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THE REAL EFFECTS OF GDP MANIPULATION ON CORPORATE INNOVATION: EVIDENCE FROM CHINA

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Abstract

Corporate innovation is fundamental to the sustainable competitiveness of any economy. This paper examines whether and how local government-level macroeconomic growth pressure induced by gross domestic product (GDP) manipulation in China affects corporate innovation. Using calibrated satellite night light data to construct the GDP manipulation index, we find that GDP manipulation reduces local firms' R&D expenditure in the year ahead. The result holds up through robustness tests using different measures of GDP manipulation and corporate innovation. Additionally, we employ an instrumental variable approach to address endogeneity issues and enhance the strength of the causal inference. Furthermore, we find that the effect of GDP manipulation on local corporate innovation is stronger in regions with higher government intervention and where local governments control greater resources. Moreover, this finding is more prominent when local governors face intensified economic growth pressure or promotion incentives. This paper provides evidence that the Chinese government's incentive to boost GDP growth negatively affects corporate innovation. Our findings offer valuable insights for policymakers aiming to stimulate economic growth and enhance competitiveness within their jurisdiction. By implication, it is necessary to form a financial and administrative system that effectively promotes industrial innovation and facilitates the transformation of the economic growth model into one driven by technology and innovation to gain a reasonable competitive advantage both within China and internationally. Future research may explore the evolving dynamics of GDP manipulation's impact on other microeconomic behaviors, with particular focus on how it hinders competitiveness across industries and regions.

Keywords: *GDP manipulation, Corporate innovation, Political promotion pressure, China*

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1 INTRODUCTION

Innovation plays a crucial role in ensuring sustainable competitiveness at both micro and macroeconomic levels (Reznakova & Stefankova, 2022), especially in developing countries (Dobrzański et al., 2021). Existing research on the factors influencing corporate innovation has primarily concentrated on macroeconomic indicators of financial development (e.g., Kapidani & Luci, 2019) or on various firm-specific factors (e.g., Denkowska et al., 2020; Tian et al., 2021). However, the existing literature on the determinants of corporate innovation remains limited in the perspective of official behavior.

As a core economic development indicator, regional GDP growth is often closely connected to officials' promotional decisions. Therefore, politicians under tremendous pressure to offer promotions are incentivized to manipulate regional GDP figures (Wallace, 2016; Lyu et al., 2018; Cai et al., 2022). According to the media, provincial officials often manipulate economic figures through typical methods, such as inflating local investment figures and exaggerating firms' earnings (Chen et al., 2020). It tends to be less persistent and raises the benchmark for

calculating the following year's GDP growth rate, making it more difficult for regional officials to beat the economic growth targets in subsequent years. However, limited research examines the negative economic consequences of GDP manipulation.

Based on the above discussion, this paper examines whether and how macroeconomic growth pressure induced by GDP manipulation at the local government level in China crowds out year-ahead innovation activities at the local firm level. In our main hypothesis, we posit that firms in provinces with more significant GDP manipulation tend to cut R&D expenditures a year ahead to cater to the government's philosophy of pursuing short-term economic growth. Since GDP manipulation is not supported by actual activity growth and raises the benchmark for calculating the following year's growth rate, it is more difficult for regional officials to beat economic growth targets in subsequent years with a higher degree of GDP manipulation. Under pressure to boost short-term GDP growth performance, local officials may guide local firms to invest in short-term projects with quick returns through resource allocation and policy-making. Featured by highly uncertain returns and long cycles for realizing benefits, corporate innovation activities are more likely to be squeezed out.

China offers an attractive setting to examine the relationship between GDP manipulation and local corporate innovation investment. First, anecdotal evidence shows that GDP manipulation is prevalent in local Chinese regions. There is also considerable academic literature on the credibility of GDP reporting figures in China (e.g., Clark et al., 2017; Holz, 2014). Under the economy-first policy and the regional decentralization of authority, local officials' promotion of personnel has mainly been based on their regional economic growth since the 1980s. This situation has triggered local officials under tremendous promotion pressure to manipulate regional GDP figures (Wallace, 2016; Lyu et al., 2018; Cai et al., 2022). Moreover, Chinese local governments have substantial control over administrative power and economic resources due to the regional decentralization system (Xu, 2011). Therefore, under substantial pressure to deliver economic expansion, local officials can exercise significant influence over local firms and decompose GDP growth targets into enterprise-level components. Firms are willing to bear part of the economic growth pressure to establish close political relationships with local governments and obtain scarce resources (Piotroski & Zhang, 2014).

Using calibrated satellite night light data to estimate each province's actual economic development level (Henderson et al., 2012) and construct the GDP manipulation index, we find a significantly negative relationship between GDP manipulation and the year-ahead R&D expenditure of local firms. Regarding economic magnitude, there would be a 6.04% decrease in local firms' R&D investment with a one-standard-deviation rise in GDP manipulation. The main results hold when conducting several robustness tests, including the adoption of an alternative proxy for GDP manipulation and a new proxy for corporate innovation output using the number of patent applications and grants. To mitigate endogeneity issues, we use last year's GDP growth target rate as an instrumental variable for GDP manipulation, and the results are robust.

Several cross-sectional tests are conducted to provide additional insights. We posit that the negative influence of GDP manipulation on local corporate innovation is more pronounced when local governments are motivated by stronger promotion incentives and possess a greater capacity to influence local firms. Consistent with our prediction, the main result is intensified when firms are located in the provinces with higher government intervention and when local governments have greater resources under control. From the perspective of pressure to boost economic growth, the primary finding is stronger for firms located in provinces where the provincial economic performance lags behind the overall standard or its adjacent competitors and in provinces where the provincial governor is over the age of 60.

The rest of this paper proceeds as follows. The literature review and hypothesis development are provided in Section 2. Description of the data, variables, and empirical model are provided in Section 3. In Section 4, the empirical results and robustness tests are presented and discussed. Finally, Section 5 concludes.

