4.4%. The stipulated cost of capital was indeed higher but not by a significant margin.

How the EVA policy affected aggregate capital productivity critically depends on what caused different SOEs to have different costs of capital. Suppose that, in the absence of any policy subsidy, all the SOEs' interest rates would have been 5.5%, and different levels of policy subsidy fully caused the difference in individual SOEs' actual interest rates. The EVA policy would have increased capital allocation efficiency by incentivizing firms not to make capital budgeting decisions based

on their actual but distorted interest rates. In contrast, suppose that the actual interest rates were unaffected by any policy subsidy but due to different risk exposures. The EVA policy would have increased capital misallocation. The reality was probably somewhere between the above two extreme cases. Unfortunately, it is difficult to pin down the causes of the dispersion in interest rates. With this caveat in mind, we conduct three tests.

We conduct the first test at the SASAC-year level and the other two at the firm-year level. We first discuss how we measure firm-level capital productivity. The literature provides various approaches to measure capital productivity. Most measures require the data on firm-level industrial value-added, which our sample firms do not report. We adopt the marginal revenue product of capital ($MRPK$) measure used by Chen and Song (2013) because their measure does not require the data on firms' industrial value-added. Specifically, $MRPK$ is calculated as the natural logarithm of operating profit divided by lagged fixed assets. Operating profit is sales minus costs of goods sold and selling, general and administrative expenses, plus depreciation. To control for the cross-industry differences, we adjust $MRPK$ by industry means. Most of the studies on $MRPK$ restrict the sample to manufacturing firms (Hsieh and Klenow, 2009). Therefore, in our analysis, besides reporting the results based on the full sample, we also report the results by restricting to the manufacturing firms.

In the first test, we use the cross-firm capital productivity dispersion to measure aggregate capital productivity (Hsieh and Klenow, 2009). Under the assumption that the differences in the costs of capital across firms in the same industry are driven by frictions such as policy distortions or financial constraints, theory predicts that the aggregate capital productivity is the highest when the marginal capital productivity equalizes across firms with an industry (Hsieh and Klenow, 2009).

Table 10 reports the results. The unit of analysis is SASAC-year. We use a difference-in-differences strategy comparing the EVA SASACs with the other SASACs. In columns 1, 2, 5, and 6, the dependent variable is the dispersion of $MRPK$, which is calculated as the standard deviation of the industry-adjusted $MRPK$ across firms controlled by a SASAC. We require at least five firms to include a SASAC-year to our analysis. The macroeconomic literature typically assumes that the cross-firm differences in the cost of capital are purely driven by frictions, such as financial constraints or policy subsidy. In the real world, the cost of capital can differ across firms because of different risk exposures. Therefore, we also calculate the dispersion of the wedge between $MRPK$

and interest rates, both of which are industry-adjusted, and report the results in columns 3, 4, 7, and 8. *Post* equals one after a SASAC adopted the EVA policy and zero otherwise. In columns 2, 4, 6 and 8, we also control the average size and the average leverage, calculated across all the firms in any SASAC-year. In most specifications, the coefficient of *Post* is indistinguishable from zero, suggesting no significant change in aggregate capital productivity. In columns 1 and 3, the coefficient of *Post* is positive, suggesting that the EVA decreased the capital allocation efficiency. Overall, Table 10 does reveal any evidence that the EVA policy had increased the capital allocation efficiency.

Second, we test whether the EVA policy increased the investment of firms with a higher $MRPK$ more than firms with a lower $MRPK$. Reallocating capital from lower $MRPK$ SOEs to higher $MRPK$ SOEs increases capital efficiency. We conduct the test using a model similar to Equation (6). Specifically, we replace the independent variable $InterestRate$ with industry-adjusted $MRPK$. Panel A of Table 11 reports the results. The coefficient of $MRPK \times Post$ is insignificant in all the specifications except in column 6. We find no robust evidence that capital is reallocated from less capital productive to more capital productive SOEs.

Third, capital allocation efficiency can also improve if capital is relocated from SOEs to non-SOEs. Non-SOEs are typically considered more capital productive. For SOEs, we include the ones whose SASAC adopted the EVA policy in our sample period. The controls are the non-SOEs from these provinces. We exclude the central SASAC from this analysis due to the difficulty in defining their controls. We run a difference-in-differences test comparing investment changes between SOEs and non-SOEs. The results in Panel B of Table 11 reveal no evidence of capital reallocation from SOEs to non-SOEs.

Overall, based on the above three empirical tests, we find no robust evidence of improving capital allocation efficiency due to the EVA policy.

