The Effect of Political Turnover on Over-Investment in State-owned Firms: Evidence from China

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Abstract: This study examines the sustainability of China's authoritarian economy by investigating the impact of political turnovers on overinvestment in state-owned firms. I collect data on political turnovers, i.e. the replacement of local government officials, spanning from 1998 to 2020, with over 7,000 observations from all prefecture-level cities in China. Additionally, data on overinvestment, representing positive deviations from the optimal investment rate, in both state-owned and non-state-owned firms are collected over the same 20-year period, encompassing more than 300,000 panel observations. The findings reveal that in the year following the appointment of a new politician, there is a 1% increase in the excessive investment rate, indicating a tendency of newly appointed politicians to overinvest in order to meet GDP targets. However, this effect becomes insignificant after 2012, suggesting a diminished emphasis on GDP targets. These results highlight the need for alternative metrics to evaluate officials' promotions, the implementation of stronger checks and balances, and market-oriented reforms within the state-owned enterprise (SOE) sector to enhance efficiency and reduce distortions.

Contents

1. Introduction

Extensive research has been conducted on the persistent issue of low efficiency in China's State-Owned Enterprises (SOEs). Scholars have identified various factors contributing to this problem, including limited competition, inadequate innovation, inefficient resource allocation, bureaucratic inefficiencies, and soft budget constraints (Li et al., 2018; Wu & Zhang, 2017; Naughton, 2018; Huang et al., 2020). However, there is a significant aspect that has not received sufficient attention: the influence of local politicians on SOE performance. Although scholars acknowledge that local officials are motivated to meet GDP growth targets for career advancement and political prospects (Li et al, 2018; Naughton, 2018), the specific mechanisms and underlying rationale driving these incentives and their impact on the promotion of low-efficiency SOEs remain largely unexplored. Consequently, there is a research gap that requires an investigation into the incentives and decision-making processes of local officials concerning SOE performance. This study aims to bridge this research gap and contribute to the literature by examining the relationship between local government incentives and the performance of state-owned enterprises (SOEs). It enhances our understanding of the complex interplay between these incentives and the performance of SOEs, providing policymakers with valuable insights to develop effective strategies for fostering a positive government-business relationship. Furthermore, by identifying the specific mechanisms that drive low-efficiency practices in SOEs, this study informs the development of targeted policies aimed at improving the overall performance, productivity, and competitiveness of SOEs within the context of China's economy.

In my research, I adopt a difference-in-differences (diff-in-diff) approach to examine the impact of municipal government party secretary replacements on the investment decisions and performance of China's State-Owned Enterprises (SOEs). Specifically, I regress the level of over-investment by enterprises onto the political turnover status to explore the causal link between these variables. To conduct this analysis, I have meticulously collected data on the replacement of officials, treating it as a quasi-natural experiment where the replacement of local officials acts as the treatment for the respective city of jurisdiction. By utilizing a comprehensive dataset encompassing over 300,000 panel observations from diverse firms spanning a 20-year timeframe, I am able to provide a thorough and holistic perspective on SOEs in China. In addition, I have painstakingly gathered over 7,000 observations of politician replacement status for all 334 prefecture-level cities in China over the same 20-year period. This extensive coverage of politician replacement status, coupled with the substantial sample size, empowers me to conduct a difference-in-differences analysis of the relationship between official replacements and the investment decisions and performance of SOEs in China.

My analysis sheds light on the strong incentive for government officials to prioritize GDP

growth within their respective regions. The findings reveal a significant association between officials' career advancement prospects and a 1% increase in the over-investment rate of state-owned enterprises, with statistical significance at the 5% level. The close link between officials' career trajectories and regional economic performance empowers local governments to exert considerable influence over enterprise investment decisions, actively promoting over-investment to achieve targeted GDP growth. This influence is particularly pronounced in State-Owned Enterprises (SOEs), while its impact on non-SOEs is comparatively limited. These findings indicate that officials may prioritize short-term economic growth over long-term sustainability, solely to meet GDP targets and advance their careers. However, a noteworthy discovery has emerged from my analysis: the effects of this incentive mechanism have waned after 2012, attributable to a policy shift by the central government that redirects the evaluation criteria for local governments away from exclusive emphasis on economic development and growth (Zhang & Pan, 2023). Paradoxically, the reduced emphasis on GDP growth after 2012 has yielded favorable outcomes, with a decrease in over-investment observed in state-owned firms.

My research makes significant contributions to the existing literature in two key areas, providing novel insights into the factors influencing over-investment in state-owned enterprises (SOEs) and extending the current understanding in this field. Firstly, while previous studies have primarily focused on factors such as market competition, innovation limitations, and resource allocation inefficiencies to explain over-investment in SOEs, my study takes a fresh perspective by examining the impact of political turnovers. By incorporating the dynamics of local politicians and their career incentives, I offer a deeper understanding of the underlying mechanisms that drive over-investment in the Chinese context. This research marks a departure from the prevailing theories that attribute over-investment solely to factors internal to SOEs (Ljungqvist et al. 2015). Instead, I shed light on the significance of external factors, specifically the political turnovers of municipal party secretaries, as key drivers of over-investment in SOEs.

Furthermore, my study builds upon and enhances the findings of Li et al. (2018) and Naughton (2018) regarding the impact of local officials on economic growth. While these prior studies briefly acknowledge the incentives of local officials to meet GDP growth targets for career advancement, they do not provide sufficient evidence to substantiate how officials achieve these short-term growth targets. In contrast, my research goes beyond previous work, providing an explanation for how opportunistic officials achieve short-term growth targets and offering corresponding empirical evidence. By addressing the limitations of previous research, I make a valuable contribution to the existing literature by deepening our understanding of the incentives and decision-making processes of local officials in relation to the performance of state-owned enterprises (SOEs). These findings have important policy implications. It is crucial for policymakers to recognize the potential negative consequences of incentives driven by career aspira-

tions on the efficiency and sustainability of SOEs. By mitigating the undue influence of short-term GDP targets and adopting alternative metrics to evaluate officials' performance, such as incorporating indicators of long-term economic sustainability and efficiency, policymakers can encourage more cautious investment decisions and foster overall improvements in the performance of state-owned enterprises. Additionally, the study emphasizes the necessity of stronger checks and balances on officials' actions and underscores the significance of implementing market-oriented reforms in the SOE sector to improve efficiency and reduce distortions.

2. Background

2.1. Existing Literature

My study aims to make a distinct contribution to the existing literature on the topic of low efficiency in State-Owned Enterprises (SOEs). Numerous studies have addressed this issue, examining SOEs in China and other countries. For instance, Megginson & Netter (2001) shed light on the challenges faced by SOEs in different countries, including poor corporate governance, lack of competition, and political interference. Soderbom et al. (2013) identify factors such as limited competition, weak governance, and lack of accountability as contributors to the low efficiency of SOEs in the Middle East and North Africa (MENA) region. Li (2012) provides a political economy perspective on the efficiency of SOEs in China, citing challenges such as bureaucratic interference and weak corporate governance. Xiong et al. (2021) emphasize the need for effective governance mechanisms and performance goals to enhance the efficiency of SOEs. Estrin et al. (2016) discuss the challenges faced by SOEs in various countries and regions and propose reforms to improve their performance. Sun et al. (2016) provides a critical analysis of SOEs in emerging market economies, including China, and identifies factors such as lack of competition and weak governance as contributors to low efficiency. However, the majority of these studies tend to attribute the inefficiency of SOEs to "downward" factors, such as internal issues within the SOEs themselves or the market environment in which they operate. What sets my study apart is its focus on examining the extent to which SOEs are influenced by "upward" factors, particularly the impact of external forces, such as the performance incentives of local Party Secretaries. I seek to explore whether the efficiency of SOEs is affected by these external factors, which have received comparatively less attention in the literature.

