Low-carbon Pilot Cities and Financialization of Listed Companies: Inhibitory Effects and Policy Analysis

Abstract

This study examined the low-carbon pilot city policy as a critical policy intervention. We explored its potential impact on the financialization of China-listed companies. The findings indicate that listed companies exhibited a significant downward trend in the proportion of financial assets held among the low-carbon pilot city projects. Policy implementation has intensified the financing constraints of enterprises, effectively curbing the degree of corporate financialization. The effect of capital returning to the actual industry under policy guidance was more prominent for companies with a high proportion of institutional investors, underscoring the positive role of policy in adjusting enterprises' capital structure while promoting the development of the real economy.

Keywords: low-carbon pilot city; corporate financialization; financing constraint

1. Introduction

The central government has emphasized sustainable development since the 18th National Congress of the Communist Party of China. This commitment was further reinforced in the report of the 20th National Congress in 2022, highlighting the need for constructing a beautiful China through carbon reduction, pollution mitigation, green expansion, and growth while prioritizing ecological conservation and pursuing intensive, green, and low-carbon development (Liu and Lv, 2023). China's evolving environmental governance concepts and strategies demonstrate a sustained focus on environmental safety and people's well-being.

The low-carbon pilot city project is significant in China's pursuit of green development (Peng and Bai, 2021). China initiated this pilot work by selecting "five provinces and eight cities" as the first batch of locations in July 2010. Subsequent batches were launched in 2012 and 2017. Following the issuance of relevant documents, each pilot city has actively collaborated with the central government, formulating locally tailored work plans encompassing business operations and resident activities. These cities strive to achieve low-carbon status with policy support (Zhang, 2023).

Low-carbon pilot project implementation in provinces and cities mobilizes stakeholders' enthusiasm and accumulates practical experience, thereby enabling classified guidance for different regions and industries. These pilots are crucial for advancing China's targets for controlling greenhouse gas emissions (Zeng et al., 2023).

The term "financialization" generally refers to growth at the macro or corporate level, achieved more through financial investment activities than production and operation activities (Feng et al., 2021). Overall, financial asset ratio growth and increasing financialization are mainly due to current structural issues regarding China's economy. Regarding the development of enterprises based on market and investment demand restrictions, industrial profits in labor and land cost increases have resulted in a large number of funds being transferred to the financial sector (Lan et al., 2021). Thus, capital allocation is severely imbalanced (Lan et al., 2023). This phenomenon exacerbates the "hollowing out" of industries, hindering domestic industrial structure transformation and sustainable economic

development.

Listed companies generally comprise enterprises with a certain amount of capital and strength. Once large-scale “deconcentration” occurs, it will deliver a heavier blow to relevant industries, and many listed companies as industry leaders (based on large volumes) will suffer. Their movements will subsequently affect the development trend of other enterprises in the same sector (Han et al., 2023). Thus, the state government should consider financialization while exploring the driving factors and effective paths. This can guide the return of finance to the real economy, which is of theoretical and practical significance for sustainable economic development.

Based on the above, this study employed the low-carbon pilot city project as the policy impact. We explored whether the low-carbon pilot city policy controls the trend of financialization of listed companies. The findings indicate that the proportion of financial assets listed companies held in the industry was suppressed under the low-carbon pilot policy. The degree of corporate financing constraints increased after the implementation of the policy, and the financialization of enterprises has been suppressed. Enterprises with a higher proportion of institutional investors’ shareholdings will exhibit a more prominent return of capital to the actual industry under the policy impact.

This paper adopted the perspective of the low-carbon pilot city policy to examine the paths that impact the degree of financialization based on past studies. The findings indicate that the entity substitution effect was not significant in this context. Furthermore, financing constraints are an essential path through which environmental regulation affects the degree of financialization. This study introduced moderating variables such as institutional investors’ shareholding ratio. We found differing impacts of policies on the degree of financialization of listed companies when the values of the moderating variables changed, enriching the understanding of corporate financialization.

