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Abstract: Within the behavioral framework of Chinese local government officials, the establishment and pursuit of ambitious fiscal revenue targets emerge as both a potent instrument and a prerequisite for realizing political aspirations. This study investigates the influence of fiscal revenue targets on corporate carbon emissions. Our findings indicate that elevating the threshold of fiscal revenue targets significantly curtails enterprise carbon emissions. This effect is manifested through heightened corporate expenditure on pollution charges and increased levels of green innovation. Our research furnishes valuable insights for carbon governance by fiscal revenue target management in developing nations.

Keywords: Fiscal revenue target, Carbon emissions, Emissions fees, Green innovation

JEL Classification:C26; H32; Q48

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Local Government's Fiscal Revenue Targets and Enterprise Carbon Emissions: Evidence from China

1. Introduction

Over the past 40 years of reform and opening up, China's economy has achieved rapid growth rates that exceed the average annual growth rate of the global economy. However, excessive carbon emissions have become an important environmental issue as the consumption of natural resources has accelerated (Lee and Lee, 2022). According to the World Resources Institute Climate Watch data platform, China surpassed the United States as the largest emitter of carbon dioxide around 2004 and accounted for as much as 28.8% of the world's total carbon emissions in 2019. The key to curbing the trend of increasing carbon emissions in China lies in controlling emissions at the enterprise level (Zhao et al., 2020). Local governments encounter diverse developmental constraints, including fiscal revenue and economic growth targets (Tang et al., 2021; Wang et al., 2024). Embracing the management by objectives model, heavily reliant on measurable indicators like fiscal revenue targets, local administrations wield increased discretionary financial resources. This shift may alleviate the historical trend of excessive fiscal expenditure concentration on productive outlays, consequently fostering a positive influence on carbon emission reduction. Therefore, the questions that this paper aims to explore are formally expressed as follows: How does the fiscal revenue targets of local government affect carbon emissions? And through which mechanisms is this influence exerted?

Previous studies on carbon emissions have focused on the impacts of internal and external factors, and especially that of government-led behavior, on carbon emissions. Scholars have proposed several initiatives through which to reduce carbon emissions based on their

influencing factors. With regard to the internal factors, many scholars believe that corporate social responsibility (CSR) can effectively improve environmental performance and reduce the level of carbon emissions (Asongu, 2007; Tang and Tang, 2012). Chen (2023) shows that CSR reduces the intensity of carbon emissions by reducing corporate financing constraints and promoting carbon neutrality. The corporate debt ratio and debt structure also profoundly affect the level of carbon emissions (Gebauer et al. 2018; Chen and Zhu, 2022). This is because the proportion of long-term debt in the debt ratio and debt structure can influence corporate environmental protection and research & development investment decisions (Chang et al. 2019). In addition, the impacts of corporate characteristics such as digital transformation, knowledge management and the asset structure on carbon emissions have been widely discussed (Yao et al. 2019; Li et al.2023; Dan et al. 2023). The government profoundly affects all aspects of social development, and environmental governance is no exception, as various policy tools are used to influence carbon emissions at the enterprise level. The carbon tax is an important tool through which the government pushes enterprises to reduce their carbon emissions and increase their investment in low-carbon technology innovation and low-carbon products (Qu and Sun, 2022). Investments in science and technology and environmental protection can significantly reduce carbon emissions (Adhikari and Agrawa, 2018; Shan et al., 2018). The government's subsidy policy has also had a positive impact on optimizing low-carbon supply chains and reducing carbon emissions (Li et al., 2021; Dai et al., 2022). Furthermore, the positive effect of city pilot programs (e.g., "smart" and low-carbon cities) on reducing the carbon emissions of enterprises has been confirmed (Liu et al., 2022; Guo et al., 2022).

Since its establishment, the People's Republic of China has been dedicated to the pursuit

of effective methods for local governance and policy implementation(Edin， 2003). In this regard, the Chinese government has adopted a vertical governance model, which, in practice, has fostered a dynamic environment of healthy competition among various regions (Blanchard and Shleifer, 2001). Simultaneously, the central government has implemented a target responsibility system to exert effective governance in the regulation and guidance of local economic and social development. This system introduces political incentives for senior local government officials through political promotion contests. Performance assessment targets are cascaded down through hierarchical levels, motivating lower-level local officials to propose more ambitious objectives. In their pursuit of surpassing these goals and achieving superior outcomes, they strive to excel in political promotion contests, thus demonstrating their allegiance and competence to higher echelons of government (Lü and Landry, 2014).

Fiscal revenue targets assume a more immediate and paramount role compared to the economic growth targets that local government officials are tasked with achieving. This is because GDP growth rates can be subject to various adjustments and manipulations, whereas the growth rate of fiscal revenues is contingent solely upon actual fiscal income (Maddison, 2009). Consequently, the establishment of fiscal revenue targets significantly reflects the political aspirations and competencies of local government officials. In their pursuit of this objective, local government officials must confront not only the challenges associated with economic development but also take pragmatic and effective measures to ensure the augmentation of fiscal revenues. This strategic endeavor positions them favorably in the competitive landscape of political promotion.

Although several studies have explored the various influencing factors of carbon emissions,

few researchers have analyzed the effects of local government's fiscal revenue targets on carbon emissions. Based on the data of Chinese A-share listed companies from 2005 to 2020, this paper explores whether the fiscal revenue targets of local government have a positive effect in controlling carbon emissions and elucidates its underlying mechanisms. Our study shows that (1) the fiscal revenue targets of local government has a significantly negative effect on carbon emissions, and this finding holds after a series of robustness tests; (2) the effect of fiscal revenue targets in reducing carbon emissions is more significant in the sample of cities with strong political affiliation and high promotion intensity as well as in non-industrial cities; and (3) emissions fees and green innovation are the pathways through which fiscal revenue targets reduces carbon emissions.

The marginal contributions of this paper are in the following three aspects. First, we study the impact of local government's fiscal revenue targets on carbon emissions from a new perspective, thereby expanding the understanding of the influencing factors of carbon emissions. Second, this paper investigates the influence of China's fiscal revenue targets on enterprise carbon emissions and delineates the heterogeneity of this influence. By offering empirical insights, it furnishes crucial research backing for policymaking entities to devise tailored strategies. Additionally, it presents novel perspectives for other developing nations to enhance their endeavors in carbon emission governance.

The remainder of this paper is organized as follows. The second part conducts a theoretical analysis and proposes our research hypotheses; the third part presents the research design; the fourth part includes the empirical analysis and results, including benchmark regression results and robustness tests, a heterogeneity analysis, a discussion of the underlying mechanisms and

further analysis; in the final part, conclusions are presented based on the preceding analysis.