Moreover, my study aims to make a valuable contribution to the existing literature on China's political competitions and their negative externalities. China's economic development is characterized by a unique combination of central planning and market-oriented reforms, with State-Owned Enterprises (SOEs) playing a significant role. A prominent feature of China's economic policy is the use of GDP growth targets as a key performance indicator for local government officials, which is often tied to their prospects of political promotion (Li et

al, 2018; Liu et al., 2020; Zhou, 2007). Several studies have examined the relationship between China's GDP growth targeting and the competition for political promotion. Li et al. (2018) argues that China's political system creates strong incentives for local government officials to prioritize short-term economic growth in order to meet GDP targets, as this is often seen as a pathway to career advancement. Zhou (2007) further emphasizes that the competition among officials for promotion creates a "tournament"-style competition, where officials are motivated to outperform their peers in terms of GDP growth to secure promotions, resulting in a focus on short-term gains rather than long-term sustainable development. Additionally, Liu et al., (2020) find that the use of GDP growth targets in China's political promotion system can lead to "GDPism," where officials prioritize achieving high GDP growth at the expense of other important socio-economic and environmental considerations. They argue that this narrow focus on GDP growth targets may result in over-investment, environmental degradation, and other negative consequences. However, these studies primarily highlight the motivations of local officials in competing for political careers based on GDP growth targets, without providing evidence on the specific strategies employed by these officials to achieve short-term GDP growth objectives, and the subsequent implications for local enterprises, such as SOEs. Furthermore, recent studies suggest a changing landscape in the relationship between GDP growth targeting and political promotion competition in China. Kutan et al. (2019), for instance, argue that recent policy shifts by the central government have led to a decreased emphasis on excessive reliance on GDP growth targets for political promotion. Instead, there is a growing focus on other indicators, such as environmental protection and poverty alleviation. However, the existing literature lacks sufficient evidence to support this shift and explore its implications.

2.2. Conceptual Frameworks

My study contributes to existing theories and conceptual frameworks in the literature. The principal-agent theory provides a conceptual framework for understanding the dynamics between the central government (as the principal) and local government (as the agent) in autocratic systems like China. In this framework, the central government evaluates local government performance based on various indicators, including GDP growth targets, which incentivizes local government officials to achieve these targets as they are often linked to their career advancement prospects (Li et al., 2018; Zhou, 2007). However, this single-task focus on GDP growth targets may result in trade-offs with other tasks, as local governments may face difficulties in simultaneously achieving multiple objectives due to negative correlations between different tasks. For instance, local governments may prioritize short-term economic growth at the expense of environmental protection or long-term sustainable development (Wang et al., 2022). Furthermore, tournament theory provides insights into the competition among local government officials for political promotion based on performance, such as

achieving GDP growth targets. According to tournament theory, officials tend to over-invest in activities that have a direct impact on their promotion prospects, even if these activities may have negative effects on other components or long-term consequences. In the context of China's political system, this may manifest as local governments directing State-Owned Enterprises (SOEs) to over-invest in projects or activities to meet GDP growth targets and improve their chances of promotion (Zhou 2007). Moreover, if the spread between prizes (i.e., the promotion prospects) is large, officials may be more inclined to engage in aggressive competition, including over-investment or prioritizing short-term gains over long-term sustainability, to increase their chances of promotion (Rosen, 1985).

In conclusion, my study contributes to the existing literature by examining the relationship between China's GDP growth targeting, political promotion competition, and the low performance of State-Owned Enterprises (SOEs), shedding light on potential negative externalities and exploring potential changes in recent policy reforms. However, further research is needed to better understand the dynamics of this relationship and its implications for China's economic and political development.

3. Identification Strategy

3.1. Overview

In this section, I will provide an overview of my data, variable definitions, and difference-in-differences specification. The data I have collected mainly includes information at both the company and politician levels. The company-level information allows me to assess the degree of inefficient investments by companies and identify if a company is classified as a zombie firm. To assess the impact of official replacement, I will treat the replacement of city politicians as an equivalent to a treatment for that specific jurisdiction. This is because newly appointed officials often have strong incentives to drive short-term economic growth in order to meet economic development goals. Cities that do not experience any official replacement in a given year will serve as the control group, as not every city undergoes personnel changes annually. Furthermore, I am particularly interested in examining whether the "treatment" effect of official replacement remains significant after 2012. As a result, I have divided the treatment effect into two periods: before and after 2012.

3.2. Politician Data

3.2.1. Replacement

To capture shifts in political power, this study follows the approach of Xu et al. (2013) and Dai et al. (2014) by using the replacement of Party Secretaries in prefecture cities as an indicator of changes in local officials. Party Secretaries hold significant influence for three main reasons. Firstly, China operates a multi-level administrative system that facilitates top-down tasks and

local policy implementation. This system comprises five administrative levels, with the central government, including the State Council and its ministries, at the top. Below that, there are four levels of local government, namely provinces, regions, counties, and towns. At each level, party and government institutions are led by a Party Secretary, who holds a higher rank than the administrative head. In local governments, major economic decisions are initially discussed in the office of the party secretary and then approved by the party committee before being passed on to the government department led by the mayor or county head for formalization and execution as a government document. While local government officials may be held accountable for failures or mistakes, the credit for achievements in local economic development is primarily attributed to the party secretary. Consequently, party secretaries wield the ultimate decision-making power when it comes to significant social and economic policies of local governments, while administrative heads such as mayors act as subordinates responsible for carrying out their orders. Therefore, the Party Secretary serves as the ultimate policy-maker.

Secondly, officials' careers in prefecture cities are significantly influenced by economic development, and lower-ranking officials overseeing prefecture cities face intense competition through promotion tournaments and frequent transfers. As a result, they have a strong motivation to interfere in enterprises under their jurisdiction. China has implemented an effective management and control system to incentivize and manage local administrative agencies. The central government provides financial and personnel incentives to local governments at different levels to control their actions. However, the inherent conflict of interest between the bureaucratic system under authoritarianism and the ruling class necessitates the use of performance evaluation systems for officials as a key incentive mechanism for the supervisory relationship between different levels of government. Performance contracts serve as the foundation of this system, requiring local governments to comply with a set of jointly formulated performance targets with their superiors, who act as the "principal." These targets encompass various policy areas, such as family planning, economic growth, labor safety supervision, and social stability maintenance, and serve as a means of evaluating officials' performance. While there is an ongoing debate between single-goal and multiple-goal performance evaluation systems, GDP growth as a single goal is the easiest and most straightforward to observe for economists and other scholars. This simplicity also applies to superior governments as other indicators and "efforts" are relatively harder to measure. Local governments not only passively accept tasks from superiors but also proactively set higher targets to impress them. For instance, while the central government sets a single-digit economic growth rate, most provinces aim for double-digit growth, creating a political competition where officials strive to demonstrate their performance and seize promotion opportunities. Government officials know that their political fate depends on how they perform against their peers and will work hard to meet these standards, such as achieving economic growth to increase their chances of promotion.

Thirdly, the target responsibility evaluation system incentivizes officials to prioritize economic development, facilitated by the combination of "political centralization" and "economic decentralization" (Zhao et al., 2015). Local party secretaries not only control all economic and administrative resources but also possess significant discretionary power in resource allocation and policy implementation. They have the ability to independently formulate economic development policies and drive local economic growth. Moreover, the ambiguous property rights of land, deficiencies in environmental protection policies, and lenient constraints imposed by financial institutions further intensify the local government's dominion over resources and their monopolistic position. This enables them to allocate economic resources at their discretion to maximize the benefits of local officials.

This study considers the turnover occurrences of all prefecture cities or districts from 1998-2020, which were manually collected from the CCP's official website, people.com.cn. Additionally, the data was supplemented by *China Vitae*, Official records of the People's Republic of China, and searches on local governmental websites. If the Party Secretary was replaced between January and June, the current year is recorded as the year of change. If the Party Secretary was replaced between July and December, the following year is recorded as the year of change. It is important to note that after the replacement of officials, the old government-enterprise relationship may not be immediately terminated, while the establishment of a new relationship may require some time. In addition to the replacement of officials, their tenure in the sample cities and other personal information, such as gender and age, were also collected.

