

Research on the Impact Mechanism of Green Transformation of Manufacturing Enterprises on Enterprise Quality Development-- Micro Empirical Study from Chinese Manufacturing Listed Companies

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Abstract: In the context of global economic transformation and sustainable development, the manufacturing industry, as an important pillar of the national economy, is facing unprecedented pressure and challenges. The call for environmental protection is increasingly high. How to pursue economic benefits while taking into account the protection of ecological environment has become an urgent problem to be solved. This paper takes the green transformation of enterprises as the starting point, based on the data of listed manufacturing companies in China from 2016 to 2020, empirically studies the impact and potential mechanism of the green transformation of manufacturing enterprises on the high-quality development of enterprises, and further verifies the regulatory role played by the government in the implementation of emission trading right. The results show that the green transformation of manufacturing enterprises can promote the high-quality development of manufacturing enterprises, and the pollutant emission has a significant intermediary effect on the green transformation of enterprises to promote the high-quality development of enterprises. At the same time, the implementation of emission trading policy is an effective means to regulate the excessive emission of enterprises and the slow green transformation. The heterogeneity analysis found that the green transformation of both state-owned enterprises and non-state-owned enterprises can improve the high-quality development level of enterprises, but compared with state-owned enterprises, the green transformation of non-state-owned enterprises plays a stronger driving role. This paper provides theoretical reference and policy enlightenment for explaining the mechanism of green transformation of

enterprises and verifying the role of the right of government emission trading right.

Keywords: Green Transformation; High-Quality Development; Environmental Regulation

1. Introduction

Under the background of global economic transformation and sustainable development, manufacturing industry, as an important pillar of national economy, is facing unprecedented pressures and challenges. The voice of environmental protection is rising day by day. How to take into account the protection of ecological environment while pursuing economic benefits has become an urgent problem to be solved. To this end, on November 24, 2016, the State Council of China officially issued the "13th Five-Year Plan for Ecological Environmental Protection", which clearly requires the establishment of a mandatory disclosure mechanism for corporate environmental protection information, and punishes listed companies that fail to disclose environmental information according to law[1]. In 2017, the report of the 19th National Congress of the Communist Party of China emphasized that enterprises should practice the concept of "Lucid waters and lush mountains are invaluable assets" and strive to solve local ecological and environmental problems. The policy orientation of the party and the state has prompted listed companies to pay more and more attention to environmental responsibility issues, and the overall level of environmental information disclosure has been continuously improved.

Green transformation is a development model guided by the concept of green development, guided by intensive resource utilization and environmental friendliness as the guidance, with

green innovation as the core, adhering to the whole process of green production, taking into account economic and social benefits, and realizing ecological environment improvement and high-quality economic and social development. The green transformation of manufacturing enterprises is not only conducive to promoting the resource intensification and environmental protection of the whole industry, but also has a certain positive impact on the development of enterprises themselves.

2. Literature Review

The existing literature focuses on the factors affecting the green transformation of manufacturing industry, and the relevant research results have been fruitful. The existing research provides a solid theoretical basis and useful reference for this paper, but there are few studies on the effect of green transformation of enterprises in the existing literature, and most of the existing studies address the impact of corporate environmental responsibility performance on enterprise financial performance, market income and other aspects. In terms of corporate financial performance, Bragdon and Marlin (1972) found that the better the environmental management, the higher the profitability^[1]. Nie Jiaqi (2018) believes that this is because the improvement of enterprise environmental protection awareness helps enterprises to reduce costs, so as to improve the economic benefits of enterprises. In terms of market earnings, Klassen and Whybark (1999) found that after enterprises strengthen environmental responsibility management, their market benefits will increase, stock prices will rise, and the expected value will rise^[2]. Ghoul et al. (2011) also found that companies with high corporate social responsibility scores have lower equity capital costs and higher corporate value. However, some studies have come to different conclusions. Some scholars believe that enterprises fulfillment of environmental responsibility will have a negative impact on enterprise value. For example, Brammer et al. (2008) found that the social performance of enterprises in environmental protection is negatively correlated with the stock return rate. Wan Shouyi and Liu Zhengyang (2013) believe that if enterprises excessively fulfill their environmental responsibilities and spend too much on environmental protection, it will increase costs and thus reduce enterprise value.

