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The Impact of Value-Added Tax Sharing on the Green Development Capability of Manufacturing Industry

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Abstract: Since the implementation of the tax-sharing reform in China, the fiscal distribution system has been continuously optimized, and the manufacturing industry has achieved historic development. However, while the manufacturing industry generates income for the local community, the long-standing problem of "high pollution and high emission" restricts the sustainable growth of the regional economy, and there is an urgent need to improve the green development capacity of the manufacturing industry. This paper selects Value-added tax (VAT) share and comprehensive index data of manufacturing industry at city and county level in China from 2010 to 2020, and measures the comprehensive value of China's manufacturing industry's green development ability by using principal component analysis. At the same time, a double fixed-effects model is constructed, which shows that the increase of VAT share of municipal and county governments helps to improve the green development capability of the manufacturing industry, and at the same time, there is a lag in this effect. Heterogeneity analysis also reveals that the promotion effect of rising local VAT share is more significant in the northeastern and western regions of China with state-owned enterprises. Further analysis of the impact mechanism shows that after the VAT share increase, Chinese city and county governments positively affect the improvement of green development capacity of the manufacturing industry by increasing the collection of sewage fees, but the competition for the liquidity tax base will have a negative impact on the manufacturing industry. In addition, the effectiveness of increasing financial subsidies to guide production upgrading is relatively weak.

Keywords: value-added tax sharing; manufacturing industry; green development ability; local government action

1. Introduction

Industry is an important engine for the competitiveness of today's international economy, and the manufacturing industry, as a key area of industry, has always been the backbone of supporting industrial development. As China's economy transitions towards high-quality development, the green transformation of manufacturing is crucial for enhancing economic development quality [1]. Since the beginning of the industrial revolution, the manufacturing industry has been crucial to economic growth, but it has also contributed to the environmental pollution problem [2], and now environmental pollution has become a global concern [3], and the global industrial competition is increasingly focusing on the green transformation, however, China's manufacturing industry has shown a weak growth trend, which is mainly reflected in the excessive energy consumption, the greening of key industries, and the lack of energy efficiency in the manufacturing industry. However, China's manufacturing industry has shown a weak growth trend, which is mainly manifested in the

excessive energy consumption of manufacturing industry, the lack of green product design in key industries, serious pollution in the production process, and incomplete laws and regulations related to green manufacturing, etc. Such problems will further eat into the momentum of manufacturing industry's development, and ultimately lead to a decline in the ability of manufacturing industry's sustainable development. China is still in a critical period of economic structural transformation, and in order to achieve high-quality economic development, it needs to reduce emissions and pollution as the main direction of improvement. The long-term practice of local governments in China focuses on a combination of government intervention and market regulation, and local governments play an important role in promoting the transformation and upgrading of the manufacturing industry, effectively linking the fiscal system with the manufacturing industry, and contributing to the incentives for the manufacturing industry, which ultimately manifests itself in the growth of the economy. In the huge fiscal system, the tax system as the norms of income distribution between different levels, the role of the manufacturing industry is more obvious, how to improve the tax system system, and then promote the green development of the manufacturing industry to enhance the ability to become an important issue.

As a basic fiscal system, the tax system plays an important role in safeguarding the financial power of local governments and coordinating the economic relationship between vertical governments. Among them, the value-added tax (VAT) sharing system occupies an important position. Due to the wide VAT tax base involved in tax sharing, VAT revenue is directly linked to economic operation. Under the current VAT sharing regulations, the central-local share is a single ratio, which remains fixed for a period of time. However, in actual operation, in order to respect the local economic development needs, local governments, provinces, cities and counties have different sharing ratios, which are directly related to the level of the local government's financial strength. When the higher-level government changes the VAT sharing ratio, the local government's revenue and expenditure behavior will be affected, and at the same time, it affects the enterprise's actual tax rate and the external institutional environment, which then affects the enterprise's intrinsic development ability. Thus, this paper speculates that changes in the tax allocation ratio between upper and lower levels of government have a substantial impact on the green development of the manufacturing industry, and the impact is mainly through the government's behavior.

The marginal contributions of this paper are as follows: first, it quantifies the green development capability of the manufacturing industry and refines the tax share indicator to the city and county level in China, i.e., it abstracts the provincial level part from the total local VAT share ratio, and retains only the VAT share ratio at the city and county level, which refines the study level. Meanwhile, in terms of measuring the green development capability of enterprises, a complete indicator system is constructed from inputs, outputs, and other internal factors of enterprises, which describes the green development capability of enterprises in a more objective way. Second, it focuses on the direct impact of VAT split on the development of manufacturing enterprises. In this paper, the research enterprises are subdivided into manufacturing industries, and the research on the tax sharing system is also subdivided into VAT tax types, which makes the conclusions more targeted. Third, using government behavior as a mediating variable, subdivided into disciplinary environmental regulations and incentive financial subsidies, and explore the impact mechanism of VAT share under the positive and negative mechanisms. In the analysis of the mechanism of inhibition, we introduce the tax competition behavior of local governments after being incentivized by the share, so as to explore the hindering effect of the VAT share on the manufacturing industry's green development capability, and refine the transmission path between the fiscal system and the market.

2. Literature Review

The tax sharing system is an important part of China's modern fiscal system, and its main function is to determine the division of financial power between the central and local levels, and between the provincial level and the cities and counties, and the arrangement of financial power sharing between the central and local levels directly affects the behavior and motivation of the local governments. Buchanan [4] concludes that the lower governments should rely on income taxes, while the higher governments are responsible for non-income taxes with a mobility element, and that this principle of distribution is convenient for redistribution of revenue to other less developed regions. The second generation of fiscal decentralization theory pioneered by Oates [5], on the other hand, mentioned that the diversity of local needs is directly proportional to the degree of decentralization. VAT sharing is a key element of the tax sharing system. Prior to the full implementation of the "business tax reform" in China, the VAT split was based on a 75:25 ratio between the central and local governments, but the abolition of the business tax had a huge fiscal impact on local governments, and in order to maintain sufficient financial resources for local governments to continue to perform their governmental functions, the Chinese government has decided to re-determine the VAT split ratio, i.e., 50:50. The document is a central-provincial

arrangement and does not regulate the sub-provincial split, which makes the sub-provincial VAT split show a differentiated performance.

The change of tax sharing rules will directly affect the tax autonomy and expenditure behavior of local governments. In order to adapt to the changes in the market economy and the new environment, China has embedded a tax-sharing system in its fiscal system, which clearly delineates the administrative and financial powers of the central and local governments [6]. This system has helped the central government to obtain a large amount of revenue and solve the problem of financial difficulties, while the local governments have a smaller share and limited revenue autonomy [7]. Chinese fiscal decentralization decentralizes expenditure responsibilities to local governments, especially to municipal and county governments, which have a direct interface with citizens and are under greater pressure to take on public affairs. Jia et al. [8] find that under this institutional arrangement, grassroots governments are burdened with a higher degree of responsibility for affairs and rights, and that the central government's model of centralization of revenues and decentralization of expenditures exacerbates the problem of vertical fiscal imbalances; Pietrovito's [9] study also suggests that the central government has a large share of revenue and solves fiscal difficulties. It also shows that the more the lower level of government receives a share, the less transfer payments it receives subsequently. Therefore, it can be argued that changes in tax sharing rules will directly affect the tax autonomy and expenditure behavior of local governments. Barry [10] points out that regardless of the policy objectives of local officials, increasing tax revenues will support the realization of policy objectives, and increasing revenues becomes the motivation for the majority of local governments to make decisions and provide financial security for the organization of public affairs in the future. The split system arrangement secondly affects government spending behavior. Jia et al. [11] found that in the county-level regions where the tax-sharing system creates a mismatch between authority and financial power, a vertical fiscal imbalance situation, and where overspending opportunism prevails, and where there is a serious fiscal imbalance, the scale of government spending expands significantly. In addition, a relatively stable and uniform tax burden will promote the increase of welfare in the region [12], and the sharing system arrangement has spatial spillover effects on the level of green innovation to a certain extent, which promotes the development of local and neighboring regions [13].