2. Theoretical analysis and research hypotheses

The Industrial Revolution ushered in technological advancements and convenience for human society; however, it posed significant pressure and challenges to living environments. With the advent of energy sources, such as oil and coal, related industries flourished, resulting in considerable pollutant emissions. Consequently, humanity is now seeking a new urban model that integrates green and low-carbon concepts to balance development with environmental protection (Beladi et al., 2021). Furthermore, various countries and regions have conducted extensive explorations in this field, offering valuable insights as references for the Chinese government.

For example, the UK government laid the groundwork for low-carbon cities by introducing the concept of a “low-carbon economy” in its 2003 Energy White Paper. This white paper advocated for an economy that achieves greater output with reduced resource and energy consumption, paving the way for the “low-carbon city” concept. In 2006, the United Arab Emirates announced plans to invest 22 billion to establish a zero-emission “Masdar City” near Abu Dhabi. This project aims to transform Masdar City into a clean technology hub, eliminating non-renewable energy use while providing fresh impetus for urban development and minimizing energy consumption.

Based on the low-carbon approaches of Western countries while considering

high-quality development and China's specific national conditions, China has gradually developed three batches of pilot cities since 2010. Currently, 81 cities in 31 provinces, municipalities, and autonomous regions have been included in the pilot study project. The National Development and Reform Commission deemed this a bold innovation for China's urban construction. Under the national ecological civilization construction framework, regions should adapt to local conditions; guide low-carbon innovation and technological progress; and promote simultaneous upgrades in industries, sectors, and energy sources.

Wang et al. (2023) argue that the most significant influence on enterprises to change their investment behavior and style is to make as much profit as possible. Capital and other resources owned by each enterprise are limited. Thus, overinvestment in short-term financial assets can be accompanied by a reduction in long-term stable investment. Wang and Yang (2022) proposed the investment substitution theory; this is where investment in financial assets of real enterprises is based on speculative considerations to obtain excess profits, crowding out the original expenditure on the main business. Expenses. This phenomenon is intensifying as the business environment and models mature. Fierce competition and excessive capital make it challenging for enterprises to break through from their main business; they may only access financial market help to obtain profits (Dong et al., 2020). If the emergence of a specific policy can guide companies to refocus on their "home" industry, the capital they initially invest in financial activities will flow back to the actual industry. Based on relevant literature and the status quo of listed companies in China, this study argues that the primary motivation for Chinese enterprises to increase financial investment is "investment substitution" if a policy can change the enterprise's return on tangible investment or financial investment. Enterprise decisions will be reflected in their asset allocation. Thus, we investigated whether it tends to be "de-realized to virtual" (Zou et al., 2022).

Based on investment substitution theory, firms tend to invest in industries and markets with higher yields to maximize the total return on investment. Therefore, when an enterprise is struggling but benefits from financial investment, it will manifest as an increase in its degree of financialization. However, the enterprise's capital will flow back from the financial market to the real business if it obtains a higher primary business income through R&D and innovation relative to financial investment (Qu et al., 2023). Therefore, implementing the pilot policy of low-carbon cities can directly lead to an increase in pollution control costs. However, based on Porter's hypothesis, environmental regulation policies can strengthen listed companies' operational efficiency and performance. Thus, the low-carbon pilot city policy may facilitate firm financialization and significantly influence the degree of financialization by improving corporate performance (Cao et al., 2022). Moreover, literature examining the mediating effect of financing constraints in the path of environmental regulation on firms' asset allocation is limited (Xing et al., 2021). Gao and Gao (2023) explored the relationship between CSR, financing constraints, and firms' financialization and found that CSR can reduce financing constraints, leading firms to hold more financial assets. This study posits that while environmental regulatory policies, such as the Low Carbon Pilot City, differ regarding the specific landing programs in various locations, work programs issued by the pilot cities contain explicit provisions on the proportion, and content of carbon emissions. These regulations will inevitably cause a significant increase in the cost of corporate pollution control in the short term. Therefore, the external financing pressure

sharply increases to maintain a company's business objectives and scale of operation (Hou et al., 2023). Based on Porter's hypothesis and the effect of "innovation compensation," firms may compensate for the shortfalls through internal operations (Wu et al., 2023). However, "innovation compensation" is generated only after a certain amount of investment and research accumulation (Sangiorgi and Schopohl, 2021). China's goal of low carbon is long-term sustainability, and the pressure elicited through the low-carbon city policy on enterprises has existed for a significant period. Thus, after implementing a low-carbon city pilot, locally listed companies may maintain a significant capital demand for an extended period. The proportion of investment in the financial industry will decrease when the enterprise capital is no longer as abundant as before the policy implementation (Zhang and Zheng, 2023).