7 Conclusion

The Chinese SOEs' EVA reform provides us a laboratory to study the real consequences of manager incentives. The reform stipulated a fixed cost of capital to virtually all the SOEs and was adopted in a staggered way across different regulators. We find that, under the EVA rule, firms deviated

from using their actual cost of borrowing to the stipulated one in their investment decisions. The change in investment leads to firm performance reduction. Our study provides causal evidence on "what gets measured gets managed." From a positive perspective, our evidence shows that the EVA policy changed firms' investments by changing the hurdle rates used for capital budgeting. If the hurdle rates were stipulated properly, such a policy might play a positive role. In many countries around the world, governments provide subsidies to various institutions through a lower cost of capital. Such a subsidy leads to 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.

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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*							1.182
	(1.71)							(1.42)
GDP per capita		-0.001						0.020
		(-0.06)						(0.40)
Age $\geq$ *65*			0.033					0.003
			(0.52)					(0.03)
Tenure				0.017				0.012
				(1.17)				(0.53)
% of SOE Assets					0.115**			0.136
					(2.33)			(1.10)
SOE Investment Growth						0.171		0.156
						(1.06)		(0.77)
Marketization							-0.007	-0.001
							(-1.09)	(-0.04)
Observations	272	272	272	272	272	269	272	269
R-squared	0.087	0.078	0.079	0.080	0.086	0.079	0.081	0.101
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2: Summary Statistics

This table reports the summary statistics. *Capex* is capital expenditure scaled by the average 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 A: Mean, median, standard deviation, and percentiles

	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 B: Correlations

	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 3: Baseline regressions

This table reports the results of the baseline regressions. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the average 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 and Industry*Year are two 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 average 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*. Province*Year and Industry*Year are two 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.

	(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 three robustness tests. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the average 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. 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 (11.0%). In Panel C, we drop firms with leverage higher than 75%. T-statistics computed are reported in the parentheses. In Panels A and B, *t*-statistics are clustered by SASAC and year. In columns (9) and (10), t-statistics are clustered by SASAC. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A. Dropping central SASAC firms				Panel B: Dropping extreme *InterestRate*				Panel C: Dropping firms with leverage>75%			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post × *InterestRate*	0.168**	0.194**	0.180*	0.181*	0.384***	0.295**	0.230**	0.178**	0.192***	0.209***	0.207***	0.184***
	(2.26)	(3.02)	(1.95)	(1.81)	(3.79)	(2.82)	(2.98)	(2.24)	(3.33)	(4.43)	(4.99)	(4.22)
Post	-0.004				-0.011				-0.002			
	(-0.58)				(-1.27)				(-0.36)			
InterestRate	-0.188***	-0.111**	-0.114**	-0.116**	-0.526***	-0.359***	-0.371***	-0.327***	-0.188***	-0.169***	-0.225***	-0.213***
	(-3.42)	(-2.79)	(-2.76)	(-2.58)	(-17.56)	(-17.69)	(-25.84)	(-9.37)	(-3.25)	(-2.79)	(-3.45)	(-3.58)
Tobin's Q	0.008**	0.007*	0.004	0.005	0.009***	0.009**	0.007*	0.006	0.011***	0.011***	0.009***	0.009***
	(2.28)	(1.82)	(1.37)	(1.43)	(3.15)	(2.83)	(2.11)	(1.50)	(6.80)	(7.27)	(5.41)	(4.30)
CashFlow	0.042	0.024	0.015	0.017	0.063**	0.054	0.038	0.022	0.047*	0.043	0.030	0.015
	(1.31)	(0.78)	(0.45)	(0.47)	(2.73)	(1.51)	(1.42)	(1.42)	(1.87)	(1.57)	(1.46)	(0.81)
Log(Assets)	-0.024**	-0.027**	-0.032*	-0.032*	-0.021**	-0.021	-0.024*	-0.030***	-0.019***	-0.021***	-0.022*	-0.027**
	(-2.61)	(-2.39)	(-1.94)	(-1.87)	(-2.24)	(-1.49)	(-1.83)	(-3.33)	(-5.85)	(-5.10)	(-2.05)	(-3.05)
Leverage	-0.049	-0.024	-0.017	-0.017	-0.051**	-0.043*	-0.037	-0.024	-0.043*	-0.034	-0.032*	-0.024
	(-1.52)	(-0.75)	(-0.61)	(-0.59)	(-2.51)	(-1.87)	(-1.47)	(-1.27)	(-2.06)	(-1.60)	(-1.96)	(-1.50)
Observations	2,488	2,453	2,433	2,429	4,159	4,120	4,099	4,082	4,099	4,071	4,054	4,039
R-squared	0.470	0.543	0.588	0.597	0.472	0.522	0.558	0.608	0.471	0.515	0.550	0.607
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 6: Firm heterogeneity

This table reports results on firm heterogeneity: Panel A for government experience and Panel B for CEO ownership. The dependent variable is *Capex*. *Capex* is capital expenditure scaled by the average 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. *PoliticalConnection* equals one if a firm's CEO was a former government employee and zero otherwise. *CEOOwnership* is the fraction of equity owned by the CEO. 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 7: Firm performance