Table 1: Descriptive Statistics: Politicians

Name	**Variable**	**N**	**Mean**	**Std. dev.**	**Min**	**Max**
City Replacement	*Turn*	7,159	.27	.44	0	1
Gender	*Male*	1,983	.96	.19	0	1
Age	*Age*	1,983	53.84	4.15	30	70
Age$>$ 55	*Old*	1,983	.37	.48	0	1
Tenure	*Tenure*	1,971	3.74	1.81	0	12

Table 1 provides a descriptive analysis of the officials, showing that there were approximately 7,000 cases of official replacement observed. On average, about one quarter of municipal party secretaries were replaced annually, and the average term length for officials was 3.74 years. This short-term length and high frequency of turnover exacerbate officials' motivation to prioritize short-term economic development goals. The overwhelming majority of officials were male, with a disproportionately low representation of females, and around one-third of officials were aged over 55 years.

3.3. Firm Data

3.3.1. NBS Firm Level Data

The National Bureau of Statistics (NBS) gathers data on corporate financial statistics and other enterprise-level characteristics through annual surveys or reports submitted by sample firms to local statistical authorities. The unit of observation is defined as a legal firm meeting a minimum size threshold for inclusion in the sample. NBS collects annual firm-level data for ”above-scale” industrial firms, which includes all state-owned firms and non-state firms with sales exceeding 20 million RMB,. This is an increase from the previous threshold of 5 million RMB in 2011.

The database includes a range of enterprise-level panel variables such as the year, enterprise code id, location (province and city), ownership type (state-owned, private, joint venture, and foreign), total sales value, total assets, total fixed assets, accumulated and current-year depreciation, total liabilities, revenue and profit, enterprise income tax expenses, enterprise loan interest expenses and etc. Additionally, other characteristic variables such as enterprise age, number of employees, and industry code are available. Despite some concerns raised by scholars regarding the accuracy of enterprise-level data in China due to suspicions of over-reporting, this dataset remains the most comprehensive and widely-used sample for studying non-listed Chinese enterprises. The NBS database provides valuable information for economists, as individual enterprise data at the micro-level is rare in China and the government usually only releases macroeconomic indicators at the provincial or national level without discussing specific calculation or statistical methods. Although statistical departments claim they are only responsible for releasing final macro indicators and keep some of the ”original data” as a state secret, it is the primary source for researchers studying the economic activities of non-listed micro-enterprises in China. As a result, most studies involving Chinese micro-enterprises rely on this dataset.

To clean the data, I followed the methods proposed by Brandt et al. (2012, 2014) and Zhao et al. (2015). Samples with missing values of major financial indicators such as total assets, gross industrial output, and net fixed assets were excluded, as well as samples with fewer than 8 employees. Additionally, samples with current assets greater than total assets, total fixed assets greater than total assets, and net fixed assets greater than total assets were excluded. Samples inconsistent with GAAP, such as those with profit margins greater than 1 or negative net fixed asset value, were also excluded. To match samples across years, I used the unique firm ID (RESSET code) generated by the RESSET database. If the RESSET code did not match or was the same, I matched samples by legal person or firm name. Due to concerns about the accuracy of the 2010 sample, it was removed, and 2009 and 2011 were treated as consecutive years (Tan et al., 2017).

3.3.2. Investment & Inefficient Investment

To examine the impact of local government officials on investment decisions of firms within their jurisdiction, it is necessary to gauge the extent and volume of inefficient investments made by these firms. To this end, I have consulted the research conducted by Richardson, 2006, approximating firm i's investment efficiency in year t by the absolute value of residuals of the following regression:

$$Investment_{it} = \alpha_0 + \alpha_1\, Growth_{i,\,t-1} + \alpha_2\, Lev_{i,\,t-1} + \alpha_3\, Cash_{i,\,t-1} + \alpha_4\, Age_{i,\,t-1} + \alpha_5\, Size_{i,\,t-1} +$$

$$\alpha_6\, Ret_{i,\,t-1} + \alpha_7\, Investment_{i,\,t-1} + \Sigma\, Industry + \Sigma\, Year + \varepsilon_{it}$$

Where $Investment_{it}$ is firm i's actual new investment expenditure in year t, this variable is not available in the NBS dataset, I calculated by the "law of motion", i.e.

$$I_{it} = K_{it} - K_{i,t-1}(1 - \delta_{it})$$

K_t is firm's total fixed asset at t, δ is depreciation rate. $Growth_i$ is firm i's growth opportunity, usually approximated by Tobin's Q (market value/ total assets). However, market value is not available for non-listed enterprises, thus I substitute by the growth rate of main business revenue. Lev_i is firm i's leverage or asset to liability ratio. $Cash_i$ represents the firm i's cash flow: the sum of total profits, current depreciation and interest expenses minus corporate tax. Age_i and $Size_i$ represent firm i's age and size (natural logarithm of total assets at the end of year) . Ret_i is firm i's rate of return: total profits divided by revenues. $\Sigma\, Industry$ and $\Sigma\, Year$ are industry and year dummies respectively. Lastly, I winsorize all the continuous variables at 1% and 99% quantiles every year.

Table 2: Variable Definitions: Richardson

Name	Variable	Definition
Corporate Investment	I	"Law of Motion"
Growth Opportunity	$Growth$	Growth rate in operating revenue
Cash Flows (Holdings)	$Cash$	(profits-tax)+δ+interest
Debt-to-assets Ratio	Lev	total debts/total assets
Size of Enterprises	$Size$	Natural logarithm of total assets
Age of Enterprise	Age	Age of enterprise at the end of period
Rate of Return	Ret	net profit/revenue
Industry Dummies	$Industry$	By NBS, 41 different 2-digit industries
Year Dummies	$Year$	Year fixed effects
Inefficient Investment	$\lvert I^{\varepsilon}_{New} \rvert$	Estimated residual from Richardson

The Wurgler, 2000 and Richardson, 2006 models directly measure investment efficiency. Wang, 2003 used these models to investigate the investment efficiency of US listed companies, and found a positive correlation between investment efficiency and the quality of accounting information. Subsequent research revealed that the Richardson, 2006 model had clear advantages over Wurgler, 2000. Non-efficient investment, intuitively, refers to the portion of new investment that cannot be attributed to either maintenance or expected additional investment. As such, Richardson, 2006 calculates a firm's level of investment under normal circumstances, and measures investment efficiency by comparing the difference between actual investment and the one estimated. According to Richardson (2006), investment expenditure on new projects can be decomposed into expected investment expenditure in new projects (I_{NEW}) and abnormal (or unexpected) investment (I^{ε}_{New}). Therefore, the magnitude of residual estimated by the model represents the extent of inefficient investment. A higher absolute value of the residual indicates a higher degree of inefficient investment. A positive residual signifies over-investment ($I^{\varepsilon}_{New} > 0$), while a negative residual indicates under-investment ($I^{\varepsilon}_{New} < 0$). While the investment rate may only reflect the quantity of investment and not necessarily a firm's deviation from the optimal investment rate, using the actual investment rate provides a more direct and transparent approach. Therefore, I include investment as an alternative dependent variable in the results section for cross-validation and robustness checks. Notably, estimates of inefficient investment can indeed signal a firm's deviation from the optimal investment rate while investment cannot.