Chen Yuqing and Ma Lili (2005) believe that the fulfillment of environmental responsibility by enterprises has no impact on enterprise value, mainly because there are big defects in the disclosure of environmental responsibility information of listed companies, and the relevance of information is not strong. Lankoski (2000), Zhang Cui et al[2]. (2017) believe that there is an inverted "U" relationship between environmental responsibility and corporate value. They believe that when enterprises pay attention to environmental responsibility, strengthen environmental information disclosure and environmental protection investment, their own popularity and social evaluation are improved, and the positive effects brought by this will further enhance corporate value, but excessive environmental protection investment will increase corporate costs, harm corporate interests and have negative effects.

Against this background, this paper uses relevant data of Chinese manufacturing enterprises from 2016 to 2020 to empirically verify the relationship between the green transformation of enterprises and the high-quality development of enterprises. The results show that the green transformation of enterprises can significantly improve the high-quality development level of enterprises, and this improvement effect is still valid after a series of heterogeneity analysis and robustness test[3].

3. Theoretical Analysis and Research Hypothesis

For manufacturing enterprises, the biggest technological change is to integrate more green elements into production, operation, sales, service and other links through green technological innovation, so that enterprise development can coexist harmoniously with nature. Manufacturing enterprises can eliminate backward production capacity through green innovation. For many manufacturing enterprises, the reason why many factory equipment is highly polluted is that the equipment is backward, there is no waste treatment and utilization after production and processing, and there is no wastewater and sewage treatment capacity. Driven by the green transition. With the support and encouragement of the governments dual-carbon policy, manufacturing enterprises cut or improve highly polluting businesses with backward processes, thereby eliminating backward production capacity and

improving the quality of enterprise development. At the same time, manufacturing enterprises actively carry out green transformation, and green innovation is conducive to establishing a good corporate image. Enterprises actively fulfilling their low-carbon and green corporate social responsibilities can enable enterprises to gain more recognition and support from the society, and play a positive role in maintaining corporate reputation and thus gaining more trust from customers and suppliers. The high-quality development of an enterprise includes seven core characteristics: transparent and open operation, first-class comprehensive performance, and good image and reputation. The implementation of green transformation by an enterprise will be improved in these seven aspects. Therefore, the green transformation of an enterprise is conducive to the achievement of high-quality development.

Hypothesis H1: Under the condition that other conditions remain unchanged, the green transformation of manufacturing enterprises promotes the high-quality development of manufacturing enterprises.

At present, green transformation has become an important strategic development direction, which means that the manufacturing industry should change the traditional extensive development model of high pollution and high energy consumption, break down the institutional barriers, and ease the pressure of energy and resource constraints and ecological environment. As an important indicator reflecting the environmental performance of enterprises, the pollutant emission has received more and more attention. Therefore, the main transformation direction of the green transformation of manufacturing enterprises is energy conservation and emission reduction. There are two main ways for enterprises to make green transformation and reduce pollutant emission. First, they can introduce clean production technology and optimize production process and reduce waste generation. At the same time, the enterprise green transformation is more used in industrial waste, sewage, waste gas treatment and utilization, through a variety of environmental protection equipment and advanced technology in the production process of waste, sewage and waste gas recycling, use the available ingredients to produce additional products, reduce pollutant discharge at the same time improve the utilization efficiency of

resources.

