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## Government Behavior and Innovation: The Role of Financial Target Setting on Corporate Green Innovation

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### ABSTRACT

As governments worldwide grapple with the urgent need to mitigate climate change, understanding the nuanced relationship between fiscal targets and environmental innovation is crucial for crafting effective policy frameworks. Green technological advancement stands as the cornerstone of enterprise competitiveness, driving improvements in both economic prosperity and environmental sustainability. Government fiscal policies play a pivotal role in shaping the landscape of green transformation within enterprises, particularly through the establishment of fiscal revenue targets. Drawing upon data from prefecture-level cities and enterprise records, this study employs empirical analysis utilizing a fixed effects model and instrumental variable method. Our findings underscore the significant impact of fiscal revenue target setting on the trajectory of green technological advancement within enterprises. Specifically, the imposition of fiscal revenue growth targets exerts a dampening effect on the propensity for green technological advancement among enterprises. Notably, this disincentive is particularly pronounced among state-owned enterprises, as well as those with lower and moderate returns on capital, and those characterized by labor-intensive operations. Furthermore, our research delves into the underlying mechanisms of this inhibitory effect. We ascertain that the pressure associated with fiscal revenue growth targets hampers corporate green technological advancement by amplifying tax burdens and exacerbating financing constraints. In light of these findings, our study not only contributes to the theoretical understanding of the interplay between government fiscal policies and corporate innovation but also provides empirical evidence to inform strategies aimed at reconciling the imperative of fiscal revenue growth with the imperative of fostering green technological advancement within enterprises. In the broader context of governmental efforts to address climate change, this research underscores the importance of aligning fiscal policies with environmental objectives.

### KEYWORDS

Government Act; Climate Change; Green Technology Progress; Financial Target Setting

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## 1. Introduction

China is committed to balancing both green development and economic growth, implementing a series of robust policies and measures within the framework of ecological and environmental protection (Lee et al., 2022; Ellström and Carlborg, 2022). This commitment has spurred various industries to gradually enhance their development modes and environmental governance awareness, thus propelling green development forward (Wan et al., 2018; Chen et al., 2023). Consequently, enterprises are urgently undertaking green transformations. Enhancing and fostering the capabilities of green technological advancement (abbreviated as GI herein) and environmental performance has emerged as a critical imperative for both governments and enterprises. Local governments play a crucial role in promoting GI technologies (Shi and Lai, 2013).

The policy goals formulated by governments significantly influence the active enhancement of enterprises' GI capabilities. The methods and orientations of collaboration between government and enterprises yield diverse economic and innovation benefits that warrant comprehensive exploration. Scholars have revealed that government behavior can impact the quality of GI within enterprises, with official promotion pressure often exerting negative regulatory effects (Wang et al., 2022). Moreover, anti-corruption measures have been observed to stimulate companies to increase investments in GI (Chen et al., 2022), while vertical environmental regulation serves as a critical driver for corporate green technological innovation (Du et al., 2022). However, the externalities associated with GI may dampen corporate innovation enthusiasm and potentially distort market mechanisms (Karhunen, 2015). Despite these insights, there remains a dearth of research examining the impact of fiscal policies, such as revenue growth targets, on corporate GI from an external perspective.

In reality, fiscal revenue growth targets, as a form of government intervention, significantly influence the GI activities of enterprises. Governments set clear fiscal revenue growth targets to demonstrate their commitment to ensuring fiscal stability, guiding effective work distribution, and pre-planning the allocation and utilization of fiscal funds. However, government intervention, utilizing performance feedback information to adjust organizational behavior, may affect the decisions made by corporate managers with vested interests (Salge, 2011). By setting growth targets, governments delineate the direction of local government efforts, reintegrate regional resource allocation, and expand financial resources. In pursuit of fiscal revenue growth targets, government officials may implement policies to incentivize green development among enterprises, while also expecting them to shoulder social responsibilities and governance costs, potentially inhibiting innovation (Wang et al., 2022). Consequently, government intervention goals shape market behaviors and micro-decisions of enterprises, with policy effects ultimately manifested through micro-enterprise performance (Chen et al., 2011; Shao et al., 2015). Therefore, our focus is specifically on the influence of setting fiscal revenue targets on corporate GI.

Building upon this analysis, we empirically test the impact and find that fiscal revenue target setting inhibits corporate GI. Following a battery of robustness tests (including instrumental variable testing, incorporation of city-level control variables, substitution of the dependent variable, lagging the fiscal target by one period, and model replacements), the fundamental conclusion remains unchanged. Additionally, we uncover that pressure from fiscal revenue growth targets inhibits corporate GI by increasing corporate tax burdens and intensifying financing constraints. Notably, state-owned enterprises, enterprises with low returns on capital, and labor-intensive enterprises are disproportionately affected by fiscal revenue growth targets.

This research makes three primary contributions. Firstly, using city data and enterprise data, we explore possible negative externalities associated with fiscal revenue growth targets. While existing literature has attempted to elucidate the impact and rationale of environmental and economic growth targets on corporate GI (Song and Yu, 2018; Shen et al., 2021), few studies have examined the impact of target setting on GI from a financial perspective. By focusing on fiscal targets, we refine the research perspective and direct attention towards specific fiscal indicators. Secondly, this study enriches our understanding of the influencing factors of corporate GI,

examining the correlation between macroeconomic behaviors and micro-market subjects. It analyzes the alignment of policy goals and their varying impacts on corporate GI, providing a foundation for advancing corporate GI. Finally, there is a paucity of literature exploring the potential mechanisms through which pressure from fiscal revenue growth targets affects corporate GI. Building upon theoretical and empirical analyses, we offer a detailed examination of this impact mechanism from the perspectives of tax burden and financing constraints.