2. Theoretical Analysis

2.1 Typical fact

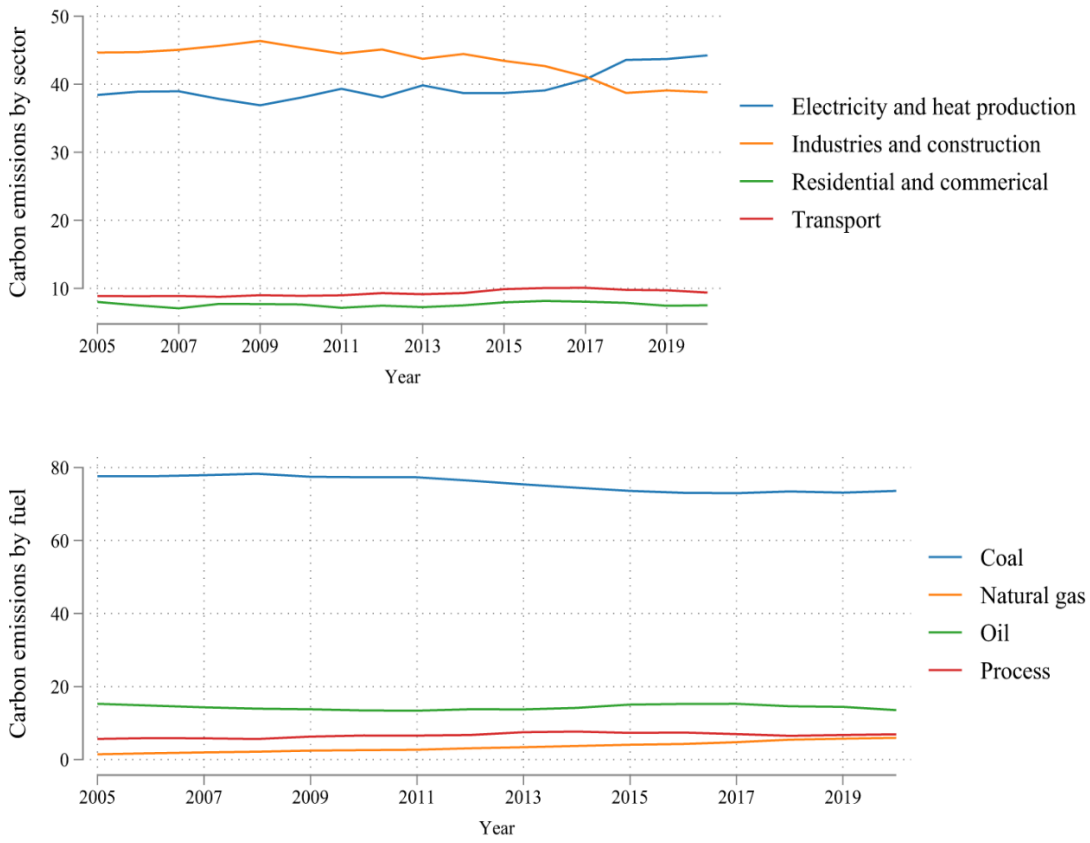
Since the initiation of China's reform and opening-up policy in 1978, its economy has undergone rapid growth, paralleled by a marked increase in energy consumption and carbon emissions (Wang et al., 2024). In response to these developments, the Chinese government has progressively acknowledged the significance of environmental preservation, integrating the regulation of carbon emissions into its policy framework. Initially characterized by relatively lenient constraints, China's approach to carbon emissions has evolved, notably during the Eleventh Five-Year Plan in 2006, which elevated the prioritization of energy conservation, emission reduction, and environmental protection to unprecedented levels (Chen et al., 2022). In alignment with the central government's directives, local governments have delineated specific targets for energy efficiency and emission reduction within their regional economic and social development plans or governmental reports. For instance, Kunming City established an objective to reduce carbon dioxide emissions per unit of GDP by over 20% in its 12th Five-Year National Economic and Social Development Plan. To enforce compliance with these targets, the Chinese government has implemented more rigorous measures, exemplified by a circular issued by the State Council in 2007, which integrated energy conservation and emission reduction into the performance evaluation system for local officials. This initiative amplifies the significance attached to energy conservation and emission reduction by local governments and establishes a robust incentive structure by correlating achievements in these domains with the annual and tenure performance assessments of officials. Local officials failing to attain

energy-saving and emission-reduction targets may face accountability measures, including disqualification for promotion (Sun, 2018).

The distribution of carbon emissions by sector and energy source in China from 2005 to 2020 is depicted in Figure 1. The data presented therein illustrate a discernible pattern in the share of carbon emissions across sectors during the specified period. Electricity and heat production, along with industries and construction, emerge as the primary contributors to carbon emissions, with electricity and heat production surpassing industries and construction as the leading sector in carbon emission since 2017. Nevertheless, the aggregate carbon emissions from the business sector remain substantial, underscoring the significance of businesses in advancing a transition towards low-carbon practices. Conversely, carbon emissions from transportation, residential and household activities, and business operations are comparatively modest. However, this does not diminish the importance of efforts to mitigate emissions in these domains.

For an extended period, coal has been the predominant component of China's energy framework, contributing significantly to the nation's elevated carbon emissions. Despite the rapid advancement of renewable energy sources, altering the entrenched position of coal in the energy landscape remains challenging in the near term. As depicted in Figure 1, coal constituted nearly 80% of annual carbon emissions from 2005 to 2020, underscoring its pivotal role in greenhouse gas emissions. Conversely, while oil, the second-largest emitter, contributes to emissions, its impact is notably less pronounced compared to coal. Moreover, the relatively minor contributions from natural gas and process emissions indicate their secondary role in the overall carbon emission profile.

Figure 1: Carbon emissions by sector or fuel



2.2 Institutional background

The establishment of local administrative tiers stands as a pivotal element in constructing a modern state system and constitutes a significant aspect of local administrative governance.[1] In administrative practice, China has established a comprehensive five-tier administrative structure comprising the Central Government, Province, Prefecture, County, and Township (Li et al., 2016). For the theoretical and empirical analyses of this paper, we choose revenue targets at the prefecture level because provincial fiscal revenue targets mainly reflect the authority and constraint of the central government in regulating local development. Moreover, the revenue targets of county-level governments are not always publicly available, and thus the use of

[1] As per the Constitution of the People's Republic of China, the country is divided into provinces, autonomous regions and municipalities. Provinces and autonomous regions are divided into autonomous prefectures, counties, autonomous counties and cities. Counties and autonomous counties are divided into townships, nationality townships and towns.

prefecture-level data results in a larger sample size. Give that prefecture-level governments are influenced by local officials' desire to be promoted, there is a sufficiently large sample size for analysis[1].