Enterprises are major players in the market economy, and along with regional economic growth, enterprise growth and development are simultaneously affected by the sharing system, for example, studies by Gramkow et al. [14], and Zhang et al. [15] have pointed out that financial incentives affect the strategic choices of enterprises. It has been argued that when local governments focus on relevant industries or firms that provide more VAT revenue, increasing the local VAT share will incentivize local governments to enhance their support. Decentralization of tax revenue can reduce the degree of distortion to the economy [16], and in order to obtain more revenue, local governments will take more active policy measures, such as tax incentives [17] and other behaviors, to promote the development of enterprises and stimulate the vitality of enterprises. Under the decentralized system, VAT sharing incentives will not only promote the increase of public investment, but will also stimulate the growth of private investment. From this perspective, the VAT sharing system creates a more favorable investment environment for enterprises to a certain extent. Sun et al. [18] argue that the current VAT sharing has not effectively promoted China's economic growth, and that the degree of decentralization should be further enhanced to release economic vitality. If the central government further decentralizes financial power, the municipal and county governments will gain more autonomy and a larger share of the sharing ratio, which will motivate the government to adopt proactive tax policies and encourage enterprises to invest, thus increasing local revenues [19].

Comprehensive domestic and international studies have been conducted on the tax-sharing system and related impacts, and have produced more theoretical results and guidance. However, the direct impact of the VAT sharing system on the green development of enterprises is still relatively small, which is of research significance to be further explored. Based on the rich research results, the following aspects can be further explored. First, most literature employs fiscal decentralization to measure the distribution of financial resources between higher-level and lower-level governments, or uses this indicator to represent the incentive level of local governments. However, this indicator exhibits certain biases in its measurement. Given this objective situation, the scientific rigor of fiscal expenditure decentralization indicators requires enhancement.

Second, while existing research extensively covers reforms to revenue sharing mechanisms across different tax types and their impacts, studies have also examined the effects of complementary measures to revenue sharing systems, such as transfer payments and tax rebates. Most studies approach this from the perspective of regulating government revenue and expenditure behavior, verifying the role of revenue sharing systems in promoting macroeconomic growth and industrial sectors. However, current research subjects predominantly focus on local government behavioral decisions and fiscal incentives, with limited attention to the direct relationship between macro-level revenue sharing systems and micro-level enterprises. Research specifically examining the direct impact on manufacturing enterprises is particularly scarce.

Third, while numerous studies suggest that local governments cultivate tax bases through optimized land allocation, government investment, financial support, and tax incentives to boost revenue during regional economic development, few examine governmental ecological construction behaviors under revenue-sharing frameworks within the context of the "dual carbon" goals. Among existing studies examining government ecological construction, most analyze isolated policy measures, employing rich and rigorous indicators for behavioral assessment. However, these studies predominantly explore government actions supporting green manufacturing development, lacking necessary comparative analyses and theoretical frameworks for decision-making. Therefore, under the tax revenue sharing system, local government decision-making requires further deliberation, and its impacts on local enterprises warrant deeper investigation.

3. Theoretical Analysis and Research Hypotheses

3.1. Theoretical Foundation

The theory of fiscal decentralization gives local governments free space to control their finances, and the theory of "voting with feet" put forward by Tiebout [20] is an important foundation of the theory of fiscal decentralization, which believes that local governments can improve the efficiency of resource allocation by providing local public goods to attract residents. Oates and Musgrave also emphasized the efficiency advantage of local governments in providing public goods [21,22]. Nowadays, advocating green sustainability has become the trend of development, and local governments should take ecological benefits into account if they consider the long-term economic benefits of the region. Therefore, local governments need to tilt their financial resources to more green industries to guide the green development of the local economy. The manufacturing industry is usually the main force of the regional economy, and assisting local manufacturing enterprises to improve their green development capability is the best choice for long-term economic development and tax revenue. Under fiscal decentralization, the central government takes local differences into full consideration, and allows local governments to subsidize the cost of green upgrading of the manufacturing industry, increase penalties for environmental pollution, and promulgate environmental laws and regulations to regulate the production of such initiatives to cultivate the tax base and improve the level of the local economy, and the strength of the implementation of the above initiatives and the breadth of the regulation can be freely adjusted within the scope of the decentralization. Theoretical guidance given by the fiscal decentralization, combined with national conditions to creatively develop a tax system, so that the financial system and the government, the government and the manufacturing industry production capacity to produce links, from the optimization of the system to explore the path of green development of the manufacturing industry.

The theoretical basis of government intervention encourages local governments to assist manufacturing enterprises in green development capacity enhancement. Manufacturing enterprises operating in the market, mainly to maximize profits as the main goal, the lack of long-term planning in terms of social benefits. And the manufacturing industry to realize the green transformation, its cost cannot be accurately budgeted, and greatly affect the current profit realization, the manufacturing industry choose to slow down the transition or choose to reduce the scale of energy-consuming production. Relying on the market to spontaneously adjust to the green development of little effect, the need for local governments to intervene and guide the market in the green development. To avoid directly affecting production and operations, local government interventions are complementary. For example, providing green production subsidies, tax incentives to compensate for the transition costs, or enacting environmental sectoral regulations, increasing the collection of pollution fees to regulate the manufacturing industry's production behavior, and assisting and urging manufacturing enterprises to achieve green production and improve green production capacity.

3.2. Research Assumptions

3.2.1. Analysis of the Impact of VAT Share on Manufacturing Industry's Green Development Capability

China's manufacturing labor productivity and GDP have shown an upward trend year by year, but the growth rate of labor productivity has been significantly lower than that of GDP. Labor productivity is influenced by the size of the labor force. Since the reform and opening-up, China has long enjoyed the advantage of a "demographic dividend", with abundant labor resources, but this has also slowed the growth rate of manufacturing labor productivity. Meanwhile, the efficiency of green development in China's manufacturing sector was only effective in 2004 during the early stage, in the mid-stage from 2010 to 2011, and in the late stage from 2016 to 2018 and in

2020. In other years, the efficiency of green development in manufacturing was inefficient. However, when viewed annually, the efficiency of green development follows a trend similar to that of changes in gross national product.

The influence of VAT share on the manufacturing industry depends on the strong willingness of local governments to increase revenue, and it is also the result of local governments' behavioral choices to promote the development of the manufacturing industry under the guidance of the goal of "double carbon". Local governments' willingness to increase revenue is mainly due to the need to undertake more local affairs, i.e., the governments below the provincial level undertake public services such as health care, science and technology education, ecological environment, transportation and so on. And the Chinese government follows the principle of "keeping expenditure within the limits of revenues" when arranging budget expenditures. Tax revenues, as the main part of budget revenues, constrain the Chinese government's budget expenditures to a certain extent. How to increase tax revenue and reduce the dependence on non-tax revenue has become the focus of optimizing the public management of local governments. Therefore, local governments show a strong willingness to increase tax revenue.

Value-added tax (VAT), as the first major tax, is the main component of local government revenue, and this tax base mainly comes from the added value of the manufacturing industry. On the one hand, for regions with developed manufacturing industries, the government of the region relies more on VAT revenue, and the share of VAT is directly related to the revenue of the government of the region. On the other hand, the expansion effect, population gathering and plant demand generated in the production process of manufacturing industry also profoundly affect the tax revenue of the local government, which has been paying attention to its interaction with industrial enterprises in order to safeguard its own financial strength. In order to get more tax revenues from enterprises, local governments usually take the following ways: first, increase the tax rate. In China, changes in tax rates involve large market fluctuations and need to be considered and passed by the legislature. And in the general economic environment, tax rates in China are gradually decreasing [23]. Therefore, an increase in nominal tax rates has very low operability in practice. The second is to enhance the intensity of tax collection. With the increase of the tax share ratio, the local government receives more tax revenue than before. However, government taxation is more applicable to the short-term increase in local government revenue and is not conducive to the government's long-term increase in revenue. This is due to the fact that enterprises have to reduce tax planning and increase the cost of tax payment in order to cope with the government's collection and management. Enterprises' income shrinks, which is not conducive to further production and operation, or investment in research and development funds. As a result, the ability of enterprises to develop in a green way decline. Third, cultivate and expand the tax base. Local governments assist enterprise growth by optimizing land allocation [24], granting tax incentives [16] or financial subsidies. In the context of green and sustainable development, the government reduces the cost of green transformation of enterprises from the outside, promotes the enhancement of enterprises' green development capability, and obtains greater profitability accordingly. The enhancement of the operational capacity of enterprises will correspondingly increase tax payments, and eventually form a virtuous cycle.