The subsequent chapters of this paper are organized as follows: Section 2 reviews relevant literature; Section 3 conducts theoretical analysis; Section 4 outlines the empirical strategy; Section 5 presents empirical results and discussion; Section 6 explores heterogeneity analysis; Section 7 delves into mechanism analysis and discussion; and Section 8 concludes with policy recommendations.

## 2. Literature review

### 2.1. The government's financial goals

Local target setting exerts multifaceted pressure on the economy, politics, and society, a subject that has garnered extensive scholarly attention. The literature can be categorized into three streams, examining the macro and micro impacts of government goals on economic development, political behavior, and social governance.

The first stream of literature focuses on the macro and micro impacts of government target setting on economic development. At the macro level, government target setting influences market value growth. Luo et al. (2023) assert that many local government officials perceive setting fiscal revenue targets as a political imperative, with fiscal revenue targets impacting housing prices. Notably, as per capita GDP increases, the influence of fiscal revenue targets on housing prices diminishes. Meanwhile, at the micro level, government intervention distorts corporate investment decisions. Zhong et al. (2022) find that hindered local government growth targets often lead firms to prioritize non-green investments, crowding out green initiatives. Moreover, Liu et al. (2020) highlight the impact of official evaluation systems and public services on firms' business cycles, while government interventions such as tax incentives can promote investment and production efficiency, particularly among financially constrained enterprises (Liu and Mao, 2019).

The second stream of literature delves into the impact of government target setting on political behavior. Government promotion evaluations based on targets significantly influence government spending behavior. Appropriately set economic growth targets can bolster expenditure on environmental protection and fiscal technology (Zhang et al., 2023). However, over-setting targets and exceeding growth target tasks can hinder public services in education and science and technology (Liu et al., 2020; Zhang et al., 2023). Additionally, government target choices shape the direction of government regulation. Salge (2011) suggests that performance information is utilized to adjust public behavior, with soft budget constraints arising from various policy burdens imposed by the state (Lin et al., 1998). Furthermore, the target levels of central and local governments exhibit a negative correlation (Ma, 2015).

The third stream of literature investigates the impact of government targets on social governance, particularly on social and environmental governance. Du and Yi (2022) argue that incorporating environmental performance into cadre evaluations can balance economic development and environmental protection efforts. Local governments, aiming for short-term profits, often impose less stringent environmental regulations, with increased economic growth targets weakening environmental oversight (Li et al., 2022), particularly in cities with high promotion incentives for officials, leading to decreased corporate environmental investment (Zhong et al., 2022). Moreover, changes in economic growth goals affect the ecological efficiency of Chinese cities (Zhang et al., 2023), with strategic institutional goals under fiscal decentralization influencing energy consumption, albeit with variations based on the stage of energy development (Lin and Zhou, 2023). However, efforts to reduce pollution may inadvertently

create moral hazards, as local governments may focus solely on reducing target pollutants while neglecting non-target pollutants due to ecological financial transfer payment policy goals (Gong et al., 2021). Finally, the relationship between economic growth goals and the quality of public occupational health exhibits a "U-shaped" trend (Wang et al., 2021), indicating complex dynamics between government targets and social transformation.

## 2.2. Green technological progress

Scholars have extensively explored the specific factors influencing the Green Technological Advancement (abbreviated as GI) of enterprises, considering both external and internal factors.

External factors, particularly policy governance, play a pivotal role in shaping GI. Firstly, the green credit policy serves as a catalyst for enterprises' overall green development strategy (Liu and Dong, 2022), actively fostering the generation of green patents (Hu et al., 2021). Liu et al. (2021) observed a significant enhancement in GI performance among heavily polluting and energy-consuming enterprises due to the green credit policy, surpassing mere constraint effects and leading to what is termed as the "Porter effect." Secondly, environmental governance exhibits differential impacts on corporate GI over the short and long terms. While environmental regulations may initially reduce corporate cash flows and inhibit GI efficiency (Tang et al., 2020), stricter regulations tend to incentivize firms to pursue green innovations (Wang et al., 2020; Li and Li, 2022), with effects varying based on firm size, ownership structure, and lifecycle (Su et al., 2022). In markets with stringent environmental regulations, multinational corporations demonstrate increased filings of green patents (Kim et al., 2021). Thirdly, the effectiveness of different regulatory approaches varies in influencing GI performance. For instance, the "province-managing-county reform" has bolstered county government fiscal autonomy, significantly fostering more and better GI patents for firms (Liu et al., 2022). Government subsidies stimulate business innovation (Shao and Chen, 2022), with their positive impact on private enterprises strengthened amidst increased exposure of subsidy fraud (Wang et al., 2022). Chen et al. (2022) suggest that intensified anti-corruption measures can spur investment in GI within energy-intensive industries. Furthermore, initiatives such as telecommunications infrastructure development and carbon emissions trading schemes can facilitate GI management (Tang et al., 2021; Zhou et al., 2023). Wang et al. (2020) observed an inverted U-shaped relationship between official tenure overseeing environmental protection and corporate GI.