Reducing pollutant emission in manufacturing enterprises can promote the high-quality development of enterprises themselves. Enterprises in order to reduce the pollutant emissions introduced the advanced production technology and equipment and choose the environmental standards suppliers can reduce pollutant emissions from the source, makes the enterprise in the subsequent production link reduces the cost of environmental protection, reduce the resource consumption, at the same time improve the product quality and product added value, and improve the overall economic benefits. At the same time, enterprises can make full use of industrial waste materials, sewage and waste gas through green transformation, and the production of additional products can explore new business areas and markets, and create new profit growth points. Consumers and the market demand for green products is increasing day by day. By reducing pollutant emissions, enterprises can improve their brand image and product attractiveness, and meet the markets preference for environmentally friendly products, so as to stand out in the market competition.

Suppose H2: With other conditions unchanged, the green transformation of manufacturing enterprises will promote the high-quality development of manufacturing enterprises by reducing pollutant emissions.

As a market-oriented environmental governance mechanism, pollutant emission trading policy has gradually attracted the attention of governments all over the world. By setting pollutant emission caps and allowing enterprises to trade emission rights among them, this policy aims to encourage enterprises to reduce emissions and improve resource utilization efficiency by economic means. The implementation of the pilot program of emission trading uses the price of emission rights as an indication signal to increase the cost of polluting enterprises and reduce the income of enterprises. When the marginal cost is close to the marginal income, enterprises have only two choices: stop production or carry out green innovation, so as to reduce the total amount of pollutant emissions. The amount is controlled and the green transformation of corresponding enterprises is promoted.

The vigorous implementation of emission trading can also promote the transformation of

scientific and technological achievements and reduce the number of "sleeping patents". The green patents of enterprises will no longer be just numbers in patent books, and more green technologies can be applied to actual production, and the effect of energy saving and emission reduction can be really applied to the production process. In order to enhance their competitive advantages, other enterprises will continue to carry out green technological innovations, which will have a strong role in promoting the green transformation of manufacturing enterprises.

At the same time, the pollutant emissions trading policy also encourages cooperation and information sharing among manufacturing enterprises. Enterprises can improve the environmental performance of the overall industry by cooperating to develop low-carbon technologies and sharing emission reduction experiences. Industry associations and relevant institutions can also play a role in promoting exchanges and cooperation among enterprises and forming a joint force to jointly address environmental challenges.

Hypothesis H3: Under the condition that other conditions remain unchanged, the implementation of pollutant emission trading policies can improve the role of pollutant emission control in promoting the green transformation effect of enterprises.

4. Research Design

4.1 Sample Selection and Data Sources

This paper takes the data of A-share manufacturing listed companies from 2016 to 2020 as the research sample, and processes the data as follows: (1) Excluding S T, S T* Class sample; (3) The continuous variables were tailed by 1%. A total of 4972 data were obtained after the above processing. The data on green transformation in this article comes from the annual reports of listed companies, and other data come from the Guotaian database. In this paper, s tata software is used for data processing.

4.2 Variable Selection

(1) Explained variable: adopting the economic added value of enterprises (E VA) to measure

the high-quality development of enterprises. Two kinds of enterprise economic added value measurement methods in Guotaian database are selected to measure the data.

(2) Explanatory variable: enterprise green transformation index. According to the research of Loughran & Mcdonald (2011), the green transformation of enterprises is measured by using the text information disclosed in the annual report. From the five aspects of publicity initiative, strategic concept, technological innovation, pollution management and monitoring management, a total of 113 enterprises of green transformation keywords were selected. The frequency of each keyword in the annual report of listed enterprises is counted to form the frequency of green transformation words. Both the frequency of the word and 1 is used to depict the green transformation index of the enterprise. The larger the value indicates that the larger the length of the green transformation of the enterprise in the annual report, the higher the importance to the green transformation, the higher the degree of green transformation of the enterprise.