2 THEORETICAL BACKGROUND

In recent years, there have been numerous scandals concerning Chinese local government officials exaggerating economic statistics. In the West, governments often intervene in economic data to cover up recessions and to get through a crisis (Wallace, 2016), to maintain social stability (Hollyer et al., 2015), or to gain popular electoral support (Healy & Lenz, 2014). However, in China, GDP manipulation is more motivated by the promotion incentives of local officials.

Since China's reforms and opening up of the economy, the promotion assessment criteria for local officials have changed from purely political indicators to local economic performance indicators. Chinese officials' promotion opportunities are closely related to the economic performance within their jurisdictions, especially the GDP growth rate. Under the promotion tournament, officials set high growth targets at the beginning of the year and strive to exceed economic growth by the end of the year to highlight their performance. Although the economic-first policy and the intense political tournament environment have contributed to the miraculous and continuous high growth of the Chinese economy, they have caused a range of side effects (e.g., Tan et al., 2012) and even economic statistics manipulation (Lu et al., 2017; Lyu et al., 2018).

2.1 GDP Manipulation and Local Corporate Innovation

Like earnings management, the manipulated GDP figure is not supported by actual economic activities and thus remains less persistent. Moreover, the exaggerated GDP figure raises the criteria for calculating growth rates in the second year, making it more difficult for regional officials to beat the economic growth targets in subsequent years. In pursuit of short-run economic performance, local governments can cascade economic growth targets to the firm level. Numerous studies find that local firms change their financial policy to help the Chinese government reach political goals (Piotroski & Zhang, 2014). For example, in regions with stronger economic growth pressure, affiliated firms are more likely to manage earnings to collaborate in window-dressing GDP numbers (Chen et al., 2020; Cai et al., 2022). The Chinese government also plays an essential role in affecting corporate tax avoidance (Li et al., 2020; Chen et al., 2021), information disclosure (Piotroski et al., 2015; Yao et al., 2023), IPO decisions (Piotroski & Zhang, 2014), corporate social responsibility performance (Li & Lu, 2020), and so on.

Since technological innovation is characterized by slow and uncertain returns and cannot boost economic growth rapidly, it tends to be squeezed out under solid incentives to deliver short-term economic (Gu & Shen, 2012; Wang et al., 2023). Under considerable pressure to achieve rapid economic performance, local officials may use policy tools, such as project approval or financial resources, to direct firms to invest in physical investment projects, thereby crowding out resources for technological innovation. Under the dual pressure of short-term performance and government policy guidance, corporate managers also reduce R&D activities and invest in projects that yield quick results. Accordingly, the first hypothesis is formulated:

H1. All else being equal, local GDP manipulation negatively affects local corporate innovation in the year ahead.

2.2 The Role of Government Intervention

The impact of GDP manipulation on corporate innovation should be stronger where the local government can exert greater influence on local firms. In provinces with well-developed markets, government intervention in firms' decisions is often modest (Chen et al., 2015). However, local governments still have considerable control over firms in areas with poor market development. Local firms tend to take on more political tasks in provinces with more government intervention (Fan et al., 2016a). In this context, firms in areas of solid local government intervention would be apportioned more short-term growth targets, which may lead to more R&D expenditure reduction.

Moreover, we predict the main relationship to be stronger when local officials have greater capacity to intervene in the local economy. From the perspective of ways to influence local firms, we take into account the financial resources held within the domain of local officials. Local governments with more substantial margins of available financial resources can allocate larger amounts of funds (Lyu et al., 2018). Beforehand, local governments with more significant slack can guide local firms' resource allocation through various financial means. The above discussion leads to our second prediction:

H2. All else being equal, the negative relationship between GDP manipulation and corporate innovation is stronger when firms are located in regions with stronger government intervention and when local governments have more resources under control.

2.3 The Role of Promotion Pressure

Furthermore, the likelihood of local officials' intervention is heightened when the expected benefits are more extensive. Therefore, negative relationships should be stronger when local officials bear more substantial pressure to boost economic growth and have a strong incentive to pursue political promotion.

From the perspective of pressure to boost economic growth, we consider the relative performance of local politicians since the evaluation system for local politicians is the economic growth-based tournament system in China. When a province's economic performance indicator falls behind its neighboring provinces and the overall standard, the local government confront heightened pressure to boost it (Chen et al., 2020; Cai et al., 2022). From the perspective of promotion incentives, we consider officials' age. Under China's personnel cadre management system, age is an essential factor in influencing the promotion pressure of local politicians. Since 1980, provincial-level government officials have faced a mandatory retirement system, which mandates their retirement upon reaching 65 years of age unless they have been promoted to higher positions. As the term of provincial officials' tenures typically amounts to approximately five years or less, incentives for promotion reach the peak for provincial politicians over the age of 60 under this regime. Overall, the following hypothesis is formulated:

H3. All else being equal, the negative relationship between GDP manipulation and corporate innovation is stronger when local politicians have a stronger incentive to boost economic growth.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

3.1 Research Objective

The primary research aim of this study is to investigate the impact of GDP manipulation on local corporate innovation.

3.2 Methodology

We test our hypotheses in a multivariate regression model as follows:

$$RDI_{i,j,t} = \alpha_0 + \alpha_1 GDPDIS_{i,j,t-1} + \beta_1 Controls_{i,j,t} + Year + Industry + \varepsilon \quad (1)$$

where *RDI* denotes the R&D investment intensity of the firm *j* in province *i* in year *t* and is calculated as enterprise R&D expenditure divided by operating income. $GDPDIS_{i,j,t-1}$ is the GDP manipulation of province i in year t-1, i.e., the difference between the officially reported and actual GDP growth rates. Year and industry represent year and industry fixed effects, respectively. In all of the regressions, we report t-statistics based on standard errors adjusted for clustering at the firm level.

The objectivity and reliability of using data obtained from DMSP/OLS night light observations to measure real local economic growth have been widely recognized (e.g., Henderson et al., 2012; Hodler & Raschky, 2014; Nordhaus & Chen, 2015; Xu et al., 2015; Fan et al., 2016a). We first set up the following model to calculate the fitted values as $\hat{g}_{i,t}$.

$$g_{i,t} = \omega_0 + \omega_1 light_{i,t} + \eta_i + \delta_t + \varepsilon_{i,t} \quad (2)$$

where g is the authoritative GDP growth rate, light represents the regional light brightness growth rate per unit area, the formula also include the year fixed effect (δ_t) and the province fixed effect(η_i). ε is the random disturbance term.

