



Research on the Impact of Fintech on Corporate Green Innovation

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Abstract. This study examines the effects of fintech development on green innovation of enterprises from the standpoint of financial mismatch using data on green patent applications from A-share listed companies from 2012 to 2021 of China. An index measuring the level of fintech development was created using the Baidu Index. A mechanism analysis reveals that financial mismatch inhibits efforts of enterprises to innovate in the green sector, whereas fintech, which relies on information technology, can enhance capacity of financial institutions to identify green risks, reduce information asymmetry, direct the precise flow of credit resources, reduce the impact of financial mismatch, and encourage enterprise green innovation.

Keywords: Fintech; Enterprise green innovation; Financial mismatch

1 INTRODUCTION

As global environmental concerns intensify and societal attention towards sustainable development grows, green innovation becomes a vital strategic choice for corporate sustainability. In this context, the rapid advancement of fintech offers new opportunities and challenges for corporate green innovation. As an innovative technology, fintech has profoundly reshaped the landscape of the financial industry; however, its mechanism of influence on corporate green innovation remains insufficiently understood and expounded. Based on the above analysis, in the context of the current fintech development in full swing, it is of great theoretical and practical significance to study the impact of fintech development on enterprise green innovation from the perspective of financial mismatch.

2 THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

2.1 Financial mismatch and enterprise green innovation dilemma

On the one hand, credit mismatch will have an impact on corporate green innovation (Liu et al., 2019)^[1]. Credit mismatch means that state-owned enterprises with low

efficiency and insufficient incentives for green innovation have capital redundancy, while small and medium-sized private enterprises with higher efficiency and stronger willingness for green innovation are difficult to obtain R&D funds for green innovation from the credit market. On the other hand, the rent-seeking activities generated by financial mismatch will also affect corporate green innovation. When rent-seeking rewards are large enough, enterprises will allocate financial resources to projects with short and fast returns, reducing the profits of innovation projects and crowding out the investment in green innovation projects with high risks and long investment cycles (Zhang et al., 2017)^[2].

2.2 Fintech improves financial mismatch and improves the level of green innovation of enterprises

On the one hand, fintech can increase banks' credit support to small and medium-sized private enterprises, alleviate credit mismatch, and facilitate enterprises' green innovation. Fintech can collect information comprehensively and accurately, and can deeply mine and process enterprise production and sales, credit, tax payment and even water and electricity consumption behavior data, effectively reducing information asymmetry to make up for the credit shortage of long-tail enterprises and meet the capital needs of small and medium-sized private enterprises (Mocetti et al., 2017; Huang, 2018)^{[3][4]}. Artificial intelligence plays an efficient role in identifying and screening projects, which helps to identify the credit needs of enterprises that tend to conduct green innovation (Sutherland, 2018)^[5]. On the other hand, for the rent-seeking space generated by financial mismatch, fintech can make financing business online and automated (Gomber et al., 2018)^[6], reshape the function of market resource allocation and reduce the space for rent-seeking. The "ex post" supervision role of fintech can effectively avoid the illegal appropriation of funds and effectively curb the rent-seeking behaviors caused by the lack of supervision. Therefore we suggest:

Hypothesis 1: the growth of fintech can help businesses innovate in a greener way.

Hypothesis 2: fintech can alleviate financial mismatch and promote corporate green innovation

3 RESEARCH DESIGN

3.1 Model building

To examine the relationship between fintech development and corporate green innovation, this study designs the model as presented in Equation (1).

$$\text{Patent}_{i,t} = \alpha + \beta \text{Fintech}_{m,t} + \gamma \text{Controls}_{i,t} + \delta_i + \varphi_t + \varepsilon_{i,t} \quad (1)$$

Here, the dependent variable $\text{Patent}_{i,t}$ denotes the green innovation level of company i in year t ; $\text{Fintech}_{m,t}$ represents the fintech development level in region m in year t ; $\text{Controls}_{i,t}$ stands for control variables; δ_i and φ_t denote firm and year fixed effects, respectively, and $\varepsilon_{i,t}$ denotes the random error term.

3.2 Description of key variables

About the measurement of green innovation, this study utilizes green innovation output and, recognizing that a company's green patent information might be disclosed earlier in the research process, employs the count of green patent applications to assess corporate green innovation. Specifically, this study combines the counts of green invention patent applications (Inva) and green utility model patent applications (Uma) to obtain the total number of green innovation applications (Total). The natural logarithm is taken after adding 1 to the variables to address skewed distributions, resulting in $\ln Total$, $\ln Inva$, and $\ln Uma$.

Considering the authentic development of fintech and adopting a financial functionality perspective, this study focuses on the enabling role of fintech for businesses to determine relevant keywords. By utilizing Baidu Search Index, a Fintech Development Index is constructed to measure the level of fintech development in the regions where companies are situated. To do so, this study references existing research and extracts 25 main keywords related to fintech. The fintech index is subsequently established by matching these keywords with 31 provinces on the Baidu Index page. Weightings for the indicators are computed using the entropy method, leading to the calculation of the regional fintech index (Fintech).

Considering that various other factors may influence corporate green innovation, drawing from existing literature, this study includes firm size, leverage, profitability, proportion of fixed assets, cash flow, corporate growth ability, board independence, and social wealth creation capacity, regional economic development level and financial development scale as control variables. The specific definitions are shown in Table 1.

