The Impact of Green Finance Policy on Corporate R&D Expenses

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Abstract. In 2017, the pilot policy of green finance was initially officially implemented to govern the corporate environmental issue. Five provinces with different levels of development were selected to carry out pilot policies of green finance by being provided with credit support and low interest rate. This paper aims to study the effect of the implementation of green finance policies on local R&D. We look the pilot policy of green finance in 2017 as a natural experiment and use the DID method to regress the fixed effects of individuals and years with the R&D spending. We found that green finance policies could ease the constraints brought by the original local economic and political environment to enterprises. Another explanation may be that banks' financial support for enterprises improves the efficiency of R&D, reduces unnecessary R&D waste, and enables enterprises to continue to develop in the period of economic growth with less capital. In order to verify the validity of the model construction, we conducted the Hausman test to verify the validity of selecting the fixed effect, and conducted the parallel trend test to verify the accuracy of our 2017-2019 policy pilot time. Finally, we conducted two robust tests——placebo test to control the time and the PSM-DID. We all obtain the significant experimental results. Then, we puts forward policy suggestions based on the conclusions, which can be used as reference for future research and for the effect of the application of green finance policies in heavily polluting enterprises.

Keywords: Green finance, R&D expenses, DID, Parallel trend test, PSM-DID.

1. Introduction

The concept of green finance has grown increasingly significant in recent years due to both companies' growing awareness on their impact to the environment and relating government policies. In 2017, Zhejiang, Jiangxi, Guangzhou, Xinjiang and Guizhou were selected as green finance pilot areas in China and certain policies were enforced to encourage the environmental- friendly company behaviors.

In previous studies, there are a lot of researches that measure the impact of the green finance policies on company behaviors. Zhang Xueying proposed the method of valuing a company's innovation ability by the amount of its green innovation patent [1]. Hongjie Huang used the ratio between intangible asset increments and total assets to measure a company's innovation capacity [2]. In the article China Population Resources & Environment, Huan Jin, Lihong Yu and Yuanbin Xun mentioned using DID to measure the implementation of green finance innovation policy [3]. Our research is built upon previous researches, using DID as our model to quantitatively describe the relationship between green finance policies and company's research and development expenditure. Compared to previous researches, we innovatively chose the R&D sum as an indicator of a company's green innovation ability instead of the amount of patent a company applied for or the ratio between intangible assets and total assets.

We chose not to measure on the quantity of the patent or the increment of a company's intangible asset because we couldn't measure the quality of the patents effectively, therefore it is hard to determine whether the large amount of patents refers to a company's good innovation capacity. Moreover, the necessity to apply for patents varies from different types of companies, thus companies

with relatively fewer patents don't mean they are inferior to some other companies from other areas that have high patent quantity.

The reason we chose to measure a company's innovation capacity by its R&D cost is because R&D spend has a promotion effect on the "green degree" of technology innovation, according to the research by Zhang Yueting [4]. In addition, the R&D cost takes into account the quality as well as the quantity of patents and copyrights resulted from discoveries or innovations. It is a more comprehensive factor to measure the amount of intellectual property a company possesses. According to another survey by Henriquez, he proved the positive relationship between R&D cost and company innovation by a machine-learning method. It is another proof to the plausibility of measuring companies' green innovation based on their R&D cost [5].

2. Hypothesis

Before we select data to build a specific model, we refer to the literature review section. Green finance policy provides financing preference for loans to small and micro enterprises, and technical financial support to small and medium-sized enterprises applying high-tech to control pollution. The government will provide loans at low interest rates to small and medium-sized manufacturing industries and encourage them to use environmentally friendly technologies for production, so as to achieve the purpose of green finance, which promotes environmental protection. After the government gives financial support to the enterprises of technological environmentalism, the enterprises' R&D and innovation should be encouraged to research and development more environmentally friendly techniques. Therefore, we proposed the following hypothesis:

H1: The implementation of green finance policy will promote the ability of R&D and innovation in pilot areas.

H2: Green finance policies increase enterprises' investment in R&D expenses.

H3: Green finance policy will alleviate the inhibition effect of local policy environment on enterprise R&D investment.

H4: Green finance policy will save the wastage of unnecessary R&D spending and improve the capital utilization.

3. Data

3.1. Variable Selection

3.1.1 Explained variable

We used the total R&D spend sum to measure companies' innovation. If the implementation of the green finance policies has a positive impact on companies' innovation then the company would have a higher R&D sum. Due to the fact that for most of the companies, R&D cost is more than a hundred million, we shrink the data by a factor of 10^8, so that it is easier for computing.