While fiscal decentralization tends to be coupled with political federalism in most countries, in China, it occurs within a vertical administrative system, and the combination of economic decentralization and political centralization is one of its distinctive features (Weingast, 1995)[2]. The incentives that the Chinese-style fiscal system creates for local governments emphasizes the importance of local revenue generation. Fiscal arrangements that allow local governments to capture the majority of local revenues are generally associated with faster economic growth. Therefore, local governments are concerned with generating revenue (Gordon and Li, 2012). In response to the deficiencies in the decentralization of China's financial resources, a reform of the tax-sharing system was implemented in 1994. The primary aim of this reform was to rationalize the distribution of fiscal revenues between the central and local governments. Taxes directly linked to economic development, such as consumption tax, value-added tax, enterprise income tax, and personal income tax, were categorized as central taxes or shared taxes between the central and local governments. Conversely, taxes deemed suitable for local administration were designated as local taxes. Concurrently, to empower local governments, they were granted autonomy to determine fiscal revenue sizes and budgets within

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[1] The criteria for classification as a prefecture-level city are explicitly outlined in the Circular of the Ministry of Civil Affairs on Regional Formation Adjustment issued in 1999. Only those meeting specified thresholds in population density, non-agricultural workforce, gross domestic product (GDP), tertiary industry proportion, and total fiscal revenues qualify for such classification.

[2] Provincial government officials are appointed by the central government, while local authorities possess the authority to appoint and dismiss lower-level government personnel. The democratic recommendation process and semi-competitive elections at Party congresses constitute essential procedures for the appointment of prefectural municipal government administrators (Zeng, 2016).

their jurisdictions, formulate local policies and regulations, and oversee local economic activities. As depicted in Table 1, the central government's revenue share surged to 55.7% in 1994, marking a 33.7 percentage point increase from 1993, and has since maintained a relatively stable level, hovering slightly above and below the 50% mark.

Table 1. Proportion of central and local government revenue

Year	Centre government	Local government
1992	28.1	71.9
1993	22	78
1994	55.7	44.3
1995	52.2	47.8
1996	49.4	50.6
1997	48.9	51.1
2000	52.2	47.8
2005	52.3	47.7
2010	51.1	48.9
2015	45.5	54.5
2020	45.3	54.7

In China, the setting of fiscal revenue targets follows a combination of upward and downward procedures. Specifically, local finance departments at all levels first formulate annual fiscal revenue and expenditure plans based on local economic conditions and financial needs, which are then reported to higher-level finance departments. In this process, the higher-level financial institutions are responsible for comprehensively analyzing the data collected and, on this basis, formulating approved indicators of financial revenue and expenditure that are consistent with the overall economic development trend, and then sending these indicators down to the lower-level financial departments. Lower-level agencies then adjust and determine their own work priorities and scope of tasks based on the targets issued by their superiors. In setting fiscal revenue targets, policymakers not only need to refer to the planned figures proposed by lower-level finance departments, but also must comprehensively assess the actual fiscal revenue and expenditure situation of the previous year and the effectiveness of budget

execution. This approach ensures the scientific and reasonable nature of fiscal target setting, and it strikes a balance between stability and flexibility through the "base plus growth" approach, which preserves respect for historical data while allowing room for future development. In this way, China's fiscal management reflects a combination of dynamic adjustment and forward-looking planning, with the aim of promoting fiscal health and stability in the service of economic and social development.

Tax revenue constitutes the primary element of local government income, and achieving revenue targets necessitates the realization of substantial tax proceeds (Liu & Liu, 2013). In the realm of tax collection and administration, both the State Administration of Taxation (SAT) and local authorities delineate the roles and responsibilities of tax agencies across all administrative tiers through the formulation of tax plans and assignments. To incentivize tax authorities to attain fiscal objectives, governmental bodies at various levels have instituted mechanisms encompassing performance assessments, rewards, and penalties. These mechanisms not only furnish tangible incentives for departments and individuals who successfully meet tax collection objectives but also factor into considerations for career advancement. Conversely, falling short of fiscal targets may result in censure notifications and severe repercussions concerning awards and promotions, exemplified by the "one-vote veto" practice.

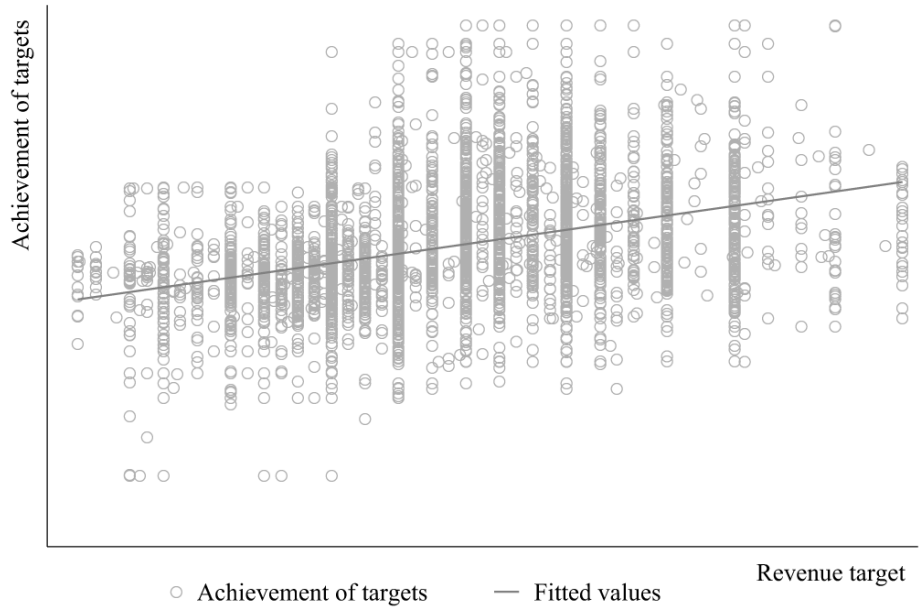
In China's fiscal system, the authority to determine tax types and rates rests with the central government, as explicitly outlined in policies and regulations. Nonetheless, the tax distribution system, coupled with the operational dynamics of fiscal decentralization and the dual structure of tax administration (prior to the merger of the State Taxation Bureau and the Local Taxation Bureau), affords local governments leeway to intervene in tax affairs. This intervention is driven

by the fiscal imperatives and incentives of local administrations, facilitated by the adaptable framework of tax allocation and fiscal decentralization. Furthermore, local governments wield a degree of autonomy in devising tax incentives, bolstering their capacity to influence tax-related decisions. Despite the central government's jurisdiction over tax rates and types, local administrations can adjust the effective tax rate through modifications in tax collection mechanisms and the introduction of incentives (Wang & Yu, 2018). Confronted with the political pressure of meeting fiscal revenue targets, local governments may adopt dual strategies. On one front, to swiftly augment fiscal revenues, they may intensify tax collection and management, thereby heightening the effective tax rate on entities such as enterprises. Conversely, local authorities may opt to relax tax collection and management to reduce the tax rate on enterprises, aiming to attract external capital and expand the tax base within the locality. This strategy, oriented towards long-term objectives, fosters economic growth and broadens the tax base by fostering a conducive investment climate, ultimately fostering sustainable fiscal revenue growth (Tang et al., 2023).