This table reports the results on how the EVA policy affected firm performance. Panel A reports the results on Market-to-book ratio, and Panel B on ROE. *Market-to-Book* is measured as the market value of equity divided by the book value of equity. *ROE* is income before extraordinary items divided by lagged equity. *GAP* is the absolute value of the difference between a firm's interest rate and 7.33%. High (Low) is a dummy variable equal to one if a firm's interest rate is higher (low) than 7.33% and zero otherwise. *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, Industry*Year, and Province*Year are three interactive fixed effects. SOEs controlled by Anhui or Shaanxi SASACs are deleted. 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: Market-to-book ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × GAP	-3.425*	-3.582**	-2.423**	-1.925**				
	(-2.07)	(-2.91)	(-2.95)	(-2.50)				
Post	0.212							
	(0.99)							
GAP	1.029	1.417	1.014	0.050				
	(0.59)	(0.95)	(0.60)	(0.04)				
Post × GAP × High					-2.044	-2.562**	-3.037***	-3.174***
					(-1.28)	(-2.48)	(-4.26)	(-4.43)
Post × GAP × Low					-7.089**	-6.825*	-2.445	-0.893
					(-2.38)	(-1.88)	(-0.79)	(-0.24)
Post × High					0.320	0.089	0.126*	0.195
					(1.31)	(0.88)	(1.89)	(1.67)
Post × Low					0.292			
					(1.26)			
GAP × High					1.452	1.734	2.318	1.160
					(0.92)	(1.38)	(1.51)	(0.99)
GAP × Low					-0.313	0.264	-1.968	-2.378
					(-0.11)	(0.09)	(-0.69)	(-0.88)
Cash Flow	1.548***	1.426***	1.166***	1.099***	1.528***	1.402***	1.137***	1.070***
	(5.20)	(5.22)	(4.06)	(3.56)	(5.16)	(5.48)	(3.90)	(3.25)
Log(Assets)	-1.025***	-1.052***	-1.013***	-0.999***	-1.021***	-1.049***	-1.013***	-1.001***
	(-8.38)	(-9.69)	(-9.92)	(-7.48)	(-8.30)	(-9.40)	(-9.74)	(-7.85)
Leverage	1.895***	1.888***	2.077***	1.996***	1.922***	1.921***	2.097***	2.021***
	(5.84)	(5.44)	(6.67)	(5.33)	(4.83)	(5.48)	(6.58)	(5.29)
Observations	4,392	4,356	4,339	4,325	4,392	4,356	4,339	4,325
R-squared	0.677	0.716	0.753	0.788	0.678	0.717	0.753	0.788
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 7: Firm performance (Continued)

Panel B: ROE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × *GAP*	-0.384	-0.317	-0.460*	-0.440**				
	(-1.77)	(-1.56)	(-1.86)	(-2.22)				
Post	0.009							
	(0.52)							
GAP	0.204**	0.187**	0.168	0.181				
	(3.10)	(2.46)	(1.64)	(1.35)				
Post × *GAP* × *High*					-0.373	-0.219	-0.376	-0.389
					(-1.11)	(-0.82)	(-1.27)	(-1.46)
Post × *GAP* × *Low*					-0.423	-0.553*	-0.660**	-0.564**
					(-1.32)	(-2.15)	(-3.02)	(-2.57)
Post × *High*					0.011	-0.003	-0.006	-0.007
					(0.46)	(-0.15)	(-0.33)	(-0.29)
Post × *Low*					0.010			
					(0.76)			
GAP × *High*					0.221**	0.217**	0.206	0.239
					(2.57)	(2.53)	(1.71)	(1.60)
GAP × *Low*					0.157	0.075	0.054	0.018
					(0.71)	(0.32)	(0.39)	(0.10)
Log(*Assets*)	-0.019	-0.016	-0.014	-0.022*	-0.019	-0.015	-0.014	-0.021*
	(-1.45)	(-1.71)	(-1.55)	(-2.09)	(-1.55)	(-1.65)	(-1.38)	(-1.96)
Leverage	-0.018	-0.002	0.014	0.045	-0.017	-0.000	0.015	0.047
	(-0.35)	(-0.04)	(0.26)	(0.97)	(-0.32)	(-0.00)	(0.27)	(0.94)
Observations	4,582	4,547	4,528	4,515	4,582	4,547	4,528	4,515
R-squared	0.407	0.470	0.513	0.577	0.407	0.470	0.513	0.577
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: 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 the average 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 the average total assets. *External Equity Financing* is the sum of rights issues and secondary equity offerings, scaled by the average 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. 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 9: Aggregate capital productivity

