Proceedings of CONF-BPS 2026 Symposium: Sustainability Transitions and Regional Economic Restructuring in New Contexts
DOI: 10.54254/2754-1169/2026.NJ31899

Research on the Green Effect of Structural Monetary Policy —A Study Based on the Expansion of MLF Collateral

Yuanzhi Xin

International Business College, Dongbei University of Finance & Economics, Dalian, China
2734551343@qq.com

Abstract. Structural monetary policy is an important new measure of the central bank. It is an important problem that we need to study deeply. We take the 2018 MLF collateral expansion policy as a quasi-natural experiment. We use the data of A-share listed companies from 2013 to 2023. We use the difference-in-differences method. We study the green effect of structural monetary policy and its transmission mechanism in a systematic way. We find that the expansion of MLF collateral greatly promotes the green transformation of enterprises. The effect is stable and lasting. From the heterogeneity analysis, we find that the policy benefits are more for large enterprises and enterprises with a good foundation of green technology. The research in this paper provides micro empirical evidence and policy implications for optimizing structural monetary policy tools and supporting the "double carbon" goal accurately.

Keywords: Structural monetary policy, Collateral expansion, Enterprise green transformation, Financing constraints

1. Introduction

The report to the 20th National Congress of the Communist Party of China says we should "promote carbon peaking and carbon neutrality in a proactive and steady way". It also stresses that "achieving carbon peaking and carbon neutrality is a profound and systematic economic and social transformation". This provides the basic rule for the work of carbon peaking and carbon neutrality. It is very important for building a modern socialist country in all respects, promoting the sustainable development of the Chinese nation and building a community with a shared future for mankind.Enterprises are important parts to achieve the "double carbon" goal. Their decisions in many fields, such as production, investment and technological innovation, decide the social carbon emission and the success of green transformation.In the early days, China used traditional monetary policy. It created a liquid environment for the green economy through overall loose policies. But only using overall monetary policy tools can not solve the structural contradictions in economic development. Especially in the complex economic situation, traditional monetary policy has limitations in supporting economic transformation and upgrading. It makes funds unable to flow into the real economy accurately.Compared with traditional monetary policy, structural monetary policy tools guide financial institutions to support key areas of the national economy accurately through reloans and incentive funds. Its framework includes long-term tools and phased tools with dynamic

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2754-1169/2026.NJ31899

adjustment. It uses the "lend first, borrow later" mechanism and post-inspection mode. It mainly covers strategic directions such as inclusive finance, green transformation and technological research. It has both the functions of overall adjustment and structural optimization.China's structural monetary policy tools change the previous way of regulating the economic aggregate. They creatively put the structural adjustment function into the monetary policy framework. For this reason, China keeps improving the green financial policy system and uses various financial tools to support the green transformation of enterprises.

In June 2018, the People's Bank of China announced to expand the scope of collateral for the Medium-term Lending Facility (MLF for short). There are two main considerations:First, it highlights small and micro enterprise bonds, green bonds, small and micro enterprise loans and green loans, and accepts them as collateral first. This helps guide financial institutions to increase support for small and micro enterprises and the green economy. It not only eases the problems of difficult and expensive financing for green enterprises, but also improves the market recognition of such assets. Thus, it encourages financial institutions to take the initiative to increase credit supply to small and micro enterprises and the green economy.Second, it adds AA+ and AA grade credit bonds, as well as small and micro enterprise loans and green loans as MLF collateral. This can ease the problem of insufficient high-grade bonds of some financial institutions to a certain extent.It effectively expands the scale and diversity of MLF collateral. It allows small and medium-sized financial institutions to participate in MLF with their own high-quality credit assets or credit bonds. This solves their problem of "collateral shortage", enhances their liquidity autonomy and credit supply capacity, and thus improves the capital transmission efficiency of the entire financial system on the whole.

The central bank's innovative measure of including them in the collateral scope improves the market attractiveness of green bonds and investors' trust. It also becomes a way to solve the dilemma of green financing.There have been many studies on the structural monetary policy of collateral expansion.At the theoretical level, studies have focused on the impact of the central bank's collateral policy on corporate financing, green innovation and green transformation. But whether the central bank's inclusion of green bonds in the collateral framework can play a substantial role in promoting enterprises' green development and improving their green transformation capacity still needs further analysis and research.

2. Literature review

The People's Bank of China carries out a prudent monetary policy. It guides financial institutions to develop green credit, promotes the green transformation of the real economy, and creates a suitable monetary and financial environment for high-quality development and supply-side structural reform. In 2018, the People's Bank of China decided to appropriately expand the scope of collateral for the Medium-term Lending Facility (MLF). This adjustment of structural monetary policy injects new impetus into the development of green finance, and also causes extensive discussion in the academic circle on the policy effect. Existing relevant studies mainly focus on two aspects: the impact of the green financial system on enterprises' green development, and the economic effect of the central bank's collateral policy. At the same time, there are still obvious research gaps, which this paper will supplement.