(3) Control variables: This paper controls other variables that may affect the effect of green transformation in the manufacturing industry. Low-latitude enterprise-level control variables were selected: company size, return on equity, revenue growth rate, enterprise age, and Tobin q-value

(4) Mediation variable: SO₂ emissions. Sulfur dioxide emission is used to measure the pollutant emission of enterprises. The smaller the value indicates that the better the energy saving and emission reduction effect of enterprises is.

(5) Adjusting variable: emission trading policy. According to the pilot policy of emission trading system in 11 provinces of Hebei, Tianjin, Shanxi, Inner Mongolia, Jiangsu, Henan, Zhejiang, Shaanxi, Chongqing, Hunan and Hubei approved by the Ministry of Finance, the former Ministry of Environmental Protection and the National Development and Reform Commission in 2007, the number of enterprises in the pilot policy area will be 1, and the number of enterprises not in the pilot policy area will be 0.

Table 1. Variable Definition and Description

Variable Type	Variable	Symbol	Variable definition
Independent variable	Enterprise Green Transformation Index	Green	The logarithm of (green transformation word frequency +1)

Dependent variable	Economic added value of enterprises	<i>EVA</i>	Economic added value of enterprises
Mediating variables	Commercial credit financing	Credit	Finance Expenses/Total Debt
	<i>SO2 emissions</i>	Emission	
Adjusting variable	Emissions trading policy	Treat	If the enterprise is in the emission trading pilot area, it is 1, otherwise it is 0
Control Variable	Company Size	<i>SIZE_{i,t}</i>	Natural logarithm of Accompany total assets
	Return on equity	<i>ROE_{i,t}</i>	Net profit/total assets
	Revenue growth rate	<i>GROWTH_{i,t}</i>	(Current operating income-historical operating income)/historical operating income
	Enterprise age	Age	Calculation Year-Year of Enterprise Establishment
	To bin Q value	<i>Q_{i,t}</i>	Market Cap/Total Assets

4.3 Model Settings

According to the above analysis of the mechanism of the impact of green transformation on the high-quality development of enterprises, the following model is constructed for benchmark regression:

$$EVA = \alpha_0 + \alpha_1 Green + \alpha_2 Size_{it} + \alpha_3 ROE_{it} + \alpha_4 GROWTH_{it} + \alpha_5 Q_{it} + \alpha_6 Age + E_{i,t} \quad (1)$$

Where *i* and *t* represent the observation company and year, is the explanatory variables *EVA* for enterprise economic added value, the explanatory variable *Green* for enterprise green transformation index, α_0 is constant, α_1 reflects the green transformation enterprise affect the development of high quality coefficient, if the coefficient α_1 is positive, the enterprise green transformation will promote the development of high quality.

mesomeric effect:

Based on the theoretical mechanism analysis, this paper constructs the existing mediation effect test method, and constructs the following measurement model to analyze the mediation effect of pollutant emission in hypothesis 2:

$$Emission = \gamma_0 + \gamma_1 Green + \gamma_2 Size_{it} + \gamma_3 ROE_{it} + \gamma_4 GROWTH_{it} + \gamma_5 Q_{it} + \gamma_6 Age + E_{i,t} \quad (2)$$

$$EVA = \varepsilon_0 + \varepsilon_1 Green + \varepsilon_2 Emission + \varepsilon_3 Size_{it} + \varepsilon_4 ROE_{it} + \varepsilon_5 GROWTH_{it} + \varepsilon_6 Q_{it} + \varepsilon_7 Age + E_{i,t} \quad (3)$$

In the system of mediation effect tests, *Emission* represents the mediation variable *SO2* emission. If both γ_1 and ε_1 are significant, it indicates that the pollutant emission plays a significant intermediary effect in the impact of the

enterprise green transformation on the high-quality development of enterprises.

In addition, this paper establishes the following (4) regression equation, to analyze the regulation effect of the emission trading right policy on the green transformation in the high-quality development of enterprises proposed in hypothesis 3.