Under the Chinese-style fiscal decentralization system, officials at all levels are prone to engage in “political tournaments” due to the centralization of administrative power and top-down management practices (Ma, 2016). Under the dual pressures of political centralization and the revenue mismatches created by the tax sharing system, local government officials’ political ambition generally results in their prioritizing sustained fiscal revenue growth over other considerations. Local officials seeking promotion will thus endeavor to reach the set fiscal revenue target, i.e., the local government strives to bring the actual growth rate of fiscal revenue closer to the set fiscal revenue growth target, and there is a close correlation between the fiscal

revenue growth target and the growth rate of fiscal revenue. Figure 2 is a scatter plot reflecting the relationship between the fiscal revenue target and the realization of the target, showing that there is a positive correlation between the fiscal revenue target announced by local governments in their annual government work reports and the actual growth rate of fiscal revenue.

Figure 2: Revenue targets and achievement of targets



In this paper, we manually compiled data on fiscal revenue targets from government work reports and related budget documents for 31 provinces, autonomous regions, and municipalities directly under the central government as well as 233 prefecture-level cities in China from 2005 to 2020. We further grouped statistics according to fiscal revenue targets and their difference with their associated province-level fiscal revenue targets, and the results are shown in Table 2. By doing so, we can make the following observations. (1) Most of the prefecture-level municipalities set their fiscal revenue targets above 5%, most of the fiscal revenue targets are set in the range of 10%–15%, and only 7.62% of the sample has fiscal revenue targets below 5%. (2) In general, the differences between the fiscal revenue targets of prefecture-level cities

and their provinces are more varied, but the vast majority of prefecture-level cities set higher fiscal revenue targets than those of their provinces, as those that do not account for only 16.97% of the full sample. (3) The distribution of local government's fiscal revenue targets is relatively decentralized, but again, the actual completion value of the fiscal revenue rate in the vast majority of prefecture-level cities is greater than 0, and the sample that did not achieve the fiscal revenue target only accounts for 29.62% of the sample as a whole.

Table 2. The disparity between the fiscal revenue targets of prefecture-level cities and those of their provinces

Statistical analysis of the difference between the fiscal revenue target of prefecture-level cities and the target value of their provinces								
Variable	The fiscal revenue target		The goal gap with the state			The difference between the actual completion and the target		
Grouping (%)	Number	Proportion (%)	Grouping (%)	Number	Proportion (%)	Grouping (%)	Number	Proportion (%)
Less than 0	12	0.32	Less than 0	638	17.11	Less than -10	217	5.82
0-5	246	6.6	0-1	932	25	-10-0	887	23.8
5-10	1077	28.89	1-2	644	17.27	0-5	1072	28.76
10-15	1274	34.17	2-3	442	11.86	5-10	537	14.4
15-20	817	21.92	3-4	332	8.91	10-15	446	11.96
20-25	225	6.03	4-5	184	4.94	15-20	262	7.03
25 and above	77	2.07	5 and above	556	14.91	20 and above	307	8.23
Total	3728	100		3728	100	Total	3728	100

2.3 Analysis of the Mechanism Through Which Fiscal Revenue Targets Affect Carbon Emissions

Externality theory suggests that environmental pollution creates strong negative externalities. Since the marginal private cost is lower than the marginal social cost to the polluter, this leads to a lack of incentives for polluters to independently reduce their polluting activities. Likewise, environmental protection generates lower economic than social benefits, so

enterprises lack the initiative to sustain their environmental protection activities. Therefore, the negative externalities of environmental pollution must be addressed by the government through the imposition of environmental taxes or emissions fees. The latter is an important element of China's environmental protection laws and a common practice worldwide that optimizes the allocation of resources and protects the environment while adjusting the costs and benefits of emissions pollution and environmental protection (Niu et al., 2018). China announced and implemented the *Interim Measures for the Collection of Emissions fees* and the *Interim Measures for the Reimbursable Use of Special Funds for the Treatment of Pollution Sources* in 1982 and 1988, respectively. With the development of environmental protection measures and the reform of the financial system, China formulated and promulgated the *Regulations on the Collection and Use of Emissions fees* in 2003 on the basis of its experience in collecting and managing emissions fees over the past twenty years. Per regulations, emissions fees are assessed on a monthly or quarterly basis, with the charging criteria based on a dual framework of "charging for discharges" and "charging for exceeding standards." Initially, during the regulation's inception, emissions fees were predominantly established by pertinent central government departments, with limited involvement from local governments in setting charges. However, in 2014, the National Development and Reform Commission (NDRC) issued the Circular on Adjustment of Sewage Charge Collection Standards and Other Relevant Issues, granting local governments the authority to adjust charging standards as per actual circumstances, significantly enhancing local autonomy in sewage charging. Given that sewage charge targets encompass greenhouse gases like nitrogen oxides and carbon monoxide, as well as solid wastes produced post-consumption of fossil fuels such as fly ash, slag, and coal gangue,

it is plausible to assert that sewage charge collection has augmented the cost of carbon emissions for enterprises. Studies have shown that environmental taxes can not only reduce overall emissions pollution and improve environmental quality but also have a positive impact on reducing carbon emissions in particular (Elkins and Baker, 2002). By following the theoretical framework outlined in the Porter hypothesis, the government can play a positive role in coordinating economic growth by enacting targeted environmental policies; through environmental regulation, it can guide firms in maximizing their own interests while achieving its environmental policy goals. Pollution charges, as a market-incentivized environmental regulation tool, can increase the adoption of green and low-carbon production technologies by increasing firms' pollution costs so that they are driven by profit maximization incentives to improve their environmental performance and avoid environmental enforcement (Ji et al., 2021). In the context of higher costs faced by energy-intensive and high-polluting firms, emissions fees can generate economic incentives to reduce pollution and motivate firms to increase their environmental investments (Wang et al., 2022). This not only directly reduces CO_2 emissions but also promotes industrial upgrading, which indirectly reduces carbon emissions.