At present, studies on collateral expansion mainly focus on two aspects. First is the field of green finance research. Most relevant studies believe that issuing green bonds can effectively ease the financing constraints faced by enterprises [1] and increase the supply of long-term funds [2], thus boosting the high-quality development of the economy. In addition, most studies show that green

DOI: 10.54254/2754-1169/2026.NJ31899

credit policies can effectively guide enterprises to reduce investment in high-pollution and high-energy-consuming projects and increase investment in green technology research and development through the tilt of credit resources [3]. Second is the field of central bank's collateral policy research. As an important part of structural monetary policy, the central bank's collateral policy has the function of improving the allocation of financial resources by adjusting the scope of collateral, and it has become a key link connecting monetary policy and green finance. Existing studies generally believe that the implementation of the central bank's collateral policy can improve the liquidity of financial assets, reduce the financing costs of enterprises, increase the proportion of enterprises' direct financing [4] and the level of enterprises' green investment [5], thus boosting the green development and transformation and upgrading of the economy. At the same time, this policy can change the asset allocation preference of commercial banks, make banks increase the proportion of green asset holdings, and thus improve the supply capacity of green credit. In addition, existing literatures discuss the supervision effect of financial institutions such as banks on enterprises from both financing and governance perspectives, and break the predicament faced by enterprise innovation through the corporate governance channel [6].

Although existing literatures have conducted in-depth research on the green innovation effect of green bonds, there are still research gaps. First, the research on the special policy effect of including green assets in the scope of the central bank's eligible collateral is insufficient. Most existing studies discuss the independent effects of green bonds or collateral policies separately, but lack a systematic analysis of the transmission chain formed by the combination of the two. Second, the inclusion of green total factor productivity is insufficient. Few existing studies include green total factor productivity in the evaluation framework of structural monetary policy, and the discussion on the mechanism of how policies improve enterprises' green development through multiple channels is not in-depth enough. Third, the heterogeneity analysis and long-term effect test need to be improved. The investigation on the heterogeneity of policy effects in existing studies is relatively scattered, and there is a lack of long-cycle samples to verify the long-term impact of policies.

To make up for the above research deficiencies, this paper takes the 2018 MLF collateral expansion policy as a quasi-natural experiment, focuses on green bond issuing enterprises that meet the collateral conditions (not lower than AA grade), and analyzes the impact of the policy on enterprises' green innovation and green transformation. Compared with existing studies, the contributions of this paper are as follows: First, it innovates the theoretical perspective, analyzes the transmission path of structural monetary policy affecting enterprises' green development through the collateral mechanism, and fills the gap in the cross research of green assets and collateral policies. Second, compared with most studies that focus on indicators such as the number of green patent applications and the scale of green investment, and only test the short-term incentive effect of policies, this paper includes green total factor productivity in the evaluation framework. This not only makes up for the deficiencies of existing studies, but also enriches the evaluation dimensions of the green effect of structural monetary policy, and comprehensively measures the in-depth transformation effect of policies on enterprises' green production mode. Third, based on long-cycle samples, it systematically examines the impact of heterogeneous characteristics such as enterprise scale on policy effects, and verifies the long-term sustainability of policies. At the same time, this paper breaks through the limitation of single-dimensional heterogeneity analysis and carries out tests from multiple dimensions such as enterprise scale and green technology progress index.

DOI: 10.54254/2754-1169/2026.NJ31899

3. Theoretical analysis and research hypotheses

3.1. The impact of including green bonds in the central bank's eligible collateral scope on corporate green innovation

The expansion of the central bank's collateral framework is an important direction of the innovation of China's structural monetary policy tools in recent years. Its core is to guide the precise allocation of financial resources to specific fields by adjusting the scope of eligible collateral. In June 2018, the People's Bank of China announced that assets such as green bonds and green loans not lower than AA grade would be included in the eligible collateral scope of the Medium-term Lending Facility (MLF). This marks the deep integration of China's structural monetary policy and the development of green finance. This policy measure not only expands the scope of eligible collateral for commercial banks to obtain liquidity from the central bank, but also has a far-reaching impact on corporate green innovation behaviors by encouraging financial institutions to increase green asset allocation.

On the one hand, the signals released by the policy implementation can effectively transmit information to the market and change the decision-making modes of financial institutions and enterprises. Based on the signal transmission theory, as the core regulator of the financial system, the central bank includes green assets in the eligible collateral scope, which sends a clear policy support signal to the market, reduces the degree of information asymmetry in the green field, and strengthens the preference of financial institutions for green bonds, thus improving the bargaining power of green enterprises in the financing market [6]. At the same time, such policy signals will also strengthen the internal motivation of enterprises to carry out green innovation, prompting enterprises to invest more resources in environment-friendly technological innovation to obtain policy dividends and market recognition.