From the internal perspective, factors such as government-enterprise relationships, employee quality, and transformation strategies significantly influence GI. Firstly, favorable government-enterprise relations bolster venture capital investment in corporate research and development and organizational capital, thereby promoting GI within state-owned enterprises (Zhang et al., 2022). Secondly, the scale and caliber of human resources exert a profound impact on corporate GI. Strengthening enterprise information transmission management and external supervision by investors enhances GI performance (Wang, 2023). Additionally, a CEO's hometown identity influences GI through institutional ownership regulation (Ren et al., 2020), while expanding the size of the board of directors encourages companies to broaden their innovation scope and acquire external resources and knowledge (Zhao et al., 2022).

## 2.3. Government behavior and green technology progress

Currently, research on government targets and corporate Green Technological Advancement (GI) has garnered considerable attention. However, there remains a scarcity of theoretical studies that comprehensively analyze the combined impact of government targets on corporate GI. Some studies have focused on the influence of government target pressure on corporate GI. Shen et al. (2021) noted that setting economic growth targets significantly hampers green technology innovation, with a more pronounced inhibitory effect observed in cities with high levels of economic development and target overachievement. Furthermore, the degree of excess in achieving goals directly

correlates with the inhibitory effect.

While existing literature discusses the impact of economic performance targets, such as economic growth goals and environmental goals, on corporate GI, there is limited research on the pressure exerted by fiscal revenue targets. In light of this gap, our study systematically investigates the actual impact of fiscal revenue growth targets on corporate GI. Moreover, we address the heterogeneous characteristics of enterprises comprehensively. Specifically, we analyze the heterogeneous impact of fiscal revenue growth target pressure on GI across different enterprise types, return on investment levels, and industry sectors. Furthermore, we examine the mechanisms underlying tax burden and financing constraints. These findings will offer valuable policy insights for the rational formulation of fiscal revenue growth targets and the promotion of GI development among enterprises.

### 3. Theoretical analysis

#### 3.1. Fiscal revenue target setting, tax burden and enterprise green innovation

The fiscal revenue growth target stands as a pivotal objective for local governments, determined based on previous year's data (Li et al., 2019). Achieving this target reflects the government's performance completion level (Guo, 2007). However, uncertainties surrounding government targets and economic policies can significantly impact enterprise tax burdens. On one hand, to meet ambitious growth targets, superior governments may indiscriminately allocate revenue-increasing tasks, thereby escalating fiscal pressure on subordinate governments, eventually passed on to corporate tax burdens. Economic policy uncertainty serves as a basis for enterprise tax planning. Heightened uncertainty may lead governments to formulate task plans exceeding past targets to ensure performance completion for the following year, consequently raising enterprise tax quotas (Dang et al., 2019). Conversely, local governments wield certain autonomy in tax collection and administration, enabling them to bolster tax revenue growth by enhancing collection and inspection efforts (Taliercio, 2004). Intense fiscal revenue growth pressure prompts taxation departments to intensify tax collection, inspection, and non-tax revenue management, aiming to augment tax revenues (Dong et al., 2019).

The tax burden, occupying enterprises' available funds, significantly impedes their Green Technological Advancement (GI) activities. Tax burden serves as a key determinant of enterprise investment, demand, and supply, exerting both direct and indirect effects on enterprise operations and production (Abuselidze, 2012). On one hand, it constrains enterprises' production and research and development (R&D) capacities, complicating the enhancement of green production technology innovation. Moreover, high tax burdens diminish total factor productivity and distort resource allocation in heavily taxed areas (Kéïta and Laurila, 2021). Enterprises often factor corporate tax and high-skilled labor tax burdens into their investment location decisions (Elschner et al., 2006). On the other hand, fluctuations in tax burdens alter the budget for corporate economic activities, hindering GI pursuits. Unlike conventional innovation activities, GI demands substantial resource investment and robust technical support within firms (Lu and Zhou, 2023). However, government access to tax revenues for economic stimulus fluctuates (Abuselidze, 2012). Elevated tax burdens curtail firms' expenditure on productive activities, disrupting planning for work, savings, and investment (Nuță, 2008).

#### 3.2. Fiscal revenue target setting, financing constraints and enterprise green innovation

Higher fiscal revenue growth targets exacerbate corporate financing constraints. Given that Green Technological Advancement (GI) targets both technology and environmental aspects, government intervention becomes increasingly crucial. Both governments and enterprises establish goals to stimulate green technology innovation output (Liu et al., 2023). For instance, companies set governance ratings to transmit positive market

information and attract investment and financial support, facilitating necessary funding for corporate GI (Tan and Zhu, 2022). Governments actively promote ecological civilization construction through R&D expenditure and regulatory interventions, gradually transitioning conventional venture capital into green financing to support GI in real industries (Zhang and Jin, 2021; Wei Z. et al., 2015).

Financing constraints significantly impact corporate GI. Firstly, green innovative enterprises face elevated financing risks, and green finance tends to be more cautious, amplifying inspection difficulties. Green venture capital is pivotal for promoting GI in real industries, necessitating long-term stable financial support (Wei et al., 2015; Stanko and Henard, 2017). However, financial resources are limited and unevenly distributed, leading some enterprises to bear substantial financing risks to secure funding (Talavera et al., 2012). Financing risks pose significant constraints on enterprises' innovation activities, reducing banks' willingness to extend credit and dampening enthusiasm for GI research, particularly among privately operated, pollution-intensive enterprises (Garcia-Quevedo et al., 2018; Yu et al., 2021; Li et al., 2022, 2023).

