

Green Synergy Between Financial Centers and Manufacturing Hubs: A Study Based on Capital Flows and Industrial Upgrading Pathways in Shanghai and Suzhou

Zhixin Wu

Department of Economics and Finance, Hong Kong Shue Yan University, Hong Kong, China

**Corresponding Author*

Abstract: This paper aims to explore the cross-regional coordination mechanism whereby capital flows from financial centers to manufacturing hubs to drive industrial upgrading, guided by green finance. Adopting a case study approach, the research selects Shanghai (a financial center) and Suzhou (a manufacturing hub) as a paired case, focusing on the period from 2019 to 2025. Through the analysis of four typical sub-cases—Heng tong Optoelectronics, GCL Technology, Bosch Suzhou, and a Suzhou-based private group that encountered obstacles—the study reveals the synergistic mechanism of two-way interaction between ‘capital and industry’. The research finds that the cross-regional flow of green capital follows diverse pathways, such as ‘leading enterprises + capital markets’, ‘technology enterprises + equity capital’, and ‘chain-leading enterprises + performance-based financing’, forming a two-way interactive relationship in which capital and industrial upgrading mutually shape one another. However, this process faces the combined constraints of institutional, market and capacity barriers, with institutional barriers being the critical determinant of financing success or failure. The core contribution of this study lies in opening the ‘process blackbox’ of green capital, from financial institution decision-making to the implementation of enterprise projects, constructing a ‘capital–industry’ synergy analysis framework, and providing operational policy pathways—such as ‘single-location certification, dual-location acceptance’—for high-quality green transformation in the Yangtze River Delta.

Keywords: Green Finance; Capital Flows; Industrial Upgrading; Regional Coordination; Yangtze River Delta; Case Study

1. Introduction

Rooted in the national “dual carbon” strategy, this study focuses on cross-regional coordination between Shanghai and Suzhou within the Yangtze River Delta Integration Demonstration Zone. As a typical spatial pairing of the “capital supply side” and the “industrial demand side”, the interaction between these two cities is highly representative. Driven by policy, the National Green Finance Catalogue and ESG standards have raised the “green threshold” for capital, guiding Shanghai’s funds to flow precisely towards compliant projects in Suzhou. Meanwhile, Shanghai’s 15th Five-Year Plan is driving the financial center to shift from scale expansion to functional upgrading, creating an urgent need for the implementation of green industrial scenarios; as a pilot for carbon peaking, the Suzhou Industrial Park faces an urgent demand for capital and technology to support the green upgrading of its manufacturing sector. This synergy of policies has established a clear supply-demand relationship: Suzhou requires capital to drive reform, whilst Shanghai requires industrial outcomes to demonstrate effectiveness. Together, these factors point towards the deep integration of financial capital and green industries, providing this study with a real and concrete case study aimed at exploring practical pathways for effective synergy between finance and industry under high-quality transformation. Against the backdrop of the above reality, this paper focuses on the following three core research questions: First, how can green finance guide resource allocation and industrial upgrading promote emission reduction and carbon reduction, and achieve deep synergy between Shanghai and Suzhou, thereby driving high-quality green transformation in the region? Secondly, within a specific geographical space, how can green capital break through institutional and market barriers and flow precisely and

efficiently from Shanghai, a financial center, to manufacturing enterprises in Suzhou? Thirdly, how does this capital flow process interact with the existing upgrading path of Suzhou's local manufacturing industry, ultimately catalyzing and reshaping a new "green synergy" development model? To this end, this study constructs a "capital-industry" collaborative analysis framework, aiming to reveal the flow and combination mechanism of cross-city green elements and explain the internal logic of the transformation jointly promoted by "government guidance" and "market-driven" in the Chinese context.

2. Literature Review and Research Gaps

In the field of green finance, existing research has systematically elaborated on its macro-level mechanisms for promoting regional sustainable development [8] and confirmed its role in facilitating industrial green transformation in regions such as the Yangtze River Delta [15]. However, such studies tend to focus on the overall evaluation of policy outcomes, lacking a detailed description of the intermediate transmission mechanisms through which resources traverse the interface between the financial and real sectors—from the “introduction of policies” to their implementation on the “factory floor”—resulting in an unclear connection between policy and execution.