Schumpeter's theory of technological innovation considers innovation as an important driver of economic development, and it is regarded as a key factor in improving the quality and efficiency and economic development in China (Liu et al., 2019). Compared to general innovation activities, green innovation has positive knowledge spillover effects and environmental externalities (Arfi et al., 2018). Green innovation can gradually reduce the dependence on fossil energy and reduce the energy loss in fossil energy extraction through technological progress (Dong et al., 2020). The technological effect of green innovation is also

reflected in the improvement in the utilization rate of resources, the rate of recycling, and the reduction of carbon emissions. The structural effect is also the pathway through which green innovation reduces carbon emissions (Grossman and Krueger, 1991). The impact of green innovation on energy consumption is that it optimizes energy consumption by increasing the utilization of clean energy sources such as solar and wind while alleviating energy constraints to a certain extent. Green technology innovation can also promote the transformation of the industrial structure. Over time, production factors flow from industries or sectors with low productivity levels to those with high productivity levels, which transforms the industrial system as a whole (Wang et al., 2022). In this process, high-energy-consuming and high-emissions industries transition to low-carbon technologies, and the energy consumption and carbon emissions of secondary industries decline. Moreover, the allocation of production factors becomes more rational, thus bringing about an increase in production efficiency, which in turn reduces carbon emissions. However, it should be noted that there are factors common to green and general innovation activities. Both have the characteristics of certain public goods, and enterprises tend to worry that they will not be able to enjoy the benefits of R&D exclusively in the presence of spillover effects, which may outweigh the benefits brought about by innovation (Greenacre et al. 2012). Faced with the reality that enterprises are often unwilling to innovate independently, local governments either use financial subsidies and tax incentives or market incentive-based environmental regulation to motivate enterprises to do so (Dai et al., 2022). We argue that local government with higher fiscal revenue targets may be more motivated to use policy tools to promote firms to engage in green innovation, which in turn leads to a reduction in carbon emissions.

Based on the above theoretical analysis, the following research hypotheses are proposed in this paper:

H1: The higher the fiscal revenue targets of local government are, the more likely they will be to reduce carbon emissions.

H2: The fiscal revenue targets of local government reduce carbon emissions through the pathway of corporate spending on emissions and green innovation.

3. Research Design

3.1 Sample Description and Data Sources

The data used in our empirical study are microeconomic data of Chinese listed companies. The raw data on the carbon emissions of listed companies are obtained from the annual, social responsibility, environmental, and sustainability reports of listed companies. The raw data of fiscal revenue targets are manually compiled from the government work reports and budget reports published by province- and prefecture-level governments; the data of green patents are obtained from the national intellectual property database and matched with the green list of World Intellectual Property Organization's international patent classification; the data of emissions fees are manually obtained from the "payment of other cash related to operating activities" disclosed in the appendices of the annual reports of listed companies. The data on emissions fees were manually obtained from the "cash paid for other operating activities" disclosed in the appendices of the annual reports of listed companies, as well as from the annual, environmental, and social responsibility reports of other enterprises. The data of other variables were obtained from the WIND and CSMAR databases. Considering the availability of data, this paper selects the period from 2005 to 2020 for econometric analysis, and the variables for which

the data show little variance are logarithmically processed. Finally, the main variables are processed with tailing at the 5% and 95% levels, and the microdata at the enterprise level are matched with the fiscal revenue target data at the local and municipal levels, thereby resulting in panel data for 22,838 observations.

3.2 Variable Descriptions

3.2.1 Explained variables

According to the GHG Accounting System, the carbon emissions of enterprises can be divided into three scopes. Scope I is direct GHG emissions, which arise from sources owned or controlled by an enterprise, such as combustion emissions from boilers, furnaces, vehicles, etc., as well as emissions from chemical production generated by process equipment owned or controlled by the enterprise. Scope 2 accounts for indirect GHG emissions from purchased electricity and heat consumed by an enterprise. Companies can be divided into two categories based on disclosure. The first category directly discloses annual direct, indirect, or total carbon emissions. For enterprises in this category, we use the data they disclose and classify them as the same type. The second category of enterprises does not directly disclose annual carbon emissions but rather discloses different types of fossil energy, electricity, and heat consumption. For this category of enterprises, we calculated their Scope 1 and Scope 2 emissions separately according to the “Guidelines on Enterprise Greenhouse Gas Emissions Accounting Methods and Reporting” issued by the NDRC for different industries; if an enterprise reports its Scope 1 and Scope 2 emissions, they are summed to obtain the total carbon emissions. The carbon emissions of listed companies are derived from the sum of emissions from combustion and escape, production process emissions, waste emissions and land use conversion (conversion of

forests to industrial land).

Among them, combustion and fugitive emissions include fossil fuel combustion emissions, biomass fuel combustion emissions, fugitive emissions from raw material extraction, fugitive emissions from oil and gas systems, and indirect carbon emissions from electricity transfers. Waste emissions refer to carbon emissions from solid waste incineration and sewage treatment.

3.2.2 Explanatory variables

Drawing on the study by Wang et al. (2024), based on the descriptions of fiscal revenue targets in local government work reports and related budget documents, the annual fiscal revenue targets (*revenue*) of prefecture-level municipalities are collected manually as explanatory variables. The specific fiscal growth target value is used as the fiscal revenue target for the current year when the reported values are estimates. When ranges are used, the average value is used as the fiscal revenue target for the year. For the few cities that do not report a specific growth target for a given year, this paper applies the growth rate of the planned general public revenue budget to the budget of the previous year.

3.2.3 Instrumental variable

Considering the endogeneity problem stemming from omitted variables and other factors, this study employs the instrumental variable method to mitigate such issues. Drawing from the research of Liu et al. (2020) and Liu et al. (2020), the mean value of fiscal revenue targets among other prefecture-level cities within the same province is chosen as the instrumental variable.

Within China's governmental management system, the target responsibility system and the performance appraisal mechanism for officials are pivotal drivers motivating local government

officials. Provincial governments and their immediate agencies oversee the evaluation of municipal officials' target achievements, fostering an internal promotion competition mechanism primarily observed among cities within the same province (Edin, 2003). Consequently, municipal government revenue targets are heavily influenced by those of other cities within the province, suggesting a close correlation between revenue targets and the average level of revenue targets set by other prefecture-level cities in the province. Moreover, these targets adhere to the exclusivity constraint, driven by objective factors such as geographic location. Furthermore, the average fiscal revenue targets among other prefectures within the same province represent an entirely objective value based on administrative management, devoid of any involvement with enterprise carbon emissions (Chen et al., 2022).

3.2.4 Other variables

Referring to previous studies on carbon emissions (Chen and Zhu, 2022; Liu et al., 2022; Dai et al., 2022; Chen, 2023), this paper selects firm size (*size*), gearing (*lev*), and return on net assets (*roa*) as control variables.

The emissions fees (*ep*) is expressed as the natural logarithm of the firm's emissions fees (Wang et al., 2022), and the firm's level of green innovation is expressed as the natural logarithm of the total number of green patents obtained by the firm (Xu et al., 2022). More detailed definitions of the variables are presented in Table 3. The descriptive statistics of the main variables are given in Table 4.