Secondly, amidst high financing constraints and limited internal funds, green innovative enterprises exhibit heightened sensitivity and caution towards the financial environment and R&D funding, relying on external financing more effectively (Li et al., 2022). Thirdly, sustainability goals and financing oversight elevate innovation demands on green enterprises. GI, with its environmental protection mission, entails high research and development costs and failure risks, often trapping innovative companies in financing constraints (Doran and Ryan, 2012).

## 4. Empirical strategy

### 4.1. Variables and data

1. Independent variable: local fiscal revenue target (target). Consult Luo et al. (2023), we represent the general budget revenue target growth rate (unit: %) as the measurement indicator of the local fiscal revenue target (target). The target was proposed in the government work report early every year of the city where the enterprise is located. The figures from the "Government Work Report" of prefecture-level cities are collected and compiled manually.

2. Dependent variable: enterprise green innovation. Referencing Tang et al. (2021), the measurement objectives of enterprise GI include enterprise GI patent authorization (pat\_total), enterprise GI invention patent authorization (pat\_inv) and enterprise GI utility patent authorization (pat\_uty). Invention patent authorization is used to represent a company's substantive innovation; utility model patent authorization is used to represent a company's strategic innovation. In addition, we use the number of green patent applications (pat\_apply\_total) and the number of green invention patent applications (pat\_apply\_inv) to conduct robustness checks. In the empirical analysis, the above variables are all processed by "add 1 and then take the natural logarithm".

3. Control variables. To control for the effects of omitted variables, referencing the published researches (Hu et al., 2021; Kim et al., 2021), we select control variables that represent enterprise characteristics: total debt ratio (lev), cash flow (cashflow), net profit margin of total assets (roa), Enterprise age (lnage), R&D investment (R&D) and enterprise growth ability (tobinQ). (2) City-level control variables such as fiscal expenditure effectiveness (expend), financial development level (finance), education level (edu), trade openness (open), and population density (pop) are added to the robustness test.

4. Data sources. Enterprise data was collected from CSMAR database and Wind database. City-level data was obtained from the China Urban Statistical Yearbook. This article selects 2009-2020 as the research period. In order to prevent abnormal samples from affecting results, according to the methods in existing literature, this article processed the raw data as follows: (1) Due to the particularity of the asset-liability structure and regulatory policies of the financial industry, their data was eliminated; (2) Eliminate listed companies whose listing status is "ST", "\*ST",

"listing suspension", "termination of listing" and "delisting preparation period"; (3) Eliminate samples with serious missing key variables; (4) Eliminate obviously not in compliance with accounting standards outlier samples (Table 1).

**Table 1.** Summary statistics for key variables.

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
pat_total	Ln (number of green patent authorization +1)	20301	0.884	1.127	0	6.878
pat_inv	Ln (number of green invention patent authorization +1)	20301	0.360	0.754	0	6.732
pat_uty	Ln (number of green utility patents granted +1)	20301	0.740	1.031	0	6.346
target	Local fiscal revenue target (%)	20295	8.045	3.700	0	20
lev	Total corporate liabilities / total assets	20301	0.401	0.203	0.008	2.861
cashflow	Net operating cash flow / total assets	20300	0.050	0.070	-1.686	0.726
roa	Net profit margin of total assets	20301	0.042	0.093	-3.164	7.445
lnage	Ln (year- year of listing)	20301	1.913	0.953	0	3.466
R&D	The proportion of R&D expenditure in operating income	19183	6.638	232.96	0	31729
tobinQ	The ratio of company market capitalization to assets	20001	2.051	1.542	0.684	92.25

## 4.2. Empirical model

In order to research the influence of local fiscal revenue target on enterprise's green innovation, this paper constructs the fixed effects model for empirical analysis:

$$patent_{it} = \alpha_0 + \alpha_1 target_{it} + \alpha_k Controls_{it} + Ind + year + \varepsilon_{it} \quad (1)$$

Where  $i$  represents enterprise;  $t$  indicates the year;  $patent$  is enterprise green innovation;  $target$  is local fiscal revenue target;  $Controls$  represents control variables;  $\alpha_0$  is the intercept term;  $\alpha_1$  and  $\alpha_k$  are the estimated parameters;  $Ind$  represents industry fixed effect;  $year$  represents year fixed effect;  $\varepsilon_{it}$  is the random disturbance term.

## 5. Empirical results and discussion

### 5.1. Basic results

Table 2 presents the estimation results of the fixed effect regression. In columns (1) - (2), the dependent variable is the number of green patent authorizations ( $pat\_total$ ); When these control variables are added, the coefficient of  $target$  is -0.012, showing that the pressure of local government fiscal revenue growth significantly reduces the level of GI of enterprises. In columns (3) - (4) and (5) - (6), the dependent variables are the number of green invention patent authorizations ( $pat\_inv$ ) and the number of green utility patent authorizations ( $pat\_uty$ ); Where the coefficient of  $target$  are -0.013 and 0.009 in columns (4) and (5), showing that for every 1% raise on the growth rate of local government fiscal revenue target, the level of substantive and strategic GI of firms will decrease by approximately 1.3% and 0.9% respectively. The estimation results are basically consistent with theoretical expectations. According to goal orientation theory, goal setting affects individual behavior, organizational behavior, and performance (Kaplan and Maehr, 2007). In order to clarify the direction of government work and stabilize economic expectations, government departments will also manage the economy and society by setting goals (Zhang, 2021). Local officials who have completed performance appraisals are more likely to receive promotion opportunities and transfers from superior governments (Tang et al., 2021). Therefore, when the goal of elevating local fiscal revenue is set too high, fiscal funds are more likely to be allocated to short-term, high-yield projects under the incentives of promotion and transfer payments; while GI is a long-term, difficult, and slow-acting activity. Under the pressure of fiscal revenue growth, the financial funds allocated to green innovative technology research

and equipment purchase will be squeezed out.