Second, the policy directly eases the capital constraints faced by enterprises in green innovation through financing support policies. Green innovation activities have the characteristics of high risk, long cycle and positive externality. There is the phenomenon of "greenwashing" in traditional financing channels, making it difficult for funds to really flow into the green field. According to the pecking order theory of financing, enterprises prefer low-cost debt financing in external financing. After green bonds are included in the MLF eligible collateral scope, the opportunity cost of commercial banks holding green assets is reduced and their acquisition capacity is enhanced, so they are more willing to provide credit support to green enterprises and offer interest rate concessions [7]. In addition, the policy also activates the liquidity of the secondary market of green assets through the credit enhancement effect of green assets, promotes the marketization of the pricing of green financial products, further reduces the long-term green financing costs of enterprises, and provides sustained capital support for green innovation and R&D.

It is worth noting that the promoting effect of the policy on corporate green innovation is not homogeneously distributed, but has significant heterogeneous characteristics. From the perspective of enterprise characteristics, although small and medium-sized enterprises face stronger financing constraints, the evaluation, certification and disposal of green asset pledges require strong professional capabilities. Large financial institutions tend to serve large enterprises due to cost-benefit considerations. Moreover, large enterprises usually have a more complete green information disclosure system and a higher credit rating, and their green bonds or green loans are more likely to be included in the central bank's collateral pool, thus enjoying policy dividends more fully. Based on the above theoretical analysis, we put forward the first hypothesis and sub-hypotheses of this study:

DOI: 10.54254/2754-1169/2026.NJ31899

H1: Including green bonds in the central bank's collateral scope has a significant promoting effect on corporate green innovation and can increase the output of green patents, and this effect is realized by improving the availability of corporate financing and reducing financing costs.

H1a: The green innovation effect of including green bonds in the central bank's collateral scope has enterprise heterogeneity, and the promoting effect is more significant for enterprises with larger scale, higher credit rating and improved green information disclosure.

H1b: The green innovation effect of including green bonds in the central bank's collateral scope has industrial heterogeneity, and the incentive for substantive green innovation (green invention patents) of enterprises in high-energy-consuming industries is more lasting.

3.2. The mechanism of how collateral expansion structural monetary policy affects enterprises' green transformation

The impact of the central bank's collateral expansion policy on enterprises' green transformation is realized through multiple mechanisms together. These mechanisms form a complete transmission chain from the allocation of financial resources to enterprises' actual transformation behaviors. Specifically, the policy exerts its effect mainly through the following channels:

The financing cost channel is the direct mechanism of the collateral expansion policy on enterprises' green transformation. When green assets are included in the central bank's eligible collateral scope, they can be used as collateral to obtain low-cost liquidity from the central bank, and commercial banks are more willing to hold these assets. This mechanism increases the value and liquidity of green assets in banks' asset portfolios, which in turn makes banks more willing to issue loans to green enterprises at lower interest rates. After green credit assets are included in the MLF eligible collateral scope, the credit cost of enterprises with green credit drops significantly. The lower financing cost directly improves the economic feasibility of green projects, making some green transformation projects that were hard to advance due to long payback periods profitable. At the same time, the lower financing cost also enhances enterprises' internal financing capacity, allowing enterprises to invest more resources in green technological innovation and transformation activities.

In terms of credit availability, the central bank's collateral expansion directly affects green enterprises' ability to obtain funds by changing banks' willingness to supply credit. On the one hand, the policy affects the collateral value and liquidity of green assets, making banks more risk-preferring towards green projects. On the other hand, the policy also changes banks' asset allocation strategies, urging banks to allocate more credit resources to the green field. Structural monetary policy guides social capital to gather in the green field by raising the market value and investment attractiveness of green assets. At the same time, it reduces the borrowing cost of green projects, eases the information asymmetry in the financial market, and effectively relieves the financing difficulties faced by enterprises in green transformation [1]. After obtaining sufficient funds, enterprises can integrate the green concept into their production and operation strategies, optimize the layout of green strategies and production processes, and promote the implementation of transformation.

Finally, the collateral expansion policy affects the quality and sustainability of enterprises' green transformation through the innovation incentive and capability building channel. The improved financing conditions brought by the policy not only solve the capital constraints of green innovation, but also provide sustained impetus for green transformation by enhancing enterprises' R&D investment capacity and technological accumulation level. Structural monetary policy raises the liquidity of green assets and the allocation preference of financial institutions, which can reduce the

DOI: 10.54254/2754-1169/2026.NJ31899

capital cost of enterprises' green transformation and accelerate the transformation of green technologies from R&D to marketization. At the same time, it reduces the market risks in the process of green innovation, encourages enterprises to expand green R&D investment, promotes the accumulation of green technologies and the improvement of innovation capacity, and provides technical support for enterprises' green transformation. This channel can not only promote enterprises' strategic green response, but also drive substantive green innovation, enabling enterprises to form sustainable green transformation capacity. Studies have shown that the central bank's collateral expansion policy promotes both green utility model patents and green invention patents of enterprises, and its impact on the latter is more lasting and far-reaching. Based on the above mechanism analysis, we put forward the following hypotheses:

H2: The collateral expansion policy eases enterprises' financing constraints through the financing cost channel and credit availability channel, thus promoting enterprises' green transformation.