3.1.2 Explanatory variables

We measure the green finance policies by using the product of treat multiply by post. Post means whether or not the city the company is situated in belongs to one of the green finance pilot areas. If the city belongs then we give the company a number of one, if not we give it a number of zero. Treat means whether the year we measured on belongs to the time after the policy of green finance came out. The green finance policies were introduced in 2017, so before 2017 we give the company a treat value of zero, while after 2017 we give the company a treat value of one.

3.1.3 Control variables

(1) Cash

Cash is calculated by the total cash and cash equivalents balances divided by assets at the end of the period. The cash available represents the total amount of liquidity a company has, therefore may have an impact on companies' innovation.

(2) PPE

PPE is calculated by the net fixed assets at the end of the year divided by total assets. PPE is an important factor to measure whether or not a company has a large portion of idle funds. If the company has sufficient idle funds, then the funds may lead to better innovation.

(3) Size

Size is measured by the natural logarithm of total assets a company possesses. Large companies may have more incentives and capability on investing for company innovation.

(4) Leve

Leve is the total liabilities at the end of the year divided by total assets. Leve shows a company's capacity to clear off its debts, and companies that have a lower proportion of debts may have better incentives to invest for innovation.

(5) ROA

ROA is calculated by PBIT divided by total assets. ROA shows a company's ability to gain profits. Therefore a company that have better ROA value may be able to devote more money into company innovation, and this leads to better innovation.

(6) CDR

CDR is measured by the total current liabilities divided by total liabilities. It shows a company's ability to clear off its debts in a short period of time. Lower CDR leads to better liquidity of funds, thus may lead to higher R&D spend.

(7) LnLabor

Lnlabor is calculated by the natural logarithm of total staff. Due to the fact that for most companies the number of staff is more than 3000, using a natural logarithm for the total number of staff is a method of data processing to reduce the computing pressure.

(8) NPR

NPR is net profit divided by total comprehensive income. It shows a company's ability to gain profits from the market. A high NPR indicated better company performance, and these types of companies probably put more stress on the innovation process.

3.2. Data Resource and Descriptive Statistic

3.2.1 Data resource

This paper takes the implementation of green finance policy as a quasi-natural experiment when studying the relationship between green finance and corporate R&D expenses. It takes Chinese listed companies as research samples, and the data comes from the CSMAR database, spanning from January 1, 2014 to December 31, 2019. In order to ensure the reliability of the results, the original data collected were processed as follows:

First, remove ST, *ST and other enterprises with the risk of delisting. The unsustainable operation of these companies will lead to a large deviation with those going concern in the company's financial indicators, which is not representative and will interfere with the regression.

Second, for completeness of regression and comparability of data, we screened companies with available data between 2014 and 2019 and excluded samples with missing data.

3.2.2 Descriptive statistic

Table 1 reports the results of descriptive statistics. We have gathered statistics on the financial data of listed companies during the period of six years from 2014 to 2019. As can be seen from the table, 4986 listed companies have been counted, among which the maximum R&D expense is 218.718 (*10^8) and the minimum is 0, indicating a large gap between the R&D expenses of different enterprises. Therefore, it is of practical significance to study green finance and R&D expenses in this paper. In addition, in terms of the control variables, the standard deviation of most control variables

is small, which indicates the reliability of the selection of control variables. However, there are still a few control variables with large standard deviation, which provides the ideas for the subsequent test of control variables.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RDSpendSum	4986	3.137	12.287	0	218.718
cash	4986	.171	.114	.002	.779
PPE	4986	.219	.149	.001	.876
size	4986	22.441	1.368	19.138	28.636
leve	4986	.407	.21	.014	4.588
ROA	4986	.038	.095	-4.946	.526
CDR	4986	.825	.166	0	1
LnLabor	4986	7.912	1.286	1.609	13.189
NPR	4986	1.013	3.947	-163.851	206.803

4. Research Design and Result

4.1. DID Model

DID is an effective tool for analyzing policy impact and it is done by regressing on a dummy variable which represents whether or not a policy is implemented. DID is optimal for evaluating policy influence because it largely avoids endogenous problems. In addition, the use of fixed-effect estimates can alleviate the problem of missing variable bias.