To summarize, the first two approaches increase government revenue in the short term while increasing the tax share ratio, but are less sustainable. The heavy tax burden and additional tax costs will affect the sustainable development of enterprises, which obviously violates the "tax neutrality principle", creates a distortion of the market economy, and is not conducive to the future tax revenue of local governments. In the third way, in the long run, the enhancement of local financial autonomy is conducive to the green innovative development of enterprises [25], assisting enterprises to enhance their green development ability, and developing the economy in a sustainable way, which not only realizes the enhancement of local ecological benefits, but also helps form a win-win situation for the government and the enterprises in terms of increasing revenues. Therefore, facing the increase of the tax share ratio, the municipal and county governments focus on cultivating the tax base and adjusting their behaviors and economic decisions to assist the manufacturing industry in green development. Thus, this paper puts forward the following hypotheses:

H1: *The improvement of VAT share ratio incentivizes local governments to achieve more revenue, which will promote the improvement of green development ability of manufacturing enterprises.*

3.2.2. Analysis of Mediating Effects Based on Environmental Regulation, Fiscal Subsidies and Tax Competition

From the VAT share system to the promotion of green growth of manufacturing industry, the transfer of influence needs to be completed through the behavior of local governments and policy implementation. Under the background of "double carbon", it is a regular government behavior for local governments to implement environmental regulation, which will also strongly regulate the green production of manufacturing industry. With the gradual increase of the share of VAT at city and county levels, the city and county governments will get more stable VAT revenues under the condition that the total VAT revenues remain unchanged. VAT revenue is the main

component of local income, and the increase of VAT share ratio will ensure that the municipal and county governments are in a relatively relaxed fiscal revenue environment, and the municipal and county governments will actively carry out environmental management and urge the manufacturing industry to expand green production [26]. The increase in the proportion of VAT share can, to a certain extent, ease the contradiction between local governments' revenue increase and environmental protection, reduce the emergence of local governments' "environmental opportunism", and pay more attention to strengthening environmental regulation and actively improving the efficiency of local environmental governance. In addition, a more relaxed fiscal environment can also play a role in environmental governance and assist the green development of the manufacturing industry [27]. The government can invest in personnel, environmental monitoring costs, tighten its grip and crack down on the manufacturing industry's violation of regulations on the discharge of three wastes and other behaviors, and reduce the rent-seeking behavior of the manufacturing industry for the purpose of sewage discharge, and so on. Therefore, after the increase of VAT share ratio at city and county level, the government will increase the strength of environmental regulation and improve the efficiency of environmental management. Environmental regulation plays a crucial role in guiding green technological innovation in the manufacturing sectors [28]. As the government strengthens environmental regulation, the manufacturing industry will face high pollution costs if it fails to accelerate the improvement of green development capability. Compared to soft measures such as green innovation subsidies, punitive and rigid measures are more efficient in guiding companies to green production. Especially for manufacturing enterprises, facing high penalties and regulations, they need to transfer the funds used for financial risk investment to green production chain investment and green R&D projects [29]. As a result, the ability of enterprises to go green is enhanced by the increase in environmental regulations by the government.

Similar to environmental regulation, financial subsidies may also be involved in impact mechanisms. Fiscal subsidies provide monetary support and economic incentives for firms to develop environmentally friendly technologies and products, or to establish environmental management systems [30]. Manufacturing industries often apply for fiscal subsidies for environmental programs to reduce internal costs, and the availability of subsidies is also related to the share of VAT revenues shared by municipal and county governments, i.e., the VAT share. As the share of VAT share increases at the municipal and county levels, municipal and county governments retain more VAT revenue and receive more budgetary revenue than in the previous budget year. With the increase in budget, the municipal and county governments have more room to use the financial resources at their disposal, and are likely to arrange more financial subsidies when faced with funding applications for environmental protection programs in the manufacturing sector. It should be noted that this inference needs to be emphasized in the context of the "dual carbon" goal to be achieved as soon as possible is very likely to happen. In particular, the manufacturing sector has an annual need to submit environmental projects to the government for financial subsidies in order to cover the costs of green transformation or to develop green and low-carbon technologies; and local governments have plans to use their generous revenues for financial subsidies to the manufacturing sector in order to develop the green economy in their cities. The increase in financial subsidies to the manufacturing industry in the jurisdiction will generate more incentives to invest more money in R&D projects or replace green production lines, etc., thus enhancing their own green development capability. Note that VAT has a broad tax base and is highly concentrated on the liquidity tax base. In the current economic system, production factors are highly mobile across regions, which provides objective conditions for local governments to compete for the mobile tax base and start tax competition. Under the pressure of difficult to reduce fiscal expenditures, along with the incentive of VAT share ratio, it leads to the intensification of tax competition among local governments to compete for the tax base. It can be observed that local governments, in order to attract investment and to strive for a more liquid tax base, have given various forms of preferential policies and lowered the comprehensive tax rate in disguise, including slackening environmental management and encouraging the entry of high-pollution and high-value-added enterprises, which has led to a "race to the bottom". As the former manufacturing enterprises are under loose environmental regulation, they are not willing to improve their own green development capability and cater to the local government's vision of economic growth and increase in tax revenue, which ultimately leads to the decline of the overall green development capability of the manufacturing enterprises in the region. Therefore, after the increase of local VAT share, local governments are stimulated to compete for the liquidity tax base and neglect the requirements for environmental protection, and the lax environmental regulation will have a negative impact on the region, which will lead to the obstruction of green development of the manufacturing industry. The behavior of local governments competing for liquid tax base is the main way of tax competition, but the neglect of ecological protection in the process of competition essentially forms vicious tax competition.

As a result, the following hypothesis is proposed:

H2: *The increase in VAT share promotes the improvement of enterprises' green development ability by enhancing environmental regulation and increasing fiscal subsidies; however, it will also stimulate local governments to blindly increase revenue, exacerbating vicious tax competition and hindering the improvement of manufacturing industry's green development ability.*

4. Model Setting and Variable Selection

4.1. Model Setting

4.1.1. Benchmark Regression Model

According to the analysis of the impact of the VAT share of municipal and county governments on the green development capability of enterprises, the benchmark regression model is set up using the double fixed effect model as shown below:

$$Gda_{it} = \beta_0 + \beta_1 vat_{it} + \beta_2 X_{it} + area_i + year_t + \varepsilon_{it} \quad (1)$$

Among them, Gda_{it} is the comprehensive index of green development ability of manufacturing enterprises, vat_{it} refers to the proportion of VAT share of municipal and county governments, X_{it} is the ensemble of control variables, which contains city characteristics, government behaviors and enterprise characteristics, $area_{it}$ and $year_{it}$ denote the individual and year fixed effects, respectively, and ε_{it} is the random error term of the model.

4.1.2. Intermediary Effect Model

This paper verifies that the VAT split affects enterprise development through government measures, and selects representative measures of disciplinary and incentive types, i.e., environmental regulations and fiscal subsidies, as the mediating variables. The mediation effect model is constructed as follows:

$$cha_{it} = c_0 + c_1 vat_{it} + c_2 X_{it} + area_i + year_t + \varepsilon_{it} \quad (2)$$

$$Gda_{it} = d_0 + d_1 vat_{it} + d_2 cha_{it} + d_3 X_{it} + area_i + year_t + \varepsilon_{it} \quad (3)$$

where cha_{it} is the mediating variable, representing the environmental regulation and fiscal subsidies implemented by the government on enterprises. The mechanism test is mainly on c_1 and d_2. In the first case, if both of them are significant, it is necessary to further test d_1. If d_1 is significant, it means that cha_{it} plays a partial mediation effect; if not, there is a full mediation effect. In the second scenario, if at least one of c_1 and d_2 is not significant, then a Sobel test should be conducted. If the Sobel test is significant, it still indicates that there is a mediating effect of cha_{it}, and repeat the previous test of the coefficient of d_1 to determine whether it is partially mediated or fully mediated. If the Sobel test result is not significant, then cha_{it} has no mediating effect.