Regulatory effects:

$$EVA = \beta_0 + \beta_1 \ln GIIN + \beta_2 Emission + \beta_3 Treat \times Emission + \beta_4 Size_{it} + \beta_5 ROE_{it} + \beta_6 GROWTH_{it} + \beta_7 Q_{it} + \beta_8 Age + E_{i,t} \quad (4)$$

Tree represents the adjustment variable emission trading right. *Treat* *Emission*, the key explanatory variable in the model (4), is the interaction term of the emission trading right and the pollutant emission. If it is significantly negative, it indicates that the emission trading right can promote the positive impact of green transformation on the high-quality development of manufacturing enterprises.

5. Analysis of the Empirical Results

5.1 Descriptive Statistical Analysis and Correlation Analysis

According to the descriptive statistical results in Table 2, there is a big difference between the maximum and minimum values of enterprise economic added value (*EVA*), the measurement index of enterprise high-quality development, and the standard deviation is 1.53, indicating that the level of high-quality development between different manufacturing enterprises is quite different. There is little difference between the maximum value and the minimum value of

the enterprise Green transformation index level of Green transformation development (Green), and the standard deviation is 0.52, among manufacturing enterprises, indicating that there is little difference in the

Table 2. Descriptive Statistics Table

Var Name	Obs	Mean	SD	Min	Median	Max
Eva	4972	18.46	1.53	9.667	18.407	21.632
Lngiin	4972	4.02	0.52	2.551	4.066	5.248
Size	4972	21.77	1.01	19.978	21.635	24.499
Roe	4972	0.12	0.06	0.055	0.109	0.283
Growth	4972	0.15	0.46	-0.614	0.000	2.859
Age	4972	18.40	5.12	9.000	18.000	31.000
Tobinq	4972	2.13	1.15	0.925	1.742	6.199

Table 3. Correlation Coefficient Table

	Eva	Lngiin	Size	Roe	Growth	Age	Tobinq
Eva	1	0.218***	0.682***	0.647***	-0.091***	0.135***	0.071***
Lngiin	0.221***	1	0.143***	0.155***	-0.070***	0.083***	0.043***
Size	0.672***	0.144***	1	-0.002	-0.058***	0.178***	-0.203***
Roe	0.606***	0.154***	0.037***	1	-0.058***	-0.046***	0.327***
Growth	-0.067***	-0.073***	-0.011	-0.058***	1	-0.067***	-0.031**
Age	0.127***	0.089***	0.185***	-0.043***	-0.046***	1	-0.047***
Tobinq	0.144***	0.067***	-0.082***	0.359***	-0.027*	-0.012	1

Note: The pearson correlation coefficient is shown in the lower left, and the spearman correlation coefficient is shown in the upper right

The green transformation index is positively correlated with the economic added value of enterprises, indicating that the green transformation of manufacturing enterprises can promote the high-quality development of enterprises. The above correlation analysis results are consistent with the research hypothesis to some extent, but to determine whether the hypothesis is valid, further empirical testing of the model is needed.

5.2 Analysis of Benchmark Regression Results

Table 4. Robust regression

	(1)	(2)
	c1	c2
Lngiin	0.229***	0.051**
	(6.396)	(2.080)
Size		0.861***
		(15.585)
Roe		15.699***
		(54.481)
Growth		-0.055*
		(-1.908)
Age		-0.092*
		(-1.740)
Tobinq		-0.006
		(-0.392)
Firm	Yes	Yes
Year	Yes	Yes
cons	17.343***	-1.004

	(126.059)	(-0.676)
N	4972	4972
r2	0.078	0.581
R2_a	-0.55	0.29
Note: * * * p < 0.01, * * p < 0.05, * p < 0.1, t statistic in brackets		

Table 4 and Table 5 reports the benchmark regression results of the linear relationship between the green results transformation index and the economic added value of enterprises. The green transformation index of enterprises in column (1) is positively correlated with the economic added value of enterprises, with a coefficient of 0.229 and passing the significance test of 1%. This shows that the green transformation of enterprises can significantly promote the high-quality development of manufacturing enterprises, which is consistent with H1. And the regression results passed the robustness test.