In accordance with Henderson et al. (2012), we construct a comprehensive estimating equation to measure real local economic growth in the following way:

$$Real\ Growth = \rho g_{i,t} + (1-\rho)\hat{g}_{i,t} \quad (3)$$

where $\hat{g}_{i,t}$ is the fitted value of Equation (2) and $g_{i,t}$ represents the official GDP growth rate. The weight parameter ρ serves to minimizes the error of GDP measurement, which is calculated as 0.586 in this study. GDP manipulation (*GDPDIS*) is then calculated as the difference between estimated real growth and the official one. A positive value of *GDPDIS* indicates that official economic growth is higher than real economic growth. A larger *GDPDIS* indicates more exaggeration of the statistical economic data from the real economic development level of the province.

We employ corporate innovation intensity to capture corporate innovation, measured as enterprise R&D expenditure divided by operating income. We calculate corporate investment intensity in the robustness test as R&D expenditure divided by total assets (Adhikari & Agrawal, 2016). As a further analysis, we also employ two measures of corporate innovation output. The first measure, PATENT, is the natural logarithm of one plus the sum of patent applications (Meng et al., 2019). The second, GRANT, is the natural logarithm of one plus the sum of granted patents (Meng et al., 2019).

Controls denote a set of control variables influencing corporate innovation, including firm-level and region-level factors. As for firm characteristics, we control for firm size (SIZE), the leverage ratio (LEV), firm age (AGE), and the concentration of controlling shareholder structure (CTRL)as the fundamental firm characteristics. We control for firm profitability (PROFIT) and cash flow capacity (CF) because it is well established that corporate innovation is primarily influenced by firms' financial situation. We include the capital intensity ratio (CAP) as a control variable because there is a higher propensity for capital-intensive firms to invest in R&D than labor-intensive firms (Kang, 2013). We also control industrial market concentration (HHI) to control the impact of industry competition on corporate innovation. Following prior research (Gu & Shen, 2012), our analyses include several regional characteristics as control variables. We control the level of economic development (LNGDP) because a more developed local economy helps local firms to expand their financing channels, thus promoting their R&D investment. We include the openness of the province (OPEN) as a control variable because the opening of the province to the outside world will increase competition, and local firms have to

carry out more innovative activities to survive in a highly competitive environment. We further control regional property rights protection degree (PROP), because property rights protection exhibits a positive and statistically significant association with corporate R&D activity (Lin et al., 2010). The definitions of all variables utilized in our analysis are presented in Table 1, and in order to attenuate the impact of extreme values, all continuous variables undergo Winsorization at 1%.

Tab. 1 – Variable definitions. Source: own research

	Variable	Explanation
Dependent Variable	*RDI*	Enterprise R&D expenditure scaled by operating income.
	RDI_AssetRatio	Enterprise R&D expenditure scaled by total assets.
	PATENT	Natural logarithm of the sum of patent applications plus one.
	GRANT	Natural logarithm of the sum of granted patents plus one.
Independent Variable	*GDPDIS*	The difference between the official GDP growth rate and the actual GDP growth rate, where the actual GDP growth rate is measured using equation (2), referring to Henderson et al. (2012).
	GDPDIS2	The residual component resulting from the regression of the GDP growth rate on the changes in freight volume, electricity and bank loans, referring to Lyu et al. (2018).
Control Variables (*Controls*)	*AGE*	Natural years of the corporate establishment.
	SIZE	The natural logarithm of the aggregate value of assets.
	PROFIT	Net operating profit margin, calculated as the ratio of net profit to operating income.
	LEV	The ratio of total debt to total assets.
	CAP	Capital intensity ratio, calculated as the net fixed assets scaled by the total workforce.
	CF	Cash Flow, calculated as the net operating cash flow scaled by total assets.
	CTRL	The ownership proportion of direct controlling shareholders.
	OPEN	The total foreign direct investment of the local province scaled by provincial GDP.
	PROP	Patent applications accepted in the province scaled by the number of scientific and technological personnel.
	HHI	Industry competition, computed as the Herfindahl Hirschman index at the industry level.
	LNGDP	Local economic development level, calculated as the natural logarithm of the provincial GDP.
Moderator Variables	*GOV*	An indicator variable that equals to 1 when the marketization index for the province-year is below the sample mean, and 0 otherwise. The marketization index data is sourced from the sub-index "the relationship index between government and market" of China's marketization index (Fan et al., 2016b).

	SLACK	An indicator variable that equals to 1 when the financial slack for the province-year is below the sample mean, and 0 otherwise. Financial slack for local governments is gauged by the average fiscal budget surplus (calculated as the difference between budget income and budget expense) over the preceding two years, referring to Lyu et al. (2018).
	REP	An indicator variable equals to 1 when the GDP growth of the focal province is below either the average GDP growth of its neighboring provinces or the national average GDP growth, and 0 otherwise.
	GOVAGE	GOVAGE assumes a value of 1 if the provincial governor is over 60, and 0 otherwise.
Instrumental Variable	*TARGET*	The GDP growth target rate specified in the provincial government's work statement.

3.3 Data

As the largest developing country and a major emerging market, China's official promotion system provides a valuable context for research (Sun et al., 2022). Consequently, our initial sample comprises all A-share publicly traded firms in China from 2010-2013. We exclude samples in the financial sector, observations identified as PT (particular transfer) or ST (special treatment), and observations without three consecutive years of observations. Observations with missing values are also excluded. Applying the above criteria resulted in a final sample of 4,949 observations. Firm-level and official characteristics data are sourced from CSMAR and CCER databases, while provincial data are obtained from the National Bureau of Statistics. The marketization index data is from the sub-index "the relationship index between government and market" of China's marketization index compiled by Fan et al. (2016b). The above databases are widely recognized in the existing literature (e.g., Chen et al., 2020; Cai et al., 2022).

