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The Impact of Digital Inclusive Finance on Corporate ESG Performance

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Abstract

Against the backdrop of the "dual carbon" goals of carbon peaking and carbon neutrality, the advancement of sustainability disclosure regimes, the convergence of ISSB standards with domestic frameworks, the expansion of green investment and financing, and the normalization of supply chain due diligence, firms are facing increasing external pressures in capital markets. Enhancing ESG performance has become a critical pathway to sustainable development, playing a key role in reducing financing costs, strengthening innovation capacity, and improving corporate resilience. Using a sample of Chinese A-share listed firms from 2020 to 2023, this study combines the Peking University Digital Inclusive Finance Index with firm-level ESG data to construct a panel fixed-effects model, examining the impact of digital inclusive finance on corporate ESG performance and conducting heterogeneity analyses across industries. The results show that digital inclusive finance significantly improves corporate ESG performance. Both coverage breadth and usage depth exert important effects by promoting ESG-related innovation, thereby enhancing firms' environmental, social, and governance performance. These findings remain robust across a series of robustness checks. Moreover, the effects exhibit significant heterogeneity across industries. Based on these findings, this study suggests further strengthening digital financial infrastructure and institutional frameworks, implementing differentiated policies across regions and industries, and guiding firms and regions toward a virtuous interaction between financing and technological development, so as to jointly advance ESG transformation and high-quality economic growth.

Keywords

digital inclusive finance, corporate ESG performance, digitalization level

1. Introduction

1.1 Research Background and Significance

Digital inclusive finance, by leveraging digital technologies to reduce financing frictions and enhance information transparency, represents an adaptive form of modern financial development. Existing studies provide limited evidence on the chain transmission mechanisms between digital inclusive finance and corporate ESG performance, as well as on multidimensional heterogeneity, while the associated risks also remain insufficiently examined. Under a unified analytical framework, this paper offers micro-level empirical evidence by examining the effects, mechanisms, and applicable boundaries of digital inclusive finance on

corporate ESG performance, thereby providing empirical support for policy formulation and governance optimization aimed at digitally enabling ESG development.

The development of digital inclusive finance can be divided into four stages, as shown in Table 1.