Table 5. Baseline Regression Results

	(1)	(2)
Patent	8.921***	
	(2.610)	
Lngiin		0.051**
		(2.080)
Size	0.856***	0.861***
	(15.497)	(15.585)
Roe	15.775***	15.699***
	(55.300)	(54.481)

Growth	-0.056*	-0.055*
	(-1.947)	(-1.908)
Age	-0.091*	-0.092*
	(-1.735)	(-1.740)
Tobinq	-0.009	-0.006
	(-0.613)	(-0.392)
Firm	Yes	Yes
Year	Yes	Yes
_cons	-0.725	-1.004
	(-0.489)	(-0.676)
N	4972	4972
r2	0.581	0.581
R2 _a	0.29	0.29
Note: *** p < 0.01, ** p < 0.05, * p < 0.1, t statistic in brackets		

5.3 Heterogeneity Analysis

In order to further examine the impact of corporate green transformation on the high-quality development of enterprises, this paper conducts a grouping regression according to the degree of company ownership and corporate equity concentration. The regression results are as follows Table 6 :

Column (1) and column (2) respectively report the regression results of dividing enterprises into non-state-owned enterprises and state-owned enterprises according to their different equity properties. The results showed that the influence coefficient of green transformation on the economic added value of non-state-owned enterprises was 0.329. It passed the significance test of 1%, and the influence coefficient on the economic added value of state-owned enterprises was 0.023, which failed the significance test of 1%. This shows that the green transformation of enterprises has a significant impact on the high-quality development of non-state-owned enterprises and has little impact on state-owned enterprises. Since their largest controlling shareholder is the government, state-owned enterprises assume more social functions, that is, to achieve the goal of maximizing social interests, the government will require state-owned enterprises to assume more social responsibilities such as environmental governance. Therefore, the performance of the environmental responsibility of state-owned enterprises is generally better than that of non-state-owned enterprises. In this

way, stakeholders are accustomed to the situation of state-owned enterprises actively fulfilling their environmental responsibilities. In the view of stakeholders, the performance of environmental responsibility is the "duty" of state-owned enterprises, so the market response to the performance of environmental responsibilities of state-owned enterprises is low. In addition, if state-owned enterprises cause environmental pollution or environmental crisis, in order to avoid negative effects and maintain the reputation of state-owned enterprises, the government will try to take measures to minimize the environmental loss. Therefore, the state-owned nature of enterprises will reduce the stakeholders for the environment. The worry level of the crisis. To sum up, stakeholders are less sensitive to the performance of environmental responsibility, and the impact of environmental responsibility on enterprise value is relatively higher.

5.4 Analysis of Mediation Effect Results

With the help of the mediation effect model, this paper analyzes the impact path of corporate green transformation on the high-quality development of enterprises by selecting SO2 emissions (Emission) as the mediation variable. The results are shown in Table 7.

Table 7 reports the estimation results of the intermediary mechanism test of SO2 emissions (Emission) in the impact of enterprise green transformation on enterprise high-quality development. Column (1) shows the impact of green transformation (Green) on SO2 emissions (Emission). The impact coefficient of green transformation (Green) is -0.056, which passes the test at the significance level of 1%, indicating that the green transformation of enterprises will reduce SO2 emissions. Column (2) shows the enterprise green transformation (Green) and SO2 emissions (Emission) the influence of high quality development, the influence coefficient of enterprise green transformation is 0.046, SO2 emissions (Emission) influence coefficient of 0.092, under the significance level of 1% through the test, also shows SO2 emissions (Emission) in the enterprise green transformation on the development of the high quality play the intermediary effect.