In our research, we built the following model to evaluate the relationship between the implementation of green finance policy and company innovation.

$$Y_{i,t} = \beta_0 + \beta_1 \text{treat} \times \text{post} + \beta_2 \text{Year}_i + \beta_3 \delta_{it} + \varepsilon_{i,t} \quad (1)$$

$Y_{i,t}$ refers to the sum of R&D spending. Treat refers to whether or not a company belongs to the pilot areas. If a company do belong then treat has a value of 1, in the other case, the company has a value of 0. Post refers to whether or not the year of measuring the sample is after 2017. If it is after 2017 which is the year when the green finance policy was established, then the sample data has a value of 1, in the other case a value of zero. Year_i is the year when the sample is measured. δ_{it} is the control variable, and $\varepsilon_{i,t}$ is the random perturbation item.

4.2. The Effect of the Green Finance on the R&D Expenditure

We carried out regression analysis on the above model. The pilot areas from 2017 to 2019 were taken as the treatment group, and the non-pilot areas from 2017 to 2019 were taken as the control group. According to the first linear regression results in columns 2 and 8 (Table 2), the coefficient of treat (1.586) is significantly positive at the 1% level, indicating that R&D investment of all enterprises in the sample has increased to some extent after 2017. The coefficient of post (-2.391) is significantly negative at the 1% level, indicating that R&D expenditure in the five pilot regions is small compared to other regions, and the pilot region is negatively correlated with R&D expenditure.

Table 2. Linear regression results without control variables

RDSpendSum	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
treat	1.586	.347	4.57	0	.906	2.267	***
post	-2.391	.801	-2.98	.003	-3.962	-.82	***
Constant	2.462	.249	9.91	0	1.975	2.949	***

*** p<.01, ** p<.05, * p<.1

To explore the role of green finance policies whether to promote or inhibit R&D spending in 2017, that is, the combined effect of time and post on companies in the five pilot regions, we performed a

DID regression of the individual and year fixed effects, aimed at the treat and post's interaction ite, treatafter. In order to make the results more robust, we further added control variables. According to the results in column 2 and 8 (Table 3), the coefficient of treatafter (-1.639) is significantly negative at the 5% level. Separately, from the coefficient, the implementation of green finance policy has a negative impact on the expenditure of enterprise R&D funds. In other words, from the perspective of time and pilot provinces, under the background of the economic environment promoting R&D after 2017, the implementation of green finance policy will provide financial incentives to enterprises in pilot provinces. Compared with other regions, R&D expenses in pilot provinces still show a trend of reduction.

Table 3. DID regression results with control variables

RDSpendSum	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
treatafter	-1.639	.668	-2.45	.014	-2.948	-.33	**
2014b	0	.	.	.	.	.	
2015	-.198	.253	-0.78	.434	-.694	.298	
2016	-.004	.269	-0.01	.988	-.531	.523	
2017	.444	.289	1.54	.125	-.123	1.011	
2018	.98	.304	3.23	.001	.385	1.575	***
2019	1.541	.312	4.94	0	.929	2.152	***
cash	.325	1.149	0.28	.778	-1.928	2.578	
PPE	2.229	1.627	1.37	.171	-.961	5.42	
size	1.683	.351	4.80	0	.995	2.37	***
leve	-1.171	.895	-1.31	.191	-2.925	.584	
ROA	-.17	.991	-0.17	.864	-2.113	1.774	
CDR	.842	.842	1.00	.317	-.809	2.494	
LnLabor	.538	.111	4.83	0	.32	.757	***
NPR	-.006	.02	-0.31	.753	-.045	.033	
Constant	-40.051	7.867	-5.09	0	-55.474	-24.627	***

*** p<.01, ** p<.05, * p<.1

According to the experimental results above, the original intention of green finance policy is to link financial behaviors such as finance, taxation, price and investment with sustainable development, to support the development of green and low-carbon industries, to provide funds for energy conservation and emission reduction industries, and to advocate green production [6]. It also includes the bank's investment support for small and micro low-carbon manufacturing industries. By comparing the two regression models, we can further clarify the positive impact of the implementation of green finance policies on the R&D expenses.

After adding control variables, we found that the correlation coefficient (-1.639) was smaller for the regression of the interaction terms than for the regression of post only (-2.391). What's more, the coefficient when regressing the treat alone, was (1.586). This indicates that the implementation of green finance policy has a restraining effect on the negative correlation between the original region and R&D expenditure. Although the R&D expenditure of enterprises in the five pilot regions was smaller than that of companies in other regions before policy, the implementation of the policy after 2017 still promoted R&D development in these regions, and the negative correlation between the regions was relieved after implementation.