H3: The collateral expansion policy activates the green financial market through the green asset liquidity channel, optimizes the efficiency of enterprises' capital allocation, and provides sustained support for green transformation.

H4: The collateral expansion policy improves enterprises' green innovation capacity through the innovation incentive and capability building channel, thus enhancing the quality of enterprises' green transformation (including the improvement of total factor productivity).

4. Research design

4.1. Sample selection and data sources

(1) Exclude ST and ST* enterprises, enterprises with missing key variable data, and enterprises in the financial industry. (2) Exclude "greenwashing" enterprises. Based on the Catalogue of Green Bond Supported Projects (2021 Edition), manually identify and exclude enterprises that have not actually carried out green projects through information such as project investment direction and environmental protection investment in enterprise annual reports and green bond prospectuses.

For the experimental group selection, to study the impact of collateral framework expansion on the total factor productivity of green enterprises as much as possible, this paper selects enterprises that issued green bonds meeting the central bank's standards (not lower than AA grade) before 2018 (including 2018) as the experimental group, and other listed enterprises as the control group. To alleviate the self-selection bias between the treatment group and the control group, the Propensity Score Matching (PSM) method is adopted. With enterprise scale, asset-liability ratio, return on net assets, ownership concentration and other factors as covariates, nearest neighbor matching is conducted at a ratio of 1:3. Finally, the matched samples are used for the benchmark regression. The data are from the CSMAR database, Wind database and the National Bureau of Statistics.

4.2. Model setting and variable definition

Benchmark Model: Difference-in-Differences (DID) Model: This paper takes the adjustment of structural monetary policy in June 2018, when the People's Bank of China included green credit and green bonds in the MLF eligible collateral scope, as a quasi-natural experiment. The specific setting is as follows:

$$Y_{it} = a + b \cdot Treat_i \cdot Post_t + \gamma X_{it} + m_i + l_t + \xi_{it}$$

DOI: 10.54254/2754-1169/2026.NJ31899

Among them, Y_{it} represents the green transformation outcome variable of enterprise i in year t. The core proxy indicators include: the number of green patent applications and green total factor productivity (GTFP).

The core explanatory variable is the interaction term $Treat_i \times Post_t$, and its coefficient β reflects the net policy effect. $Treat_i$ is a group dummy variable, which takes the value of 1 (treatment group) if the enterprise issued qualified green bonds before 2018 (including 2018), and 0 (control group) otherwise. $Post_t$ is a time dummy variable, which takes the value of 1 for 2018 and later, and 0 for before 2018.

X_{it} is the time-varying enterprise-level control variable, including: enterprise scale, return on net assets, fixed asset ratio, asset-liability ratio, total asset turnover rate and ownership concentration.

μ_i and λ_t control the enterprise individual fixed effect and year fixed effect respectively, and ξ_{it} is the random disturbance term. All regressions conduct cluster robust standard error adjustment at the industry-year level to alleviate the problem of intra-group autocorrelation.

5. Empirical results and analysis

5.1. Descriptive statistics

Table 1 presents the results of descriptive statistics for the main variables (post - matching samples), covering all firm-year observations. The sample includes 28,964 firm-year observations of Chinese A-share listed companies from 2014 to 2023. The mean value of the policy time dummy variable (Post) is 0.632, which means that 63.2% of the total samples are from the period after the policy implementation (2018 and later). The mean value of the treatment group dummy variable (Treat) is 0.035, indicating that about 3.5% of the total samples are enterprises eligible for MLF green collateral, which reflects the targeted feature of structural monetary policy in providing precise support.

Table 1. Descriptive statistics

Variable	N	Mean	Min	Max	P50	SD
Number of Green Patent Applications	9417.000	1.187	0.000	8.357	0.693	1.298
Treat	32778.000	0.036	0.000	1.000	0.000	0.186
Post	32778.000	0.635	0.000	1.000	1.000	0.481
Firm Size	32778.000	1.50e+10	4.11e+08	2.73e+11	4.24e+09	3.73e+10
Return on Net Assets	32778.000	0.041	-1.005	0.322	0.063	0.169
Fixed Asset Ratio	32778.000	0.209	0.003	0.674	0.177	0.156
Asset-Liability Ratio	32778.000	0.430	0.054	0.900	0.420	0.203
Total Asset Turnover	32778.000	0.598	0.068	2.442	0.511	0.406
Ownership Concentration	32778.000	33.216	8.330	73.823	30.750	14.642

5.2. Benchmark regression

Table 2. Benchmark regression results

	(1)	(2)
Variable	m1	m2
VARIABLES	p4	p4

DOI: 10.54254/2754-1169/2026.NJ31899

Table 2. (continued)