Table 6. Heterogeneity Regression Results

	(1)	(2)	(3)	(4)
	Non-state	State-owned	Top10 accounts for a	Top10 accounts for a large

	enterprises	enterprise	small proportion	proportion
Lngiin	0.170*** (2.825)	0.023 (0.871)	0.036 (0.975)	0.080** (2.280)
Size	0.995*** (7.501)	0.827*** (13.287)	0.684*** (7.010)	0.905*** (11.318)
Roe	17.941*** (23.151)	15.372*** (48.586)	16.922*** (37.098)	14.661*** (35.061)
Growth	-0.022 (-0.394)	-0.084** (-2.445)	-0.059 (-1.388)	-0.037 (-0.864)
Age	-0.037 (-0.218)	-0.102* (-1.743)	-0.168 (-1.315)	-0.087 (-1.419)
Tobinq	-0.057 (-1.335)	-0.006 (-0.327)	-0.010 (-0.398)	-0.020 (-0.955)
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
cons	-5.292 (-1.239)	-0.034 (-0.021)	4.188 (1.417)	-2.029 (-1.014)
N	1059	3913	2152	2820
r2	0.581	0.590	0.613	0.512
R2 a	0.23	0.30	0.29	0.08

Note: *** p < 0.01, ** p < 0.05, * p < 0.1, t statistic in brackets

Table 7. Mediation Regression Results

	(1)	(2)
	Emission	Eva2
Green	-0.056*** (-2.915)	0.046* (1.873)
Emission		-0.092*** (-3.889)
Size	-0.150*** (-3.470)	0.847*** (15.342)
Roe	-2.492*** (-11.086)	15.471*** (52.730)
Growth	-0.032 (-1.419)	-0.058** (-2.013)
Age	-0.005 (-0.122)	-0.092* (-1.753)
Tobinq	-0.014 (-1.180)	-0.007 (-0.478)
Firm	Yes	Yes
Year	Yes	Yes
cons	9.922*** (8.565)	-0.095 (-0.063)
N	4972	4972
r2	0.253	0.583
R2 a	-0.26	0.30

Note: *** p < 0.01, ** p < 0.05, * p < 0.1, t statistic in brackets

5.5 Analysis of the Regulated Mediation Effects

In order to explore the impact of environmental regulation on the effect of green transformation

of enterprises, this paper tests the role of the governments implementation of emission trading right to promote the high-quality development of enterprises through the green transformation of enterprises by affecting the pollutant emission through the adjustment effect. The results are shown in Table 8.

Columns (1) and (2) of Table 6 give the estimated results of the moderating effect of emission trading policy on the green transformation effect of enterprises. Column (1) shows that the influence coefficient of enterprise green transformation is 0.015, the influence coefficient of pollutant Emission is-0.09, the influence coefficient of interaction term (Treat × Emission) of pollutant Emission and Emission trading policy is 0.087, and column (2) shows that the influence coefficient of interaction term (Treat × Emission) of pollutant Emission and Emission trading policy is-0.087, which is significant at the level of 1%, indicating that Emission trading policy significantly negatively regulates the negative mediation impact of pollutant Emission on enterprise green transformation and promoting enterprise high-quality development.

Table 8. Moderated the Regression Results

	(1)	(2)	(3)
	Eva	Emission	Eva
Green	0.015 (0.524)	-0.021 (-0.934)	0.013 (0.463)

Policy	-0.362**	0.273**	-0.350**
	(-2.218)	(2.144)	(-2.148)
Inter (interaction item)	0.087**	-0.087***	0.083**
	(2.129)	(-2.736)	(2.024)
Emission			-0.090***
			(-3.812)
Size	0.839***	-0.143***	0.844***
	(14.944)	(-3.309)	(15.277)
Roe	15.580**	-2.399***	15.406**
	(53.484)	(-10.598)	(52.165)
Growth	-0.058**	-0.031	-0.057**
	(-2.013)	(-1.365)	(-1.971)
Age	-0.090*	-0.005	-0.093*
	(-1.710)	(-0.128)	(-1.770)
Tobinq	-0.009	-0.013	-0.009
	(-0.592)	(-1.095)	(-0.604)
Firm	Yes	Yes	Yes
Year	Yes	Yes	Yes
cons	-0.406	9.658***	0.122
	(-0.271)	(8.325)	(0.081)
N	4972	4972	4972
r2	0.582	0.256	0.584
R2_a	0.29	-0.26	0.30