In the realm of regional coordination, whilst empirical analyses have revealed the spatial spillover effects of financial agglomeration in the Yangtze River Delta on manufacturing upgrading [16], and established a basic paradigm, they have failed to subject ‘green capital’ to dedicated analysis as a factor possessing unique policy attributes and allocation logic. Given that green capital is subject to stricter information disclosure requirements, compliance costs and emission reduction constraints, neglecting its distinct characteristics results in insufficient theoretical explanatory power regarding how financial centers can precisely empower the green transformation of manufacturing.

In the field of industrial upgrading, research based on the ‘Porter Hypothesis’ has validated the central driving role of green technology in transformation [11,2], profoundly revealing the

logic of technology-driven development. However, current studies often reduce financial support to an external context or a control variable, failing to regard it as an endogenous core factor determining enterprises’ technological trajectories and the pace of transformation. How the availability, cost and contractual design of green capital substantially influence the timing, depth and pathways of enterprise transformation remains a key issue to be clarified.

In the field of capital flows, whilst research has affirmed the positive impact of green capital on the green efficiency of manufacturing [3,17], it tends to excel in measuring macro-level outcomes but falls short in revealing micro-level processes. Faced with barriers such as information asymmetry, difficulties in risk assessment, and regional policy disparities, the dynamic process by which green capital moves from decision-making by financial institutions in Shanghai to its integration into specific projects in Suzhou—including identification, pricing and regulation—remains a largely unexplored “black box”.

In summary, whilst existing studies are individually robust, they remain relatively isolated: research on green finance fails to delve into specific contexts; studies on regional coordination do not focus on the characteristics of green capital; research on industrial upgrading marginalizes financial support; and research on capital flows overlooks process mechanisms. It is precisely these ‘discontinuities’ and ‘gaps’ in the areas of overlap that this paper aims to address as its core research gap.

3. Case Overview

3.1 Research Methodology and Case Selection

This study adopts an exploratory embedded case study design. As shown in Table 1, this study selects Shanghai and Suzhou as the main case pairs, mainly based on the considerations of the following three dimensions: functional positioning, policy pilot programs, and resource endowments. These three dimensions are highly complementary, forming a natural spatial matching of "capital supply and industrial demand" (see Table 1).

Table 1. A comparison between Shanghai and Suzhou on three levels

Dimensions	Shanghai	Suzhou	Synergistic Value
Functional Positioning	International Financial Centre, undertaking capital	Advanced manufacturing hub, undertaking industrial	Creating a natural spatial alignment between ‘capital

	allocation and risk management functions	transformation and green manufacturing functions	supply' and 'industrial demand'
Policy Pilot	Green Finance Reform and Innovation Pilot Zone, National Carbon Market Trading Centre	National-level carbon peak pilot zone, green industry demonstration base	With overlapping policy pilot initiatives, it possesses the capacity for institutional innovation
Resource Endowments	A concentration of financial resources such as green loans, green bonds and carbon finance products	A concentration of industrial projects such as energy-saving technological upgrades, clean energy and green supply chains	Spatial separation of capital and technology generates an intrinsic demand for cross-regional flows

At the sub-case level, this paper adopts a 'polarity-based' sampling strategy, selecting four sub-cases that are both extreme and instructive to maximize the revelation of the diverse pathways and obstacles to green capital flows. Selection criteria include: (1) coverage of different enterprise scales (leading enterprises, SMEs and private conglomerates); (2) coverage of different financing instruments (bonds, equity, bank loans); (3) encompassing both successful and obstructed outcomes. The four sub-cases are: Heng tong Optic-Electric (leading enterprise + green bonds), GCL Technology (technology enterprise + equity investment), Bosch Suzhou (chain-leading enterprise + sustainability-linked loans), and a Suzhou-based private conglomerate (obstructed case). Case data is sourced from secondary public materials such as corporate announcements, financial media reports, publicly available bank documents and company websites, with the timeframe focusing on the period from 2019 to 2025. Cross-case analysis employs a 'replication logic' approach, comparing successful and unsuccessful cases to identify common conditions and barriers to green capital flows.

3.2 Introduction to Sub-cases

To meet the research requirements, this paper selects four representative sub-cases covering different enterprise types, financing instruments and synergy pathways, whilst balancing a comparative analysis of successful practices and lessons from failed attempts.