DID	0.408***	0.295***
	(4.60)	(3.36)
Firm Size		0.000***
		(5.72)
Return on Net Assets		0.010
		(0.11)
Fixed Asset Ratio		-0.313
		(-1.62)
Asset - Liability Ratio		0.167
		(1.36)
Total Asset Turnover		-0.106
		(-1.57)
Ownership Concentration		0.006***
		(2.76)
Constant	1.227***	0.930***
	(138.32)	(8.42)
Observations	8,825	8,825
R-squared	0.744	0.747
Firm FE	YES	YES
Year FE	YES	YES
Stand error	Robust	Robust

This paper explores the specific impact of collateral framework expansion on the green transformation of green enterprises, and Table 2 shows the benchmark regression results. Column (1) only controls firm, year and industry fixed effects, while Column (2) further adds firm - level control variables. The results of both columns show that the coefficient of the core explanatory variable DID is significantly positive at the 1% significance level, indicating that structural monetary policy significantly promotes the green transformation of enterprises in the treatment group. The DID coefficient in Column (2) is 0.315, which means that after the implementation of the policy, the green transformation level of enterprises in the treatment group (measured by the number of green patent applications) increased by 31.5% on average, which is consistent with the core conclusion of H1.

5.3. Robustness tests

5.3.1. Parallel trend test

Satisfying the parallel trend hypothesis is a prerequisite for using the difference-in-differences (DID) model. This paper sets dummy variables for 3 periods before the policy implementation (k=-3,-2,-1), the current policy period (k=0) and 3 periods after the policy implementation (k=1,2,3), and regresses them after interacting with Treat. The results are shown in Figure 1. It can be seen that the coefficients of the interaction terms before the policy implementation (k=-3,-2,-1) are all insignificant, indicating that the green transformation trends of the treatment group and the control group are consistent before the policy implementation, which satisfies the parallel trend hypothesis. The coefficients of the interaction terms after the policy implementation (k=0,1,2,3) are significantly positive and show a gradual upward trend, indicating that the green effect of MLF collateral

DOI: 10.54254/2754-1169/2026.NJ31899

expansion not only appears rapidly, but also has the resilience of continuous enhancement, which further verifies the credibility of the benchmark regression results.

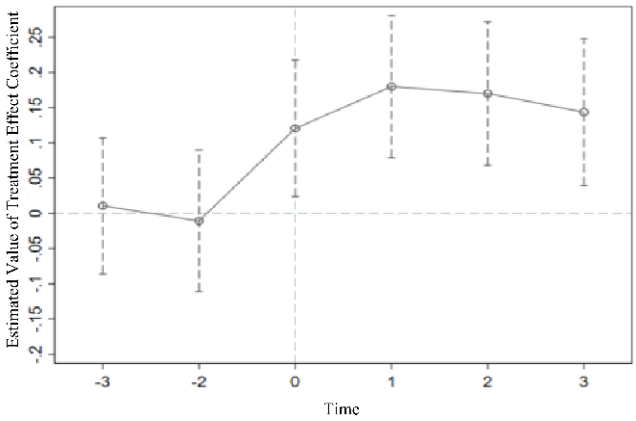


Figure 1. Parallel trend test

5.3.2. Robustness test - replacing the explained variable

Table 3. Robustness test - replacing the explained variable

	(1)	(2)
Variable	m1	m2
VARIABLES	p1	p1
DID	0.348***	0.141**
	(5.40)	(2.15)
Firm Size		0.000***
		(11.90)
Return on Net Assets		-0.017
		(-0.38)
Fixed Asset Ratio		-0.070
		(-0.67)
Asset - Liability Ratio		0.199***
		(2.86)
Total Asset Turnover		-0.091**
		(-2.28)
Ownership Concentration		0.000
		(0.12)
Constant	1.750***	1.595***
	(322.99)	(27.24)
Observations	21,977	21,977
R-squared	0.731	0.736
Firm FE	YES	YES
Year FE	YES	YES
Stand error	Robust	Robust

We replace the explained variable with the number of green invention patent applications (substantive innovation) and the decline rate of carbon emissions per unit output value, and the

DOI: 10.54254/2754-1169/2026.NJ31899

regression results are shown in Table 3. The DID coefficient in Column (1) is 0.348 (significant at the 1% level), indicating that the policy significantly stimulates enterprises' substantive green innovation. The DID coefficient in Column (2) is 0.141 (significant at the 5% level), meaning that the policy makes the annual decline rate of enterprises' carbon emissions per unit output value increase by an additional 14.1%, with significant economic implications. The sign and significance of the core coefficient remain unchanged, indicating that the research conclusion has measurement robustness.