3.3.3. Zombies

Zombie companies are those inefficient and should have gone bankrupt, yet they continue to exist irrespective of market. A significant portion of these companies have negative profits or returns on investment, but they can survive even if their owners can't sustain losses. I use zombie companies as an alternative measure of the relationship between politics and business in China because this relationship can't be measured solely by whether a company is state-owned or privately owned. Economic institutional reform in China is incomplete, and the political system is highly exploitative, resulting in local officials monopolizing market operations and access. As a result, private companies, particularly those in underdeveloped regions, find it difficult to enter and operate in the market without being entirely free from government relationships. While different literature may provide varying definitions of zombie companies depending on the economic environment, my definition characterizes them as lacking continuous profitability, surviving on "bloodsucking," having insufficient cash flows, and being unable to timely pay off maturing debts. What sets zombie companies apart is their ability to continue operating in the market without being forced to give up market share and resources to more efficient companies through regular bankruptcy procedures. This persistence suggests that zombie companies may have received preferential loans with government connections, state-owned bank interest subsidies, or direct government transfer

payment subsidies. borrow to invest

I indirectly assess the presence of a political-business relationship in private enterprises by using the concept of ”zombies,” which can provide insights into investment efficiency. Zombies can be categorized into two types: those that survive due to political connections despite poor performance, and those whose investment decisions are artificially influenced by local officials, resulting in low investment efficiency and returns. Thus, a company can become a zombie due to both internal and external factors. Based on my findings, both types of zombies coexisted before 2012; however, after 2012, zombies tended to fall into the former category. The definition of Chinese zombies in this paper is based on the definitions provided by Caballero et al. (2008) and Fukuda &; Nakamura (2011) for zombie companies in Japan. In the case of Japan, zombie companies receive interest subsidies from the government or banks when repaying their debts and continue to operate despite ongoing financial difficulties. In the Chinese context, becoming a zombie means that these companies can continuously borrow funds while rarely repaying or deferring repayments. These companies take on excessive debt to meet the local officials' demands for over-investment, and local officials can instruct banks to continuously provide financial support to these companies, even if it deviates from rational decision-making by the banks. Therefore, building upon the framework of Caballero et al. (2008) and Fukuda & Nakamura (2011), I incorporate this characteristic to determine whether a company is a zombie in the Chinese context. Please refer to the appendix for the specific steps used to identify zombie companies in this paper.

3.3.4. Other Firm Level Independent Variables

To assess the impact of government intervention on enterprise investment decisions, I include the following firm level covariates: return on equity (ROE), city GDP growth rate, marketization index, total factor productivity, and number of employees. ROE is determined by dividing net profits by net assets. Investment decisions are influenced by both general economic performance and business cycles, with firms tending to invest more during periods of high GDP growth. To account for this effect, I include the GDP growth rate as a control variable. The marketization index, as developed by Fan et al., 2011, consists of a general index and several sub-indices, including scores of the relationship between government and market, non-state-owned economic development, product market development, factor market development, intermediary organization development, and law. This index reflects China's progress in economic reform and the development of market mechanisms. A higher marketization index suggests a more open economy with fewer centrally planned components, and is thus pertinent to government distortions in firm investment decisions. The firm's total factor productivity is computed using the Olley-Pakes (OP) method (Olley and Pakes, 1996). I employ the OP semi-parametric method to address simultaneity and sample selection biases in the least squares estimation.

Further details can be found in the appendix.

3.4. Descriptive Statistics

Table 3: Descriptive Statistics: Firms

Variable	Mean	Std. dev.	Min	Max
Over-Investment	.04	.29	-.55	.92
Investment	.10	.29	.07	5.12
GDP Growth	.14	.05	-.09	.28
TFP	5.29	.98	.08	7.86
Debt-to-assets Ratio	.57	.32	0	36.07
Staff	4.99	.98	2.08	10.54
Firm Age	10.07	7.73	0	51
Size	10.04	1.21	0	14.40
Ret_t	.03	.07	-1.26	.31
ROE	.24	.45	-1.76	4.30
Growth Opp.	.23	.56	-.95	7.86
# of Firms	334,708			

To mitigate the impact of extreme values or outliers, all continuous variables were winsorized by trimming observations below the 1st percentile or above the 99th percentile. Table 3 presents the descriptive statistics of the variables after winsorizing. Chinese enterprises have an average annual investment rate of 10%, and a positive average overinvestment, indicating that the average investment exceeds the optimal investment predicted by the model by approximately 4%, resulting in relatively low investment efficiency. During the early 21st century, China experienced high growth, with an average GDP growth rate of 14.1%. While some areas showed negative growth, the highest-growth regions experienced growth rates of nearly 30% for one year. Enterprises have an average liability or debt-to-asset ratio that exceeds 50%, an average age of 10 years, and around 150 employees, since only "above-scale" enterprises are included in the NBS firm data. The average current year rate of return or return on investment (Ret_t) is about 3%, but the return on equity (ROE) and growth in revenues are high, around 24%. Such high returns are not surprising for China in the early 21st century, considering that the country was striving for economic reform from a starting point of extreme poverty. The unbalanced panel data includes over 300,000 different enterprises, with entry and exit, spanning almost 20 years.

Table 4 shows the mean values of different variables for various types of firms. Private enterprises and non-zombie firms dominate social investment, while state-owned enterprises (SOEs) and zombie firms tend to make more extra-marginal investments. Non-SOEs and non-zombies have higher productivity and invest closer to their optimal amounts, while SOEs and zombies carry more debt and typically operate at a loss. Despite owning most state-owned assets, SOEs often enjoy tax advantages and report government transfers or bank subsidies as

Table 4: Means Across Different Types

Variable	All	SOE=1	SOE=0	Diff.	Zombie=1	Zombie=0	Diff.
Over-Investment	.035	.043	.033	.01***	.040	0.034	.006***
Investment	.10	.06	.11	-.06***	.07	.11	-.04***
TFP	5.29	4.21	5.36	-1.15***	4.86	5.38	-.52***
Debt Ratio	.57	.70	.55	-.14***	.78	.52	.26***
Ret_t	.03	-.05	.04	-.09***	-.06	.05	-.11***
ROE	.24	.07	.25	-.18***	.02	.28	-.25***
Cash Flows	5.63	3.52	5.78	-2.25***	1.51	6.44	-4.93***
Bank Subsidies	.70	1.09	.67	.41***	1.27	.59	.68***
Size	4.94	6.01	4.87	1.14***	5.18	4.90	.29***
Zombies>= 0 Yrs	7%	19%	6%				
Zombies>=5 Yrs	2%	7%	1%				
Zombies>=10 Yrs	1%	2%	0%				

part of their profits, their return on equity is low. Additionally, SOEs and zombies frequently receive more bank subsidies to maintain their operations or continue overinvestment, but they never possess adequate cash flow to repay their debts. Compared to non-SOEs, SOEs are three times more likely to become zombie firms, which are insolvent and perform poorly. While private zombie firms typically exit the market gradually, the survival rate for zombie SOEs is almost 40% after five years and 11% after ten years. In contrast, no private zombie firms survive for over ten years, indicating that the private sector is more in line with the standard market exiting rule. In summary, SOEs or zombie firms have lower productivity, carry a high debt burden, rely heavily on government/bank subsidies, but unfortunately, control most resources and assets. They inefficiently invest (partially due to officials' intervention) by continuously borrowing and cannot exit the market normally so that redistribute resources to the more efficient private sector.

3.5. Empirical Strategy

To investigate whether officials engage in excessive interference with corporate investments in their jurisdiction to maximize personal gains, I estimated the following difference-in-difference specification to test my hypothesises. Denote enterprise by i, city by j, industry by d and year by t:

$$Overinvestment_{ijdt} = \beta_0 + \beta_1\ Turn_{jt} + \beta_2 Turn_{jt} * Post_{2012} + \beta_3 X_{ijdt}$$

$$+\Sigma\ Province + \Sigma\ Industry + \Sigma\ Year + \varepsilon_{ijdt}$$

$Overinvestment_{ijdt}$ was estimated by Richardson's model, which refers to excessive investment of firm i, industry d in year t. $Overinvestment_{ijdt} > 0$ if a firm overinvests and < 0

if otherwise. The dummy variable $Turn_{jt} = 1$ when there is a replacement of the city party secretary in city j at the end of year t. Due to the fact that an average of one-quarter of officials are replaced every year, while the remaining three-quarters are not replaced, the non-replaced officials can be considered as the "control group". I use replacement rather than promotion status, as officials cannot predict their promotion before the announcement at the end of their term. The assumption is that officials who achieve the equivalent local GDP growth target in different cities have the same probability of being promoted and will therefore strive for economic growth during their term. While this assumption is strong, it helps to analyze and focus on the effects of official interventions. I would relax this assumption later. The dummy variable $Post2012$ is set to 1 if the observation was after 2012, to test the sustainability of government investment-driven growth and whether the effect of officials' promotions based on GDP growth changes over time. Like many external observers and researchers, the replacement of China's top leader in 2012 is widely regarded as a crucial inflection point in the country's history. The impact of official turnover on excessive investment in firms after 2012 is the sum of the effects of turnover and post-2012 periods, i.e. $\hat{\beta}_1 + \hat{\beta}_3$. X_{ijdt} are control variables such as the firm's profitability (ROE), regional GDP growth rate, regional marketization index, firm's total factor productivity, number of employees, and industry, year, and provincial fixed effects. These variables control for time effects, industry fixed effects, and distinguish between developed and underdeveloped provincial fixed effects.