This table reports the results on aggregate capital productivity. 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. In columns (1), (2), (5), and (6), the dependent variable is the dispersion of MRPK across all the SOEs under the control of a SASAC. In the other columns, the dependent variable is the dispersion of the wedge between MRPK and interest rates. MRPK is the natural logarithm of (sales – costs of goods sold – S&A expenses + depreciation expenses)/lagged fixed assets. Both MRPK and interest rate are industry-adjusted. *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. 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			
	Dispersion of MRPK		Dispersion of the wedge between MRPK and interest rate		Dispersion of MRPK		Dispersion of the wedge between MRPK and interest rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	0.195*	0.095	0.173**	0.018	-0.030	-0.025	-0.053	-0.051
	(1.88)	(0.65)	(3.02)	(0.17)	(-0.30)	(-0.26)	(-0.46)	(-0.49)
Average Log(Assets)		-0.133**		-0.323**		-0.142		-0.194
		(-2.21)		(-2.97)		(-1.12)		(-1.64)
Average Leverage		1.896**		2.778***		-0.289		-0.214
		(2.96)		(4.80)		(-0.43)		(-0.26)
Observations	106	106	106	106	198	198	195	195
R-squared	0.436	0.509	0.221	0.417	0.268	0.279	0.261	0.276
SASAC FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Table 10: Capital reallocation

In Panel A, we examine how the EVA policy affected capital reallocation across SOEs with different MRPK. In Panel B, we examine how the EVA policy affected capital reallocation between SOEs and non-SOEs. The dependent variable is *Capex*. Panel A has the same sample as in our baseline analysis with the requirement that we can calculate MRPK. Panel B has all SOEs from the SASACs that adopted the EVA (except the central SASAC) and non-SOEs from these provinces. In Panel B, we drop firms whose nature of ownership has changed during the sample period. *Capex* is capital expenditure scaled by the average total assets. *MRPK* is the natural logarithm of (sales – costs of goods sold – S&A expenses + depreciation expenses)/lagged fixed assets. *SOE* equals to 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 and Industry*Year are two interactive fixed effects. We only keep manufacturing firms in this analysis. In all columns except columns (4) and (5), t-statistics are calculated by clustering at the SASAC and year levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Across SOEs

	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

Table 10: Capital reallocation (Continued)

Panel B: Between SOEs and non-SOEs

	Manufacturing Firms				All Firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × *SOE*	-0.002	-0.010	0.007	0.001	-0.002	-0.007	0.000	0.006
	(-0.11)	(-1.19)	(0.73)	(0.09)	(-0.18)	(-0.69)	(0.02)	(0.31)
Post	0.012				0.007			
	(1.24)				(1.21)			
Tobin's Q	0.010***	0.008***	0.007**	0.008***	0.012***	0.010***	0.011***	0.012***
	(6.85)	(3.28)	(2.77)	(3.19)	(4.60)	(4.05)	(5.43)	(5.16)
CashFlow	0.024	0.004	-0.005	-0.003	0.037*	0.035*	0.033	0.031
	(0.56)	(0.09)	(-0.11)	(-0.07)	(1.84)	(1.82)	(1.32)	(1.10)
Log(*Assets*)	-0.023**	-0.027**	-0.027**	-0.027**	-0.013**	-0.019**	-0.020**	-0.019**
	(-3.10)	(-2.76)	(-3.08)	(-2.82)	(-2.40)	(-3.07)	(-2.61)	(-2.45)
Leverage	-0.076***	-0.068**	-0.065***	-0.067**	-0.050***	-0.051***	-0.048***	-0.048***
	(-3.59)	(-3.04)	(-3.14)	(-2.69)	(-4.83)	(-3.78)	(-3.71)	(-3.56)
Observations	1,605	1,571	1,560	1,523	3,168	3,154	3,138	3,112
R-squared	0.503	0.609	0.640	0.648	0.515	0.573	0.623	0.630
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES	NO	NO	NO	YES

Figure 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. "NA" indicates that the EVA has not been adopted by 2015