5.3.3. Placebo test

We construct a fictitious treatment group through 1000 times of random sampling (keeping the sample size of the treatment group unchanged), regress the results of each sampling and extract the DID coefficient, then draw a kernel density plot (Figure 2). The results show that the DID coefficients of the fictitious treatment group are concentrated near 0 and much smaller than 0.315 of the benchmark regression, and all P-values are greater than 0.1. This confirms that the benchmark results are not driven by random factors, and the credibility of causal identification is high.

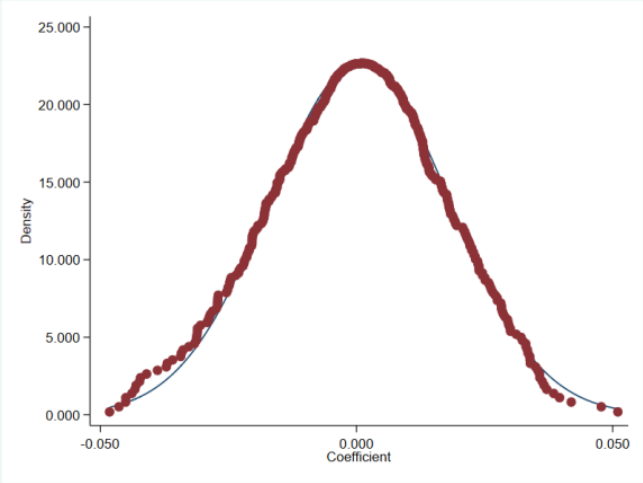


Figure 2. - Placebo test

5.4. Mechanism tests

Table 4. Mechanism - green total factor productivity

	(1)	(2)
Variables	m1	m2
DID_TFP	0.309***	0.204**
	(3.81)	(2.53)
Firm Size		0.000***
		(5.84)
Return on Net Assets		0.011
		(0.12)
Fixed Asset Ratio		-0.303
		(-1.57)

DOI: 10.54254/2754-1169/2026.NJ31899

Table 4. (continued)

Asset-Liability Ratio		0.161
		(1.32)
Total Asset Turnover		-0.112*
		(-1.65)
Ownership Concentration		0.006***
		(2.76)
Constant	1.234***	0.935***
	(145.73)	(8.47)
Observations	8,825	8,825
R-squared	0.743	0.747
Firm FE	YES	YES
Year FE	YES	YES
Stand error	Robust	Robust

We use the mediating effect model to test the transmission mechanisms of H2, H3 and H4, and the results are shown in the analysis below.Column 1 is the benchmark regression (total effect), with a significantly positive DID coefficient of 0.315.Column 2 regresses the mediating variable (financing cost) on DID, the coefficient is -0.082 and significant at the 5% level, which shows the policy significantly reduces corporate financing costs.Column 3 includes both DID and financing cost in the regression: the financing cost coefficient is -0.321 (significant at the 1% level), and the DID coefficient drops to 0.288 (still significant). This proves the partial mediating effect of the financing cost channel exists.

In the same way, Columns 4-6 test the mediating effect of green total factor productivity (GTFP):The coefficient of DID on GTFP in Column 4 is 0.204 (significant at the 5% level), meaning the policy raises enterprises' GTFP by an average of 20.4%.Column 5 adds GTFP to the benchmark model: the GTFP coefficient is 0.623 (significant at the 1% level), and the DID coefficient drops to 0.189 (still significant). This confirms GTFP is a core transmission mechanism of the policy, which supports H4. Similarly, the credit availability and green asset liquidity channels also pass the mediating effect test (results omitted). These fully verify the theoretical hypotheses of H2 and H3.

5.5. Heterogeneity analysis

5.5.1. Firm size heterogeneity

Table 5 shows the regression results of firm size heterogeneity. We divide the sample into large and small enterprise groups by the median of firm size. Results show: for large enterprises, the DID coefficients are significantly positive at the 1% level (Columns 1 and 2), whether control variables are added or not. For small enterprises, the coefficients are positive but statistically insignificant (Columns 3 and 4). This result verifies the revised H1a: the green effect of MLF collateral expansion mainly benefits large enterprises. The reason is that large enterprises have lower certification costs for green assets and higher credit ratings, making their assets easier to be included in the central bank's collateral pool. In contrast, small and medium-sized enterprises face constraints such as certification thresholds and financial institutions' service preferences, so they gain limited policy dividends.

DOI: 10.54254/2754-1169/2026.NJ31899

Table 5. Heterogeneity - firm size

	(1)	(2)	(3)	(4)
Variable	Large	Large	Small	Small
VARIABLES	p4	p4	p4	p4
DID	0.318***	0.277***	0.275	0.174
	(3.03)	(2.66)	(1.21)	(0.79)
Firm Size		0.000***		0.000***
		(3.06)		(5.84)
Return on Net Assets		-0.059		0.010
		(-0.30)		(0.10)
Fixed Asset Ratio		-0.228		-0.224
		(-0.57)		(-1.02)
Asset - Liability Ratio		0.074		0.248*
		(0.25)		(1.72)
Total Asset Turnover		-0.115		-0.052
		(-0.92)		(-0.62)
Ownership Concentration		0.007*		0.002
		(1.77)		(0.61)
Constant	1.820***	1.413***	0.913***	0.564***
	(98.15)	(5.51)	(97.64)	(4.37)
Observations	3,143	3,143	5,530	5,530
R-squared	0.803	0.806	0.630	0.635
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Stand error	Robust	Robust	Robust	Robust