To construct the GDP manipulation index, we select the calibrated nighttime light remote sensing data product, the CCNL (consistent and corrected nighttime light) data (Zhao et al., 2022), which is derived from the DMSP/OLS (defense meteorological satellite program's operational linescan system) nighttime light data. The raw DMSP/OLS nighttime data have a range of "noise" to calibrate, i.e., the interannual inconsistency (Wu et al., 2013), saturation (Hu et al., 2022), and blooming (Cao et al., 2019) problems. Specifically, the saturation value of the nighttime light brightness data is 63, which is too low as the economy grows and the population gradually converges into large cities. However, existing literature ignores this problem. The CCNL data have addressed the above three problems, and provided reliable data for the applications of historical DMSP-OLS data.

4 RESULTS AND DISCUSSION

4.1 Descriptive Statistics and Correlation Matrix

Table 2 provides descriptive statistics of the main variables. Among 4,949 observations, the mean value of the R&D expenditure of enterprises is 3.854%, with a median of 3.156. The minimum value is as low as 0.023%, while the maximum value reaches 25.775%, indicating significant variation in R&D investment intensity, as reflected in the standard deviation of 4.090. Furthermore, the national GDP distortion from 2010 to 2013 appears to be relatively mild, with an average of -0.359. However, the highest value reached 2.019, indicating structural differences in the accuracy of economic data among provinces.

The correlation matrix serves as a vital and informative tool for identifying relationships between variables (Novotna et al., 2023). Appendix Table 1 provides the corresponding tables and analytical insights, offering preliminary support for Hypothesis 1.

Tab. 2 – Descriptive statistics. Source: own research

Variable	Observations	Mean	Standard Deviation	Minimum	Median	Maximum
RDI	4949	3.854	4.090	0.023	3.156	25.775
GDPDIS	4949	-0.359	0.634	-1.721	-0.368	2.019
AGE	4949	13.983	5.078	1	13	58
PROFIT	4949	0.099	0.100	-0.190	0.079	0.448
SIZE	4949	21.673	1.156	19.684	21.467	25.512
LEV	4949	0.374	0.209	0.030	0.364	0.828
CF	4949	0.037	0.067	-0.150	0.036	0.218
CTRL	4949	0.407	0.163	0	0.397	0.789
OPEN	4949	2.673	1.247	0.277	2.584	7.352
PROP	4949	0.397	0.183	0.108	0.369	0.861
HHI	4949	0.058	0.123	0.009	0.009	0.477
CAP	4949	12.258	0.951	9.630	12.250	14.839
LNGDP	4949	9.468	0.871	6.229	9.465	13.293

4.2 Baseline Regression Results

Hypothesis 1 posits that local GDP manipulation negatively impacts corporate innovation in the subsequent year. To test this hypothesis, we employ the model specified in Equation (1), with the results detailed in Table 3. Columns (1) and (2) in Table 3 present how GDP manipulation affects local corporate innovation without fixed effects. The univariate regression coefficient is -0.676 and is significant at the 1% level. Columns (3) and (4) in Table 3 include the year and industry fixed effects. In line with our prediction, the coefficient estimates for GDPDIS are negative and significant at the 1% level across all four columns. Regarding economic magnitude, the coefficient of -0.367 on GDPDIS in column (4) of Table 3 implies a 6.04% decrease in local firms' R&D investment for a one-standard-deviation increase in GDP manipulation. These findings suggest that local officials may exert pressure on enterprises to scale back their R&D investments in favor of achieving short-term economic growth, thereby supporting Hypothesis 1.

Tab. 3 – Regression of local corporate innovation on GDP manipulation. Source: own research

	RDI	*RDI*	*RDI*	*RDI*
	(1)	(2)	(3)	(4)
GDPDIS	-0.676***	-0.410***	-0.375***	-0.367***
	(-4.956)	(-3.588)	(-3.201)	(-3.348)
Control Variables	No	Yes	No	Yes
Year FE	No	No	Yes	Yes
Ind FE	No	No	Yes	Yes
Observations	4949	4949	4949	4949
Adj-R^2	0.013	0.282	0.229	0.372

Notes: Variable definitions are described in "Table 1". *** denotes statistical significance at the 1% level for a two-tailed test.

4.3 Cross-sectional Results

We posit that the impact of GDP manipulation on local corporate innovation is enhanced when local governments show heightened incentives and possess greater capacity to influence local firms. This section tests our hypotheses from the government intervention and promotion incentive perspectives.

Hypothesis 2 posits that the impact of GDP manipulation on corporate innovation is more pronounced for companies located in provinces characterized by a greater extent of government

intervention. To test H2, we use two variables as proxies for government intervention. The first variable is GOV, an indicator variable that equals to 1 when the marketization index for the province-year is below the sample mean, and 0 otherwise. The marketization index data is from the sub-index "the relationship index between government and market" of China's marketization index compiled by Fan et al. (2016b). The second variable is SLACK, an indicator variable that equals to 1 when the financial slack for the province-year is below the sample mean, and 0 otherwise. Financial slack for local governments is gauged by the average fiscal budget surplus (calculated as the difference between budget income and budget expense) over the preceding two years, referring to Lyu et al. (2018).

Table 4 presents the impact of GDP manipulation on corporate innovation expenditure, categorized into subsamples based on levels of government intervention. Column (1) and column (2) of Table 4 contain high or low government intervention observations. In column (1), the coefficient for GDPDIS is statistically significant at the 1% level, with a negative value of -0.682 and a t-value of -3.628. However, in column (2), the coefficient becomes insignificant, with a value of -0.019 and a t-value of -0.125. In column (3), the coefficient for GDPDIS is statistically significant at the 1% level, with a negative value of -0.386 and a t-value of -2.993. However, in column (4), the coefficient becomes insignificant, with a value of 0.218 and a t-value of 1.073. The disparity in coefficients between the inter-group comparisons is significant at the 1% statistical level (p-value=0.0059). Those results confirm our hypothesis that in provinces characterized by high levels of government intervention and increased financial slack, local politicians may exert greater pressure on local firms.