4.2. Selection of Variables and Indicators

4.2.1. Measurement of VAT Tax Share

China's administrative hierarchy is generally divided into five levels, and those involved in VAT revenue sharing are the central, provincial, municipal and county levels. The central document stipulates that the share ratio between the central government and the three levels below the province is fixed, i.e., it is stipulated that the localities share 25% (50% after 2016), which is the sum of the three levels of the province, the city, and the county; however, the share ratio of VAT involved in this paper is the share ratio of the city and county levels in total, and there is no fixed ratio for this share. In addition, the 2016 VAT split reform is at the central and local levels, different from the city and county level split ratio in this paper, which has less impact on the results.

Based on the combing of existing literature, at present, there are two main methods to obtain the VAT share ratio of the municipal and county governments below the provincial level: the document extraction method and the numerical measurement method. The document extraction method refers to searching the government documents about the fiscal system of each province through the Internet and directly extracting the number of share ratios stipulated in the documents. The numerical calculation method uses the government's publicly available VAT data to make direct calculations. The two acquisition methods have their own advantages and disadvantages. The document extraction method has a good exogenous nature and is based on government

documents, which makes it a more reliable source. However, the document extraction method requires a high degree of availability of government documents, and it is more difficult to collect government documents that have lapsed in previous years because they are usually not published on official government websites. On the other hand, the data of numerical calculation method mainly comes from the government's public final account report and statistical yearbook, and the fluctuation of the value is closer to the actual situation of sharing VAT revenue at city and county levels.

In order to verify the accuracy of numerical measurement, this paper illustrates and verifies the theoretical derivation. According to the 2019 financial budget report of Changchun City, China, and the 2021 statistical yearbook of Hohhot, public information shows that the composition of VAT revenues at the municipal and county levels is the general public budget revenues, the central government, and the provincial level, and it can be seen that the VAT revenues in the "general public budget revenues" are the part retained by the municipal and county levels, and other VAT part The China Tax Yearbook shows that the municipal and county revenues are equal to the sum of the revenues organized by the tax department and the financial department, and the VAT revenues in the "revenues organized by the tax department" are the total amount of VAT collected at the municipal and county levels during the year, i.e., the revenues that include the municipal and county revenues that are retained by the municipal and county governments and the revenues that have been transferred to the provincial level. Since the statistical method implemented in Changchun and Hohhot is a national standard, it can be regarded as a universal formula. From this derivation, it can be proved that the numerical calculation method is scientific in theory. Therefore, the final measurement formula is:

$$VAT\ sharing = \frac{VAT\ revenue\ in\ municipal\ and\ county\ government\ budget\ revenue}{VAT\ revenue\ organized\ by\ municipal\ and\ county\ tax\ authorities} \quad (4)$$

From the Formula (4), the VAT share ratio of each municipality and its counties and townships can be calculated, but the organizational income of the tax departments at the municipal and county levels cannot be fully accessed, and it is considered that this arithmetic will be improved based on the reality. As can be seen from the previous section, after the reform of China's tax system in 1994, the central government only stipulated its own fixed share ratio, but did not stipulate the specific share at the provincial level, and each province set its own share ratio at the provincial level according to its own needs, so that the actual VAT share formed a pattern of "one rate for one province" or "multiple rates for one province". The actual VAT share forms a pattern of "one rate for one province" or "multiple rates for one province". In view of the unavailable financial data, this paper assumes that the total share ratio is different between provinces at city and county levels, and the share ratio is the same at city and county levels within the province, and uses the calculation of "all VAT revenues organized by city and county tax departments minus the share ratio between the central level and the provincial level" to fill in the missing data of VAT share.

In addition, the numerator of Formula (4) can also be calculated by using "the VAT revenue in the province's general public budget revenue minus the VAT revenue at the provincial level".

In summary, both the document extraction method and the numerical measurement method can accurately portray the VAT split, but in comparison, the numerical measurement method is richer in terms of data reflection, so in the later benchmark test, the results measured by the numerical measurement method are used, while the robustness test uses the data obtained by the document extraction method.

4.2.2. Measurement of Green Development Capability of Manufacturing Industry

The green development capability of the manufacturing industry requires the pursuit of economic benefits in the production process while taking into account the goals of low energy consumption and low pollution. In addition to updating green production equipment, research and development and use of green technology are common green development means. In order to reflect the comprehensive nature of the green development capability of manufacturing enterprises, this paper categorizes the green development capability of the manufacturing industry into three parts, namely, "operation", "green" and "finance", and the specific indicators and the measurement of the indicators are shown in Table 1. Specific indicators and indexes are measured as shown in Table 1.

Indicators in the category of business operations and production are the inflows and outflows of economic resources and capital accumulation held by the manufacturing industry, which is the basic prerequisite for sustained production in the manufacturing industry. This category of indicators is associated with productivity, and a larger scale of economic resources is usually associated with higher productivity. However, an increase in the size of economic resources may come from the enterprise's own higher production efficiency, or at the expense of high energy consumption in exchange for high returns. This should be complemented by an enterprise green

production category of indicators to measure green production in the manufacturing sector. Enterprise financial performance indicators reflect the survival of enterprises. Since the concern for ecological protection and social welfare will generate additional financial burdens for the enterprise, whether the enterprise can seek a dynamic balance between realizing economic benefits and environmental protection can be measured by the financial performance of the enterprise. Therefore, this paper chooses the compensation ratio to reflect its comprehensive profitability, while using the current ratio to measure its short-term solvency.

Table 1. Indicator System for Green Development Capability.

First-Level Indicator	Second-Level Indicator	Measurement
Enterprise Operation and Production	Total Production Input	Ln (Period Expenses + Operating Costs)
	Capital Input	Ln (Net Fixed Assets)
	Total Production Output	Ln (Operating Revenue)
Enterprise Green Production	Green Innovation Rate	Ln (Number of Green Invention Patent Applications + 1)
	Green Investment Ratio	Ln (Environmental Protection Investment Amount + 1)
Enterprise Financial Performance	Return on Total Assets	(Earnings Before Interest and Taxes, EBIT) * 2/(Beginning Total Assets + Ending Total Assets)
	Current Ratio	Current Assets/Current Liabilities

The construction of comprehensive indicators for the manufacturing industry in this paper takes into account both economic and ecological benefits, but focuses more on reflecting economic benefits. Manufacturing enterprises and government operations are different, the pursuit of profit is the primary goal in the fierce market competition, social responsibility and ecological benefits is the economic benefits of the latter goal, so the construction is more in line with the actual manufacturing industry. For the above indicators, the use of principal component analysis to synthesize a number of indicators, to get the green development capability indicators of the manufacturing industry.

4.2.3. Environmental Regulation, Financial Subsidies and Tax Competition

In order to test the conduction path of the impact of the VAT split on the manufacturing industry, this paper selects environmental regulation, fiscal subsidies and tax competition to refine the behavior of local governments in the theoretical assumptions, and the three behaviors are measured by different indicators. First, environmental regulation as the local government's mandatory measures, the local government's implementation of environmental regulation on behalf of enterprises to participate in market activities, after the destruction of ecological supervision and punishment. In this paper, we use the sewage tax actually borne by China's manufacturing industry to measure the strength of environmental regulation in their localities. Second, financial subsidies in this paper are measured by government environmental subsidies reported by Chinese manufacturing firms. Measuring fiscal subsidies actually received by the manufacturing sector is more discriminating to sample differences compared to the total environmental protection expenditures of local governments. Third, the behavior of local governments competing for a liquid tax base to enter the local area and thus increase tax revenues is actually local governments competing for tax revenues, so the degree of tax competition can be used to measure the degree of local governments' efforts to compete for a liquid tax base. This paper uses the macro tax burden of the sample city to measure horizontal tax competition, i.e., the ratio of the tax revenue of the sample city to its GDP, the higher the value, the more intense the competition among local governments.