**Table 2.** Basic results.

	(1)	(2)	(3)	(4)	(5)	(6)
	pat_total	pat_total	pat_inv	pat_inv	pat_uty	pat_uty
target	-0.011*** (-3.86)	-0.012*** (-4.035)	-0.012*** (-6.455)	-0.013*** (-6.602)	-0.008*** (-3.128)	-0.009*** (-3.2635)
Controls		√		√		√
Ind FE	√	√	√	√	√	√
Year FE	√	√	√	√	√	√
Cons	-0.078 (-1.450)	-0.937*** (-3.297)	0.021 (0.653)	-0.657*** (-14.186)	-0.071 (-1.4377)	-0.741*** (-2.636)
N	20295	18900	20295	18900	20295	18900
R <sup>2</sup>	0.178	0.268	0.112	0.161	0.173	0.257

Note: *t* statistics in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 5.2. Robustness test

### 5.2.1. IV estimations

Endogeneity is an important consideration when identifying causal relationships. Estimates from OLS regression may be endogenously biased. On the one hand, some unobservable factors may simultaneously affect the growth target of local government fiscal revenue and the level of GI of enterprises, thereby interfering in the identification of causality. On the other hand, there may be a possibility that corporate green innovations can provide reference for local governments to set fiscal revenue growth targets. That is, when local governments formulate targets around the growth of fiscal revenue and expenditure, they have examined and based on the corporate GI efficiency standards of previous years. Then, the fiscal revenue growth target may have the opposite causal relationship with corporate GI.

To ensure the robustness of our conclusions, instrumental variable is used in this section for re-estimation. Learning from Wang et al. (2021), "the average target growth rate of other prefecture-level cities in the same province" is used as the instrumental variable of the fiscal revenue growth objective, and 2SLS estimates are performed. The logic behind the selection of this instrumental variable is: on the one hand, in order to attract the inflow of technology, capital and other mobile factors of production, neighboring local governments will compete in investment environment, market system, public service and goods supply, government efficiency, etc. (Li et al., 2019). Fiscal investment is a key element that directly affects these competitive areas. Therefore, the higher fiscal revenue targets set by other prefecture-level cities in the province where the city is located may drive the city to set higher target growth rates. Accordingly, the correlation requirements of instrumental variables are satisfied. On the other hand, it is difficult for the fiscal goals of other cities in the same province to affect the GI level of regional players through other mediums, so the exogenous requirements of instrumental variable are met. The results are shown in Table 3, to a large extent, the fiscal revenue growth target pressure still inhibits the GI of enterprises.

**Table 3.** IV estimation.

	(1)	(2)	(3)	(4)
	First-stage regression		2SLS regression	
	target	pat_total	pat_inv	pat_uty
IV	0.704*** (125.91)			
target		-0.020*** [-4.494]	-0.021*** [-6.552]	-0.015*** [-3.779]



Controls	√	√	√	√
Ind FE	√	√	√	√
Year FE	√	√	√	√
Cons	2.402 (7.28)	-0.989*** [-5.348]	-0.3785*** [-2.858]	-0.966*** [-5.658]
N	18894	18894	18894	18894
R <sup>2</sup>	0.766	0.268	0.160	0.256

Note: z statistics in []

### 5.2.2. Add city-level control variables

The control variables in the benchmark regression are firm-level data. For robustness, we added a series of city-level control variables and performed the regression again. First, considering the different levels of economic development and the large gap in fiscal revenue among cities in China, the fiscal revenue growth targets formulated are greatly affected by the city's own situation. At the same time, the layout of industries in each city is different, resulting in different emphases of GI for enterprises. In this regard, we opted to add city-level control variables. The control variables at the city level are: (1) Fiscal expenditure effectiveness: the proportion of local fiscal general budgetary expenditures in the regional GDP; (2) Financial development level: the ratio of the loan balance of financial institutions to the regional GDP at the end of the year; (3) Educational level: the number of students in regular colleges and universities; (4) Trade openness: the number of foreign-invested enterprises; (5) Population: population density, that is, the number of residents per square kilometer. In Table 4, whether it is enterprise patent authorization (*pat\_total*), enterprise invention patent authorization (*pat\_inv*) or enterprise utility patent authorization (*pat\_uty*), *target* still has a major harmful influence with making green innovations for enterprises.