It fully demonstrates the positive role of the governments implementation of emissions trading policies in reducing pollutant emissions, promoting the green transformation of enterprises, and promoting the high-quality development of enterprises. At the same time, the implementation of emissions trading policies can control the large pollutant emissions caused by enterprises insufficient green transformation. The situation continues to deteriorate, and plays a role in promoting enterprises emission reduction transformation through government means.

6. Conclusions and Recommendations

6.1 Study Conclusions

Based on the data of Chinese A-share manufacturing listed companies from 2016 to 2020, this paper constructs a comprehensive indicator of green transformation, sets up an adjusted mediation effect model, and explores the effective path for the green transformation of manufacturing enterprises to affect the high-quality development of enterprises. The results show that: First, the green transformation of manufacturing enterprises can promote the high-quality development of manufacturing

enterprises and significantly increase the economic added value of manufacturing enterprises. The above results have passed the robustness test; Secondly, mechanism analysis found that pollutant emissions have a significant intermediary effect on the green transformation of enterprises and the promotion of high-quality development of enterprises, and this intermediary effect is regulated by the governments emissions trading policy. Through this regulating effect, it can be found that the implementation of emission trading policy is an effective means to regulate the excessive emission of emissions and the slow green transformation of enterprises. Finally, heterogeneity analysis found that the green transformation of both state-owned enterprises and non-state-owned enterprises can improve the high-quality development level of enterprises, but compared with state-owned enterprises, the green transformation of non-state-owned enterprises has a stronger driving effect.

6.2 Countermeasures and suggestions

Based on the research conclusions and some challenges existing in the current situation of green transformation of manufacturing enterprises, this paper puts forward the following suggestions:

First, the government should give full play to its guiding and supporting role. In the process of green transformation of manufacturing enterprises, they need to introduce green innovative technology and environmental protection equipment, which requires high capital investment and high technical support. Some enterprises can have less working capital for investment transformation, and technology is in shortage. This requires the government to encourage and support the green transformation of the manufacturing industry through the corresponding policies. The government can reduce the financial pressure on enterprises by providing financial subsidies, tax breaks and low-interest loans. At the same time, the government leads the establishment of a support mechanism and reward mechanism for green technology research and development to promote green technology innovation.

Second, improve the emission rights allocation mechanism and emission rights trading mechanism. The pollutant emissions trading policy has played a positive role in promoting the green transformation of enterprises, but there are still some problems in the implementation

process. The allocation method of emission rights may lead to market unfairness, and some companies may obtain too many emission rights and fail to effectively incentivize emission reductions. Therefore, the government should improve the emission rights allocation mechanism, formulate scientific and reasonable emission rights allocation standards, ensure that all enterprises enjoy fair emission rights under the same conditions, avoid inequality caused by historical emissions and other factors, and ensure fairness and transparency. At the same time, the government should constantly improve the emissions trading mechanism, standardize the rules and procedures of emissions trading, and establish a mechanism to deal with abnormal market fluctuations, so as to prevent excessive market fluctuations or collapse and ensure the stability and transparency of market operations.

Third, apply intelligent manufacturing and digital transformation to the green transformation of enterprises. Intelligent

manufacturing and digital transformation are important means to reduce pollutant emissions. Through technologies such as the Internet of Things, big data, and artificial intelligence, enterprises can monitor energy consumption and emissions in the production process in real time, adjust production plans and process parameters in time, optimize resource allocation, and minimize pollutant emissions.

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