The detailed explanation is as follows. From the perspective of pilot areas, the five pilot areas are Guangdong Province, Zhejiang Province, Jiangxi Province, Guizhou Province and Xinjiang Uygur Autonomous Region. Guangdong Province and Zhejiang Province have large enterprise density, fierce market competition, and high local financing demand. Before the implementation of the policy, there was a large degree of research and development restrictions. The average scientific and technological level of local enterprises is strong, so the improvement of the research and development of energy conservation and emission reduction is not obvious. Therefore, before the implementation of the policy, its research and development is limited and therefore low. After the implementation of

the policy, the government's deregulation of the industry and financial support for high and new technologies have improved the research and development motivation of many enterprises, so it has a positive effect. However, due to the accumulation of negative effects of the fierce competition, it also appears a negative effect. Jiangxi Province and Guizhou Province are less developed regions, and their relatively weak R&D performance before 2017 may be explained by the lack of industrial impetus. Although the implementation of policies can enable local banks to provide policy support to enterprises, the promotion effect still does not exceed the inhibition effect of the original industry due to the unsound management system, so a negative correlation also appears. However, finally, as enterprises in Xinjiang Uygur Autonomous region are located in remote areas. Not only the local have weak demand for green development, but also the support from banks is week. Therefore, after the implementation of green finance policy, the certain promoting effect is still weaker than the negative impact caused by the nature of the original region.

Another explanation is that green finance policy improves the efficiency of enterprises in using funds and reduces the investment of unnecessary R&D expenses, leading to the negative of the coefficient of the treatafter variable. In the macro-environment of overall economic growth, maintaining the operation of enterprises with less funds to a certain extent also indicates the improvement of ente.

Based on the above analysis of the five pilot provinces, although the regression coefficient for treatafter is significantly negative, combined with the regression for treat and post respectively, it can still be seen that the inhibitory effect is due to the nature of the region, and the promotion of the policy has weakened this negative effect.

5. Model test

5.1. Hausman Test

The Hausman test is a test to detect endogenous predictor factor in a regression model. Endogenous factors are factors that are determined by the other variables in the model and its existence may lead to failure in the prediction model. The Hausman test is often used for determining whether to adopt a fixed effect model. If there is significant difference between the coefficient of the fixed effect model and the random effect model, then it is optimal to choose fixed effect, in the other case, it is optimal to choose the random effect [7].

Our purpose for doing the Hausman test is to evaluate whether we should choose the fixed effect to describe the relationship between green finance policies and company innovation or to choose random effect.

In a hausman fixed effect test, we consider the relationship between the variables based on the assumption that the company is fixed. In a hausman random effect test, we consider the relationship between variables based on the belief that all the company behave as a whole, and we do the regression randomly without fixing on a single company. In the fixed effect test, we find that the p-value for the policy group is 0.06 which is only a bit bigger than 0.05, and is much lower than 0.01. Therefore, the test result shows a correlation between the green finance policy with cooperation innovation. Moreover in the test, we can see that there is a strong correlation between the R&D spend with size and labor force, which means it is necessary to keep them as control variables. In the hausman random effect test, the coefficient for the policy group is -1.433 which has a significant difference with the fixed effect group, which shows a coefficient of -1.251. This difference suggests that it is optimal to choose the fixed effect test rather than the random effect test.

5.2. Parallel Trend Test

The parallel trend hypothesis holds that, before proceeding the DID test, we assume that if the implementation of green finance policy is not carried out in the pilot area, the same trend exists between the treatment group and the control group, which is a prerequisite for the differential estimation [8].Therefore, in order to test the feasibility of the different-in-difference model, namely,

to verify the impact of policy on local R&D expenses happening in 2017, and to verify the accuracy of 2014, 2015 and 2016 as control group and 2017, 2018 and 2019 as treatment group, we conducted research through parallel trend test.

We applied the implementation date to 2014, 2015, and 2016 respectively, forming the variables, treatyear1-treatyea3, and regressed the changed three groups of interaction items respectively. Table 4 shows that none of the three regressions is significant. This indicates that the increase in R&D expenses from 2014 to 2016 is not due to the implementation of green finance policies. At the same time, this also verified the correctness of taking the year of policy implementation, 2017, as the processing group, thus providing testing support for the construction of DID model.