4.2.4. Control Variables

The control variables are divided into macroeconomic environment and internal market operations. Macroeconomic environment: ① the level of economic development can comprehensively reflect the strength of regional development. ② the proportion of regional industries. The manufacturing industry is mainly concentrated in the secondary industry, and the ratio of the secondary industry to GDP is used to measure the degree of industrial scale of a region. The higher the proportion of the secondary industry, the stronger the development ability of the region's enterprises. ③ government support preferences. Specifically refers to the strength of government spending in technology subsidies. ④ Government deficit ratio. It indicates the government's financial surplus situation, when it shows a positive number, it means that the income is not enough to meet the expenditure and there is a deficit situation; while a negative number indicates that the region has a financial surplus.

The internal operation of the market consists of enterprise scale and market competition: ① enterprise scale. In this paper, we mainly use the logarithm of the total assets of enterprises to measure the size of enterprises. ② Market competition. In this paper, the Herfindahl-Hirschman index is used to indicate the degree of market competition, which represents that the competition in the market varies across industries. When the index tends to 1, there is only one firm in the industry and a monopoly is formed. As the number of enterprises in the industry increases, the value is infinitely close to 0, accordingly, the more intense competition between enterprises. The final variables in this paper are summarized as follows in Table 2:

Table 2. Variable Definition.

Variable Type	Name	Name Explanation	Variable Definition
Core Explanatory Variable	vat_{it}	Value-Added Tax Sharing Ratio	See Formula (4)
Dependent Variable	Gda_{it}	Indicator of Comprehensive Green Development Capability	See Table 1 for details
Mediating Variables	cha_{it}	Environmental Regulation	Ln (Total Pollution Discharge Taxes and Fees Undertaken by Enterprises + 1)
	X_{it}	Environmental Subsidies	Ln (Subsidies for Environmental Protection Projects + 1)
	vat_{it}	Tax Competition	Tax Revenue of Sample City/GDP of Each City
Control Variables	Gda_{it}	Level of Regional Economic Development	Per Capita GDP of the Enterprise's Location
	cha_{it}	Degree of Market Competition	Herfindahl-Hirschman Index (HHI)
	X_{it}	Company Size	Ln (Total Assets at the End of the Period)
	vat_{it}	Regional Industry Proportion	Secondary Industry Output/Total GDP
	Gda_{it}	Government Support Preference	Science and Technology Expenditure/General Public Budget Expenditure
	cha_{it}	Local Government Deficit Rate	(Budget Expenditure–Budget Revenue)/GDP

4.2.5. Data Source and Description

This paper selects the data of China's A-share listed companies from 2010 to 2020 to make corresponding calculations, and treats the data as follows: firstly, only the manufacturing enterprises are retained; secondly, since the municipalities directly share the VAT revenue with the central government and do not share the revenue with the provincial governments, the data of enterprises in the four municipalities directly under the central government, namely, Beijing, Tianjin, Shanghai, and Chongqing, as well as the data of the relevant regions are excluded; Third, we exclude ST, ST*, and PT delisted firms, as well as firms with serious missing data; finally, in order to test whether environmental regulations or financial subsidies play an intermediary role, we only retain manufacturing firms that were subject to both regulations and subsidies during the empirical window period. After processing the data, there are 178 firms remaining, with a total of 1785 observations. The enterprise data in this paper comes from the Cathay Pacific database and public annual reports of enterprises, while the regional data comes from the CEIC database, China Tax Yearbook, local statistical yearbooks, provincial and municipal government announcement documents, local annual final reports, and other public information on the Internet. It should be noted that the tax share indicators in this paper correspond to the city and county level share indicators, and if the enterprises under study are distributed in the same city, the corresponding share indicators are the same. And the maximum value has more than 0.5, indicating that some cities and counties actually receive more than the general regulations of self-retention income, enjoying the financial care of the higher government. The average value of VAT share at city and county level is concentrated at 0.283, which shows that the city and county governments basically share VAT revenues half with the provincial government from the average level.

The basic characteristics of the data in this paper are shown in Table 3. Among these, the green development capability of the manufacturing sector is calculated using principal component analysis and serves as a comprehensive indicator. Standard deviation indicates minimal variation in corporate capabilities. This likely stems from China's ongoing green transition phase, where most manufacturing enterprises have yet to fully achieve

green transformation. Additionally, slight discrepancies exist between VAT sharing data and regulatory stipulations. This arises because provincial governments dynamically adjust sharing ratios with municipal and county-level authorities based on their respective responsibilities, while adhering to prescribed proportions. This results in flexible allocation ratios. Other indicators reveal significant variations across industries and regions. Notably, the standard deviation for company size is large, reflecting substantial disparities in enterprise development within the manufacturing sector. The market competition index shows small differences but a low average, indicating intense operational competition across Chinese manufacturing industries. Regarding government data, the maximum value for government support preference is only 8.4%, suggesting low regional government emphasis on technological development. Regarding municipal and county-level government deficit rates, positive values indicate expenditures exceeding revenues, while negative values suggest fiscal surpluses. The maximum deficit rate reached 150.8%, reflecting severe deficits. Currently, as responsibilities are increasingly delegated to lower-level governments, local authorities face expanded mandates and excessive spending on implementation documents, leading to severe deficits. However, the national average deficit rate remains at 7%, within a reasonable range.

Table 3. Descriptive statistics.

Definition	Number	Mean	Standard Deviation	Max	Mini
Gda_{it}	1785	0.075	0.088	0.004	0.485
vat_{it}	1785	0.283	0.118	0.076	0.588
Level of Regional Economic Development	1785	11.01	0.534	9.270	12.40
Degree of Market Competition	1785	0.066	0.053	0.002	0.341
Company Size	1785	22.53	1.246	18.29	26.21
Regional Industry Proportion	1785	0.489	0.946	0.151	0.824
Government Support Preference	1785	0.024	0.038	0.001	0.084
Local Government Deficit Rate	1785	0.070	0.084	−0.090	1.508
Environmental Regulation	1785	14.111	4.604	0.000	19.841
Financial Subsidies	1785	6.218	1.484	0.693	7.444
Tax Competition	1785	0.0645	0.0363	0.0181	0.5631

4.2.6. Exploring the Relationship between VAT Allocation and Manufacturing Development Capacity

To preliminarily examine the relationship between the two, this study fits the VAT allocation shares of local governments (covering provincial, municipal, and county levels) against the comprehensive green development index of manufacturing from 2001 to 2020. The results are shown in Table 4 and Figure 1. Additional notes: First, this fitting serves as a preliminary assessment of the relationship between VAT sharing ratios and green manufacturing development. Therefore, it directly employs the aggregate VAT sharing ratios across the three local levels. The calculation method subtracts the central government's VAT share from the total VAT volume ("1"), yielding the combined VAT sharing ratio for provincial and lower-level governments. This represents the broad-based VAT sharing ratio at the local level. Relevant data are extracted from the China Taxation Yearbook and the China Fiscal Statistics Yearbook. Second, the comprehensive value for China's manufacturing green development is calculated using the entropy method. Both sets of data employ annual figures and represent broad statistical scopes.

As shown in Figure 1, the horizontal axis displays the local government's share of value-added tax revenue, while the vertical axis represents the annual composite index of China's manufacturing sector. Observing the fitted region reveals a strong positive correlation between the two variables: as the local government's revenue share increases, the overall manufacturing capability also rises.

Table 4. Components of China's Manufacturing Green Development Composite Index.