**Table 4.** Add city-level control variables.

	(1)	(2)	(3)
	<i>pat_total</i>	<i>pat_inv</i>	<i>pat_uty</i>
target	-0.018*** (-4.238)	-0.015*** (-5.561)	-0.014*** (-3.498)
Firm controls	√	√	√
City controls	√	√	√
Ind FE	√	√	√
Year FE	√	√	√
Cons	-1.468*** (-4.568)	-1.062*** (-12.089)	-1.109*** (-3.543)
N	6180	6180	6180
R <sup>2</sup>	0.252	0.167	0.237

### 5.2.3. Replace the dependent variable

Not all applications for green patents are authorized, so there is a difference between the number of green patent applications and the number of authorizations. From the perspective of enterprises, the number of the former can better reflect the activeness which they make GI activities. Therefore, the dependent variables are replaced with green patent applications (*pat\_apply\_total*) and the number of green invention patent applications (*pat\_apply\_inv*), which are as alternative indicators of corporate GI for robustness testing. In Table 5, the impact of fiscal revenue growth target pressure on corporate GI is negative.

**Table 5.** Replace the dependent variable.

	(1)	(2)	(3)	(4)
	<i>pat_apply_total</i>		<i>pat_apply_inv</i>	
target	-0.005*	-0.005**	-0.006***	-0.007***

	(-1.952)	(-1.977)	(-3.070)	(-3.374)
Controls	√	√	√	√
Ind FE	√	√	√	√
Year FE	√	√	√	√
Cons	0.011 (0.213)	0.086 (0.252)	0.031 (0.738)	0.010 (0.044)
N	20295	18900	20295	18900
R <sup>2</sup>	0.118	0.143	0.095	0.116

#### 5.2.4. Lagging treatment

The influence of fiscal revenue growth targets on corporate GI may have a lag. Enterprises will adjust their business and investment plans according to the setting of policy goals, and these plan adjustments mean that the recruitment of talents, equipment replacement and departmental restructuring will take a long time. Therefore, this part deals with the fiscal revenue growth target in the next period. As shown in columns (1) - (3) of Table 6, there is no change between the regression results and the previous ones.

**Table 6.** Lagging treatment.

	(1)	(2)	(3)
L.target	pat_total -0.010*** (-3.016)	pat_inv -0.012*** (-5.757)	pat_uty -0.007** (-2.298)
Controls	√	√	√
Ind FE	√	√	√
Year FE	√	√	√
Cons	-0.711** (-2.227)	-0.666*** (-11.940)	-0.502 (-1.577)
N	15939	15939	15939
R <sup>2</sup>	0.278	0.170	0.266

#### 5.2.5. Replace regression model

In the sample of this article, part of the observed value of the dependent variable is 0, and the Tobit model is suitable for the case where the dependent variable is limited. Thus, this article adopts Tobit regression to test the model. As shown in table 7, using these estimation methods, the regression coefficient of target is significantly positive at the 1% level on the basis of controlling related variables. This shows that some of the 0 values in the sample of this paper do not affect the raw conclusion of this paper.

**Table 7.** Replace regression model.

	(1)	(2)	(3)
target	pat_total -0.0381*** (-12.6480)	pat_inv -0.0209*** (-5.1440)	pat_uty -0.0463*** (-14.0125)
Controls	√	√	√
Ind FE	√	√	√
Year FE	√	√	√
Cons	-0.5127*** (-8.5378)	-1.8539*** (-22.2613)	-0.7178*** (-11.1356)
N	18900	18900	18900

Note: z statistics in parentheses

## 6. Heterogeneity analysis

### 6.1. Heterogeneity of enterprise ownership

Operations with diverse property ownership have varied in capital structures and different ways of allocating funds for green innovation, which makes a difference in the degree of spillover of fiscal revenue targets on corporate GI (Tang et al., 2020). The direct impact of local government fiscal revenue on state-owned industries is different from that on non-state-owned industries. The research plans and fund allocation of state-owned enterprises need more financial support and system deployment. In addition, the categories of green patents developed by firms of different natures are different, and the pressure brought about by fiscal revenue growth or not has different impacts on them (Ren et al., 2021). To this end, we further analyzed the heterogeneity in the influence of fiscal revenue growth target pressure on the degree of GI for various kinds of enterprises.

Based on firm ownership, we test and study respectively the state-owned and non-state-owned firms. In Table 8, columns (1), (3) and (5) are the impact of the fiscal revenue growth target on the GI of state-owned enterprises, all showing that it was significantly negatively affected. The reasons may be as follows: state-owned enterprises must take into account the interests of the state, enterprises and employees when distributing profits, provide capital accumulation for the nation, increase employment in an effort to improve the people's livelihood, and develop through continuous transformation (Du et al., 2012). Therefore, the fiscal revenue growth target is one of the barometers to provide supporting services for the operating activities of state-owned enterprises. The greater the target pressure, the heavier the financial burden on state-owned enterprises to support people's livelihood and system reform, and the less room for GI activities (Lin et al., 1998). Columns (2), (4) and (6) are the impact of the fiscal revenue growth target on the GI of non-state-owned enterprises, and the impact is not significant. It may be because the capital allocation and investment decisions of non-state-owned enterprises are more derived from fluctuations in marketplace value, and the profits obtained from their innovation activities are handed over to the government in the form of taxes. Therefore, the GI of enterprises is not influenced by the pressure of fiscal revenue growth targets.