Table 3. Variable definition

	Variable	Definition
Dependent variables	Carbon emission (*rce*)	Annual growth rate of carbon emissions
	Carbon emission intensity (*cei*)	The ratio of carbon emissions to revenue

Independent variables	Fiscal revenue target1 (*revenue*)	Fiscal revenue targets for prefecture-level cities
	Fiscal revenue target2 (*drevenue*)	The difference between the target of fiscal revenue growth of prefecture-level cities and their respective provinces
Control variables	Company size (*size*)	Ln (Annual total assets)
	Asset-liability ratio (*lev*)	The ratio of total liabilities to total assets at year-end
	Net profit rate on total assets (*roa*)	Ratio of net profit to average balance of total assets
	Cash flow ratio (*cashflow*)	Ratio of net profit to average balance of total assets
	Fixed assets ratio (*fix*)	Ratio of net fixed assets to total assets
	Revenue growth rate (*growth*)	The increase in revenue from the previous year
	Proportion of independent directors (*indep*)	The proportion of independent directors
	Two-post executives(*dual*)	The chairman and the general manager are the same person 1, otherwise 0
	Shareholding ratio of the largest shareholder (*top1*)	The ratio of the number of shares held by the largest shareholder to the total number of shares
	Market life (*listage*)	Ln (Year of the year - Year of listing +1)
	Management expense ratio (*mfee*)	Ratio of administrative expenses to operating revenue
Intermediate variables	Emissions fees (*ep*)	The natural logarithm of pollution charges
	Enterprise green innovation level (*lngretotal*)	Ln (Total green patents +1)

Table 4. Descriptive statistical results of main variables

Variable	N	Mean	p50	SD	Min	Max
rce	22838	21.20	10.65	57.48	-73.44	284.1
cei	22838	0.450	0.428	0.142	0.176	0.920
revenue	22838	9.544	9	4.210	0	43.30
drevenue	22838	0.934	0.500	2.258	-5	33.30
size	22838	22.14	21.95	1.219	19.96	25.13
lev	22838	0.440	0.440	0.196	0.076	0.813
roa	22838	0.044	0.038	0.046	-0.094	0.154
cashflow	22838	0.051	0.049	0.061	-0.103	0.232
fix	22838	0.239	0.210	0.157	0.012	0.680
growth	22838	0.148	0.111	0.259	-0.365	1.299
indep	22838	0.370	0.333	0.0460	0.286	0.500

dual	22838	0.239	0	0.426	0	1
top1	22838	0.357	0.342	0.141	0.126	0.681
listage	22838	2.140	2.303	0.738	0.693	3.296
mfee	22838	0.080	0.069	0.048	0.015	0.251
ep	1451	14.58	14.71	1.953	5.888	20.15
lngretotal1	3353	2.176	1.946	0.900	1.099	4.431

3.3 Model Building

Based on the above theoretical analysis and research hypotheses, this paper constructs the following econometric regression model to explore the relationship between local government's fiscal revenue targets and carbon emissions:

$$Y_{it} = \alpha_0 + \alpha_1 X_{it} + \gamma Control_{it} + \theta_i + \mu_t + \delta_{it}, \quad (1)$$

where i denotes the enterprise, t denotes the year, and Yit denotes the increase in carbon emissions from the previous year for enterprise i in year t. Xit denotes the fiscal revenue target of local government in city i in year t. $controlit$ denotes the set of control variables, θi denotes the enterprise-level fixed effects, μt denotes year fixed effects, and δit represents the random error term.

4. Empirical Process and Results Analysis

4.1 Benchmark Regression Results

This paper examines the impact of local government's fiscal revenue targets on the carbon emissions of listed companies based on the panel data of Chinese listed companies from 2005–2020. The baseline regression results of the model are shown in Table 5. Columns (1) and (2) show the regression results of the fixed effects model; columns (3) and (4) present the empirical results of fiscal revenue target on the carbon emissions of listed companies, respectively, using the instrumental variables approach. The first stage Kleibergen-Paap rk LM statistics in columns (3) and (4) correspond to a p-value of 0.000, so the original hypothesis is rejected, thus

indicating that there is no under-identification of instrumental variables; the Kleibergen-Paap rk Wald F statistics are 4561.347 and 4530.976, which are significantly larger than Stock and Yogo's (2002) critical value of 16. 39 at the 10% bias level, thus indicating that there is no weak instrumental variable problem. After including the year and individual fixed effects, fiscal revenue target has a significant inhibitory effect on the carbon emissions of listed companies, as shown by the significantly negative regression coefficients on fiscal revenue target in columns (1) and (3). On this basis, a series of control variables are added in columns (2) and (4), and the effect of the fiscal revenue target of local government on the carbon emissions of listed companies is still negative, as the coefficients on fiscal revenue target in columns (2) and (4) are significantly negative at the 1% and 5% levels, respectively. The above regression results indicate that the growth rate of the carbon emissions of listed companies is significantly reduced when local government have high fiscal revenue target.

Table 5. Regression results of the influence of fiscal revenue target on enterprise carbon emission

	(1) FE	(2) FE	(3) IV	(4) IV
revenue	-0.254*	-0.389***	-0.621*	-0.767**
	(0.150)	(0.118)	(0.337)	(0.300)
Variable of control	NO	YES	NO	YES
Effect of individual	YES	YES	YES	YES
Effect of time	YES	YES	YES	YES
K-P LM-stat			3219.883	3197.151
			[0.000]	[0.000]
K-P F-stat			4561.347	4530.976
Observed number	22838	22838	22681	22681
R^2	0.031	0.229	0.031	0.228

Note: *, ** and *** are statistically significant in the sense of 10%, 5% and 1% respectively; () is the robust standard error, and [] is the p value.

4.2 Robustness Tests

To test the robustness of the research findings, this paper conducts robustness tests on the variables, model, and samples, and the test results are shown in Table 6. First, since there are large differences in resource endowments and economic and financial market development in different regions, measuring the fiscal revenue target of local government solely by the value of fiscal revenue target may affect the accuracy of the findings. Therefore, we use the difference between the fiscal revenue target of prefecture-level cities and that of the provinces in which they are located (*drevenue*) as a new explanatory variable for testing. The results are shown in column (1). The regression results after replacing the explanatory variables still indicate that the fiscal revenue target of local government has a significantly negative impact on the carbon emissions of listed companies, as shown by the significantly negative coefficient on the variable *drevenue* in column (1). Second, drawing upon Chen (2023), the ratio of carbon emissions to the operating income of listed companies is regressed as a new explanatory variable, and the findings remain robust. In addition, since there may be differences between provincial capitals and municipalities that are under the direct control of the central government in terms of economic development and difficulty in promoting officials compared to general prefecture-level cities, the effect of fiscal revenue target on the carbon emissions of listed companies is again examined after excluding the provincial capitals and the municipalities directly under the central government samples, and the results are shown in column (3). A panel quantile regression model is used and the 0.5 quantile is selected for the regression, and the results are presented in column (4). The conclusions drawn from the above robustness tests are consistent with those of the benchmark regression.

