Green Credit Policy, Cash Holding Level and Enterprise Investment Efficiency

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Abstract. By analyzing the data of Shanghai and Shenzhen A-share listed companies from 2008 to 2021, this paper discusses the impact of green credit on enterprise investment efficiency by using the differential model. The research shows that green credit policy can significantly improve the investment efficiency of heavy polluting enterprises; the influence mechanism test shows that the cash holding level plays a positive moderating role in the relationship between green credit policy and enterprise investment efficiency.

Keywords: Green credit policy · Investment efficiency · Cash holding level

1 Introduction

With China's rapid economic growth, the pace of industrialization has also accelerated, resulting in a series of environmental problems. By contrast, heavy polluting enterprises have easier access to credit financing, and abundant free cash flow leads to irrational investment behavior. Therefore, inefficiency investment exists in heavy polluting enterprises.

In order to promote the green development of Chinese industry, the green Credit Guidelines were issued in 2012, which means that the green credit policy system is further improved. As to whether the green credit policy can achieve the expected effect, the paper studies the green credit policy from the perspective of enterprise investment efficiency.

The significance of this paper lies in the addition of the moderating variable of cash holding level on the basis of the original literature, which to some extent makes up for the deficiency in the empirical analysis of the influence mechanism of green credit policy on the investment efficiency of enterprises. At the same time, the heterogeneity analysis is carried out from the level of firm size, which expands the research on the heterogeneity of the policy on investment efficiency to a certain extent.

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2 Literature Review

Compared with foreign countries, the development of green credit policy is slow, and the research results of green credit policy are relatively few. Existing literatures mainly focus on the following aspects: First, on the level of debt financing, Xu X.J. and Qi Q.Y. (2022) found that green credit policies have a great impact on the penalty effect and penalty asymmetry of financing. The second is the study on loan scale and cost [1]. Chen Q. (2019) found that the introduction of green credit policy significantly increased the borrowing cost of "two high, one high and the remaining" enterprises and reduced the credit issuance. The third is the research on the level of new loans of enterprises and its impact on environmental protection [2]. CAI H.J., Wang X.Y. and Tan C. (2019) The implementation of this policy significantly reduced the new bank loans of enterprises with "two high levels" and significantly improved the environment [3]. Fourthly, research on the investment efficiency of enterprises. Ning J.H., Yuan Z.M. and Wang X.Q. (2021) find that green credit policies can greatly curb the excessive investment of heavily polluting enterprises [4].

It can be seen that relevant literatures mainly focus on the net effect of policies and the nature of property rights in recent years, and few literatures pay attention to the heterogeneity of firm size. On the basis of previous studies, this paper proposes a new idea, which is to test the heterogeneity of enterprise scale. In addition, for the first time, this paper studies the relationship between cash holding level and investment efficiency of companies under the influence of green credit policy, which makes up for the deficiency in this aspect of research.

3 Theoretical Analysis and Research Hypothesis

When making investment, an enterprise often encounters the following problems: First, the agency problem of the enterprise. Due to the separation of management and ownership, the interests of all parties often conflict, and the management usually makes excessive investment for personal gain [5]; The second problem is information asymmetry. The conflict between management and external investors on the feasibility of the project leads to the decrease of the company's stock price, the high financing cost, and the shortage of free cash flow during the investment, which makes it impossible for the enterprise to make reasonable investment [6]. Therefore, most enterprises have the problem of inefficient investment.

In this regard, China implements green credit policy, controls heavily polluting enterprises, reduces credit release, and reduces unreasonable investment in investment, thus improving the investment efficiency of enterprises. Assume the following:

Hypothesis 1: Green credit policy can significantly improve the investment efficiency of heavily polluting enterprises.

As an economic policy to promote environmental protection and accelerate the transformation of economic growth mode, green credit policy directly determines the credit line issued by financial institutions to enterprises. The higher the level cash holdings, the less the phenomenon of under-investment, and the higher the level will lead to

over-investment [7]. After the implementation of green credit policy, heavy polluting enterprises tend to hoard more cash due to high loan cost and shortage of funds, and maintain a high level of cash holdings in order to withstand fluctuations and uncertainties of cash flow [8]. As heavy polluting enterprises have invested a large amount of funds in environmental protection upgrading and are short of free cash flow, they need to ensure a high level of cash holdings to meet the requirements of enterprise transformation, and the management should ensure that all investments are reasonable and effective during project investment. Assume the following:

Hypothesis 2: The cash holding level of heavily polluting enterprises has a positive moderating effect on the relationship between green credit policy and investment efficiency.