Firstly, Heng tong Optoelectronics, as a leading player in Suzhou's optoelectronics sector, successfully issued green bonds via the Shanghai Stock Exchange's green bond platform, with the assistance of intermediaries such as Haitong Securities. This channeled low-cost capital into offshore wind power projects, demonstrating a "lending enterprise + capital market" financing pathway [7].

Secondly, GCL Technology, focusing on

photovoltaic R&D, attracted equity investment from Shanghai state-owned and private capital based on long-term ESG expectations. By deeply integrating this capital with technological R&D, the company achieved a "technology+ capital" win-win scenario that combines low-carbon transition with capital appreciation [4].

Furthermore, a private group in Suzhou, having failed to meet environmental performance standards, faced a "one-vote veto" on its environmental assessment when applying for credit from the Suzhou branch of the Agricultural Bank of China, resulting in the rejection of a 1.3-billion-yuan loan application and the postponement of its technological upgrading. This case highlights the practical difficulties faced by SMEs in green financing and the challenges in implementing assessment tools. Finally, Bosch Suzhou has partnered with HSBC to launch sustainability-linked loans, directly linking interest rates to carbon reduction performance. Through market-based incentive and constraint mechanisms, this initiative drives continuous improvement in corporate environmental performance and extends these benefits throughout the supply chain.

The above cases cover multiple dimensions, including leading enterprises and SMEs, equity and debt, capital markets and bank credit, as well as success and setbacks. They summaries positive experiences whilst analyzing negative lessons, providing a solid empirical foundation for subsequent in-depth analysis of the flow pathways, interaction mechanisms, obstacle diagnosis and synergy models of green capital.

3.3 Analytical Framework: The Logical Chain of Capital-Industry Synergy

The flowchart in Figure 1 directly demonstrates the logical chain of mutual synergy between capital and industry in Shanghai.

4. Case Analysis

4.1 Analysis of Green Capital Flow Pathways

4.1.1 The Heng tong optoelectronics case
 Headquartered in Suzhou, Heng tong Optoelectronics operates in sectors including marine energy. Having secured a contract for an offshore wind power project [10], the company required financing and identified eligible clean energy projects in accordance with the 'Catalogue of Projects Supported by Green Bonds'. The Shanghai Stock Exchange has established a 'green channel' for green bonds, requiring companies to disclose project details and environmental benefits in their prospectuses, and to set up a dedicated account after issuance to monitor the use of funds [6]. During the bond's term, the company is required to regularly disclose project progress and emissions reduction data. This case illustrates a typical pathway for leading enterprises in Suzhou to achieve low-cost financing through standardized green bonds by leveraging the Shanghai capital market.

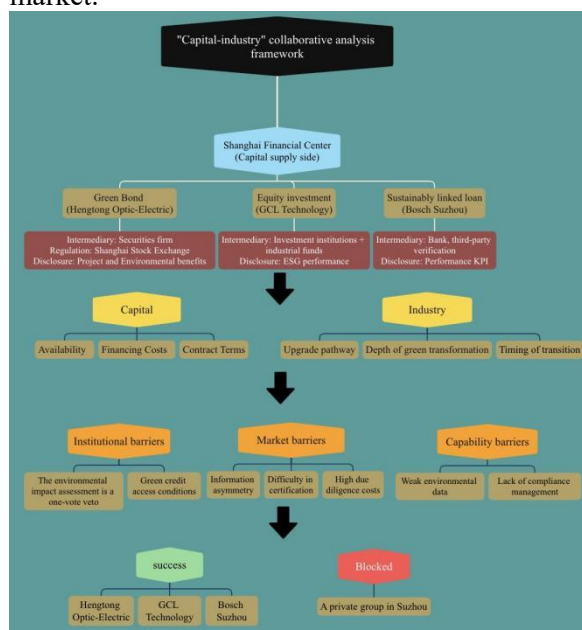


Figure 1. The Logical Chain of Capital-Industry Synergy

4.1.2 GCL technology case study

Headquartered in Suzhou, GCL Technology is a global leader in the research, development and manufacturing of photovoltaic materials, specializing in cutting-edge fields such as granular silicon low-carbon technology and perovskites. Due to the characteristics of its technological approach-which involves substantial upfront investment and a long return cycle-the company requires long-term capital support. In September 2025, GCL Technology