Indicator Name	Labor Productivity	Total Profit	Valid Patents	Final Energy Consumption	Wastewater Discharge
Indicator Nature	Positive	Positive	Positive	Negative	Negative

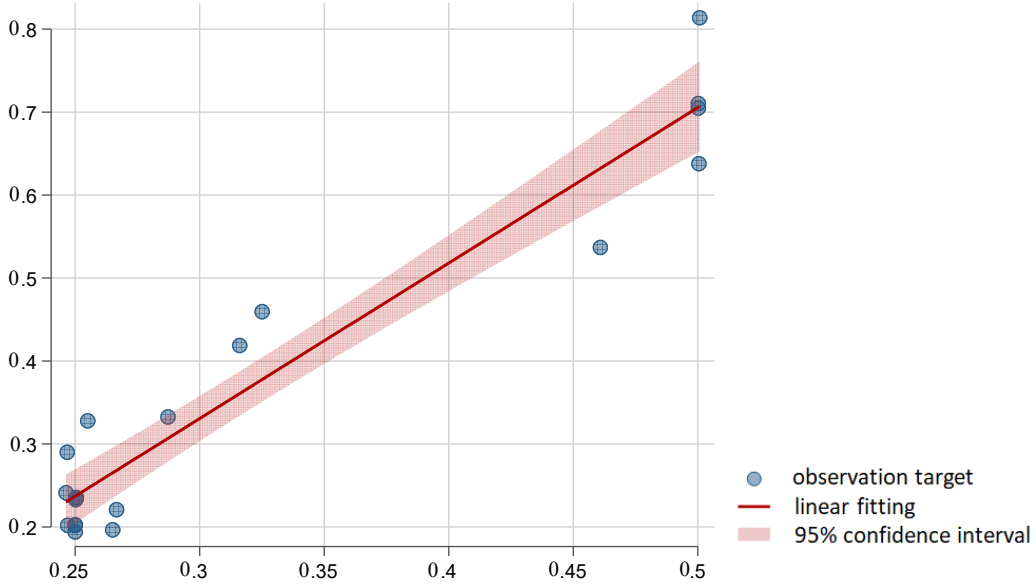

Figure 1. Relationship between VAT Sharing and Green Development in Manufacturing.

5. Empirical Results

5.1. Benchmark Regression

Column (1) and (2) in Table 5 respectively present the impact of changes in the VAT sharing ratio on enterprises' green development capabilities under two scenarios: without incorporating control variables and with all control variables incorporated in a bidirectional fixed model. The estimation results indicate a significant positive correlation between the VAT sharing ratio and green development capacity. Specifically, as the VAT sharing ratio increases—reflecting a higher proportion retained by municipal and county-level governments—the green development capacity of enterprises in those jurisdictions also rises. Examining the impact of VAT sharing alone, a one-unit increase in the VAT sharing ratio leads to a 1.0275-unit improvement in enterprise green development capacity. After controlling for other variables, the coefficient for the VAT sharing ratio's impact on corporate green development capability is 0.6314. A one-unit increase in the VAT sharing ratio promotes a 0.6314-unit improvement in corporate green development capability. Although the coefficient has decreased, it still maintains a positive influence on green development capability.

Table 5. Benchmark regression results.

Variable	(1)	(2)
	Gda_{it}	
vat_{it}	1.0275 ***	0.6314 ***
	(11.9897)	(4.9207)
Constant	−0.3205 ***	−0.2849
	(−13.1967)	(−0.9489)
Controls	no	yes
Individual fixed	yes	yes
Year fixed	yes	yes
Number	1785	1784
adj-R^2	0.0107	0.5142

t statistics in parentheses; *** $p < 0.01$.

5.2. Robustness Test

5.2.1. Replacing Explanatory Variables

In the basic regression, principal component analysis was used to measure the green development capability of Chinese enterprises, and here the measure was replaced by using the entropy value method to measure the explanatory variables. The entropy method involves the same secondary indicators as shown in the previous

section, in which the total production inputs, capital inputs, and green investment ratios represent the cost expenditures of enterprises [31] set as negative indicators. While the total production output, green innovation rate, and return on total assets represent the results of the enterprise in terms of economic and ecological benefits are set as positive indicators. The reasonable range of current ratio should be controlled below 2.6, but the current ratio of the manufacturing industry in the sample is obviously higher, and this financial indicator should tend to a low value when it reaches a healthy state, so it is set as a negative indicator. In addition, in order to reflect the green ability of enterprises, the green patented technology and green investment of enterprises are given more entropy value. The results are shown in column (1) of Table 5, and the results are robust.

5.2.2. Lagged Explanatory Variables Test

There is a time lag in the transmission of government policies to enterprises. It takes time for the government to make decisions from the time the government promulgates the document on tax sharing to the time the municipal and county governments make the final account report in the current year and arrange the public budget for the next year. Then it takes time for the market and enterprises to accept the government's decision and react to the policy arrangement. Therefore, the impact of the change of VAT share ratio on enterprises is about one year. Here, the lagged one-period variable of the core explanatory variables is utilized to extend the regression time window for testing. The results are shown in column (2) of Table 6 and the results remain robust. This suggests that changes in the VAT share ratio can have a positive impact over a longer period of time, while producing an incentive stack effect.

Table 6. Robustness Test.

Variable	(1)	(2)
vat_{it}	0.0446 ***	
	(5.8384)	
vat_{it} - lag term		2.5051 ***
		(5.9628)
Constant	0.0559	−5.6411 *
	(0.9897)	(−2.0466)
Controls	yes	yes
Individual fixed	yes	yes
Year fixed	yes	yes
Number	1784	147
adj-R^2	0.3282	0.6898

t statistics in parentheses; * $p < 0.1$, *** $p < 0.01$.

5.3. Endogeneity Test

This paper also examines the impact of the municipal and county governments' own fiscal status in the previous year on the split, which is measured by the municipal and county governments' deficit rates. At the same time, considering that the provincial and city and county governments need to refer to the provincial documents when sharing VAT revenues to stipulate the VAT share ratio of the municipal and county governments, the actual number of shares has a strong correlation with the number stipulated in the documents. In addition, the share ratio stipulated in the document is stable over a period of time, which is related to the decision-making of the provincial government and does not affect the green development of the manufacturing industry within cities and counties. Therefore, in this section, the VAT share stipulated in the document is selected as an instrumental variable and tested by two-stage least squares (2SLS). The specific results are shown in Table 7.

Column (1) of Table 6 shows insignificant results, indicating that the promotion effect of VAT sharing on China's manufacturing development is not affected by the fiscal status of local governments at city and county levels themselves. Regardless of the financial status of the city and county governments, it does not significantly affect the city and county governments, after the VAT share ratio is increased, to implement governmental behaviors to help the green development of the manufacturing industry in the case of budgetary relaxation; Columns (2) and (3) in the table report the results of the two-stage least squares method, and the *p*-values in the correlation test of the instrumental variables are all less than 0.1, which rejects the hypothesis that the instrumental variables are under-identified. And the Cragg-Donald Wald F-statistics are all greater than their corresponding critical values, rejecting the hypothesis of weak instrumental variables, indicating that the instrumental variables are appropriately selected. The regression results of the number of document extractions are significantly positive, consistent with the benchmark regression results, proving that the conclusions of this paper are reliable.

Table 7. Handling of Endogeneity Issues.

Variable	Reverse Causality Test (1)	IV-2SLS (2)	IV-2SLS (3)
	vat_{it}	Gda_{it}	
Fiscal Status–lag term	0.0061		
	(0.3331)		
Stipulated Profit Sharing Ratio in Documents		0.4595 ***	0.4628 ***
		(6.16)	(5.87)
P-value of Anderson Canonical Correlation LM Statistic		0.000	0.000
Cragg-Donald Wald F Statistic		677.12	655.86
		[37.92]	[34.51]
Controls	yes	no	yes
Individual fixed	yes	yes	yes
Year fixed	yes	yes	yes
Number	1784	1784	147
adj-R^2	0.3282	0.5123	0.6898

t statistics in parentheses; *** $p < 0.01$.