To avoid spurious regression, I conducted LLC, Harris-Tzavalis, and IPS unit root tests on the dependent variable, independent variables, and all control variables to test for stationarity. The results indicated no unit roots in the dependent or explanatory variables. Subsequently, a Hausman test was performed on the estimation model, concluding that fixed effects should be used. Table 5 presents the results of the simple difference-in-differences.

4. Results: Official Distortions

4.1. A Graph

Figure 1 illustrates how the degree of overinvestment in state-owned enterprises (SOEs) changes in response to the turnover of local officials. It reveals that the degree of overinvestment in SOEs rises sharply in the first two years following officials' turnover, before gradually subsiding from the third year onwards. Given that the average tenure of city party secretaries in my sample ranges from 3 to 4 years, the degree of overinvestment in SOEs remains high in the three years prior to turnover (lead3) due to the previous officials' influence on corporate overinvestment. In summary, official turnover leads to a short-term increase in the degree of overinvestment in SOEs, and this effect gradually dissipates after three years.

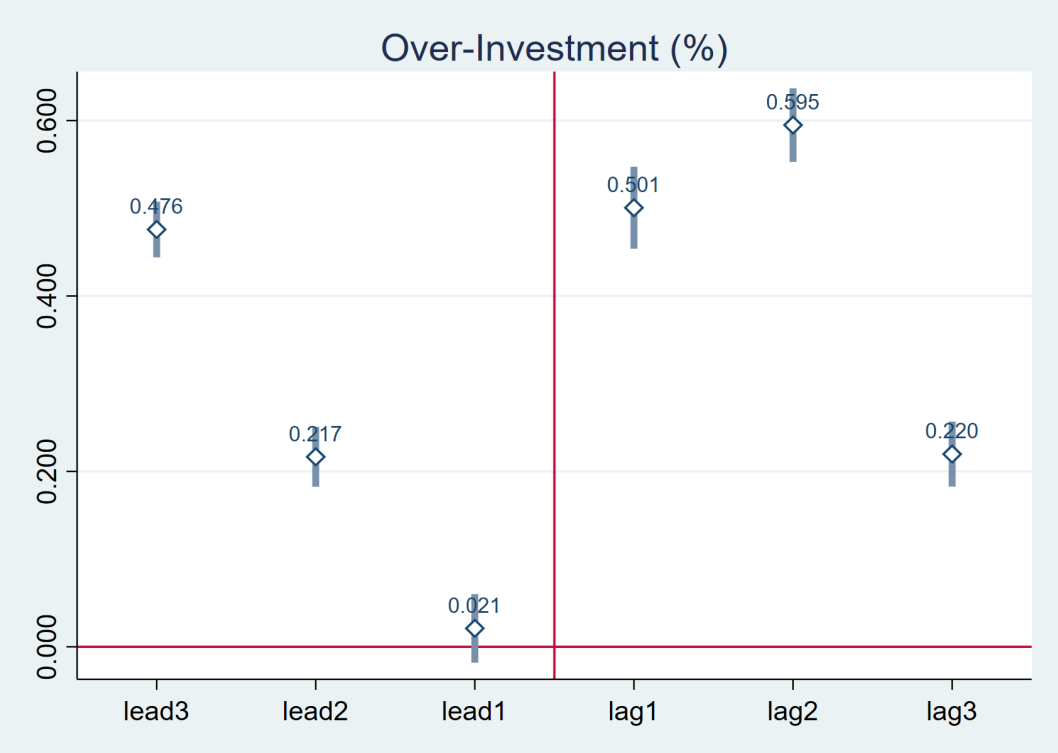

Fig. 1: Over-Investment:
Figure 1 illustrates the extent of overinvestment in state-owned enterprises in relation to the turnover of local officials. The label ”Lead” indicates the year before the next official turnover, ”Lead3” signifies three years before the next turnover, ”Lag” represents the period after the turnover, and ”Lag3” denotes three years after the turnover.

4.2. Main Results

Table 5 presents the findings from the specifications discussed in Section 3.5, results are reported by different ownership types of firms. Column (1) represents state-owned enterprises, while column (2) represents non-state-owned enterprises. The results reveal a significant impact of officials' turnover on the excessive investment rate of state-owned enterprises. In this context, turnover refers to the first year within the three years following the replacement of officials. It is observed that new officials tend to interfere in the investment decisions of state-owned enterprises in order to meet short-term economic growth targets. The turnover of officials leads to a 1% increase in the excessive investment rate of state-owned enterprises, and this increase is statistically significant at the 5% level. This 1% increase corresponds to approximately one-fourth of the total over-investment by state-owned enterprises. The significant impact can be attributed to the greater influence and control that government officials have over state-owned enterprises. Conversely, the turnover of officials does not have a significant effect on the investment efficiency of non-state-owned enterprises. However, it is worth noting that non-state-owned enterprises may experience a slight reduction in their investment levels following the replacement of the local party secretary. Although the reduction itself is not statistically significant, it can be regarded as a consequence of the reconfiguration of the

government-enterprise relationship. This restructuring introduces heightened uncertainty and necessitates the establishment of new relationships with the government.

The study reveals that firms with higher profit margins or return on equity tend to avoid excessive investment, as it would negatively impact their profitability. Additionally, in cities with a higher GDP growth rate, firms exhibit a reduced tendency for excessive investment, as it suggests that officials have likely already met their short-term growth targets and are less inclined to interfere in investment decisions. However, if officials have greatly surpassed their annual growth targets, higher-level government may set even higher targets for the next stage, creating challenges for officials to meet these new goals. Areas with greater marketization have undergone extensive economic reforms, possess well-developed legal systems, and maintain improved government-enterprise relationships. Non-state-owned enterprises in these areas are driven by profit motives and adhere to market rules, resulting in a lower likelihood of inefficient investment. Conversely, state-owned enterprises face minimal market constraints and remain under complete government control. They primarily invest to achieve economic growth and production targets, even if their actions distort the market and lead to sustained losses (state apparatus). Firms with higher total factor productivity exhibit a lower tendency for inefficient investment. Conversely, firms with a larger workforce are more prone to excessive investment due to their optimistic outlook on investment prospects and increased opportunities for government support and financing. Notably, the influence of officials on firm investment appears to have diminished after 2012, as indicated by the negative and significant coefficient of ”Turn*post.” This implies a decrease in officials’ motivation to interfere in firm investment decisions following 2012. The study also found that firms with higher total factor productivity are less likely to invest inefficiently, while firms with more employees are more likely to invest excessively because large enterprises are often more optimistic about investment prospects and more likely to obtain government support and financing.