secured a strategic investment of US\$700 million from Wuji Capital, completing the financing through a private placement [5]. Wuji Capital is an international long-term capital firm with a Middle Eastern sovereign wealth fund background; based on long-term ESG investment return expectations, it is deeply aligned with the company's R&D process [13]. The two parties also jointly established a specialized industrial fund, focusing on consolidating inefficient production capacity within the industry and promoting the concentration of resources towards high-quality production capacity. Part of the investment was used to support GCL Technology in increasing its investment in perovskite technology and advancing its commercialization [14]. This case illustrates a model whereby Shanghai-based and international capital form deep ties with Suzhou-based technology enterprises through equity investment, achieving capital appreciation whilst supporting the enterprises' low-carbon transition, thereby creating a 'technology + capital' win-win pathway.

4.1.3 Case study of a private group in Suzhou

The company is a private enterprise group based in Suzhou with operations spanning manufacturing, logistics and trade, and has previously been ranked among China's Top 500 Private Enterprises. To accelerate its development, the enterprise proposed to apply for a comprehensive credit facility of 1.3 billion yuan from its long-standing principal bank, the Suzhou Branch of the Agricultural Bank of China. However, despite the enterprise's sound credit standing, rapid growth and high profitability, and a long-standing cooperative relationship with the bank, the loan application was rejected. The reason was that the enterprise's annual environmental performance assessment had not yet met the required standards, rendering it ineligible for the bank's 'green credit' access criteria [12]. The bank strictly enforced an "environmental assessment veto system", treating compliance with environmental assessment standards as a fundamental prerequisite for credit access and a minimum threshold for credit restructuring; it refused to grant credit to any enterprise that had not obtained a valid environmental assessment certificate. Ultimately, the enterprise's application for a 1.3-billion-yuan credit facility was rejected. This case highlights the practical dilemma that, within the framework of green

credit policies, even enterprises with sound credit standing and normal operations may face financing obstacles due to failure to meet environmental assessment standards.

4.1.4 The Bosch Suzhou case

Bosch Suzhou is a key manufacturing base for the Bosch Group in China, primarily engaged in the research, development and production of automotive components and industrial automation products. To achieve its carbon reduction targets, the company partnered with HSBC (whose China headquarters is in Shanghai) to launch a sustainability-linked loan. This loan directly links the interest rate to the company's agreed carbon reduction key performance indicators (KPIs); the interest rate is reduced if targets are met and increased if they are not. In designing the loan scheme, both parties jointly selected key performance indicators such as the rate of reduction in energy consumption per unit of output and the proportion of renewable energy used and introduced a third-party organization to conduct annual verification of performance achievement [9]. This mechanism dynamically links financing costs to environmental performance, creating market-based incentives and constraints: to secure preferential interest rates, the company proactively increases investment in energy-saving technological upgrades and optimizes production processes; the bank, meanwhile, achieves risk pricing through performance linkage, driving the company to continuously improve its environmental performance. Concurrently, as the lead enterprise in the industrial chain, Bosch Suzhou has passed on emission reduction pressures to its upstream and downstream suppliers, driving collaborative emission reductions across the supply chain [1]. This case illustrates a typical pathway through which performance-driven financing instruments promote corporate green transformation via market-based mechanisms.

The four cases above illustrate the diverse pathways and varying outcomes of green capital flowing from Shanghai to Suzhou. Heng tong Optoelectronics utilized the Shanghai Stock Exchange to issue green bonds, achieving low-cost financing; GCL Technology integrated its R&D efforts with Shanghai capital through equity investment; and Bosch Suzhou established performance-driven market-based incentives via sustainability-linked loans. Conversely, a private group in Suzhou faced a

'one-vote veto' due to failing to meet environmental assessment standards, highlighting the rigid constraints of green credit policies. The common characteristics of the successful cases lie in comprehensive information, accessible certification, and seamless institutional coordination; the cases that encountered obstacles, however, demonstrate that even with good credit standing, environmental compliance remains an insurmountable bottom line for financing.