4 Research Design

4.1 Sample Selection and Data Sources

This paper takes A-share listed companies in Shanghai and Shenzhen from 2008 to 2021 as the initial sample, and the screening criteria are as follows: ST, *ST and PT companies are excluded; Eliminate financial companies; Excluding companies that have been listed for less than one year or have been suspended from listing; Eliminate the companies listed in Beijing Stock Exchange; Remove missing samples. In order to avoid the influence of extreme values, all continuous variables were tail-tailed according to 1% and 99% quartiles.

4.2 Variable Definitions

Explained variable.
The explained variable of this paper is enterprise investment efficiency. The Richardson model was used to calculate the investment efficiency [9], and the absolute residual value was used to describe the level of investment efficiency. The more the value approached zero, the higher the investment efficiency of the company. Otherwise, the lower it is.

$$\begin{aligned} \mathrm{Invest}_{i,\ t} = {} & l_0 + l_1 \mathrm{Invest}_{i,\ t-1} + l_2 \mathrm{Age}_{i,\ t-1} + l_3 \mathrm{Cash}_{i,\ t-1} \\ & + l_4 \mathrm{Size}_{i,\ t-1} + l_5 \mathrm{Growth}_{i,\ t-1} + l_6 \mathrm{Return}_{i,\ t-1} \\ & + l_7 \mathrm{Lev}_{i,\ t-1} + \sum \mathrm{Industry} + \sum \mathrm{Year} + \varepsilon_{i,\ t} \end{aligned} \tag{1}$$

Explanatory variables.
The core explanatory variable of this paper is did, equal to treat × period. Among them, treat is the experimental variable, enterprises are classified according to the pollution degree, the value of heavy pollution enterprises is 1, vice versa, the value is 0; period is the time variable. The value before 2012 is 0 and after 2012 is 1.

Regulating variable

The moderating variable for this paper is the level of cash held, equal to cash and cash equivalents / (total assets - cash and cash equivalents).

Control variables.
The control variables in this paper are total asset turnover, listing years, growth, tangible assets, size of the board of supervisors, size of the board of directors, financial leverage, and shareholding ratio of the largest shareholder.

4.3 Empirical Model

$$\begin{aligned} Inv_{i,t} = {} & l_0 + l_1 did_{i,t} + l_2 treat_{i,t} + l_3 period_{i,t} \\ & + l_4 Controls + \mu_i + £_t + \theta_{i,t} \end{aligned} \tag{2}$$

In Eq. (2), μ is the industry fixed effect, £ is the annual fixed effect, and θ is the error term. Equation (2) is mainly used to test the degree of impact of green credit policy on the investment efficiency of enterprises. Hypothesis 1 holds if l1 is less than 0 and significant in this model.

5 Analysis of Empirical Results

5.1 Regression Analysis

As can be seen from Table 1, the coefficient of did was significantly negative at the level of 5%, regardless of whether control variables were added. This indicates that green credit policies can significantly improve the investment efficiency of heavily polluting enterprises, and hypothesis 1 is valid.

5.2 Influence Mechanism Test

In order to further study the mechanism between the two, this paper, referring to the practice of Jin X.Y. et al. (2022) [10], embedded the cash holding level into the benchmark model of Eq. (2) and set it as follows:

$$\begin{aligned} Inv_{i,t} = {} & l_0 + l_1 did_{i,t} \times CHL_{i,t} \\ & + l_2 did_{i,t} + l_3 treat_{i,t} + l_4 period_{i,t} \\ & + l_5 Controls + \mu_i + £_t + \theta_{i,t} \end{aligned} \tag{3}$$

It can be seen from columns (3) and (4) in Table 1 that the coefficients l1 are significantly positive, indicating that cash holding level plays a significant positive role in the relationship between green credit policy and investment efficiency, and hypothesis 2 is valid.

Table 1. Regression analysis and influence mechanism test

Model	(1)	(2)	(3)	(4)
Variable	Inv	Inv	Inv	Inv
did	-0.0027** (-2.22)	-0.0029** (-2.39)	-0.0041*** (-3.30)	-0.0046*** (-3.76)
did × CHL			0.0079*** (5.40)	0.0099*** (6.83)
treat	-0.0020 (-0.00)	-0.0013 (-0.00)	-0.0070*** (-4.93)	-0.0062*** (-4.42)
period	-0.0070*** (-4.90)	-0.0063*** (-4.43)	-0.0030 (-0.00)	-0.0026 (-0.00)
controls	No	Yes	No	Yes
Annual fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
N Adj R-squared	21161 0.0455	21161 0.0834	21161 0.0468	21161 0.0854