Tab. 4 – The effect of government intervention. Source: own research

	RDI	*RDI*	*RDI*	*RDI*
	(1)	(2)	(3)	(4)
	High government Intervention (*GOV*=1)	Low government Intervention (*GOV* =0)	Large Slack (*SLACK*=1)	Small Slack (*SLACK*=0)
GDPDIS	-0.682***	-0.019	-0.386***	0.218
	(-3.628)	(-0.125)	(-2.993)	(1.073)
Control Variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes
Diff. of Coeff.	0.0059		0.0058	
Observations	2026	2923	3576	1373
Adj-R^2	0.399	0.357	0.375	0.365

Notes: All variable definitions are described in "Table 1". All results are robust to heteroscedasticity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Hypothesis 3 predicts that the effect of GDP manipulation on corporate innovation is stronger for firms when local politicians encounter stronger pressure for promotion. Following prior studies (Chen et al., 2020; Cai et al., 2022), we employ two measures of the promotion pressure on the local governor.

The first measure is constructed based on China's tournament competition system. We refer to Chen et al. (2020) and generate an indicator variable REP to capture the GDP growth incentive of the local governor. Age is also essential in determining whether a provincial governor can be promoted. The second proxy is GOVAGE, an indicator that equals 1 if the provincial governor is above 60 and 0 otherwise, referring to Cai et al. (2022). We break the sample according to the governor's characteristics because, in China, the party secretary and governor are the top two provincial authorities, with the governor in charge of the province's financial resources and economic performance.

Table 5 presents the impact of GDP manipulation on the corporate innovation, categorized into

subsamples based on the promotion pressure faced by politicians. Consistent with our prediction, the coefficient for GDPDIS is statistically significant at the 1% level, with a negative value of -0.682 and a t-value of -3.628 in column (1). However, in column (2), the coefficient becomes insignificant, with a value of -0.025 and a t-value of -0.169, which indicates that the main effect is stronger when the province has relatively poor economic performance. Column (3) also indicates that the effect of GDP manipulation on firms' corporate innovation is stronger in instances where provincial governors are particularly attentive to their political advancement. Our findings align with the hypothesis that local politicians might exert influence on local enterprises, compelling a reduction in corporate innovation as a strategy to secure their political promotion.

Tab. 5 – The effect of local politicians' promotion incentives. Source: own research

	RDI	*RDI*	*RDI*	*RDI*
	(1)	(2)	(3)	(4)
	REP=1	*REP*=0	*GOVAGE*=1	*GOVAGE*=0
GDPDIS	-0.490***	-0.025	-0.611***	-0.199**
	(-2.676)	(-0.169)	(-3.374)	(-2.023)
Control Variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes
Diff. of Coeff.	0.0352		0.0127	
Observations	3285	1664	2441	2508
Adj-R^2	0.373	0.361	0.379	0.367

Notes: See "Table 1" for variable definitions. All results are robust to heteroscedasticity. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, correspondingly.

4.4 Endogeneity Issues

We have posited that a local politician would pressure local firms to reduce R&D expenditure to boost GDP performance. We employ an instrumental variable methodology to mitigate endogeneity issues and strengthen the causal inference. We use TARGET as an instrumental variable for GDP manipulation because the target GDP growth rate would significantly impact GDP manipulation. However, the past target GDP growth rate should not impact local corporate innovation in the year ahead.

Column (1) of Table 6 presents the outcomes of the first-stage analysis in the two-stage least squares (2SLS) regression. The significant and positive coefficient suggests that the target GDP growth rate positively relates to GDP manipulation in the same year, indicating that the instrument satisfies the relevance condition. Column (2) of Table 6 reports the second-stage results of the 2SLS regression, the coefficient of GDPDIS remains negative and is significant at the 1% level. The main results are robust to instrumental variable estimation.

Tab. 6 – Instrumental variable method. Source: own research

	First Stage	Second Stage
	GDPDIS	*RDI*
	(1)	(2)
TARGET	0.403***	
	(52.174)	
GDPDIS		-0.629***
		(-4.632)
Control Variables	Yes	Yes
Year FE	Yes	Yes
Ind FE	Yes	Yes
Kleibergen-Paap Wald rk F-statistics	2722.13***	
Observations	4949	4949
R^2	0.700	0.374

Notes: The first column reports the first-stage results of the 2SLS regression. F-statistic is Kleibergen-Paap Wald rk F statistic for weak identification test. The definitions for all variables are described in "Table 1". All results are robust to heteroscedasticity. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, correspondingly, for a two-tailed test.

4.5 Robustness Tests

We conduct several robustness tests that strengthen confidence in our preliminary results. First, we adopt the paper-based GDP manipulation following Lyu et al. (2018) as an alternative measure of GDP manipulation. They define the paper-based GDP growth rate as the residuals from regressing the officially reported GDP growth rate on the annual changes in freight volume, electricity and bank loans. As the preliminary results show in Table 7, the coefficient of GDP manipulation using an alternative measure (GDPDIS2) is still negative and significant at the 5% level. Our results are still in line with the findings reported in Table 3.

Tab. 7 – An alternative measure of GDP manipulation. Source: own research

	RDI	*RDI*
	(1)	(2)
GDPDIS2	-0.020**	-0.017**
	(-2.136)	(-1.962)
Control Variables	No	Yes
Year FE	Yes	Yes
Ind FE	Yes	Yes
Observations	4891	4891
Adj-R^2	0.225	0.369

Notes: All variable definitions are described in "Table 1". All results are robust to heteroscedasticity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, for a two-tailed test.

We employ three different metrics to proxy for corporate innovation. The first measure of R&D expenditure intensity is calculated as R&D expenditure scaled by total assets (RDI_AssetRatio) since many firms may be forced by performance pressure to conduct earnings management on operating income, thus reducing the accuracy of operating income.

The second and third proxy for corporate innovation is based on the innovation output perspective. PATENT is the natural logarithm of one plus the sum of patent applications. GRANT is the natural logarithm of one plus the sum of granted patents. As demonstrated in Table 8, the primary results remain in line with those presented in Table 3 after employing alternative measures for corporate innovation.