Table 4. Regression results of parallel trend test

RDSpendSum	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
treatyear1	1.437	.936	1.54	.125	-.397	3.272	
treatyear2	1.433	.936	1.53	.126	-.402	3.267	
treatyear3	1.027	.936	1.10	.273	-.808	2.861	
2014b	0	.	.	.	.	.	
2015	.083	.255	0.33	.745	-.416	.582	
2016	.583	.255	2.29	.022	.084	1.082	**
2017	1.217	.252	4.82	0	.722	1.712	***
2018	1.877	.252	7.43	0	1.382	2.372	***
2019	2.524	.252	10.00	0	2.029	3.019	***
Constant	2.058	.181	11.34	0	1.702	2.414	***

*** p<.01, ** p<.05, * p<.1

6. Robust Test

6.1. Placebo Test

The placebo test is a test to evaluate the robustness of a DID model. The test is to make sure that certain factors that are not being considered as variables don't have an impact on our variable being explained. During the test, we consider these factors as variables and see if they have an impact on the final result. If they do, then it may indicate certain flaws in the model.

Table 5. The result of placebo test

RDSpendSum	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
newtreatafter	-1.378	.89	-1.55	.122	-3.124	.367	
2014b	0	.	.	.	.	.	
2015	-.122	.256	-0.48	.634	-.624	.38	
2016	.077	.271	0.29	.775	-.453	.608	
2017	.45	.29	1.55	.121	-.119	1.02	
2018	.991	.305	3.25	.001	.394	1.589	***
2019	1.555	.313	4.97	0	.941	2.168	***
cash	.356	1.151	0.31	.757	-1.9	2.612	
PPE	2.092	1.627	1.29	.198	-1.097	5.281	
size	1.638	.35	4.68	0	.952	2.325	***
leve	-1.233	.895	-1.38	.168	-2.988	.521	
ROA	-.063	.99	-0.06	.949	-2.005	1.878	
CDR	.845	.843	1.00	.316	-.807	2.497	
LnLabor	.541	.111	4.85	0	.322	.759	***
NPR	-.003	.02	-0.14	.885	-.042	.036	
Constant	-39.051	7.854	-4.97	0	-54.449	-23.653	***

*** p<.01, ** p<.05, * p<.1

In our placebo test, we referred to the method in the You's article [9]. and changed the calculation method for the interaction item. We assume that during the two time periods 2014-2016 and 2017-2019 the performance of the company should be almost the same regardless of the implementation of green finance policies, so even if pre-treatment effect exists, it won't be significant. In the placebo test we assume that the green finance policy took place in 2014 rather than 2017 and we changed the original value of post. The result is as follows (Table 5), the table shows for the newtreatafter, the p-value reached 0.122 which is bigger than 0.1. This indicates that the increase of RD spend sum is because of the implementation of green finance policies in 2017, if we push the time backward to 2014 then their would be no correlation between the interaction item and the total R&D spending.

6.2. PSM-DID

Propensity score matching was used to identify and mitigate data bias in variables. Because the random grouping method is not adopted in the observation study, the influence of confounding variables between the experimental group and the control group cannot be weakened based on the large number theorem, which is easy to produce systematic bias and data bias and confounding variables. Propensity score matching can reduce the influence of these biases and confounding variables in order to make a more reasonable comparison between the experimental group and the control group and eliminate the interference factors between groups. Although this method cannot completely solve the problem of variable endogeneity, it can alleviate the bias caused by self-selection to a large extent.

Before using the PSM method [10], the samples were randomly sorted and then matched, and the distance between the treatment group and the control group was within 0.001. According to the final matching results of samples in Table 6, there were only 490 samples in the control group that were not in the common value range (off support). However, there are 4496 samples within the common range (on support). It indicates that most samples are consistent with sample selection, and the data deviation is small.

Table 6. The statistic of matching result

Treatment	support		
assignment	Off support	On support	Total
Untreated	489	4,374	4,863
Treated	1	122	123
Total	490	4,496	4,986