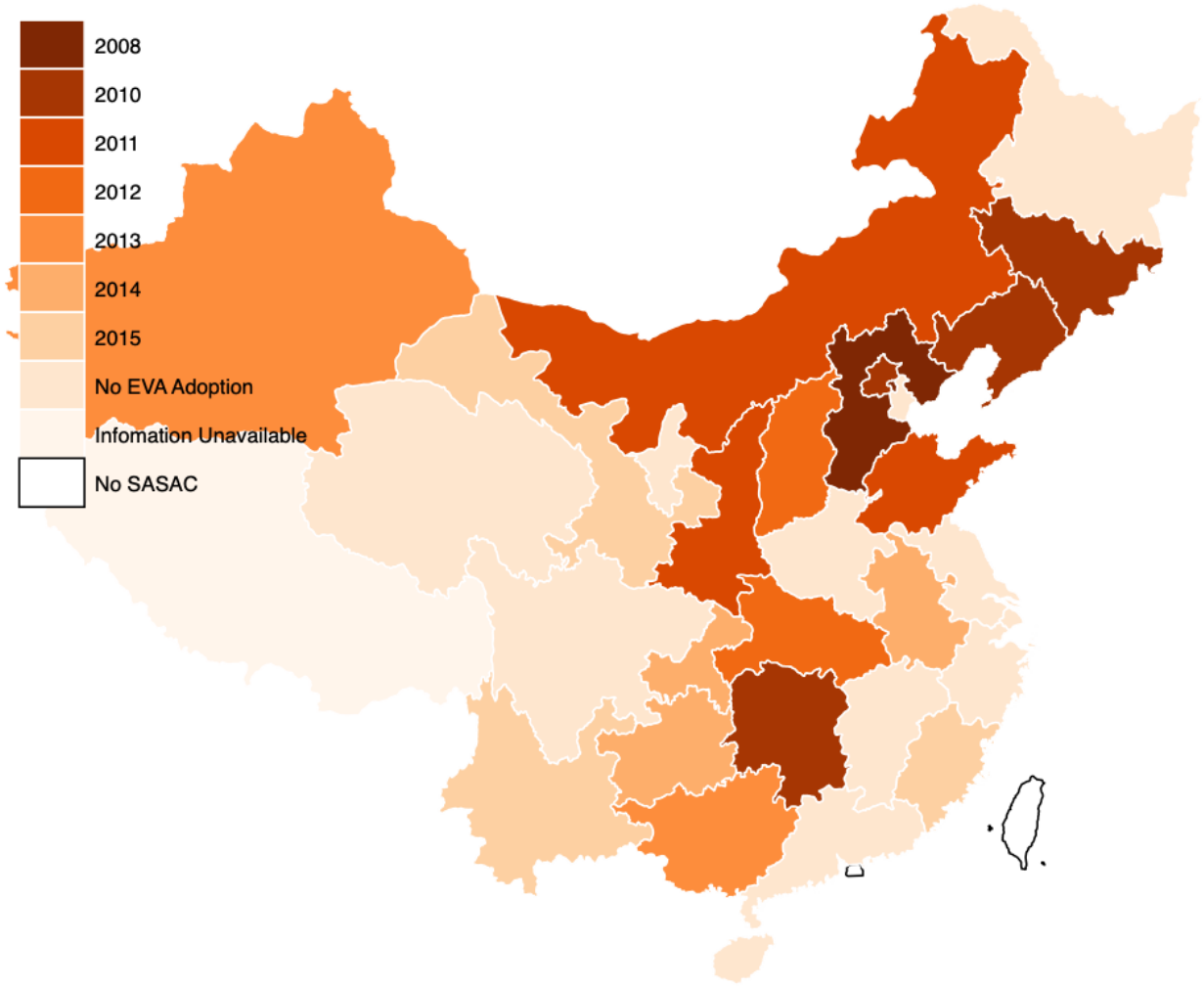
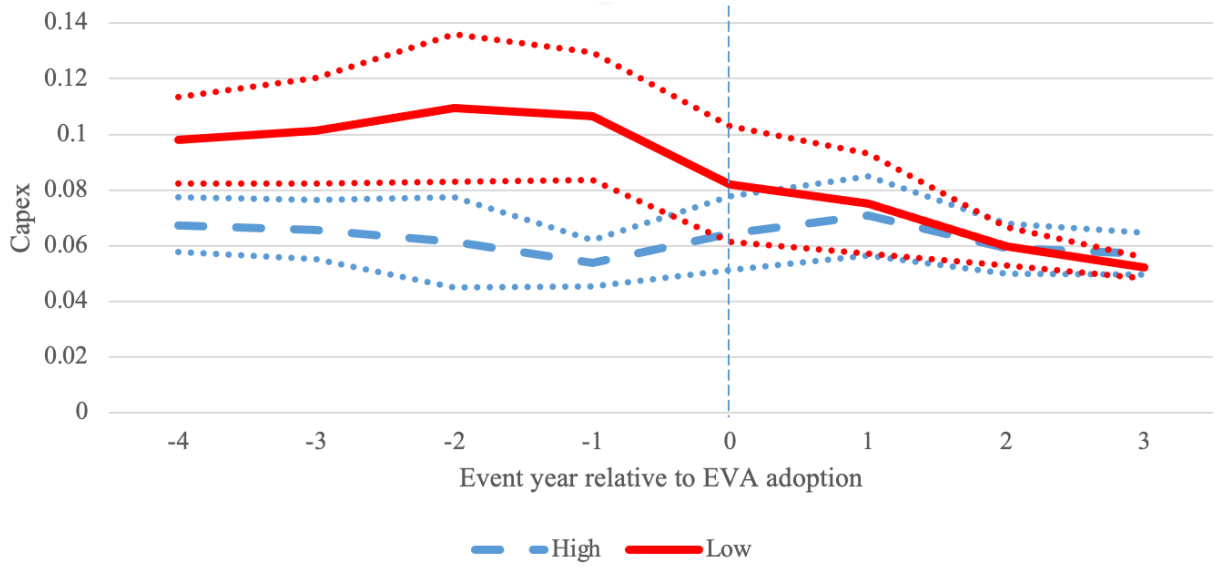