Tab. 8 – Alternative measures of corporate innovation. Source: own research

	RDI_AssetRatio	*PATENT*	*GRANT*
	(1)	(2)	(3)
GDPDIS	-0.212***	-0.078*	-0.081*
	(-4.714)	(-1.792)	(-1.834)
Control Variable	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes
Observations	4949	4949	4949
Adj-R^2	0.274	0.319	0.315

Notes: The definitions for all variables are described in "Table 1". All results are robust to heteroscedasticity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, for a two-tailed test.

In oil exploitation, the ground persistent gas flame interferes with satellite light data, thus damaging the accuracy of the lighting brightness value and estimation results (Xu et al., 2015). Because it is difficult to obtain accurate data on the scope of oil exploitation, referring to Xu et al. (2015), we re-estimate our primary results by excluding the observations of provinces with

large-scale oil exploitation, including Heilongjiang, Guangdong, Shaanxi, Xinjiang, Shandong, and Tianjin. Table 9 reports the results. The coefficient estimates for GDPDIS are still negative and significant at the 1% level in all four columns.

Tab. 9 – Results excluding observations in major oil provinces. Source: own research

	RDI	*RDI*	*RDI*	*RDI*
	(1)	(2)	(3)	(4)
GDPDIS	-0.738***	-0.519***	-0.439***	-0.478***
	(-7.162)	(-5.390)	(-3.005)	(-3.345)
Control Variables	No	Yes	No	Yes
Year FE	No	No	Yes	Yes
Ind FE	No	No	Yes	Yes
Observations	3625	3625	3625	3625
Adj-R^2	0.016	0.274	0.237	0.371

Notes: The definitions for all variables are described in "Table 1". All results are robust to heteroscedasticity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5 CONCLUSION

5.1 Results and Conclusion

Innovation plays a critical role in ensuring sustainable competitiveness at both micro and macro-economic levels (Reznakova & Stefankova, 2022), particularly for developing countries (Dobrzański et al., 2021). This paper investigates how macro-level manipulation of economic statistics, driven by political promotion incentives, impact micro-level corporate innovation activities.

Our findings reveal that GDP manipulation is negatively correlated with local firms' R&D expenditure in the following year. This effect is more pronounced in provinces with higher government intervention, greater control of resources by local governments, and stronger pressure on politicians to meet economic growth targets or secure promotions. We employ an instrumental variable methodology to address endogeneity concerns and strengthen the causal inference. We verify the robustness of the empirical results through the utilization of different measures of GDP manipulation and alternative metrics for corporate innovation and excluding observations that may cause noise.

The empirical results indicate that local governments, under pressure to meet or exceed growth targets, may manipulate GDP figures. This manipulation leads firms to focus more on short-term gains, diverting resources away from long-term R&D projects. While this reallocation of resources may temporarily boost economic activity, it fails to foster genuine innovation or sustainable development. Moreover, as manipulated GDP figures set increasingly unrealistic benchmarks for future growth, both local governments and firms become trapped in a cycle of pursuing unattainable targets. This dynamic not only distorts resource allocation but also hampers firms' long-term competitiveness by stifling their innovation potential.

Regarding the motivation behind GDP manipulation, a plausible explanation could be its potential to create a "placebo effect." By inflating economic statistics, local governments create a temporary sense of optimism, misleading businesses and investment sentiment. However, as our findings suggest, this optimism is short-lived, as it is not supported by real economic activities. This artificial optimism prompts firms to prioritize short-term projects that align with inflated growth figures, rather than investing in long-term R&D. Consequently, corporate innovation suffers, as firms and governments become entrenched in unsustainable growth practices, further undermining long-term competitiveness.

While GDP manipulation is particularly pronounced in China (e.g., Yao et al., 2023; Fang et al., 2024), similar interventions in economic data may also occur in Western countries (e.g., Hollyer, 2015; Wallace, 2016). However, while Western governments use more transparent fiscal and monetary policies to influence economic sentiment, the result can still be short-term optimism without fostering long-term growth. In both scenarios, whether through direct manipulation or policy interventions, short-term gains may obscure fundamental economic weaknesses, ultimately threatening long-term competitiveness.

5.2 Theoretical and Practical Implications

This study makes several important theoretical contributions. First, it expands the literature on corporate innovation determinants from the perspective of official behavior and political incentives. Innovation is essential to sustainable competitiveness at both micro and macro-economic levels, particularly in developing countries (Reznakova & Stefankova, 2022; Dobrzański et al., 2021). Previous studies have mainly focused on macroeconomic indicators of financial development (Kapidani & Luci, 2019) or firm-level factors such as network embeddedness (Tian et al., 2021), compensation contracts (Ederer & Manso, 2013), and ownership structures (Kim et al., 2019). However, limited literature explores corporate innovation determinants from the point of official behavior. We complement relevant studies and find that local governments may interfere with firms' R&D activities in pursuit of short-term economic growth, stifling long-term innovations.

Second, this paper enriches the debate on GDP manipulation and the quality of macro-level data in China. While there has been extensive discussions on the scope and motives behind GDP manipulation (Lyu et al., 2018; Wallace, 2016), little is known about how such behavior influences firms' economic decisions. Since GDP manipulation is widespread in developing countries (Henderson et al. 2012), its economic implications, such as effects on accounting and financial policies, are crucial areas for investigation.

Third, we extend the literature on the interaction between political officials and firms by exploring how economic data distortion affects micro-level firms' resource allocation, aligning with the macro-micro research paradigm discussed by Li et al. (2014). Our findings suggest that political incentives combined with economic figure distortion drive firms to prioritize short-term gains at the expense of long-term innovation.

In terms of practical implications, our results indicate that a promotion system prioritizing GDP growth may distort officials' behavior, adversely impacting the technological innovation of enterprises in their jurisdiction and weakening the quality of long-term economic development. This paper introduces a macro-level factor that may hinder corporate innovation and contributes to the literature on the determinants of corporate innovation. Though GDP manipulation is particularly prominent in China (Cai et al., 2022; Fang et al., 2024), similar motivations and mechanisms may exist in other countries. Policymakers should prioritize fostering genuine technological innovation and R&D rather than relying on inflated economic figures. Such a shift is essential for achieving sustainable long-term growth and maintaining global competitiveness.