Table 7. The result of PSM-DID

Variable	Unmatched Matched	Mean		%bias	%reduct	t-test		V(T)/V(C)
		Treated	Control		|bias|	t	p>t	
cash	U	0.179	0.171	6.5	71.2	0.72	0.474	1.06
	M	0.179	0.181	-1.9		-0.15	0.882	1.21
PPE	U	0.206	0.22	-10.1	41.7	-1.02	0.308	0.67*
	M	0.205	0.197	5.9		0.51	0.614	0.94
size	U	21.805	22.457	-56.1	93.5	-5.24	0	0.43*
	M	21.815	21.773	3.6		0.36	0.722	0.9
leve	U	0.388	0.407	-5	80.9	-1.03	0.304	7.20*
	M	0.359	0.355	0.9		0.09	0.928	4.65*
ROA	U	0.007	0.039	-9.8	46.2	-3.71	0	54.82*
	M	0.047	0.03	5.3		1.3	0.195	1.17
CDR	U	0.885	0.824	39.6	80.4	4.03	0	0.72
	M	0.89	0.878	7.8		0.71	0.478	0.98
LnLabor	U	7.561	7.921	-32.7	90.5	-3.07	0.002	0.44*
	M	7.568	7.534	3.1		0.27	0.788	0.60*
NPR	U	1.028	1.012	0.6	-185.9	0.04	0.965	0.01*
	M	1.028	0.983	1.6		1.13	0.258	4.09*

* if variance ratio outside [0.70; 1.43] for U and [0.70; 1.43] for M

Secondly, we use pstest to investigate whether the matching structure balances the data well and verify the effectiveness of the selection of control variables. As can be seen from Table 7, the equilibrium assumption is satisfied. We selected control variables with better matching quality, that is, variables with significantly reduced standard deviation of data after matching and becoming more concentrated. The filtered covariables are size, ROA, CDR and LnLabor.

Finally, we delete samples that do not fall within the common value range. In addition, size, ROA, CDR and LnLabor were re-selected as control variables to re-carry out regression on the implementation of green finance policy and R&D expenses. As shown in Table 8, the coefficient of treatafter is significantly negative (-0.728) at the importance level of 1%. Compared with the above different-difference result (-1.639), not only has the significance level increased, but also the implementation of green finance policy has reduced the original negative impact of local enterprises to a greater extent. That is, the green finance policy restrains the local negative impact on R&D spending.

Table 8. PSM-DID Regression results

RDSpendSum	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
treatafter	-.728	.191	-3.82	0	-1.102	-.354	***
size	1.449	.104	13.95	0	1.245	1.653	***
ROA	.467	.463	1.01	.313	-.441	1.374	
CDR	.317	.257	1.23	.218	-.187	.822	
LnLabor	.211	.037	5.76	0	.139	.283	***
2014b	0	.	.	.	.	.	
2015	-.091	.076	-1.20	.232	-.239	.058	
2016	-.089	.081	-1.10	.272	-.247	.07	
2017	.012	.087	0.14	.886	-.159	.183	
2018	.257	.092	2.81	.005	.078	.437	***
2019	.447	.095	4.72	0	.261	.633	***
Constant	-32.505	2.275	-14.29	0	-36.966	-28.044	***

*** p<.01, ** p<.05, * p<.1

7. Conclusion

7.1. Research Result

Our research built upon the DID model shows a positive relationship between the government's green finance policy with company innovation. Our regression result indicates that although the coefficient between the areas and R&D expenditure is negative, the implementation of green finance policies makes the absolute value of the coefficient smaller, relieving the original negative effect. What's more, another explanation is that the lower R&D expenditure is due to reduce the wastage of inefficient R&D investment. In addition, Hausman test verifies the rationality of choosing the fixed effect model and the parallel trend test shows that the same trend exists between the control group and the treatment group which is a prerequisite for establishing the DID model. Our model also shows good robustness. In the placebo test, our model shows good correlation between the implementation of green finance policy and company innovation; shows minor correlation with the impact of time. In PSM-DID we matched our treatment group sample with our control group sample to eliminate self-selected bias and after the test, the regression result stands the same, and supported our original conclusion.

7.2. Policies Suggestion

First, different policies are provided for enterprises with different development levels and natures. It is necessary to take into account the development level of the local area and the available resources, and make adjustments to local conditions, avoid "one-size-fits-all" policies, and give preferential

treatment to different enterprises through interest rate relief and loan limits of different strength. And to the same market enterprises to give the same policy scope, actively promote policy preferences, do not ignore any in the development of small and medium-sized enterprises.

Secondly, measure the level of enterprise utilization policy reasonably. Corporate innovation based on research and development expenses is only one measure, and the innovation effectiveness can also be measured by indicators such as green patents. At the same time, the research and development of low-carbon technology is an indirect indicator. The most direct measurement method is the change of heavy pollution emission, and the environmental contribution of enterprises is directly measured from the result. The local government can also reward and punish enterprises based on their contribution to national GDP, the efficiency of capital utilization and the change of total factor productivity, and adjust the financial support to enterprises at any time.

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