**Table 8.** Heterogeneity of enterprise ownership.

	(1)	(2)	(3)	(4)	(5)	(6)
	pat_total		pat_inv		pat_uty	
	State-owned	Non-state-owned	State-owned	Non-state-owned	State-owned	Non-state-owned
target	-0.031** (-2.074)	0.004 (0.843)	-0.026** (-2.322)	-0.002 (-1.008)	-0.029** (-2.111)	0.006 (1.319)
Controls	√	√	√	√	√	√
Ind FE	√	√	√	√	√	√
Year FE	√	√	√	√	√	√
Cons	-0.209 (-0.636)	-0.269** (-2.268)	-0.213 (-0.898)	-0.358*** (-3.291)	-0.020 (-0.063)	-0.176* (-1.828)
N	5792	12061	5792	12061	5792	12061
R <sup>2</sup>	0.307	0.249	0.201	0.133	0.304	0.234

### 6.2. Heterogeneity of business return on investment

Group by the median, divide the variable value below the median into low return on capital (Low ROC), and divide the variable value above the median into high return on capital (High ROC). In Table 9, columns (1) - (6) show the impact of fiscal revenue growth targets on the GI of enterprises with different rates of return on capital, all of which have an adverse impact, among which the green monopoly authorization and green utility monopoly authorization of enterprises with high return on capital are affected effect is not significant. For ROA, the

heterogeneity results are the same as above. Enterprises with a higher rate of return on capital have stronger risk-taking capabilities, greater self-sufficiency space and market potential, so their GI decisions and R&D directions are less affected by finances. The government subsidy required for utility patent authorization is less than that for invention patent authorization, so it is relatively insignificant. In addition, enterprises with high return on capital may choose different business scopes. Some enterprises give up investment in R&D and tend to support operations in order to pay less for higher income, which will also inhibit green innovation.

**Table 9.** Heterogeneity of business return on investment.

	(1)	(2)	(3)	(4)	(5)	(6)
	pat_total		pat_inv		pat_uty	
	Low ROC	High ROC	Low ROC	High ROC	Low ROC	High ROC
target	-0.021***	-0.001	-0.019***	-0.006**	-0.019***	0.002
	(-4.624)	(-0.238)	(-6.025)	(-2.339)	(-4.534)	(0.620)
Cons	-0.552*	-0.440***	-0.474***	-0.457***	-0.408	-0.291***
	(-1.718)	(-5.521)	(-6.272)	(-9.500)	(-1.302)	(-4.012)
N	9393	9506	9393	9506	9393	9506
R <sup>2</sup>	0.276	0.276	0.172	0.170	0.267	0.255
	(7)	(8)	(9)	(10)	(11)	(12)
	pat_total		pat_inv		pat_uty	
	Low ROA	High ROA	Low ROA	High ROA	Low ROA	High ROA
target	-0.021***	0.0001	-0.018***	-0.006**	-0.019***	0.003
	(-4.722)	(0.035)	(-5.7751)	(-2.372)	(-4.548)	(0.736)
Cons	-0.486	-0.491***	-0.448***	-0.473***	-0.343	-0.342***
	(-1.500)	(-6.041)	(-5.865)	(-9.819)	(-1.092)	(-4.620)
N	9334	9565	9334	9565	9334	9565
R <sup>2</sup>	0.273	0.283	0.171	0.171	0.264	0.264
Controls	√	√	√	√	√	√
Ind FE	√	√	√	√	√	√
Year FE	√	√	√	√	√	√

### 6.3. Heterogeneity of industry type

According to the classification of industry factor intensity, the samples are divided into labor-intensive type (lab), capital-intensive type (cap) and technology-intensive type (tech). In Table 10, we found that the fiscal revenue growth target has a major negative impact on the GI of labor-intensive enterprises, while the GI activities of other kinds of enterprises have not been significantly affected. It may be because the fiscal revenue growth target is related to people's livelihood issues, and the revenue increase channel comes from taxes and fees, so the impact on manpower employment is more direct.

**Table 10.** Heterogeneity of industry type.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	pat_total			pat_inv			pat_uty		
	lab	cap	tech	lab	cap	tech	lab	cap	tech
target	-0.047**	-0.0027	-0.005	-0.036**	-0.006	-0.010	-0.040*	-0.003	-0.001
	(-2.050)	(-0.3163)	(-0.487)	(-2.194)	(-1.087)	(-1.509)	(-1.841)	(-0.430)	(-0.095)
Controls	√	√	√	√	√	√	√	√	√
Ind FE	√	√	√	√	√	√	√	√	√
Year FE	√	√	√	√	√	√	√	√	√
Cons	-0.231	-0.434***	-0.947***	-0.076	-0.142	-0.500***	-0.183	-0.376***	-0.865***
	(-1.014)	(-2.9584)	(-5.930)	(-0.674)	(-1.298)	(-3.713)	(-0.753)	(-3.736)	(-6.350)
N	3571	4909	10418	3571	4909	10418	3571	4909	10418
R <sup>2</sup>	0.384	0.167	0.257	0.250	0.100	0.152	0.370	0.158	0.242

## 7. Mechanism analysis

The theoretical analysis of this article proves that the pressure on fiscal revenue target setting can inhibit corporate green innovation. Therefore, how does the burden on fiscal revenue growth target affect corporate green innovation? This article conducts the following analysis from two perspectives: tax burden and financing constraints.