As a check for robustness, I present in columns (3) and (4) the results when the dependent variable is changed from overinvestment to investment itself. While the investment rate may only reflect the quantity of investment and not necessarily a firm’s deviation from the optimal investment rate, using the actual investment rate provides a more direct and transparent approach. However, estimates of inefficient investment can indeed signal a firm’s deviation from the optimal investment rate while investment could be the combination of both optimal and suboptimal investment. These results closely resemble those in columns (1) and (2). It is evident that officials still have a strong degree of intervention in the investment decisions of state-owned enterprises, the replacement of municipal party secretary would increase investment rate of SOEs by approximately 1% and this effect is significant at 5% level, but this influence gradually diminishes after 2012. Moreover, during periods of higher economic growth, both efficient and inefficient investment, non-state-owned enterprises are

Table 5: Official Distortions

VARIABLES	Over-Investment		Investment		Zombie	
	SOE=1	SOE=0	SOE=1	SOE=0	SOE=1	SOE=0
Turn	0.01**	-0.00	0.01**	-0.01	0.01***	0.00
	(0.002)	(0.004)	(0.002)	(0.004)	(0.004)	(0.002)
Turn*Post2012	-0.02**	-0.01*	-0.02**	0.01	-0.00	-0.00
	(0.010)	(0.005)	(0.010)	(0.006)	(0.029)	(0.004)
ROE	-0.01***	-0.05***	-0.01***	-0.02***	-0.09**	-0.09***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.030)	(0.006)
GDP Growth	-0.07*	-0.11***	-0.09**	0.10***	-0.08**	-0.03*
	(0.044)	(0.036)	(0.044)	(0.039)	(0.035)	(0.018)
Market	-0.00	-0.01**	-0.01**	0.02***	-0.01	-0.01**
	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)
TFP	-0.02***	-0.04***	-0.01***	-0.01***	-0.01	-0.05***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)	(0.002)
Staff	0.01*	0.01***	0.02***	0.02***	0.02***	-0.01***
	(0.004)	(0.002)	(0.004)	(0.002)	(0.005)	(0.001)
Number of Firm	24,095	230,152	24,071	325,395	33,998	329,535
2-Stage DiD						
Turn	0.01***	-0.01	0.00	-0.01	0.02**	-0.00
	(0.003)	(0.007)	(0.002)	(0.006)	(0.008)	(0.003)
2-Stage DiD Post 2012						
Turn	-0.00	-0.01	-0.01	0.01	0.03	-0.01
	(0.014)	(0.007)	(0.016)	(0.010)	(0.033)	(0.008)
Province FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Turn means turnover status of city j at year t and Turn $= 1$ if turnover happened, $= 0$ if otherwise. Post2012 is binary and equals 1 for all observations after year 2012. ROE is the short of firms' return on equity. GDP growth is the regional rate of GDP growth rate in city j at year t. Market stands for the market index as discussed in section 3.3.4. TFP is enterprises' total factor productivity by OP's method. Staff is the logarithm of total number of employees. At the bottom of Table 5, I report the 2-stage estimates for the sample partitioned into observations before or after 2012.

more likely to invest, in line with market expectations. In areas with more developed markets, non-state-owned enterprises also tend to invest more due to the presence of more secure institutions that safeguard investments. I chose to use overinvestment instead of investment because overinvestment measures the extent to which a firm deviates from the optimal level

of investment, making it more conducive to supporting my argument. However, investment is more transparent and direct as it comes directly from the data rather than being estimated by the model.

To ensure robustness, I present the results with a different dependent variable in columns (3) and (4), where the focus shifts from overinvestment to actual investment itself. While the investment rate primarily reflects the quantity of investment rather than a firm's deviation from the optimal investment rate, using the actual investment rate offers a more direct and transparent approach. However, estimates of inefficient investment can still indicate a firm's deviation from the optimal level, whereas investment encompasses both optimal and suboptimal components. These findings closely resemble those in columns (1) and (2). It is evident that officials continue to exert a significant degree of intervention in the investment decisions of state-owned enterprises. The replacement of the municipal party secretary leads to an approximate 1% increase in the investment rate of state-owned enterprises, with statistical significance at the 5% level. However, this influence gradually diminishes after 2012. Furthermore, during periods of higher economic growth, both efficient and inefficient investment by non-state-owned enterprises tends to increase, aligning with market expectations. In areas with more developed markets, non-state-owned enterprises also exhibit a greater inclination to invest due to the presence of secure institutions that safeguard investments. I chose to focus on overinvestment rather than investment because it measures the extent of deviation from the optimal investment level, which better supports my argument. However, investment itself is more transparent and direct as it is directly derived from the data rather than being estimated by the model.

In columns (5) and (6), I present the results when the dependent variable is zombie firms. The findings indicate that officials' replacements will increase the number of state-owned zombie firms in the short term and this effect is significant at 1% level, while having no significant effect on non-state-owned zombie firms. This is due to the lower returns and increased reliance on government finances resulting from overinvestment. Unlike in the previous analysis, in the simple difference-in-differences results, this effect does not significantly decrease after 2012. This is because zombie firms can result not only from overinvestment but also from operational difficulties and heavy reliance on government subsidies for survival. Given the significance of state-owned zombie firms for employment, officials have incentives to continue supporting these firms even without intervention in investment. Similarly, higher GDP growth rates and profitability indicate a lower number of zombie firms.

4.3. Robustness Tests

The main specification in 3.5 assumes that the coefficient of average treatment effect (β_1) is the same for all city-year-industry groups. Aside from its endogeneity, the standard "treatment"

concept of the differences-in-differences framework with 2-cases and 2-periods is not applicable to official replacement due to its uneven occurrence over time. With only about one-fourth of officials replaced annually, a city may undergo multiple official replacements during the sampling years, similar to staggered adoptions of treatment. Consequently, the treated group is composed of cities that underwent replacements in a given year, while the control group consists of cities where replacements did not occur. Furthermore, officials encounter varying economic fundamentals and regional economic policies across provinces and industries, making them more easily to promote economic growth in economically developed regions/industries with more friendly policies. Alternatively, in regions with state-owned enterprises holding a larger share of the economy, officials may be more likely to manipulate these enterprises or banks to promote growth. Officials from the same province or neighboring regions may also influence each other in the race for promotion. Additionally, the effect of official replacements on intervention may fluctuate at different time points. In some years, lower central government economic growth targets may diminish officials' motivation to intervene in investment, and vice versa. Therefore, the 2-period 2-group difference-in-differences framework falls short in addressing these practical considerations. Let Y_{ijdt} denotes the outcomes of replacement onto enterprise i in city j, industry d and year t, and denote $Turn_{jt}$ by T_{jt}, then average treatment effect is identified by eliminating the provincial (or city) (λ_j), industry (η_d) and time (γ_t) fixed effects:

$$E(Y_{ijdt}|j,d,t,T_{jt}) = \lambda_j + \eta_d + \gamma_t + \beta_{jdt}T_{jt}$$

In cases where the average treatment effects differ across both regions and time, and the adoption of the treatment by different regions is staggered over time (i.e. $\beta_{jdt} \neq \beta_1$ for different j,d,t), the difference-in-differences regression is unable to recover a straightforward region-year average treatment effect. An apparent candidate for a heterogeneous average treatment effect is the average change in outcomes of different groups during the period when that group receives treatment:

$$E(\beta_{jdt}|T_{jt}=1) = E(Y_{1ijdt} - Y_{0ijdt}|T_{jt}=1)$$

Then the simple difference-in-differences with parallel trends assumption would imply:

$$E(Y_{ijdt}|j,d,t,T_{it}) = \lambda_j + \eta_d + \gamma_t + E(\beta_{jdt}|T_{jt}=1)T_{jt} + [\beta_{jdt} - E(\beta_{jdt}|T_{jt}=1)]T_{jt}$$

The new disturbance term $[\beta_{jt} - E(\beta_{jdt}|T_{jt}=1)]T_{jt} + \varepsilon_{ijdt}$ in case of heterogeneous βs is correlated with λ_j, η_d and γ_t. Gardner (2022) proposed a 2-stage process (2-stage DiD) to address these complexities and biases. The approach involves first estimating the regional ($\hat{\lambda}_j$), industrial ($\hat{\eta}_d$) and time fixed effects ($\hat{\gamma}_t$) in samples of untreated data ($T_{jt}=0$):

$$Y_{ijdt} = \lambda_j + \eta_d + \gamma_t + \varepsilon_{ijdt}$$

and then regressing the adjusted outcome onto the treatment indicator:

$$Y_{ijdt} - \hat{\lambda}_j - \hat{\eta}_d - \hat{\gamma}_t = \tilde{Y}_{ijdt} = \beta_{jdt} T_{jt} + \mu_{ijdt}$$

He showed that this 2-stage process would identify an estimand:

$$E(\beta_{jdt} | T_{jt} = 1) = \sum_{j=1}^{J} \sum_{d=J}^{D} \sum_{t=d}^{T} \beta_{jdt} P(j,d,t | T_{jt} = 1)$$

Where $P(j,d,t|T_{jt} = 1)$ denotes the probability of firms in region j, industry d, which received treatment in year t. Compared to the simple difference-in-differences estimate, a model that is not properly specified can lead to incorrect attribution of treatment effects to region, industry and year fixed effects. As the duration of treatment for a region increases, its treatment effects become more entangled with regional/industrial fixed effects. Similarly, treatment effects experienced by a city during a particular year can become partially absorbed by year fixed effects depending on the likelihood of receiving treatment during that year.