4.2 Analysis of the Interactive Mechanism Between Capital and Industrial Upgrading

The four cases demonstrate that capital and industrial upgrading are a mutually shaping, two-way process. Heng tong Optoelectronics utilized low-cost funds raised through green bonds to drive project implementation, whilst its demand also led to the optimization of the issuance mechanism; GCL Technology secured Shanghai-based capital to support R&D, with investors deeply involved in technical decision-making; technological breakthroughs subsequently fed back into capital appreciation, forming a reinforcing cycle; Bosch Suzhou's performance-linked loan tied interest rates to emissions reduction targets, with this two-way constraint mechanism driving the company to improve performance; whilst a Suzhou-based private enterprise's loan application was rejected due to failing to meet environmental assessment standards, revealing the rigid constraints imposed by capital on the bottom line of transformation.

In summary, capital not only provides funding but also profoundly influences the timing of corporate transformation through its availability, cost and contractual terms, whilst practical exploration at the industrial level is driving the innovation and iteration of green financial products. The relationship between the two is not one of simple transfer, but rather a deeply coupled, two-way interactive synergy.

4.3 Diagnosis of Obstacles and Cross-Case Comparison

A comparison of successful and stalled cases reveals that green capital flows in Shanghai and Suzhou face three types of barriers. Institutional barriers are the most rigid: private enterprises facing obstacles were subject to a 'one-vote veto' due to failing to meet environmental assessment standards, whereas successful cases all took

environmental compliance as a prerequisite. Market barriers stem from information asymmetry: successful enterprises established trust by relying on intermediaries to disclose information or by introducing third-party verification, whilst those facing obstacles lacked such support. Capacity-related barriers manifest as inadequate preparation: successful enterprises possess comprehensive ESG data and compliance management systems, whereas those facing obstacles exhibit significant shortcomings in these areas. In summary, successful cases manage to overcome all three types of barriers simultaneously, whilst cases encountering obstacles result from the accumulation of multiple barriers. Among these, institutional barriers constitute the critical threshold determining the success or failure of financing, whilst market and capacity barriers further exacerbate the difficulty of securing funding.

5. Summary and Implications

This study, through the analysis of four typical cases, has formed the following understanding of the flow channels of green capital, the upgrading promotion mechanism and the synergy obstacles: In terms of capital flow channels, there are multiple paths for green capital to flow from Shanghai to Suzhou: Heng tong Optoelectronics issues green bonds relying on the Shanghai Stock Exchange, presenting the path of "leading enterprise + capital market"; GCL Technology has deeply bound itself with Shanghai capital through equity investment, presenting a path of "technology enterprise + equity capital". Bosch Suzhou has linked interest rates to emission reduction performance through sustainable linked loans, presenting a "chain leader enterprise + performance financing" path. The fact that a certain private group in Suzhou was refused a loan due to failing to meet the environmental assessment standards reveals the rigid constraints of green credit - environmental compliance is an unbreachable bottom line.

In terms of the upgrading promotion mechanism, capital and industrial upgrading present a two-way interactive relationship. Capital influences the timing and path of enterprises' green transformation through availability, financing costs and contractual terms. Meanwhile, practical exploration at the industrial end is also forcing the innovation and iteration of green financial products, forming a mutually shaping cycle.

In terms of the nature of coordination barriers, cross-border flows of green capital face three overlapping types of obstacles: institutional barriers represented by the "one-vote veto" in environmental impact assessments; market barriers manifested as information asymmetry and certification difficulties; and capacity barriers reflected in insufficient corporate preparation in areas like environmental data and compliance management. Successful cases often manage to overcome all three types of barriers simultaneously, while hindered cases are typically the result of multiple barriers compounding.

Based on the above findings, this paper proposes the following optimization recommendations: At the institutional level, establish a mutual recognition mechanism for the Shanghai-Suzhou green project database to achieve "one-time certification, mutual recognition in both regions"; explore a cross-regional green credit interest subsidy fund pool to break the locking effect of administrative divisions on fiscal funds. At the information level, promote the construction of a green finance information platform in the Yangtze River Delta, aggregating data on corporate carbon emissions and environmental ratings from both regions; standardize environmental benefit measurement tools to convert emission reductions into quantifiable financial indicators, reducing due diligence costs for financial institutions and facilitating the entire process of green capital from investment to implementation.

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