5.3 Limitations and Future Research Opportunities

A key limitation of this study is that the sample period is constrained to data availability prior to 2013 due to reliance on satellite night light data. As a result, the findings may not fully capture recent developments in the relationship between GDP manipulation and corporate innovation. The political environment's impact on business decision-making is a dynamic and evolving process. Therefore, future research should explore the shifting dynamics between GDP manipulation and corporate innovation, particularly as the Chinese government gradually incorporates innovation into its official assessment metrics.

In recent years, China has taken significant steps to foster innovation, which may relieve some of the pressure on achieving GDP growth targets, potentially leading to increased long-term investment in innovation. Additionally, further research could investigate how reduced corporate innovation due to GDP manipulation affects firms' global competitiveness over time. This long-term impact is crucial for understanding the broader economic implications of prioritizing short-term gains over sustainable growth. Moreover, exploring the influence of GDP manipulation on other corporate decisions, such as tax avoidance strategies, capital investment and broader strategic planning, would provide a more comprehensive understanding of how macroeconomic manipulation shapes firm behavior and long-term economic health.

References

1. Adhikari, B. K., & Agrawal, A. (2016). Religion, gambling attitudes and corporate innovation. *Journal of Corporate Finance*, *37*, 229-248. https://doi.org/10.1016/j.jcorpfin.2015.12.017
2. Cai, G., Li, X., Lin, B., & Luo, D. (2022). GDP manipulation, political incentives, and earnings management. *Journal of Accounting and Public Policy*, *41*(5), 106949. https://doi.org/10.1016/j.jaccpubpol.2022.106949
3. Cao, X., et al. (2019). A simple self-adjusting model for correcting the blooming effects in DMSP-OLS nighttime light images. *Remote Sensing of Environment*, *224*, 401-411. https://doi.org/10.1016/j.rse.2019.02.019
4. Chen, X., Cheng, Q., Hao, Y., & Liu, Q. (2020). GDP growth incentives and earnings management: Evidence from China. *Review of Accounting Studies*, *25*(3), 1002-1039. https://doi.org/10.1007/s11142-020-09547-8
5. Chen, H., Tang, S., Wu, D., & Yang, D. (2021). The political dynamics of corporate tax avoidance: The Chinese experience. *Accounting Review*, *96*(5), 157-180. https://doi.org/10.2308/TAR-2017-0601
6. Chen, Y., et al. (2015). Institutional environment, firm ownership, and IPO first-day returns: Evidence from China. *Journal of Corporate Finance*, *32*, 150-168. https://doi.org/10.1016/j.jcorpfin.2015.03.002
7. Clark, H., Pinkovskiy, M., & Sala-i-Martin, X. (2017). China's GDP growth may be understated. *China Economic Review*, *62*, 101243. https://doi.org/10.1016/j.chieco.2018.10.010
8. Denkowska, S., Fijorek, K., & Węgrzyn, G. (2020). Formal and non-formal education and training as an instrument fostering innovation and competitiveness in EU member countries. *Journal of Competitiveness*, *12*(3), 82-98. https://doi.org/10.7441/joc.2020.03.05
9. Dobrzański, P., et al. (2021). Toward innovation-driven competitiveness across African countries: An analysis of efficiency of R&D expenditures. *Journal of Competitiveness*, *13*(1), 5-22. https://doi.org/10.7441/joc.2021.01.01
10. Ederer, F., & Manso, G. (2013). Is pay for performance detrimental to innovation? *Management Science*, *59*(7), 1496-1513. https://doi.org/10.1287/mnsc.1120.1683
11. Fan, Z., Peng, F., & Liu, C. (2016a). Political connections and economic growth: Evidence from the DMSP/OLS satellite data. *Economic Research Journal*, *1*, 114-126.
12. Fan, G., Wang, W., & Yu, J. (2016b). *Report on the marketization index of China's provinces*. Social Science Academic Press.
13. Fang, F., Luo, D., Huang, Y., & Cao, X. (2024). How does regional GDP manipulation affect livelihood investment? *Humanities and Social Sciences Communications*, *11*(1), 1228. https://doi.org/10.1057/s41599-024-03735-6