Table 1. Description of variables

Type of variable	Description	variable name
Explained variable	Enterprise green innovation, total number of green patent applications	Total
	Enterprise green innovation quality, number of green invention patent applications	Inva
	Enterprise green innovation quantity, Green utility model patent application quantity	Uma
Explanatory Variables	Fintech development level, fintech development index measurement	Fintech
Control Variables	Enterprise scale, natural logarithm of total assets of enterprises	Size
	Enterprise asset-liability ratio, total liabilities/total assets at the end of the year	LEV
	Enterprise profitability, net profit/total assets at the end of the year	ROA
	Enterprise fixed asset ratio, net fixed assets/total assets	PPE
	Enterprise cash flow, net operating cash flow/total assets	Cashflow
	Enterprise growth ability, operating income growth rate	Growth

Enterprise social wealth creation, enterprise Tobin Q value	TobinQ
Board independence, number of independent directors/board members	Indep
Economic development level, GDP growth rate	Econ
Financial development scale, regional financial industry output/GDP	FinDev

4 ANALYSIS OF EMPIRICAL RESULTS

4.1 Benchmark regression

The benchmark regression findings from the fixed effect model (1) are shown in Table 2. The empirical findings demonstrate that corporate green innovation is strongly supported by fintech development. In particular, Table 3's conclusion (1) demonstrates that the coefficient of Fintech development (Fintech) is significant at the level of 5%, demonstrating that the more a region's degree of fintech development, the greater the region's total capacity for green innovation across all enterprises. The first hypothesis is proven. The development of fintech has a stronger promotion effect on the quality of green innovation, which results from the strong "empowerment" of fintech, as shown by a comparison of the results in columns (2) and (3), which show that fintech has a stronger and more significant promotion effect on the application of green invention patents. Fintech can enhance the ability of green identification and identify high-quality innovation behaviors of firms by relying on information technologies like big data and artificial intelligence. We will accurately direct capital investments and encourage high-caliber green enterprise innovation. In conclusion, Hypothesis 1 is true.

Table 2. Benchmark regression results

	(1) LnTotal	(2) LnInva	(3) LnUma
Fintech	0.0145** (2.4432)	0.0159** (2.7176)	0.0096* (1.9915)
Size	0.3014*** (11.7675)	0.2396*** (9.9566)	0.1956*** (10.5566)
LEV	-0.0432 (-0.8557)	-0.0736 (-1.3579)	0.0246 (0.7942)
ROA	0.0565 (0.6450)	0.0053 (0.0898)	0.1211* (1.7284)
PPE	0.1134 (1.2251)	0.0750 (1.0394)	0.1368* (1.9951)
Cashflow	-0.1295* (-1.8358)	-0.0805 (-1.4362)	-0.1217* (-1.8448)
Growth	0.0085 (0.8483)	0.0007 (0.0838)	0.0122 (1.3024)
Indep	0.0129**	0.0130***	0.0073*

	(2.6901)	(3.4011)	(1.8339)
TobinQ	0.0040	-0.0848	0.0218
	(0.0168)	(-0.4228)	(0.1174)
Econ	0.0207	0.1300	-0.0884
	(0.1833)	(0.9721)	(-0.9992)
FinDev	-0.8126	0.3769	-1.1905**
	(-1.3061)	(0.7267)	(-2.5230)
Fixed effects	Yes	Yes	Yes
N	30190	30190	30190

4.2 Mechanism Analysis

According to the aforementioned empirical findings, regional fintech growth encourages businesses to engage in green innovation activities. This is particularly evident in the rise in the number of green patent applications, particularly the rise in the number of green invention patents. This paper, based on the previous analysis, investigates whether fintech can ease the restrictions of financial mismatch on corporate green innovation and promote corporate green innovation from the perspective of financial mismatch in order to further explore the action mechanism of fintech in the process of affecting corporate green innovation. Additionally, this study makes reference to Li et al. (2020)'s methodology and employs the following test model:

$$Patent_{i,t} = \alpha + \beta_2 FM_{i,t} + \gamma Controls_{i,t} + \delta_i + \varphi_i + \varepsilon_{i,t} \tag{2}$$

$$Patent_{i,t} = \alpha + \beta_3 FM_{i,t} + \beta_4 Fintech_{m,t} + \beta_5 Fintech_{m,t} \times FM_{i,t} + \gamma Controls_{i,t} + \delta_i + \varphi_i + \varepsilon_{i,t} \tag{3}$$

Where $FM_{i,t}$ represents the cost of capital use of enterprise i in industry n , which is represented by the ratio of interest expense to liabilities with the part of accounts payable deducted:

$$FM_{i,t} = \frac{r_{n,i} - r_n}{r_n} \tag{4}$$

In the formula (4), $r_{n,i}$ is the average cost of i firm's capital use of industry n . The other variables are the same as above. Here we focus on coefficients β_2 and β_5 , and the regression results are shown in Table 3. In the regression results of columns (2) and (4), the coefficient of the interaction term between fintech and financial mismatch is significantly positive, indicating that the development of fintech does alleviate the impact of financial mismatch on the green innovation output of enterprises. Fintech uses information technology to improve credit mismatch, manage capital flow to green projects, reduce information asymmetry, prevent rent-seeking and arbitrage, and boost the profitability of green initiatives, hypothesis 2 is verified.

Table 3. Mechanism test results

	(1)	(2)
	LnTotal	LnTotal

FM	-0.0135** (-2.0763)	
Fintech×FM		0.0062*** (3.2880)
Variables of control	Yes	Yes
Fixed effects	Yes	Yes
N	26180	26180

5 CONCLUSIONS

This study examines the effects of regional fintech development on corporate green innovation using data on green patent applications from Chinese A-share listed companies between 2012 and 2021. The indicator system of fintech development level was constructed using the Baidu index. The study concludes that the growth of fintech can greatly boost corporate green innovation levels, with a more pronounced promotion effect on corporate green innovation quality. Additionally, by reducing financial mismatch limitations, this paper's mechanism analysis reveals how fintech might support corporate green innovation.

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