Thus, this study proposes the following hypotheses.

H1: Low-carbon pilot cities play a dampening effect on the trend of listed companies' financialization.

H2: Low-carbon pilot cities can make listed companies reduce the proportion of financial asset holdings by increasing the degree of financing constraints.

3. Study design

3.1. Sample selection

This study took low-carbon pilot cities as an external policy shock. This was used to examine the impact of environmental regulation on corporate financialization. We selected China's A-share listed companies from 2012 to 2022 as the research sample. We excluded enterprises in the financial and real estate industries, ST and *ST companies, and samples with missing data, obtaining 18,866 research samples. The data were primarily derived from the CSMAR and Wind databases.

3.2. Modeling and variable definitions

The benchmark regression constructed in this study is as follows:

$$Fin_{i,t} = \alpha_0 + \alpha_1 Police_i * Post_t + \alpha Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (1)$$

We employed two metrics to assess the degree of financialization within enterprises. First, we adopted the ratio of the aggregate amount of money funds, held-to-maturity investments, trading financial assets, investment properties, financial assets available for sale, dividends receivable, interest receivable, and the total assets of the current period as a measure, designated as Fin_S. Second, we used an enterprise balance sheet comprising financial assets concerning trading, available for sale, bought and sold, loans, advances, and held-to-maturity investments. These were standardized against the total assets at the end of the respective period. This was an additional gauge of an enterprise's financial investment, referred to as Fin_L.

Police was employed as a control group dummy variable for the experimental group. It was assigned a value of 1 if the city where the firm is located was a low-carbon pilot city and 0 otherwise. *Post* was a policy time dummy variable. It was assigned a value of 1 at the lag of the pilot's implementation year and 0 otherwise. The *Police* variable took the value of 1 if the city appearing in the pilot city or the province to which it belongs was on the list. These cities took the value of 1 based on the corresponding pilot time, taking the value for different pilot

samples. If the city or province was in the first batch of pilot provinces, the *Post* variable of the province listed in the list in 2010 and after was assigned a value of 1. Some cities and provinces appeared simultaneously in the list of two batches of pilots; the first batch of pilots was processed in this part of the sample. This study took *Police x Post* as the core variable of this model. It indicates the impact of low-carbon pilot city construction on the proportion of financial assets held by listed companies in the locations where the policy was implemented.

This study employed control variables to ensure the reliability of the findings: firm size (*Size*), leveraging ratio (*Lev*), profitability measured by return on net assets (Roa), the presence of dual-class shareholdings or "two jobs in one" (*Coposi*), the company's growth potential (*Growth*), the proportion of independent directors on the board (*Pid*), and the book-to-market ratio (*Bm*). To mitigate potential biases, we incorporated the fixed effects of the year (*Year*) and the industry (*Ind*) (Table 1).

Table 1: Variable definitions

Variable type	Variable name	Variable symbol	Definition
Dependent variable	Financialization of enterprises	*Fin_S*	Measured by the sum of money funds, held-to-maturity investments, financial assets held for trading, investment properties, available-for-sale financial assets, dividends receivable, interest receivable, and total assets for the period
		Fin_L	Financial assets held for trading, available-for-sale financial assets, financial assets purchased for sale, loans, and advances, and held-to-maturity investments are standardized using total assets at the end of the period.
Independent variable	Policy time dummy variable	*Police*	Lag in the year of policy implementation takes the value of 1, otherwise 0
	Experimental group dummy variables	*Post*	If the city where the enterprise is located belongs to the pilot city of the policy, it takes the value of 1. Otherwise, it takes the value of 0
Control variable	Enterprise size	*Size*	ln(1 + total enterprise asset size)
	Gearing	*Lev*	gearing
	Return on net assets	*Roa*	return on net assets
	Revenue growth rate	*Growth*	Revenue growth rate
	Two jobs in one	*Coposi*	When the company's general manager and chairman of the board of directors of the two positions combined 1, otherwise 0
	Percentage of independent directors	*Pid*	Percentage of independent directors out of the total number of board members
	Book-to-market ratio	*BM*	Ratio of total book assets to a market capitalization of the company