In addition, the paper incorporates the ratio of fiscal revenue to GDP and the ratio of public

expenditure to GDP into the model, accounting for a lag period. This inclusion is vital as it provides insight into both the determinants of emission reduction and the behavior of cities with lower fiscal revenue, which may be striving to meet higher targets. In such cases, the reduction in carbon emissions could be attributed to a catching-up effect rather than a genuine increase in fiscal revenue target. Column (5) of the regression results reveals a significantly negative coefficient for fiscal revenue target, aligning with the findings of the benchmark regression.

The dataset utilized spans from 2005 to 2020, encompassing a period marked by the onset of the novel coronavirus outbreak in late 2019, which significantly impacted the Chinese economy. This event potentially influenced anomalies in government revenue targets and corporate financial indicators. Thus, the study reevaluates the relationship between the explanatory and dependent variables by excluding samples from 2019 and 2020, presenting the findings in column (6). Despite this adjustment, the regression results reaffirm that heightened fiscal revenue target correlates significantly with reduced enterprise carbon emissions.

Table 6. Robustness test results

	(1) Change the explanatory variable	(2) Change the explained variable	(3) Excluding provincial capitals and municipalities	(4) Panel quantile regression	(5) Add additional control variables	(6) Sample:2005-2018
drevenue	-5.993**					
	(2.422)					
revenue		-0.001*	-0.789*	-0.131***	-0.569*	-0.669*
		(0.001)	(0.417)	(0.004)	(0.328)	(0.401)
Variable of control	YES	YES	YES	YES	YES	YES
Effect of individual	YES	YES	YES	YES	YES	YES
Effect of time	YES	YES	YES	YES	YES	YES

K-P LM-stat	101.479	3197.151	1298.767		3004.325	1988.937
	[0.000]	[0.000]	[0.000]		[0.000]	[0.000]
K-P F-stat	97.186	4530.976	1100.874		4928.091	2574.965
Observed number	22681	22681	12047	22838	20256	17915
R^2	0.189	0.074	0.230		0.230	0.229

Note: *, ** and *** are statistically significant in the sense of 10%, 5% and 1% respectively; () is the robust standard error, and [] is the p value.

4.3 Heterogeneity Analysis

To examine the role of how heterogeneity in local government's fiscal revenue target affects the carbon emissions of listed companies, we conduct a heterogeneity analysis in this section based on four characteristics: political ties, the intensity of competition for promotions, and whether cities are industrial cities.

The influence of government–business relations on corporate governance is prevalent in most countries. Although China's market economy has developed rapidly since the reform and opening up process was initiated, the institutional development has not kept pace and the legal environment is still weak, so firms will resort to informal government–business relations in seeking resources and development opportunities (Peng and Luo, 2000). However, firms with close political ties to the government are more likely to be under pressure to accomplish various political tasks for the government, of which energy conservation and emissions reduction are among the most important. Since SOEs have natural political ties with the central government, this paper uses differences in the nature of ownership to represent the strength of political ties. The sample is divided into two subsamples based on the nature of ownership (i.e., state-owned vs. non–state-owned enterprises) to explore whether the impact of local government's fiscal revenue target on enterprise carbon emissions differs among the samples with different

ownership types, and the regression results are shown in column (1) and column (2). We find that the negative effect of the fiscal revenue target of local government on carbon emissions is more significant in the SOE sample than in the non-SOE sample, as shown in column (1), where the coefficient on fiscal revenue target is significant at the 10% level.

Because local government officials in China operate within a well-defined political hierarchy, they must strive to achieve specific targets set by their superiors. The “yardstick effect” implies that revenue targets are not only influenced by higher levels of government but also by interactions between peers (Blanchard and Shleifer, 2001). Thus, the number of rival local officials can be expressed as the number of prefecture-level municipalities in each province. In the presence of limited promotion opportunities, a larger number of prefectures implies that local officials have to work harder and compete more intensely for promotions. This paper divides the sample into two subsamples according to the number of prefectures in the province to investigate whether there is a difference in the impact of local government’s fiscal revenue target on carbon emissions under different levels of competition. The results show that the negative effect of fiscal revenue target on carbon emissions is more significant in the sample with more intense competition for promotions.

In 2013, China's National Development and Reform Commission issued the National Old Industrial Base Adjustment and Transformation Plan (2013-2022), which outlined a roster of industrial cities across the nation. Drawing upon the industrial landscape delineated during the First Five-Year Plan, Second Five-Year Plan, and the Third Line Construction Periods, and utilizing metrics such as the raw value of industrial fixed assets and total industrial output value, the plan identified 95 prefecture-level cities as industrial hubs. Leveraging this governmental

directive, we scrutinize the sample's heterogeneity by stratifying it into industrial and non-industrial cities. The regression outcomes, presented in columns (5) and (6) of Table 7, demonstrate that the fiscal revenue target of local government foster carbon emission reductions among listed companies, not only in industrial cities but also in non-industrial counterparts. However, the constraining impact of local government's fiscal revenue targets on listed companies' carbon emissions is notably more pronounced in non-industrial cities. This discrepancy may stem from industrial cities' heightened reliance on energy-intensive and heavy industries to propel urban development, thereby impeding efforts to curtail carbon emissions.

Table 7. Heterogeneity analysis

	(1) Strong political connection	(2) Weak political connection	(3) Strong competition for promotion	(4) Weak competition for promotion	(5) Industrial city	(6) Non-industrial city
revenue	-0.891**	-0.579	-0.843*	-0.529	-0.816	-0.776**
	(0.441)	(0.420)	(0.451)	(0.448)	(0.899)	(0.331)
Variable of control	YES	YES	YES	YES	YES	YES
Effect of individual	YES	YES	YES	YES	YES	YES
Effect of time	YES	YES	YES	YES	YES	YES
K-P LM-stat	1460.555	1865.414	1322.636	1640.950	338.945	2754.648
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
K-P F-stat	1754.267	4427.480	2016.913	3295.253	340.343	6926.971
Observed number	9913	12700	12015	10503	3152	19515
R^2	0.207	0.249	0.223	0.225	0.230	0.230

Note: *, ** and *** are statistically significant in the sense of 10%, 5% and 1% respectively; () is the robust standard error, and [] is the p value.

4.4 Analysis of Intermediate Mechanism

Through the above empirical analysis, we observe that local government’s fiscal revenue

targets have a significantly negative impact on carbon emissions. In the previous section, we argue that there are two pathways through which fiscal revenue target reduces carbon emissions: emissions fees and level of green innovation. This section provides the econometric basis for these conclusions, as shown in Table 8.

Columns (1) and (2) in Table 8 show that the fiscal revenue target of local government increases emissions fees, as shown by the coefficient on fiscal revenue target being significantly positive at the 10% level. Fiscal revenue target uses emissions fees to regulate the pollution and energy consumption of enterprises and thus reduce carbon emissions. Second, in the regressions of fiscal revenue target on the level of green innovation in columns (3) and (4), the coefficient on fiscal revenue target is positive and significant at the 5% level, which indicates that rising fiscal revenue target increases the level of green innovation of enterprises.