14. Gu, Y. Y., & Shen, K. R. (2012). The effect of local governments' behavior on corporate R&D investment: Empirical analysis based on China's provincial panel data. *China Industrial Economics*, *10*, 77-88. https://doi.org/10.19581/j.cnki.ciejournal.2012.10.007
15. Healy, A., & Lenz, G. S. (2014). Substituting the end for the whole: Why voters respond primarily to the election-year economy. *American Journal of Political Science*, *58*(1), 31-47. https://doi.org/10.1111/ajps.12053
16. Henderson, J. V., Storeygard, A., & Weil, D. N. (2012). Measuring economic growth from outer space. *American Economic Review*, *102*(2), 994-1028. https://doi.org/10.1257/aer.102.2.994
17. Hodler, R., & Raschky, P. A. (2014). Regional favoritism. *Quarterly Journal of Economics*, *129*(2), 995-1033. https://doi.org/10.1093/qje/qju004
18. Hollyer, J. R., Rosendorff, B. P., & Vreeland, J. R. (2015). Transparency, protest, and autocratic instability. *American Political Science Review*, *109*(4), 764-784. https://doi.org/10.1017/S0003055415000428
19. Holz, C. A. (2014). The quality of China's GDP statistics. *China Economic Review*, *30*, 309-338. https://doi.org/10.1016/j.chieco.2014.06.009
20. Hu, Y., et al. (2022). Correcting the saturation effect in DMSP/OLS stable nighttime light products based on radiance-calibrated data. *IEEE Transactions on Geoscience and Remote Sensing*, *60*, 1-11. https://doi.org/10.1109/TGRS.2021.3060170
21. Kang, Z. Y. (2013). Financing constraints, government support and Chinese local enterprises' R&D investment. *Nankai Business Review*, *16*(5), 61-70. https://doi.org/10.3969/j.issn.1008-3448.2013.05.007
22. Kapidani, M., & Luci, E. (2019). The effects on innovation from financial sector development: Evidence from developing countries. *Journal of Competitiveness*, *11*(2), 84-94. https://doi.org/10.7441/joc.2019.02.06
23. Kim, H. D., Park, K., & Roy Song, K. (2019). Do long-term institutional investors foster corporate innovation? *Accounting & Finance*, *59*(2), 1163-1195. https://doi.org/10.1111/acfi.12284
24. Li, X., Cai, G., & Luo, D. (2020). GDP distortion and tax avoidance in local SOEs: Evidence from China. *International Review of Economics & Finance*, *69*, 582-598. https://doi.org/10.1016/j.iref.2020.06.042
25. Li, S., & Lu, J. W. (2020). A dual-agency model of firm CSR in response to institutional pressure: Evidence from Chinese publicly listed firms. *Academy of Management Journal*, *63*(6), 2004-2032. https://doi.org/10.5465/amj.2018.0557
26. Li, N., Richardson, S., & Tuna, İ. (2014). Macro to micro: Country exposures, firm fundamentals and stock returns. *Journal of Accounting and Economics*, *58*(1), 1-20. https://doi.org/10.1016/j.jacceco.2014.04.005
27. Lin, C., Lin, P., & Song, F. (2010). Property rights protection and corporate R&D: Evidence from China. *Journal of Development Economics*, *93*(1), 49-62. https://doi.org/10.1016/j.jdeveco.2009.04.006
28. Lu, S., Chen, S., & Yang, Z. (2017). Officials make the statistics: GDP distortion resulted from officials' promotion motivation. *China Industrial Economics*, *7*, 118-136. https://doi.org/10.19581/j.cnki.ciejournal.2017.07.007
29. Lyu, C., Wang, K., Zhang, F., & Zhang, X. (2018). GDP management to meet or beat growth targets. *Journal of Accounting and Economics*, *66*(1), 318-338. https://doi.org/10.1016/j.jacceco.2018.07.001
30. Meng, Q. B., Li, X. Y., & Zhang, P. (2019). Can employee stock ownership plans promote corporate innovation: Empirical evidence based on the perspective of corporate employees. *Management World*, *35*, 209-228. https://doi.org/10.19744/j.cnki.11-1235/f.2019.0158

31. Nordhaus, W., & Chen, X. (2015). A sharper image? Estimates of the precision of nighttime lights as a proxy for economic statistics. *Journal of Economic Geography*, *15*(1), 217-246. https://doi.org/10.1093/jeg/lbu010
32. Novotna, L., Rowland, Z., & Janek, S. (2023). Impacts of the war on prices of Ukrainian wheat. *Agricultural Economics-Zemedelska Ekonomika*, *69*(10) , 404–415. https://doi.org/10.17221/121/2023-AGRICECON
33. Piotroski, J. D., & Zhang, T. (2014). Politicians and the IPO decision: The impact of impending political promotions on IPO activity in China. *Journal of Financial Economics*, *111*(1), 111-136. https://doi.org/10.1016/j.jfineco.2013.10.012
34. Piotroski, J. D., Wong, T. J., & Zhang, T. (2015). Political incentives to suppress negative information: Evidence from Chinese listed firms. *Journal of Accounting Research*, *53*(2), 405-459. https://doi.org/10.1111/1475-679X.12071
35. Reznakova, M., & Stefankova, S. (2022). New indicators of innovation activity in economic growth models. *Journal of Competitiveness*, *14*(3), 153-172. https://doi.org/10.7441/joc.2022.03.09
36. Sun, C., Zhang, Z., Vochozka, M., & Vozňáková, I. (2022). Enterprise digital transformation and debt financing cost in China's A-share listed companies. *Oeconomia Copernicana*, *13*(3), 783-829. https://doi.org/10.24136/oc.2022.023
37. Tan, J., Jian, Y., & Chen, Y. (2012). The government intervention and non-performing loans: An analysis based on the data during 1988-2005 from a state-owned bank. *Management World*, *7*, 29-43, 187. https://doi.org/10.19744/j.cnki.11-1235/f.2012.07.004
38. Tian, H., et al. (2021). Assessing the intermediary role of relationship ending capability and dark side between network embeddedness and SMEs' innovation performance. *Journal of Competitiveness*, *13*(1), 146-163. https://doi.org/10.7441/joc.2021.01.09
39. Wallace, J. L. (2016). Juking the stats? Authoritarian information problems in China. British *Journal of Political Science*, *46*(1), 11-29. https://doi.org/10.1017/S0007123414000106
40. Wang, X., Li, J., & Wang, N. (2023). Are economic growth pressures inhibiting green total factor productivity growth? *Sustainability*, *15*(6), 5239. https://doi.org/10.3390/su15065239
41. Wu, J., et al. (2013). Intercalibration of DMSP-OLS night-time light data by the invariant region method. *International Journal of Remote Sensing*, *34*, 7356–7368. https://doi.org/10.1080/01431161.2013.820365
42. Xu, C. (2011). The fundamental institutions of China's reforms and development. *Journal of Economic Literature*, *49*(4), 1076-1151. https://doi.org/10.1257/jel.49.4.1076
43. Xu, K., Chen, F., & Liu, X. (2015). The truth of China economic growth: Evidence from global night-time light data. *Economic Research Journal*, *9*, 17-29.
44. Yao, S., Zhang, Z., & Lin, C. M. (2023). GDP manipulation and environmental information disclosure: Evidence from China. *Asia-Pacific Journal of Accounting & Economics*, *30*(5), 1-19. https://doi.org/10.1080/16081625.2022.2067197
45. Zhao, C., Cao, X., Chen, X., & Cui, X. (2022). A consistent and corrected nighttime light dataset (CCNL 1992-2013) from DMSP-OLS data. *Scientific Data*, *9*, 424. https://doi.org/10.1038/s41597-022-01540-x

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