### 7.1. Tax burden

The fiscal revenue target increases the tax burden on enterprises, which in turn has a hold on its initiative of enterprises to improve their GI capabilities. First, the government transfers fiscal risks to corporate tax risks by setting goals. In order to deal with fiscal risks, companies will be more inclined to pursue economic profits, and corporate cash flow will be tilted towards corporate operations and production, thus occupying the R&D space for corporate GI (Elschner et al. al., 2006; Kéita and Laurila, 2021; Du et al., 2023). In addition, the fiscal revenue growth target puts the big stick on local governments. So as to increase fiscal revenue, the government may adjust the form of revenue increase and tax regulations; breaking the original tax planning plan of the enterprise; changing the budget of the enterprise's operating activities and innovation activities; various enterprises departmental mission objectives will be reallocated, and the potential of GI needs to be tapped (Nuta, 2008; Abuselidze, 2012; Odintsov et al., 2020; Yang and Zhang, 2022).

The difference between corporate taxes and tax rebates as a proportion of operating income is used as a measure of tax burden. In Table 11, we find that the coefficient of tax burden is displayed as positive, revealing that increasing the pressure on fiscal revenue growth target will heavy their tax burden of enterprises, thereby affecting corporate green innovation.

**Table 11.** Influence mechanisms.

	(1)	(2)	(3)
	Corporate tax burden	Financing constraint	
	tax	SA_index	FC_index
target	0.0005*** (3.4664)	-0.0040*** (-6.2896)	0.0026*** (4.3457)
Controls	√	√	√
Ind FE	√	√	√
Year FE	√	√	√
Cons	0.0401*** (6.3616)	-3.4171*** (-1.8e+02)	1.2667*** (40.2744)
N	16713	18900	16912
R <sup>2</sup>	0.4665	0.3451	0.5755

### 7.2. Financing constraints

Fiscal revenue target intensify corporate financing constraints, which in turn affects corporate green innovation. First, government intervention standardizes the lending standards of green finance and makes financing more difficult for enterprises' GI (Talavera et al., 2011; Garcia-Quevedo et al., 2018; Yu et al., 2021, Yu et al., 2021; Li et al., 2022; Li et al., 2023). Second, growth goal setting leads to corporate financing dependence and raise the threshold for corporate GI (Yu et al., 2021; Zhang and Jin, 2021; Li et al., 2022). Third, government goals emphasize the parallelization of economic development and environmental protection, causing corporate financing constraints (Doran and Ryan, 2012).

Accordingly, we use financing constraints as mechanism variables, and use SA index and FC index as the indicators measuring financing constraints respectively (Shi et al., 2023). Among them, the SA index and the FC

index have opposite economic meanings. The smaller the SA index value, the deeper the constraints arising from financing of enterprise. In Table 11, the coefficient of the SA index is negative and the regression coefficient of the FC index is positive, confirming that the pressure on fiscal revenue growth targets intensifies corporate financing constraints, thereby affecting corporate GI.

## 8. Conclusions and policy implications

The fiscal revenue growth target imposes significant pressure on corporate Green Technological Advancement (GI). Utilizing matched city-enterprise data from 2009 to 2020, this study employs a fixed-effect model to authentically investigate the mechanism by which fiscal revenue growth target pressure impacts corporate green innovation. The key findings are as follows: fiscal revenue growth targets inhibit enterprise GI, with the inhibitory effect exhibiting heterogeneity across enterprise ownership, return on investment, and industry characteristics. Tax burden and financing constraints serve as influential channels, and the baseline conclusion remains robust after multiple sensitivity tests. In light of these findings, the following policy implications are proposed:

(1) Implement dynamic fiscal target assessments to attract high-quality innovative enterprises. Given that fiscal revenue growth targets exert pressure on corporate GI, there is a need for dynamic monitoring of their microscopic impact on corporate performance. This would provide an effective basis for formulating fiscal revenue growth targets for the upcoming year, moving beyond mere reference to the previous year's total fiscal revenue. Adjusting the performance appraisal system for government officials dynamically can help reduce officials' inclination towards rent-seeking behavior and unhealthy competition. When attracting companies, the focus should shift from solely economic growth to also considering the quality and sustainability of green innovation.

(2) Strengthen support for green innovation and enhance quality and efficiency according to local conditions. Heterogeneity analysis reveals differing impacts of fiscal revenue growth target pressure on enterprise green innovation across various ownership structures, return on investment levels, and industry types. To address this, reforms in the state-owned enterprise system should be deepened, and the core competitiveness of state-owned enterprises enhanced. Special channels for green support should be established for small and medium-sized innovative enterprises, along with targeted credit standards and extension of green financial policies to these entities. Efforts should be concentrated on cultivating high-level talents, and special green innovation financial support extended to enterprises with intensive labor forces, particularly green innovation personnel.

(3) Increase innovation compensation measures to promote corporate green innovation. Mechanism analysis indicates that fiscal revenue growth targets heighten the tax burden and financing constraints of enterprises, thus inhibiting corporate green innovation. Enhancing "innovation compensation" through mechanisms such as green financial subsidies, special transfer payments, and improved financing channels can help alleviate tax costs and financing risks associated with green innovation. Through financial incentives and demonstration city assessment methods, corporate green innovation can be protected, benefitting entrepreneurs through tangible innovation compensation. This would enhance entrepreneurs' sense of accomplishment and mission, leading them to prioritize the environmental protection mission of GI while leveraging it for economic gains, thus establishing an enduring and effective mechanism for promoting enterprise green innovation.

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## Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

## Author contributions

Conceptualization: Huixin Ling; Investigation: Jiayi Liu; Methodology: Jianmin Liu; Formal analysis: Jiayi Liu; Writing – original draft: Huixin Ling; Writing – review & editing: Jianmin Liu.

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