At the bottom of the table 5, I present the results of 2-stage DiD. The impact of official distortions remains robust, as evidenced by the significant distortion in investment efficiency of SOEs due to the replacement of local officials. In contrast, the effect on non-SOEs is insignificant. When newly appointed officials overinvest in SOEs, the likelihood of these enterprises becoming zombies increases. However, this effect disappears after 2012. These findings differ slightly from the estimates obtained using simple difference-in-differences analysis. Although officials have an incentive to support zombies in order to maintain employment, the 2-stage process shows that the effects of official support disappeared after 2012, while the simple difference-in-differences approach still indicates strong distortions in state-owned zombies even after 2012. This suggests that there may be some potential bias or regional or time differences resulting from staggered adoption of treatment that are not addressed in simple difference-in-differences analysis.

To further ensure the robustness of the results, I conducted additional tests, including a common time trend test and a Fisher permutation test. The common time trend test evaluates whether both the treatment group and the control group would have exhibited similar changes in (over) investment over time in the absence of the treatment. On the other hand, the Fisher permutation test offers a rigorous and unbiased analysis of the statistical significance of official replacement. The findings of these tests are presented in table 6. The test for common time

trend demonstrated that the coefficient of $Turn_{t+1}$[1] for SOEs is not significant, while the coefficient of $Turn_t$ remains significant. As for non-SOEs, all main coefficients remained insignificant, similar to the previous analysis. Furthermore, the Fisher permutation test results, reported at the bottom of the table, indicated a rejection of the null hypothesis. This finding suggests that the main results remain robust despite the additional tests.

To further explore the temporal impact of officials on corporate investment, additional analysis was conducted. Due to the uncertainty regarding the timing differences in the effects of official replacement on excessive investment across different regions, an investigation was undertaken to understand why the effects of official replacement are most prominent in the first year rather than in subsequent years. To address this issue, an additional specification was included in the analysis, incorporating lags of one year, two years, and three years following the turnover of officials. The results of this analysis are presented in Table 7. The table demonstrates that official turnover has a significant effect on increasing the level of overinvestment in state-owned enterprises (SOEs), with statistical significance at the 5 percent level. This effect remains significant even after one year, but gradually diminishes from the second year onwards, aligning with the findings depicted in Figure 1. This indicates that the replacement of officials has a relatively short-term impact on corporate investment, further highlighting officials' urgent pursuit of short-term economic growth for political promotion. Conversely, official turnover does not impact the level of overinvestment in non-SOEs.

During the process of constructing the Richardson model, it is assumed that in an ideal market environment, enterprises have a normal overall investment level without any systematic investment bias. However, given China's current economic transition phase, there may be some errors in estimating enterprise investment efficiency using this model's residual. To reduce the impact of these estimation errors, as the last robustness check of sample reduction, the Richardson model's residual is divided into three equal groups based on size, and the middle group is eliminated. The remaining two groups are then used as dependent variables for regression analysis. According to table 11, the absolute values of the regression coefficients for the replacement of local government officials on enterprise investment efficiency are almost identical, while the absolute values of the other coefficients have slightly changed, but their direction and significance levels have hardly changed. Therefore, it can be inferred that the research findings of this paper are robust.

5. Conclusion

In conclusion, this study utilizes a difference-in-differences identification strategy to explore the effects of political promotion competition on investment decisions in State-Owned Enterprises (SOEs) and non-SOEs in China. The findings reveal that official distortions in

[1] $Turn_{t+1} = 1$ if there is a turnover at t+1

corporate investment decisions are substantial and significant in SOEs, while non-SOEs appear to be less affected. Such distortions can cause inefficiencies and result in the ”zombification” of firms, posing a significant concern for China's economic development. While using GDP growth as a metric for evaluating officials' promotions may promote economic development, an excessive emphasis on this measure can lead to negative externalities and long-term consequences. The central government's directives are frequently unrealistic, irrational, and contradictory, and officials' actions are generally a response to the government's objectives. It is interesting to note that the transfer of economic priorities after 2012 may have improved investment efficiency for businesses, although the effects of policy changes after 2012 remain unknown. The presence of systemic inefficiencies, irrationalities, and a lack of proper checks and balances have emerged as major challenges to China's economic development. Structural reforms in institutions must be implemented to address these obstacles, as the economy is at a critical juncture where it may struggle to maintain its impressive growth trajectory.

The results of this study have significant policy implications for the economic and political development of China. Firstly, the government needs to exercise caution when using GDP growth as the sole metric for evaluating officials' promotions and explore alternative metrics that better reflect long-term economic sustainability and efficiency. Secondly, there is a need for more stringent checks and balances on officials' actions, particularly regarding the investment decisions of SOEs. Thirdly, market-oriented reforms and increased competition in the SOE sector are essential to improving efficiency and reducing distortions. Finally, further research is necessary to better understand the dynamics of the relationship between political promotion competition, investment distortions, and economic development, particularly regarding the effects of policy changes in recent years. In terms of future research, it would be interesting to explore the extent to which political promotion competition affects other aspects of economic decision-making, such as pricing, production, and labor. Additionally, research could investigate the role of external factors such as technological change, international competition, and global economic trends in shaping investment decisions and distortions in China's economy. Finally, it would be useful to examine the impact of policy reforms aimed at reducing investment distortions in SOEs and promoting market-oriented reforms on China's long-term economic development.

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7. Appendix

7.1. Identification of Zombies

Caballero et al. (2008) first introduced the "CHK method" as a standard for identifying "zombie companies." This method suggests that zombie companies exist because banks provide preferential credit to these companies. To determine if a company is a zombie company, one can assess whether the bank is providing loan subsidies or interest relief to the target enterprise. This can be done by defining the "minimum interest payable" and comparing it with the actual interest paid by the enterprise. Using the CHK subsidy rule, one can calculate a firm's minimum required interest payment in year t as follows:

$$R^*_{i,t} = rs_{t-1} * BS_{i,t-1} + (\frac{1}{5}\Sigma^5_{j=1} rl_{t-j}) * BL_{i,t-1}$$

Where $BS_{i,t}$ = firms' short term liabilities $BL_{i,t}$ = firms' long term liabilities $\approx$ long term debts. rs_t, rl_t = the average short-term and long-term prime rate in year t. To calculate the annual minimum short-term interest rate, one can take the average of the RMB lending benchmark interest rate within 6 months and from 6 months to 1 year published by the central bank. Similarly, take the average of benchmark interest rates for loans of 1 to 3 years, 3 to 5 years, and more than 5 years to calculate the long-term minimum interest rate for each year. Time

weight is calculated based on the time interval before and after the date the central bank announces interest rate adjustments. The short-term and long-term minimum interest rates are weighted averages of each adjustment within a year, with the lowest rates cut by 10 percent each year. .[2]

Use the minimum required interest payment ($R^*_{i,t}$) minus the actual interest payments ($R_{i,t}$) to obtain credit subsidies standardized with loans in the previous period ($B_{i,t-1} = BS_{i,t-1} + BL_{i,t-1}$):

$$x_{it} = \frac{R_{i,t} - R^*_{i,t}}{B_{i,t-1}}$$

Classify

$$\text{zombie} = \begin{cases} 1 & \text{if } x_{it} < 0 \\ 0 & \text{otherwise} \end{cases}$$

Fukuda and Nakamura, 2011 argued that the CHK method may mistakenly classify some good companies as zombies (type I error) since many high-quality firms may also receive preferential loan rates. Conversely, banks may continue to renew loans for inefficient companies, and the CHK method may miss some companies that are truly zombies (type II error). Thus, they introduced "profitability" as a factor in the zombie measure (FN-CHK method). To calculate a firm's actual profit using this method, subtract the minimum interest payable from the earnings before interest and tax (EBIT):

$$Pro_{it} = EBIT_{it} - R^*_{i,t}$$

One characteristic of zombie enterprises is their lack of sustainable profitability, which indirectly drains the economy. In other words, zombies are companies that can continue to survive even when their actual profit is zero or negative, meaning their owners or shareholders are not making any profit or are even losing money. Thus, calibrate and reclassify zombie $= 0$ if $Pro_{it} > 0$.