Note: *** p < 0.01, ** p < 0.05, * p < 0.1

5.3 Heterogeneity Test

$$\begin{aligned} \mathrm{Inv}_{i,\,t} = {} & \mathrm{l}_0 + \mathrm{l}_1 \mathrm{SOE}_{i,\,t} \times \mathrm{treat}_{i,\,t} \times \mathrm{period}_{i,\,t} \\ & + \mathrm{l}_2 \mathrm{treat}_{i,\,t} + \mathrm{l}_3 \mathrm{period}_{i,\,t} + \mathrm{l}_4 \mathrm{Controls} \\ & + \mu_i + £_t + \theta_{i,\,t} \end{aligned} \tag{4}$$

$$\begin{aligned} \mathrm{Inv}_{i,\,t} = {} & \mathrm{l}_0 + \mathrm{l}_1 \mathrm{Type}_{i,\,t} \times \mathrm{treat}_{i,\,t} \times \mathrm{period}_{i,\,t} \\ & + \mathrm{l}_2 \mathrm{treat}_{i,\,t} + \mathrm{l}_3 \mathrm{period}_{i,\,t} + \mathrm{l}_4 \mathrm{Controls} \\ & + \mu_i + £_t + \theta_{i,\,t} \end{aligned} \tag{5}$$

In Table 2, columns (1) and (2) represent state-owned enterprises and non-state-owned enterprises. The coefficient l1 of state-owned enterprises is significantly negative, while that of non-state-owned enterprises is positive, indicating that the implementation of green credit policy can effectively improve the investment efficiency of state-owned enterprises compared with non-state-owned enterprises. Columns (3) and (4) represent small and medium-sized enterprises and large enterprises. It is found that the coefficient l1 of small and medium-sized enterprises is significantly negative, while the coefficient of large enterprises is positive, indicating that the implementation of green credit policy is conducive to improving the investment efficiency of small and medium-sized enterprises.

Table 2. Empirical analysis

Model	(1)	(2)	(3)	(4)
	SOE	Non-SOE	SME	LE
Variable	Inv	Inv	Inv	Inv
period_treat_SOE	-0.0033*** (-3.77)	0.0016** (1.97)		
period_treat_Type			-0.0030*** (-3.10)	0.0010 (1.06)
period	-0.0068*** (-5.05)	-0.0077*** (-5.71)	-0.0072*** (-5.37)	-0.0076*** (-5.56)
treat	-0.0004 (-0.00)	0.00001 (0.00)	0.0019 (0.00)	0.0001 (0.00)
Controls	Yes	Yes	Yes	Yes
Annual fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
N Adj R-squared	21161 0.0838	21161 0.0833	21161 0.0839	21161 0.0835

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

6 Robustness Test

6.1 Placebo Test

Through parallel trend test, it is found that the investment efficiency gap between the treatment group and the control group gradually Narrows before and after the promulgation of the policy, and the investment efficiency of the treatment group increases faster, which indicates that green credit policy can significantly improve the investment efficiency of heavily polluting enterprises.

6.2 Placebo Test

In this paper, the counterfactual method was adopted for the test of placebo, and the sample interval was set between 2009 and 2012. By observing columns (1) and (2) in Table 3, it can be seen that the coefficient of did was not significant, indicating that the change in enterprise investment efficiency was caused by the green credit policy. The placebo test passed and the original conclusion was reliable.

Table 3. Robustness tests

Model	(1)	(2)	(3)	(4)
Variable	Inv	Inv	Inv	Inv
did	0.0003 (0.18)	0.0003 (0.14)	-0.0028** (-2.07)	-0.0024* (-1.78)
treat	0.0003 (0.23)	-0.0101 (-0.82)	0.0014 (1.16)	0.0090 (1.40)
Period	-0.0015 (-1.23)	-0.0033** (-2.12)	-0.0048*** (-5.39)	-0.0080*** (-4.77)
Controls	Yes	Yes	Yes	Yes
Annual fixed effects	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes
N Adj R-squared	4606 0.0852	4606 0.1110	16073 0.0450	16073 0.0668

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

6.3 PSM-DID Test

This paper conducts PSM-DID test to further analyze how green credit policies affect investment efficiency. As can be seen from the results of columns (3) and (4) in Table 3, coefficient l1 is significantly negative, which is consistent with the conclusion above, which verifies that green credit policy can improve enterprise investment efficiency, and the conclusion is reliable.

7 Conclusion and Implications

The conclusions are as follows: First, green credit policy can improve the investment efficiency of heavy polluting enterprises. Second, compared with non-polluting state-owned enterprises, green credit policies can improve the investment efficiency of heavily polluting state-owned enterprises. Compared with large heavy polluting enterprises, green credit policies can significantly improve the investment efficiency of small and medium-sized heavy polluting enterprises. The implications are as follows: First, the implementation of green credit policy has realized the coordinated development of economic development and environmental protection. Second, green credit policies are conducive to industrial optimization and upgrading, but should be flexibly adjusted for enterprises at different levels of development. Third, the banking and insurance regulatory bodies should carry out detailed, classified supervision and differentiated treatment of policies to “force” enterprises to improve their own investment efficiency.

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