4. Empirical analysis

4.1. Descriptive statistical analysis

Table 2 presents the descriptive statistics of the critical variables. Notably, Fin_S and Fin_L ranged from 0 to 0.937 and 0.776, respectively, indicating a significant variation in the financialization levels across the sampled firms. The mean value of *Police* x *Post* was 0.475, suggesting that nearly half of the firms belonged to the pilot regions designated for low-carbon city initiatives.

Table 2: Descriptive statistical analysis

	N	Mean	Std	Min	Max
Fin_S	18866	0.165	0.179	0.000	0.937
Fin_L	18866	0.118	0.129	0.000	0.776
Police × Post	18866	0.475	0.483	0.000	1.000
Size	18866	21.665	1.307	19.878	25.226
Lev	18866	0.425	0.229	0.053	1.118
Roa	18866	0.063	0.097	−2.853	0.586
Growth	18866	0.184	0.489	−0.576	2.402
Coposi	18866	0.325	0.455	0.000	1.000
Pid	18866	0.389	0.064	0.353	0.627
BM	18866	0.008	0.136	0.001	0.883

4.2. Main test regression results

Table 3 presents an analysis of the relationship between low-carbon pilot city policies and corporate financialization. A Hausman test was conducted, yielding a significant p-value of 0.000, supporting the use of a two-way fixed-effects model for the analysis. The results indicate a significantly negative coefficient for *Police* × *Post*, thus confirming H1. This finding suggests that the implementation of low-carbon pilot city policies effectively mitigated the financialization trend among non-financial listed companies within the pilot cities.

The low-carbon pilot city policy has facilitated resource allocation optimization by steering enterprises toward low-carbon and eco-friendly transformations. Thus, enterprises are encouraged to allocate funds toward long-term beneficial low-carbon projects rather than short-term financial investments. Since transitioning to a low-carbon economy increases risk, companies must prioritize risk management. Moreover, societal expectations have shifted, prompting investors to focus more on enterprises' long-term value and sustainable development capabilities. These factors collectively contribute to the observed reduction in corporate financialization, demonstrating the positive impact of low-carbon pilot city policies on corporate behavior and resource allocation.

Table 3: Main regression results

	(1)	(2)
	Fin_S	Fin_L
Police × Post	−0.075**	−0.089***

	(−2.27)	(−3.96)
Size	0.116***	0.203***
	(9.36)	(8.75)
Lev	−0.227***	−0.303***
	(−7.29)	(−6.63)
Roa	−0.118***	−0.133***
	(−3.97)	(−4.29)
Growth	−0.207***	−0.195***
	(−2.96)	(−2.84)
Coposi	−0.035*	−0.043
	(−1.76)	(−1.35)
Pid	0.445	0.307
	(1.53)	(1.26)
BM	−0.229***	−0.306***
	(−7.73)	(−6.56)
Cons	1.075***	1.189***
	(13.39)	(11.76)
Ind	Yes	Yes
Year	Yes	Yes
N	18866	18866
Adj.R²	0.174	0.263

Note: *t* statistics are in parentheses * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$.

4.3. Intermediary effects

Financing constraints were selected as the mediating variables. Financing constraints (*SA*) were measured using the SA index to verify that the pilot policy of low-carbon cities changed companies' asset allocation by affecting their financial (Table 4). In (1), the *Police* × *Post* coefficient was significantly positive. In (2) and (3), the *Police* × *Post* and *SA* coefficients were significantly less than 0. This finding indicates that an increase in the degree of financing constraints leads company financial asset holdings to be proportionately less to some extent, reflecting the return of funds to the actual industry after becoming a low-carbon pilot city. This is partly due to increased consumption and demand for capital, resulting in companies no longer having sufficient capital to invest in the financial industry and validating the widespread speculative mentality of listed companies in China when engaging in financial activities. Low-carbon pilot cities inhibit the degree of financialization of listed companies by affecting the probability of their incurring financing constraints, which had a partial mediating effect, thus confirming H2.