However, Wang & Liu, 2018 has argued that the FN-CHK method does not fully capture the second characteristic of zombie enterprises: their lack of sufficient cash flow to repay debts in a timely manner. To address this limitation, calculate net profit by subtracting income tax from the total profit, and cash flow can then be obtained by adding depreciation and interest payments in the current period.

$$Cash_{it} = (Pro_{it} - Tax_{it}) + \delta_{it} + R_{i,t}$$

[2]Refer to Tan et al., 2017: From 1998 to 2011, the central bank set the minimum limit for the floating range of financial institutions' lending interest rates to be 0.9 times the benchmark interest rate. Since 2012, the floating range has remained within 10% of the benchmark interest rate.

To calculate the flow of current liabilities, subtract the current liabilities at time t-1 from the current liabilities at time t.

$$Ldebt_{it} = BS_{i,t} - BS_{i,t-1}$$

If the flow of current liabilities is positive, it indicates that the enterprise is continuously increasing its short-term borrowing. Therefore, the second calibration is made by reclassifying zombie $= 0$ if $Cash_{it} > Ldebt_{it}$. meaning that zombies have poor short-term solvency and keep increasing their short-term borrowing.

To calculate cash flows accurately, it is important to account for missing values such as income tax, interest payments, and current depreciation. In the NBS database, current period depreciation was not disclosed in 2008-2009 and was missing in abundance in 2011-2013. To estimate these values, multiple imputation was utilized based on multiple linear regression, using log total fixed asset and firm industry categories as predictors. This process was repeated ten times, and the tenth interpolation was selected to replace the missing values. The distribution characteristics of current depreciation after interpolation were found to be very similar to those before interpolation.

Additionally, this paper excludes new enterprises from the identification of zombie enterprises, as such companies are often prone to operating difficulties, low profitability, and insufficient cash flow. The third calibration is made by reclassifying zombie $= 0$ if the firm age is less than or equal to three.

7.2. OP's Total Factor Productivity

Following from Olley and Pakes, 1996, estimate the following for enterprise i at year t

$$LnY_{it} = \beta_0 + \beta_k LnK_{it} + \beta_l LnL_{it} + \beta_a age_{it} + \beta_s SOE_{it} +$$

$$\Sigma_m \delta_m year_m + \Sigma_n \lambda_n reg_n + \Sigma_k \zeta_k ind_k + \varepsilon_{it}$$

Y represents total outputs, K represents total fixed assets, L represents employees, and *age* represents enterprise age. *SOE* equals 1 for state-owned enterprises. *year*, *reg*, and *ind* are year, regional (province), and industry dummies, respectively. Taking K and *age* as state variables, and the firm's investment serves as the proxy variable while controlling for *SOE*. *year*, *reg*, and *ind* are all considered as free variables. If the final data point of a firm in a panel is located in year t, it is deemed to have departed from the market at that time. Then obtain OP's total factor productivity by:

$$TFP_{op} = LnY_{it} - \hat{\beta}_k LnK_{it} - \hat{\beta}_l LnL_{it}$$

7.3. Robustness Tests

Table 6: Test of Common Time Trend

VARIABLES	Over-Investment	
	SOE=1	SOE=0
Turn	0.03*	0.00
	(0.017)	(0.011)
Turn*Post 2012	-0.10***	-0.01
	(0.027)	(0.023)
Turn(t+1)	-0.02	-0.00
	(0.016)	(0.011)
ROE	0.00	-0.00**
	(0.000)	(0.000)
GDP Growth	-0.01**	-0.31***
	(0.034)	(0.069)
Market	-0.00	-0.01***
	(0.004)	(0.003)
TFP	-0.02***	-0.05***
	(0.003)	(0.003)
Staff	-0.00	0.01***
	(0.005)	(0.002)
Number of firm	19,072	234,295
Province FE	YES	YES
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Turn means turnover status of city j at year t and Turn $= 1$ if turnover happened, $= 0$ if otherwise. Post2012 is binary and equals 1 for all observations after year 2012. ROE is the short of firms' return on equity. GDP growth is the regional rate of GDP growth rate in city j at year t. Market stands for the market index as discussed in section 3.3.4. TFP is enterprises' total factor productivity by OP's method. Staff is the logarithm of total number of employees. $\text{Turn}_{t+1} = 1$ if there is a turnover at t+1

Table 7: Robustness Test: Time Effects

VARIABLES	Over-Investment	
	SOE=1	SOE=0
Turn	0.01**	-0.00
	(0.003)	(0.004)
Lag1	0.01**	0.00
	(0.003)	(0.004)
Lag2	0.00	-0.00
	(0.003)	(0.004)
Lag3	0.00	-0.00
	(0.003)	(0.004)
Turn*Post	-0.02**	-0.01*
	(0.010)	(0.006)
ROE	-0.01***	-0.05***
	(0.004)	(0.004)
GDP Growth	-0.07**	-0.30***
	(0.034)	(0.068)
Market	-0.00*	-0.01***
	(0.003)	(0.002)
TFP	-0.02***	-0.04***
	(0.003)	(0.003)
Staff	0.01**	0.01***
	(0.004)	(0.002)
Number of Firm	24,224	232,103
Province FE	YES	YES
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Turn means turnover status of city j at year t and Turn $= 1$ if turnover happened, $= 0$ if otherwise. Post2012 is binary and equals 1 for all observations after year 2012. ROE is the short of firms' return on equity. GDP growth is the regional rate of GDP growth rate in city j at year t. Market stands for the market index as discussed in section 3.3.4. TFP is enterprises' total factor productivity by OP's method. Staff is the logarithm of total number of employees. $\text{Turn}_{t+1} = 1$ if there is a turnover at t+1. Lag1-3 means 1-3 years after turnovers.

Table 8: Robustness Check: Sample Reduction

VARIABLES	Over-Investment		Investment		Zombie	
	SOE=1	SOE=0	SOE=1	SOE=0	SOE=1	SOE=0
Turn	0.01**	-0.00	0.01**	-0.01	0.01*	0.00
	(0.003)	(0.005)	(0.003)	(0.005)	(0.005)	(0.002)
Turn*Post2012	-0.02**	-0.02*	-0.02**	0.01	-0.01	-0.00
	(0.010)	(0.008)	(0.010)	(0.007)	(0.034)	(0.004)
ROE	-0.02***	-0.07***	-0.02***	-0.03***	-0.09***	-0.09***
	(0.006)	(0.005)	(0.006)	(0.004)	(0.028)	(0.006)
GDP Growth	-0.09*	-0.13**	-0.11**	0.03	-0.03	-0.03*
	(0.054)	(0.053)	(0.052)	(0.020)	(0.037)	(0.018)
Market	-0.01**	-0.01**	-0.01**	0.02***	-0.01**	-0.01**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)
TFP	-0.02***	-0.05***	-0.01***	-0.01***	-0.00	-0.05***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.007)	(0.002)
Staff	0.01**	0.02***	0.02***	0.02***	0.02***	-0.01***
	(0.005)	(0.003)	(0.006)	(0.002)	(0.006)	(0.001)
Number of firm	20,022	196,921	19,984	306,527	27,412	281,232
Province FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Turn means turnover status of city j at year t and Turn $= 1$ if turnover happened, $= 0$ if otherwise. Post2012 is binary and equals 1 for all observations after year 2012. ROE is the short of firms' return on equity. GDP growth is the regional rate of GDP growth rate in city j at year t. Market stands for the market index as discussed in section 3.3.4. TFP is enterprises' total factor productivity by OP's method. Staff is the logarithm of total number of employees.