5.4. Heterogeneity Test

China's provincial and city and county governments share VAT revenues show differentiation, mainly due to the variability in the development level of the respected economic regions. The financial information of each provincial level shows that the sharing between provinces and municipalities and counties in the eastern economic zone of China is concentrated at 5:5, while the sharing between provinces and municipalities and counties in less developed regions favors the grassroots government, i.e., the range of the proportion of the municipalities and counties government retaining their own share ranges from 60% to 80%, in order to maintain the grassroots government's investment in the construction and alleviate the financial difficulties. For manufacturing firms, there are also differences in the responses of different types of firms to changes in government behavior caused by tax sharing. Therefore, it is necessary to group the samples according to economic regions or the nature of enterprise ownership for further tests.

5.4.1. Heterogeneity of Economic Regions

From the perspective of regional disparities, we can analyze the impact of VAT revenue sharing. On one hand, China's regions exhibit significant variations in natural conditions, with distinct resource endowments across different economic zones. This is particularly true for manufacturing enterprises, whose production relied heavily on natural resources prior to industrial transformation and upgrading. Since the reform and opening-up, the northeastern region leveraged its inherent superior natural resource endowments to prioritize the establishment of manufacturing industrial enterprises. In contrast, the eastern region, benefiting from its geographical advantages, similarly developed a relatively robust manufacturing base. Conversely, the central and western regions, hampered by a lack of natural resources and geographical disadvantages, lagged behind the eastern and northeastern regions. Furthermore, local governments across China employ varying intervention methods and intensities in regional manufacturing sectors, which will further differentiate the impact of VAT revenue sharing across economic zones. Additionally, significant disparities exist in the level of green transformation within the manufacturing sector across different regions [32]. The specific results are shown in Table 8.

Table 8. Heterogeneity of Economic Regions.

Variable	Eastern Region (1)	Central Region (2)	Western Region (3)	Northeastern Region (4)
vat_{it}	−0.3715 ***	0.5179	0.5742 *	1.6046 ***
	(−4.3344)	(1.5845)	(2.0233)	(6.0097)
Constant	0.2975	−2.2606 ***	1.1887 *	1.4045
	(0.8622)	(−3.3394)	(1.8777)	(1.6975)
Controls	yes	yes	yes	yes
Individual fixed	yes	yes	yes	yes
Year fixed	yes	yes	yes	yes
Number	764	462	433	125
adj-R^2	0.5054	0.7453	0.5343	0.7615

t statistics in parentheses; * $p < 0.1$, *** $p < 0.01$.

After the division into regions, the manufacturing industry in different parts of China shows significant differences in the impact. Eastern China shows a negative development in manufacturing capacity after the tax share is raised. Meanwhile, it can be seen that the northeast and west regions of China are significant, and the manufacturing capacity in the central region is not significantly improved. After the VAT share is raised, the government makes behavioral decisions accordingly, i.e., enhancing environmental regulations or giving subsidies for environmental protection projects. As the existing manufacturing system in Northeast China is relatively mature, it can flexibly respond to the government's behavior and adjust its own production behavior in time, so the marginal effect of the green development of the manufacturing industry in this region is more significant. The eastern region of China is mainly service industry, the first to complete the transformation and upgrading in the country, the investment in green development has been saturated, continue to invest will cause a waste of resources.

5.4.2. Heterogeneity of Enterprise Property Rights

The impact of VAT revenue sharing varies depending on the ownership structure of manufacturing enterprises. Compared to non-state-owned enterprises, state-owned enterprises demonstrate more significant improvements in green development capabilities following changes in VAT revenue sharing ratios. Due to their ownership structure, state-owned enterprises maintain closer ties with municipal and county-level governments. Following changes in VAT revenue sharing, municipal and county-level governments' fiscal capacity and budgetary adjustments can more directly impact state-owned enterprises, prompting proactive responses from these enterprises. This typically leads to greater emission reduction outcomes and enhanced green production capabilities. Additionally, state-owned enterprises demonstrate superior performance in fulfilling social responsibilities compared to non-state-owned enterprises.

According to the nature of enterprise property rights, Chinese manufacturing enterprises are categorized into state-owned enterprises (SOEs) and non-state-owned enterprises (NSOEs), and NSOEs contain foreign capital, private enterprises, and so on. The results are shown in Table 9. For state-owned enterprises, the impact of higher VAT share on the green development of enterprises is significantly positive and the estimated coefficient is 0.7948, which is larger than the coefficient value of the benchmark results, while the results for other enterprises are not significant. After stripping out non-state-owned enterprises from the full sample, it can be found that state-owned enterprises' green development ability improves significantly after the VAT share is increased. State-owned enterprises are directly managed by their state-owned asset management committees, have close ties with local governments, and bear social and environmental protection responsibilities, which is in line with the local government's goal of cultivating the tax base through the development of a green economy, and they will be more proactive in transforming and upgrading their production methods, so that their green development ability is significantly enhanced after the tax share is increased.

Table 9. Heterogeneity of Enterprise Property Rights.

Variable	State-Owned Enterprises	Other Enterprises
	(1)	(2)
vat_{it}	0.7948 ***	0.1269
	(5.7600)	(0.8507)
Constant	−0.4116	1.4362 ***
	(−1.1692)	(3.3623)
Controls	yes	yes
Individual fixed	yes	yes
Year fixed	yes	yes
Number	1048	736
adj-R^2	0.5448	0.4213

t statistics in parentheses; *** $p < 0.01$.

5.5. Intermediary Effect Test

Changes in local VAT share directly affect the budget revenue of local governments, which in turn causes changes in their behavioral decisions. The government's behavioral decision-making changes, on the one hand, is based on the sustainable development goal, make the green development of the manufacturing industry favorable behavior; on the other hand, it may also be blindly pursuing economic development, compete for liquidity tax base and ignore the environmental protection, which impedes the green development of the manufacturing industry, the above two aspects respectively show the different impacts of the increase in the VAT share on the green development ability of the manufacturing industry. The impact is formed under two different governmental behavioral decisions, i.e., one is the financial subsidy that pays the cost to inhibit the behavior of polluting production of manufacturing enterprises, i.e., to enhance the environmental regulation, or to encourage the manufacturing industry to expand the behavior of green production; and the other is the behavior of rapid economic

development and tax competition. As a result, this paper sets up two conduction mechanisms, positive and negative, to further explore the mechanism of the impact of the tax share on the green development ability of manufacturing enterprises, the specific results are shown in Table 10.

Table 10. Mediation Effect Test.

Variable	Panel A		
	Environmental Regulation	**Financial Subsidies**	**Tax Competition**
	(1)	**(2)**	**(3)**
vat_{it}	0.9506 ***	0.2793	1.3990 ***
	(8.6328)	(0.7413)	(5.5823)
Constant	0.2574	0.9557 *	0.4245
	(0.6271)	(2.2005)	(1.3786)
Controls	yes	yes	yes
Individual fixed	yes	yes	yes
Year fixed	yes	yes	yes
Number	1784	1784	1784
adj-R^2	0.1350	0.0109	0.0712
Variable	**Panel B**		
	(1)	**(2)**	**(3)**
		Gda_{it}	
vat_{it}	0.5291 ***	0.6389 ***	0.5205 ***
	(4.5947)	(4.9683)	(4.9461)
Environmental Regulation	0.0390 *		
	(2.1738)		
Financial Subsidies		−0.0001 **	
		(−3.0501)	
Tax Competition			−0.0135 **
			(−2.4146)
Constant	0.0477	−0.2158	−0.1719
	(0.1692)	(−0.7529)	(−0.7145)
Controls	yes	yes	yes
Individual fixed	yes	yes	yes
Year fixed	yes	yes	yes
Number	1784	1784	1784
adj-R^2	0.5190	0.5158	0.5193

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.5.1. Environmental Regulation

Local government in ecological management, can take the form of more diversified measures, this paper selected China's manufacturing industry to pay sewage charges to measure the strength of environmental regulation, the indicator directly reflects the manufacturing industry in the production and operation process by the strength of environmental regulation. Table 9 column (1) can be seen, the local value-added tax share of environmental regulation has a significant impact on environmental regulation, environmental regulation on the ability of enterprises to green development has a significant impact on environmental regulation, and the above coefficients involved in the coefficients are positive, indicating that there is a mediating effect. Further, in models (2) and (3), the estimated coefficients of VAT share are significant at 1% level and the coefficients are positive. It indicates that environmental regulation plays a partly mediating effect in which VAT share can promote the improvement of manufacturing industry's green development capability through enhancing environmental regulation.