Table 8. Mechanism analysis of the influence of fiscal revenue target on enterprise carbon emission

	(1)	(2)	(3)	(4)
	ep	*ep*	*lngretotal*	*lngretotal*
revenue	0.043*	0.047*	0.024**	0.025**
	(0.024)	(0.025)	(0.011)	(0.011)
Variable of control	NO	YES	NO	YES
Effect of individual	YES	YES	YES	YES
Effect of time	YES	YES	YES	YES
K-P LM-stat	140.598	139.414	330.757	337.249
	[0.000]	[0.000]	[0.000]	[0.000]
K-P F-stat	134.632	133.336	622.631	604.800
Observed number	1424	1424	2985	2985
R^2	0.079	0.086	0.115	0.118

Note: *, ** and *** are statistically significant in the sense of 10%, 5% and 1% respectively; () is the robust standard error, and [] is the p value.

4.5 Further analysis

Under China's Environmental Protection Law, local governments primarily bear the

responsibility for environmental protection. However, driven by the pursuit of increased financial revenue and economic development outcomes, local officials have engaged in a form of regulatory competition, often selectively enforcing or distorting central government environmental policies, resulting in substantial disparities in environmental enforcement across different regions of China (Jin et al., 2020). These variations in regulatory rigor profoundly influence enterprise location decisions. Consequently, this study employs the number of newly established enterprises as a proxy variable for such decisions and integrates them into the analytical framework examining how fiscal revenue target shapes corporate carbon emissions (Wang et al., 2015). The sample is bifurcated based on the number of newly established enterprises to assess the heterogeneity of corporate location decisions, with findings presented in columns (1) and (2) of Table 9.

The regression analysis reveals a significant negative correlation between fiscal revenue target and carbon emissions in cities with fewer new enterprises, with the regression coefficient of fiscal revenue target meeting the 10% significance threshold. Conversely, in cities witnessing a surge in new enterprises, while fiscal revenue target still exerts a dampening effect on carbon emissions, the regression coefficient fails to achieve statistical significance. This suggests that cities experiencing higher corporate interest in their location decisions (i.e., those with more new enterprises) may exhibit lower environmental stringency, resulting in an insignificant inhibitory impact of fiscal revenue target on corporate carbon emissions. Conversely, in cities garnering comparatively less attention from corporations, local government officials place greater emphasis on environmental performance, leading to a significant inhibitory effect of fiscal revenue target on enterprise carbon emissions.

Furthermore, given that local government attitudes and policies regarding environmental objectives evolve over time, firms may relocate or opt to expand in alternative locations from their original headquarters. Thus, this study examines the ramifications of firms' off-site expansion. Specifically, we employ the number of subsidiaries established by listed firms in China beyond the jurisdiction of their primary incorporation as a proxy variable for off-site expansion. We integrate the interaction term between firms' off-site expansion and fiscal revenue target into the model, with findings presented in Column (3). The regression outcomes indicate that while the regression coefficient of the interaction term between enterprises' off-site expansion and fiscal revenue target is positive, it does not meet the threshold for statistical significance.

One possible explanation for this observation is that the sustained expansion of firms' off-site investments may erode local government tax revenues. In response, local authorities might relax environmental regulations pertaining to carbon emissions and other domains to retain tax revenues and bolster economic performance. Consequently, this dilutes the inhibitory impact of fiscal revenue target on firms' carbon emissions.

Table 9. Further analysis

	(1) More newly established enterprises	(2) Fewer newly established enterprises	(3) Off-site expansion
revenue	-0.922	-0.816*	-0.898**
	(0.681)	(0.423)	(0.397)
*offsite*revenue*			0.124
			(0.114)
offsite			-1.625
			(1.268)
Variable of control	YES	YES	YES

Effect of individual	YES	YES	YES
Effect of time	YES	YES	YES
K-P LM-stat	641.469	1751.435	1919.413
	[0.000]	[0.000]	[0.000]
K-P F-stat	1376.972	1605.122	2434.777
Observed number	10871	11580	22678
R^2	0.225	0.228	0.228

Note: *, ** and *** are statistically significant in the sense of 10%, 5% and 1% respectively; () is the robust standard error, and [] is the p value.

5. Conclusions

Based on a theoretical analysis, this paper empirically investigates the impact of local government's fiscal revenue targets on carbon emissions and the pathway through which this impact occurs based on the data of Chinese listed companies from 2005 to 2020. The results show that the fiscal revenue target of local government can reduce carbon emissions, and this finding holds after a series of robustness tests on the model, samples, and variables. A heterogeneity analysis shows that fiscal revenue target is more effective in reducing carbon emissions in the sample of cities with strong political affiliations and high promotion intensity as well as in non-industrial cities. In addition, we confirm the mechanisms through which fiscal revenue target affects carbon emissions (i.e., increasing emissions fees and promoting green innovation). Additional analysis reveals that in cities where corporate interests heavily influence location decision-making, fiscal revenue target exhibits no significant impact on corporate carbon emissions. The influence of fiscal revenue target on corporate carbon emissions may be attenuated by companies expanding their operations elsewhere.

Our study reveals several important policy insights. First, we find a negative correlation between the fiscal revenue targets of local government and carbon emissions. This finding emphasizes the importance of establishing effective fiscal revenue target management system

in developing countries, which will help improve the administrative efficiency and policy science of governments. Particularly for developing countries that are highly concerned with environmental improvement, although the top-level design of carbon emission policies may be relatively well developed, local governments may selectively implement the central government's environmental policies out of the motivation of promoting local economic development. Therefore, there is a need to motivate local governments to reduce carbon emissions. When fiscal revenue target management system is effective in incentivizing local government officials to regulate environmental pollution behaviors through emissions fees and increase the level of green innovation in their jurisdictions, they will ultimately help curb the growth of carbon emissions. While extant academic research has delved into numerous potential adverse effects stemming from the competitive behavior of local governments rooted in target management, the Chinese government continues to advocate for the target responsibility system across fiscal revenue, economic growth, and other domains. Consequently, our study contributes to comprehending the rationale and imperative behind target management, particularly in the realm of fiscal revenue, and may serve to catalyze local government engagement in carbon emission management.

Second, in conjunction with our mechanism analysis, we find that increased expenditure on emissions fees motivates firms to reduce their carbon emissions, while the adoption of green innovation technologies also pushes firms to reduce their carbon emissions. Therefore, the central government can increase the importance of environmental quality and green innovation in the performance appraisal of local government officials. At the same time, there is a need to further improve the sewage fee and environmental protection tax systems to better utilize their

role in regulating corporate carbon emissions. These policy initiatives will help to reduce corporate carbon emissions, thereby promoting the goals of environmental protection and sustainable development.

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