Figure 2: Parallel trends assumption

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

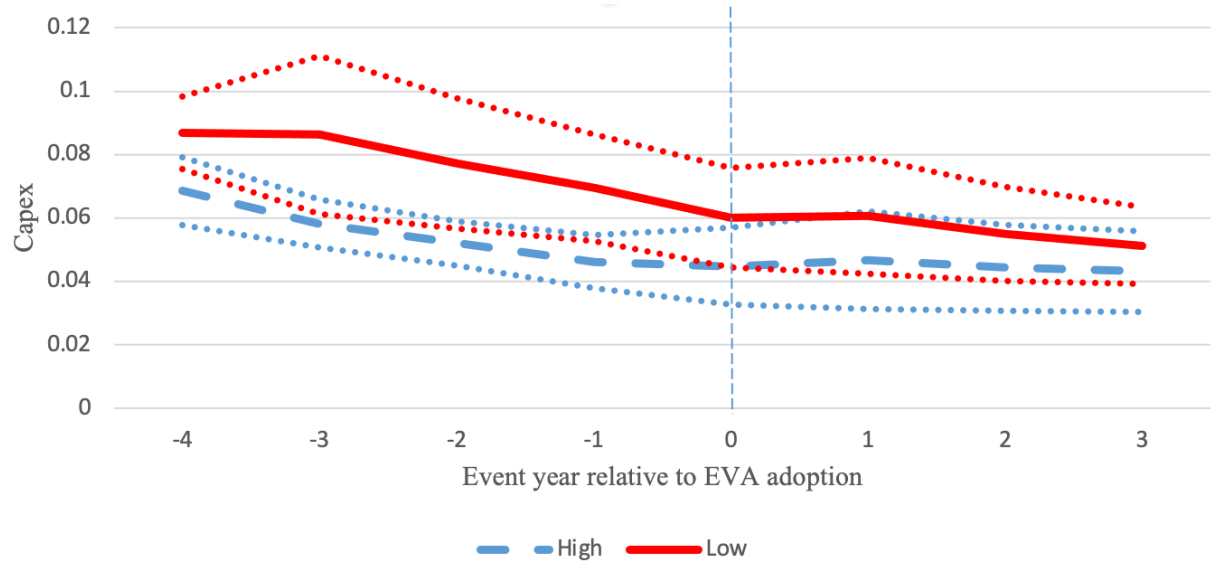
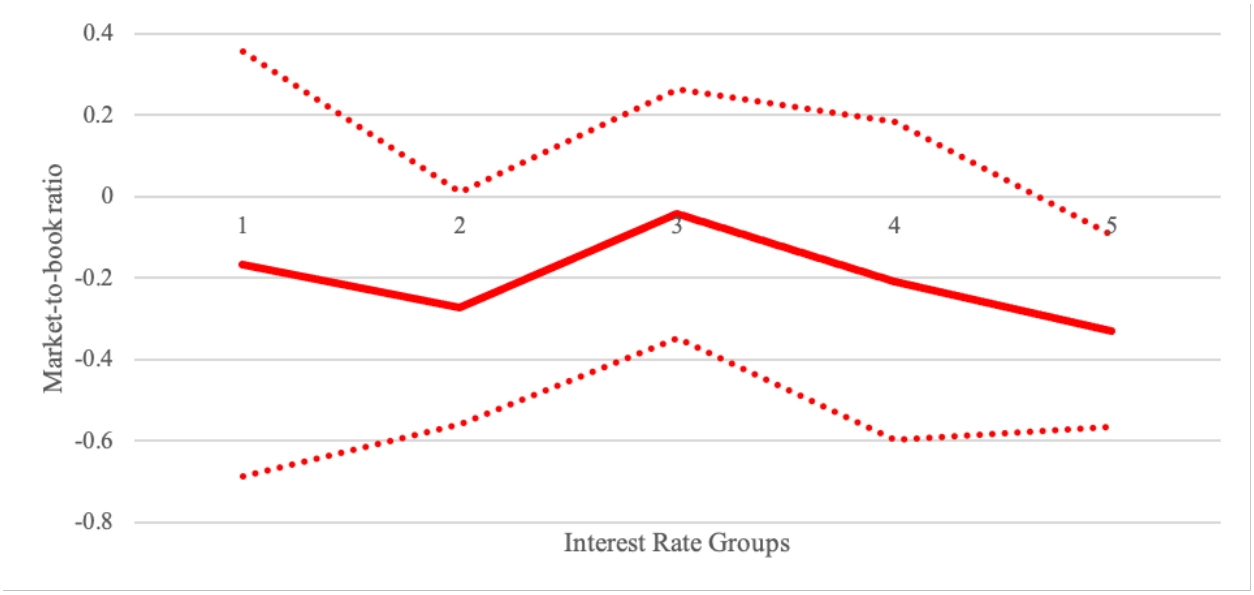


Figure 3: EVA and firm performance

This figure displays the change in firm performance (market-to-book in Panel A, and ROE in Panel B) by the level of interest rates. Firms are sorted into five groups by lagged interest rates. Group 1 contains firms with an interest rate lower than 2.5%. Groups 2 contains firms with an interest rate between 2.5% and 5%. Other groups are similarly defined. Groups 5 contains the firms with an interest rate higher than 10%.