5.5.2. Fiscal Subsidy

From column (2) of Table 9, the mechanism test of fiscal subsidy fails, indicating that the share of VAT does not contribute to the development of manufacturing industry through fiscal subsidy. The possible reasons for this are: first, the environmental subsidies allocated by the government have not been effective. The government's environmental subsidies need to be controlled within a reasonable range in order to realize the efficiency of the subsidy funds, and excessive subsidies are likely to reduce the enterprises' investment in green production, and even produce a "crowding out effect". With the increase of local VAT share, the local government budget

constraints are relaxed, in order to continue to make up for the cost of green development of the manufacturing industry, continue to increase the amount of subsidies, the increase is likely to have exceeded the reasonable range, so the financial subsidies do not play an intermediary role. Second, the manufacturing industry has the problem of inefficient use of subsidies. The disclosure of the use of manufacturing subsidies is imperfect, and information asymmetry is formed between the government and enterprises. This will lead to enterprises to produce false declaration of emission reduction projects, fraudulent subsidy tendency or behavior, which will lead to the failure of the subsidy policy. Compared with environmental subsidies, sewage taxes and fees are more effective in enhancing enterprises' willingness to produce cleaner.

5.5.3. Tax Competition

Tax competition formed by local governments due to competition for mobile production factors, and regions with high levels of tax burden correspond to higher levels of local government competition. From column (3) of Table 9, it can be seen that the increase in VAT share will significantly incentivize local governments to compete for the liquid tax base in order to increase tax revenues, and the higher the local share ratio, it is likely to lead to the intensification of competitive behavior. At the same time, the local government will place limited resources in attracting the foreign liquidity tax base to move in, the situation of neglecting environmental protection construction, and even will frustrate the enthusiasm of green production of the manufacturing industry, which is not conducive to the enhancement of the green development capability of the manufacturing industry. However, the results also show that the coefficient of the reverse mechanism is very small, and the overall effect is that the VAT share can promote the green development of the manufacturing industry, which indicates that in recent years, with the proposal of the "dual-carbon" goal and the enhancement of environmental protection awareness, creating a green business environment is more in line with the concept of sustainable development, and the competition for tax revenue can quickly increase revenue in the short term, but the long-term strategy still needs to focus on the green development of the industry. Tax competition can increase revenue quickly in the short term, but the long-term strategy still needs to focus on green development.

6. Conclusions and Policy Recommendations

The local tax revenue sharing system is an important part of China's sub-provincial financial system, which not only profoundly affects the behavior of local governments, but also influences the implementation of local economic development plans. As a material guarantee for the healthy and stable operation of the economy, how to adjust the relationship between the fiscal system and the market and further promote the green development of the manufacturing industry has become an urgent issue. Based on the empirical analysis in the previous article, this paper draws the following conclusions: Firstly, the increase of VAT share at the city and county level in China can directly promote the green development capacity of manufacturing industry. After the VAT tax share is increased, the local government thus generates fiscal incentives to cultivate a green tax base, and by changing the government's behavior, the manufacturing industry's green development capacity within the region is enhanced accordingly. Secondly, under the difference of regional or enterprise property rights, the degree of influence is different. Examining the impact of higher tax shares from different dimensions, Chinese state-owned enterprises or enterprises in eastern and northeastern China are significantly affected by changes in local shares. Third, environmental regulation has a clear positive mediating effect, while tax competition has a reverse mechanism, but the positive mechanism is stronger than the reverse mechanism, and overall an increase in share promotes manufacturing development. With disciplinary environmental regulations play a mediating role, obviously stronger than the nature of the compensation of financial subsidies. While financial subsidies to a certain extent to make up for the cost of green production, reduce the pressure of transition, but subsidies in the use of the process, there may be inefficient use of funds and other issues, so the intermediary role played by financial subsidies is not obvious.

On the basis of the previous theoretical and empirical analysis, relevant policy recommendations are put forward: first, promote the reform of value-added tax (VAT) sharing to help the green development of local manufacturing industry. As the fiscal system between provincial and county governments, the share of VAT at city and county levels should continue to improve the fiscal system below provincial level, and play its role in incentivizing local governments, especially the grassroots governments at city and county levels, so as to motivate the local manufacturing industry to develop towards the green and sustainable line of defense. For countries in the key period of the transformation of old and new kinetic energy, local governments need to adjust the relationship between the government and the market, the government's behavioral decision-making, incentives for advanced green enterprises to accelerate the pace of transformation, support the backward enterprises to change the mode of development, and enhance the capacity for sustainable development. Second, the impact varies depending on

regional or corporate property rights structures. For developed regions with high VAT revenue levels, the portion retained by municipal and county governments can be reduced while appropriately increasing provincial-level centralization. Within China's existing institutional framework, lower-level governments cannot engage in tax competition with higher-level governments. To maintain existing fiscal capacity, they will directly pursue tax base cultivation through measures like attracting investment, nurturing green enterprises, and supporting high-efficiency industries. Under favorable economic conditions, appropriate centralization by provincial governments will incentivize proactive actions by municipal and county governments, thereby boosting market development. Conversely, in underdeveloped regions, provincial governments should implement appropriate decentralization by reducing centralization levels. Additionally, following increased VAT revenue sharing, local governments should carefully differentiate intervention methods and intensity based on the nature of enterprises. Regarding state-owned enterprises (SOEs), local governments should continue strengthening oversight by promptly reviewing environmental performance, urging green transformation and upgrading, and promoting the renewal of green production chains and development of eco-friendly products. For non-state-owned enterprises, despite the enhanced fiscal capacity and enforcement power from increased revenue sharing, intervention in non-state-owned manufacturing should be minimized. Such enterprises should primarily engage in free market competition, refining their green production practices through market forces to achieve sustainable development goals.

Third, improve the environmental regulation system to force the manufacturing industry to green transformation and upgrading. First, local governments should intensify environmental regulations in a phased and systematic manner. The cost pressures arising from environmental regulations may lead to industrial efficiency being squeezed out. Therefore, they should be accompanied by relevant safeguard policies to gradually phase out outdated local production capacity and assist manufacturing enterprises in upgrading and transforming. Second, local governments should maintain robust ecological management, leveraging a favorable production environment as a competitive advantage in tax incentives. This approach curbs excessive tax competition and prevents the weakening of environmental regulations to attract businesses, thereby promoting green manufacturing and regional sustainability. Additionally, increased VAT revenue sharing provides local governments with greater financial capacity to establish fiscal incentives for ecological conservation. While creating favorable investment and business environments for manufacturing enterprises, local governments should reduce short-sighted practices like competing for volatile tax bases. When attracting enterprises, they should set ecological protection thresholds for entry, selecting green and efficient enterprises to avoid indiscriminately introducing high-energy-consuming and high-polluting enterprises for quick revenue gains. For existing local manufacturing enterprises, they should maintain original environmental control standards, aiming to stimulate green development capabilities and production vitality to achieve revenue growth at its source.

7. Limitations

This study has several limitations, primarily as follows: First, due to data and sample constraints, the precision of the calculated results requires further improvement. Specifically, indicators reflecting green production—such as the rate of enterprises phasing out polluting equipment and the total output value of green products—could not be incorporated into the manufacturing sector's green development capability index system. This limitation prevents the index system from comprehensively describing the green development capabilities of manufacturing enterprises, and the final results will be refined in future research. Second, regarding the measurement of local government behavior indicators, this study relies solely on single-data metrics to assess environmental regulatory actions. Unlike existing research, it does not employ composite values to describe the intensity of local environmental regulation, leaving room for further refinement of this indicator's conceptualization.

Author Contributions

W.L.: conceptualization, methodology, software, data curation, writing—original draft preparation; K.W.: visualization, investigation, supervision, software, validation; H.L.: writing—reviewing and editing. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare that they have no conflict of interest to disclose.

Use of AI and AI-Assisted Technologies

No AI tools were utilized for this paper.

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