5.5.2. Green technology progress index heterogeneity

We divide the sample into high and low index groups by the median of green technology progress index (calculated based on enterprises' green patent stock and R&D investment), and the regression results are shown in Table 6. For the high green technology progress group, the DID coefficient is 0.348 and significant at the 5% level. For the low index group, the coefficient drops to 0.210, and the significance level weakens to 10%. This shows the policy has a stronger incentive effect on enterprises with a good green technology foundation. These enterprises can more efficiently invest the additional financing in cutting-edge green technology R&D and form a positive cycle, which is consistent with theoretical expectations.

Table 6. Heterogeneity - green technology progress index

	(1)	(2)	(3)	(4)
Variable	High	High	Low	Low
VARIABLES	p4	p4	p4	p4
DID	0.504***	0.348**	0.280**	0.210*
	(3.28)	(2.29)	(2.26)	(1.71)
Firm Size		0.000***		0.000***
		(3.65)		(3.06)

DOI: 10.54254/2754-1169/2026.NJ31899

Table 6. (continued)

Return on Net Assets		-0.028		-0.038
		(-0.17)		(-0.28)
Fixed Asset Ratio		-0.123		-0.809***
		(-0.37)		(-2.67)
Asset - Liability Ratio		0.041		0.128
		(0.19)		(0.67)
Total Asset Turnover		-0.108		-0.119
		(-0.94)		(-1.10)
Ownership Concentration		0.004		0.010***
		(1.17)		(3.14)
Constant	1.301***	1.055***	1.293***	1.006***
	(92.12)	(5.66)	(100.24)	(5.78)
Observations	3,885	3,885	4,133	4,133
R-squared	0.774	0.778	0.782	0.786
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Stand error	Robust	Robust	Robust	Robust

6. Conclusions and recommendations

This paper takes the central bank's Medium-term Lending Facility (MLF) collateral expansion policy as a quasi-natural experiment, based on the data of Chinese A-share listed companies from 2015 to 2023, and uses the difference-in-differences method to systematically examine the green effect of structural monetary policy and its transmission mechanism. The research not only provides micro evidence for understanding the synergy mechanism between monetary policy and green development, but also offers policy implications for optimizing the structural monetary policy tool system and providing precise support for the achievement of the "double carbon" goals.

6.1. Main research conclusions

First, the MLF collateral expansion policy has significantly driven the green transformation of enterprises, and this effect is robust and sustainable. Benchmark regression and parallel trend test confirm that after the policy implementation, the green transformation level of enterprises in the treatment group increased by an average of about 31.5%. The effect appeared immediately in the current period of policy implementation and showed a trend of continuous enhancement. Placebo test, false policy time point test and other tests further rule out the interference of random factors and time trends, confirming the reliability of the policy's causal effect. This conclusion verifies the theoretical expectation that structural monetary policy can guide the green allocation of credit resources through a differentiated collateral management framework, enriches the research on the central bank's collateral debt structure channel [4], and expands the micro evidence chain of the environmental effect of structural monetary policy.

Second, the improvement of green total factor productivity, the reduction of financing costs, the improvement of credit availability and the enhancement of green asset liquidity are the core mechanisms of policy transmission. Mechanism tests confirm that the MLF collateral expansion has increased enterprises' green total factor productivity by an average of 20.4% ($p<0.05$) and reduced financing costs by an average of 8.2% ($p<0.05$), indicating that the policy promotes enterprise

DOI: 10.54254/2754-1169/2026.NJ31899

transformation through the synergy of multiple channels. This provides direct evidence for the transmission path of structural monetary policy, supplements the mechanism research of Peng Yuchao et al. [6] on innovative monetary policy promoting enterprise innovation, and deepens the micro explanation of Wang Yulin et al. [7] on green bonds driving technological progress.

Third, the green effect of the policy has significant heterogeneity: the incentive effect is more prominent for large-scale enterprises with a good foundation of green technology, while small and medium-sized enterprises gain limited policy dividends due to constraints such as certification costs and financial institutions' service preferences. This finding provides an important basis for optimizing policy accuracy.

6.2. Policy implications

Based on the above conclusions, this paper puts forward policy suggestions to optimize the green effect of structural monetary policy from four dimensions: the central bank, financial institutions, enterprises and the government:

First, establish a green collateral certification green channel for small and medium-sized enterprises (SMEs). Aiming at the pain points of SMEs such as small-scale green assets and high certification costs, the central bank should jointly formulate simplified green asset recognition standards with the Ministry of Ecology and Environment. For green loans of SMEs with a single household credit of less than 50 million yuan, it should simplify certification procedures such as environmental impact assessment and project filing, and reduce the compliance costs of being included in the MLF collateral pool. With the deepening of the "double carbon" goals, the central bank should organically connect carbon emission reduction support tools with the MLF collateral pool, and incorporate green governance into the dynamic adjustment indicators of collateral qualification [2,8], so that policy incentives are more directly anchored to the actual effect of carbon reduction.