Panel A: Market-to-book



Panel B: ROE

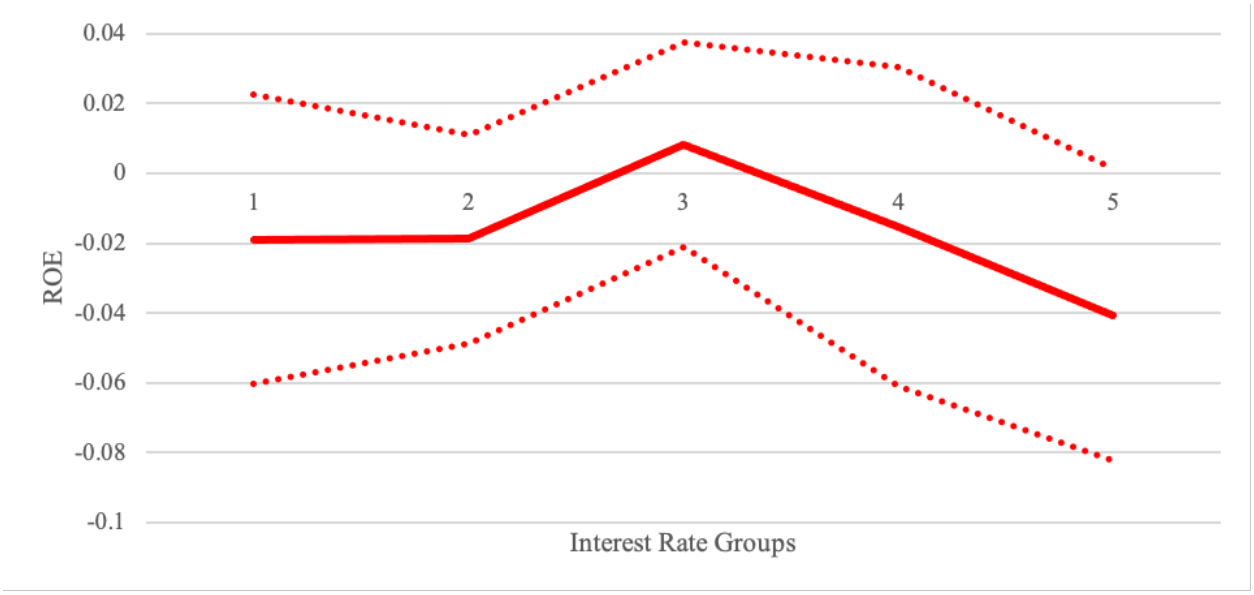
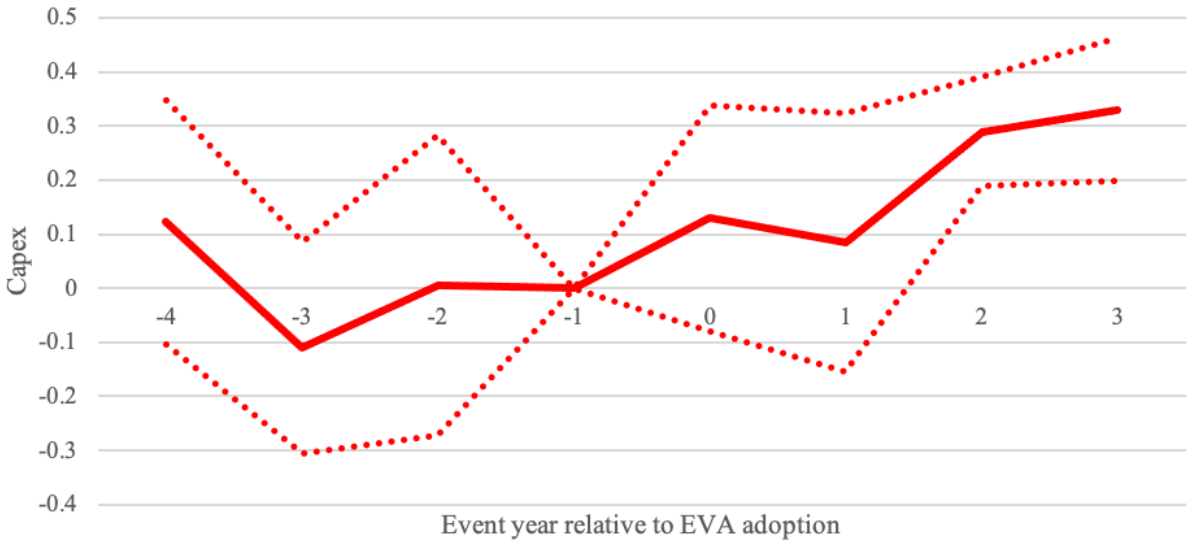