Table 4: Intermediary effect

	(1)	(2)	(3)
	SA	Fin_S	Fin_L
Police × *Post*	0.076**	−0.059**	−0.063**
	(2.33)	(−2.21)	(−2.35)

SA		−0.407***	−0.396***
		(−6.69)	(−8.78)
Controls	Yes	Yes	Yes
Cons	3.238***	2.075**	1.973*
	(11.29)	(2.06)	(1.73)
Ind	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	18866	18866	18866
Adj.R²	0.373	0.205	0.198

Note: *t* statistics are in parentheses * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$

4.4. Moderating effect

The network structure embedded by institutional investors due to the pursuit of private information can improve the ability to convert information advantages into information resources and thus influence financial decisions. The findings indicate the network embeddedness of institutional investors may impact the financialization of enterprises through two channels: Column (1) strengthening the intensity of information dissemination to enhance the willingness to preserve value and Column (2) increasing the perceived ability of decision makers. Therefore, this study introduced the proportion of institutional investors' shareholding (*Invest*) as a moderating variable. Table 5 shows that the interaction term coefficient was significantly negative. This indicates that institutional investors' shareholding can reduce the tendency of listed companies in low-carbon cities to promote the degree of financialization.

Table 5: Moderating effect

	(1) Fin_S	(1) Fin_L
Police × Post	−0.057**	−0.063*
	(−2.23)	(−1.73)
Invest	−0.013***	−0.029***
	(−5.56)	(−3.79)
*Police*Post*Invest*	0.018**	0.015***
	(2.26)	(3.37)
Controls	Yes	Yes
Cons	1.372***	0.995**
	(3.37)	(2.26)
Ind	Yes	Yes
Year	Yes	Yes
N	18866	18866
Adj.R²	0.307	0.339

t statistics are in parentheses * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$

4.5. Endogeneity

This study used PSM self-matching, where the control variables were used as matching variables. We used the Logit method to estimate the sentiment score value. The untreated group was used to match the control samples in a ratio of 1:2. We also adopted the will-sum matching method to mix the samples of all years for matching; the difference in matching scores between the control group and treated after matching was reduced to a certain extent; thus, the PSM treatment was effective. Table 6 presents the results where the coefficients were still significantly reset, indicating robust regression results.

Table 6: Endogeneity test

	(1)	(2)
	Fin_S	Fin_L
Police × *Post*	−0.055***	−0.063***
	(−3.99)	(−4.07)
Controls	Yes	Yes
Cons	−0.173***	−0.086***
	(−2.89)	(−3.07)
Ind	Yes	Yes
Year	Yes	Yes
N	15742	15742
Adj.R^2	0.273	0.245

Note: *t* statistics are in parentheses * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$

5. Conclusions

This study took the low-carbon pilot city policy as a policy shock to examine whether the policy exhibited impact the financialization of listed companies. The findings indicate that the proportion of financial assets held by listed companies in the real economy was suppressed under the low-carbon pilot policy. The degree of financing constraints for enterprises increased after policy implementation, suppressing corporate financialization. Enterprises with higher institutional investor ownership ratios exhibited a more significant phenomenon of capital returning to the real industry under the influence of the policy.

Thus, we draw the following research implications based on the findings. The government should prioritize the impact on the real economy when formulating policies, ensuring they guide capital toward it and foster industrial structure optimization and upgrading. Moreover, the government should strengthen the financing environment by enhancing the financial market system, reducing financing costs for enterprises, and providing a favorable context. Furthermore, the guidance and management of institutional investors should be improved to encourage their active role in optimizing corporate capital structure and promote the healthy development of the real economy.

The study limitations include potentially overlooked variables that may influence corporate financialization. Moreover, long-term effects of the low-carbon pilot city policy on corporate behavior and the real economy need to be further explored.

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