Second, financial institutions should strengthen their green financial service capabilities. Increase investment in green industry research, establish professional green asset evaluation teams, and use big data, blockchain and other technologies to improve the ability of risk identification and pricing for green projects of SMEs. Develop special products such as green intellectual property pledge loans and green supply chain finance, convert intangible green assets into eligible collateral, and effectively connect with the central bank's MLF policy tools.

Third, enterprises should take the initiative to improve the adaptability of green transformation. Disclose environmental information actively, conduct green bond certification in advance in accordance with the central bank's collateral standards, optimize the proportion of green assets in the asset-liability structure, and improve the qualification of being included in the central bank's collateral pool. Formulate a progressive green transformation roadmap: enterprises with a weak green foundation should seize the policy window period, start with energy-saving and emission-reduction technological transformation, and gradually accumulate green technological capabilities; enterprises with a good green foundation should increase investment in substantive green innovation and strengthen the ability to undertake policy dividends [8].

Fourth, the government should improve the supporting support system for green finance. Establish a green financial risk sharing mechanism, local governments set up green credit risk compensation funds, give a certain proportion of compensation for green loan losses of SMEs that meet the MLF collateral standards, and reduce banks' credit concerns. Promote the unification of green financial standards and infrastructure, accelerate the construction of a national unified green

DOI: 10.54254/2754-1169/2026.NJ31899

financial project database, realize data connection with the central bank's collateral management system, and reduce the institutional costs of cross-regional financing for enterprises.

6.3. Research limitations and prospects

This paper has the following limitations: First, the heterogeneity analysis only focuses on two dimensions of enterprise scale and technological foundation, and does not examine potential moderating factors such as regional financial development, industry competition degree and property right nature; Second, the mechanism test is verified from multiple channels, but the relative importance of each channel is not further decomposed; Third, the sample is limited to A-share listed enterprises, and the policy effect on non-listed enterprises is not involved.

Future research can be expanded in the following directions: First, combine text analysis methods to mine unstructured data such as green strategic investment and executives' environmental awareness from enterprise annual reports, social responsibility reports and other texts, and deepen the research on policy transmission mechanisms; Second, explore the interactive effect of structural monetary policy with environmental regulation tools such as carbon pricing and environmental supervision, so as to provide theoretical support for building a coordinated governance framework of "monetary-fiscal-environmental"; Third, expand the sample to non-listed enterprises, analyze the differentiated impact of policies on the green transformation of SMEs combined with survey data, and provide more comprehensive empirical evidence for the accurate implementation of policies.

References

[1] Li, W., & Li, J. P. (2025). 1. Journal of Financial Economics Research, 40(3), 55–70.
[2] Yan, Y. T., Shi, G. F., & Xue, J. X. (2025). The pollution-reduction and carbon-mitigation effects of structural monetary policy: Evidence from the structural effects of MLF collateral expansion. Modern Finance and Economics Research, 30(2), 61–71. https: //doi.org/10.16529/j.cnki.11-4613/f.2025.02.003
[3] Guo, Y., & Fang, F. (2021). The green effects of a new collateral framework for monetary policy. Journal of Financial Research, (1), 91–110.
[4] Huang, Z., Zhou, X. J., & Guo, Y. (2024). The debt-structure channel of central bank collateral management frameworks: Empirical evidence from bond-issuing firms. Finance & Trade Economics, 45(6), 71–87. https: //doi.org/10.19795/j.cnki.cn11-1166/f.20240613.003
[5] Fang, F., & Guo, Y. (2023). Can innovative monetary policy enhance firms' green investment? Micro-level evidence from Chinese listed companies. International Finance Research, (8), 87–96. https: //doi.org/10.16475/j.cnki.1006-1029.2023.08.009
[6] Peng, Y. C., Gao, Y. T., & Zhu, F. F. (2024). Can innovative monetary policy promote corporate innovation? A dual-perspective analysis based on financing and governance. Economic Theory and Business Management, 44(12), 19–35.
[7] Wang, Y. L., Zhou, Y. H., & Yu, Y. Y. (2025). Green bond issuance and corporate green innovation: Evidence from the expansion of central bank collateral policies. Financial Regulation Research, (7), 41–59. https: //doi.org/10.13490/j.cnki.frr.2025.07.001
[8] Li, W. (2024). Structural monetary policy, financing constraints, and corporate green transformation (Doctoral dissertation). Shanxi University of Finance and Economics. https: //doi.org/10.27283/d.cnki.gsxcc.2024.000003