Figure 4: Dynamic regression coefficients

This table 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 leval and the year level.

$$CAPEX^j_{i,t} = \beta_1 InterestRate^j_{i,t} + \sum_{s=-4}^{3} \beta_{2,s} Post^j_{i,t,s} + \sum_{s=-4}^{3} \beta_{3,s} InterestRate^j_{i,t} \times Post^j_{i,t,s} + \gamma' X_{i,t} + \epsilon_{i,t}$$

Panel A: Without the province*year fixed effects



Panel B: With the province*year fixed effects

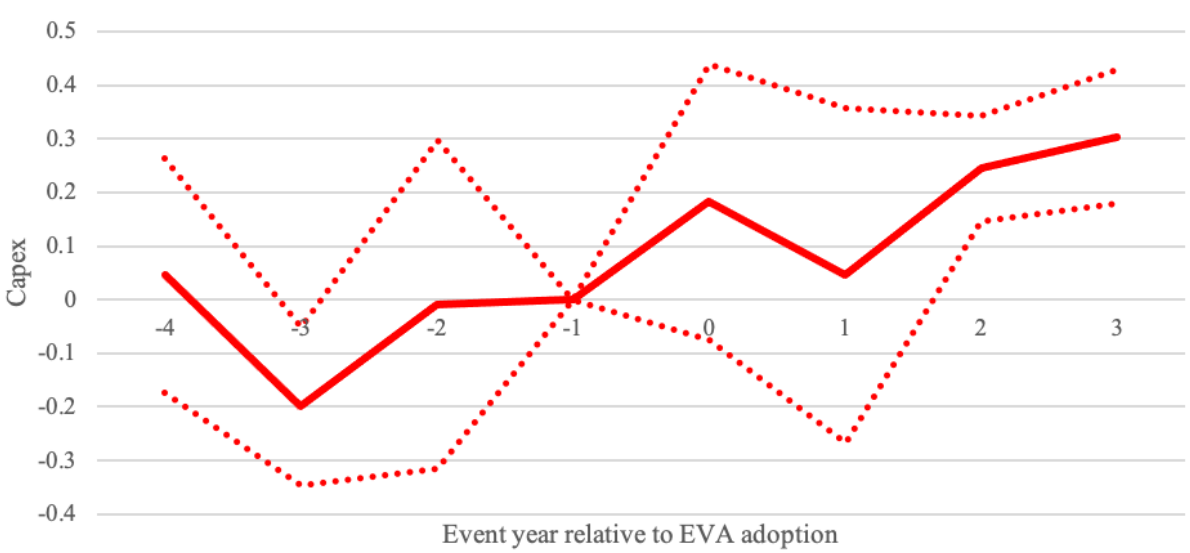


Table A.1: R&D expenses

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. *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. Industry*Year are interactive fixed effects. Data of R&D expenses are hand collected for 2004-2006 and are from CSMAR for 2007 onward. Hebei and Gansu SASACs are included. 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 A.2: Summary of external equity

This table reports the summary statistics of the external equity financing of our sample firms.

Year	Fraction of Firms with External Equity Financing	External Equity Financing / Existing Share Base conditional on being an issuer	Rights Issues / Existing Share Base conditional on being an issuer	Private Equity Placements/ Existing Share Base conditional on being an issuer	Public offerings / Existing Share Base conditional on being an issuer	Private Equity Placements / External Equity Financing conditional on being an issuer
2004	2.67%	19.93%	6.91%	0.00%	13.02%	0.00%
2005	0.52%	40.28%	0.00%	0.00%	40.28%	0.00%
2006	5.65%	58.47%	0.00%	55.38%	3.09%	86.96%
2007	11.25%	50.41%	1.92%	47.40%	1.08%	82.61%
2008	10.95%	28.00%	2.32%	21.79%	3.88%	70.27%
2009	10.28%	54.23%	2.17%	50.48%	1.57%	85.00%
2010	11.36%	43.40%	1.26%	41.83%	0.30%	90.00%
2011	9.90%	44.27%	2.97%	40.49%	0.81%	82.93%
2012	9.55%	41.80%	2.71%	38.01%	1.08%	85.00%
2013	14.59%	44.10%	3.15%	40.33%	0.61%	85.48%
2014	12.50%	38.97%	1.18%	37.79%	0.00%	94.34%
2015	17.31%	46.26%	0.00%	46.26%	0.00%	100.00%
Mean	9.77%	44.01%	1.88%	40.68%	1.45%	85.09%

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

Table A.3: 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 are reported in the parentheses. In columns (2) and (3), *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.

	(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

A Appendix A

A.1 Proof of Proposition 1