Table 1: Development Stages of Digital Inclusive Finance

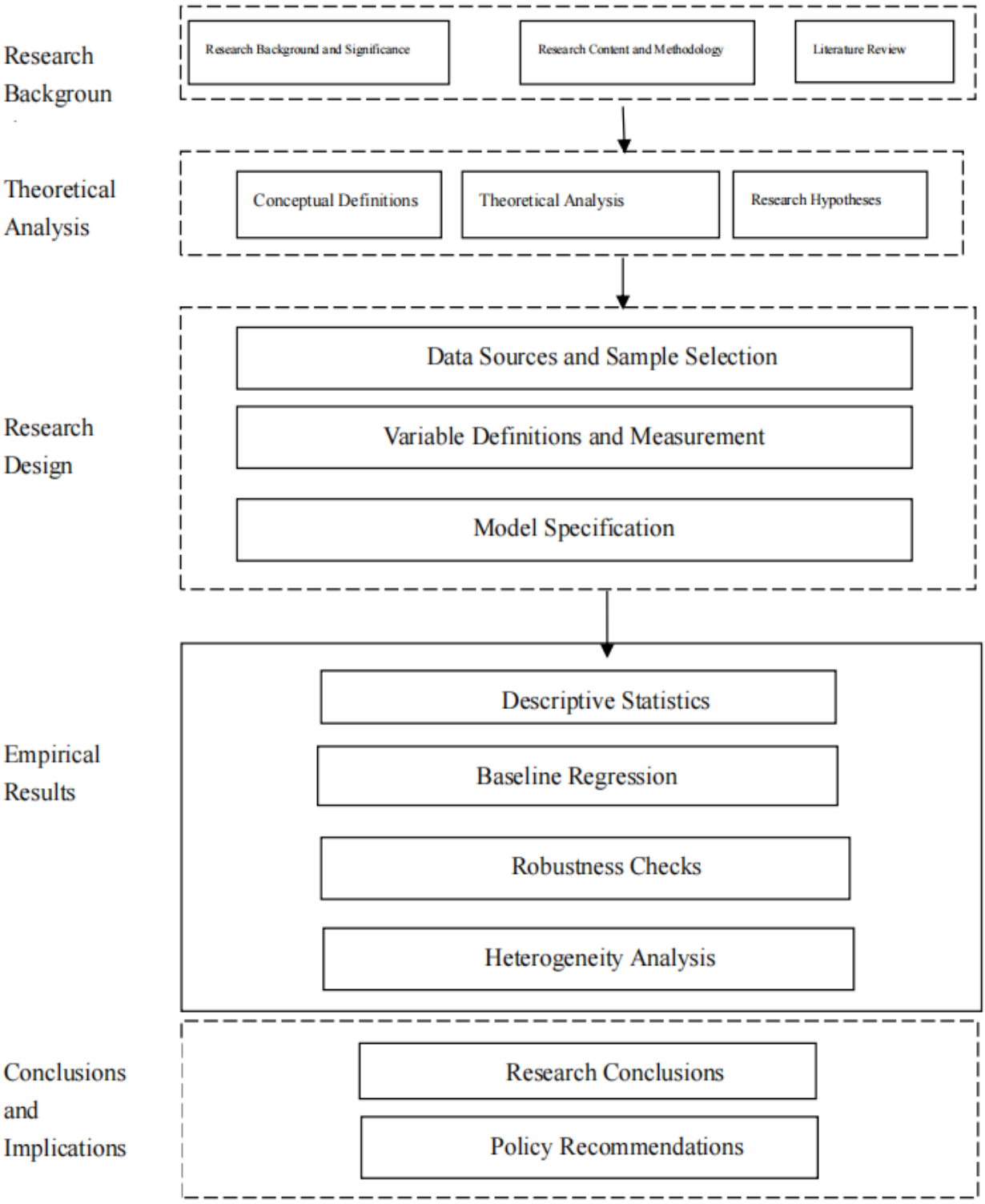
Development Stage	Key Characteristics
Emergence and Regulatory Foundation Stage (2013–2015)	Mobile payments and platform-based finance expanded rapidly. The State Council's *Guiding Opinions on Promoting the Sound Development of Internet Finance* (2015) clarified industry boundaries and regulatory responsibilities, emphasizing the use of technology to reduce costs, improve efficiency, and mitigate information asymmetry.
Institutionalization, Expansion, and Risk Rectification Stage (2016–2018)	*The Plan for Advancing the Development of Inclusive Finance (2016–2020)* established system-wide objectives and assessment requirements, highlighting key service targets such as small and micro enterprises, agriculture, rural areas, and farmers, as well as low-income groups. In 2018, Baihang Credit was established, enhancing credit identification and risk control for long-tail entities.
Digital Transformation and Infrastructure Enhancement Stage (2019–2021)	The People's Bank of China's *FinTech Development Plan (2019–2021)* promoted the digital transformation of financial institutions in areas including data governance, model-based risk management, and regulatory technology. During this period, the research, development, and pilot programs of the digital renminbi were launched, with small-scale application testing conducted to strengthen traceability and compliance capabilities.
Deep Integration and High-Quality Development Stage (2022–present)	The *FinTech Development Plan (2022–2025)* emphasized fairness and inclusiveness, strengthened governance of data elements, and promoted the application of artificial intelligence and blockchain in inclusive finance. The National Financial Regulatory Administration was officially established, and the State Council issued implementation guidelines to advance the high-quality development of inclusive finance.

1.2 Research Design and Content

This study focuses on the impact of digital inclusive finance (DIFI) on corporate ESG performance and conducts a systematic examination from three perspectives: the overall effect, the underlying mechanisms, and contextual heterogeneity. At the theoretical level, this paper reviews the relevant literature on digital inclusive finance and corporate ESG, clarifies key concepts, constructs an analytical framework for the mechanisms through which digital inclusive finance affects environmental, social, and governance performance, and proposes corresponding hypotheses. From an empirical perspective, using a sample of Chinese A-share listed firms and the regional Digital Inclusive Finance Index, this study establishes a baseline regression model to examine the effects of digital inclusive finance on overall corporate ESG performance as well as its individual dimensions, and conducts robustness checks using alternative variable specifications and related methods [1]. Finally, grouped regressions are performed based on industry characteristics and other dimensions to capture heterogeneity in the effects, thereby deriving corresponding policy implications and managerial recommendations.

The technical roadmap of the study is presented in Figure 1.

Figure 1. Technical Roadmap of the Study



2. Literature Review and Hypotheses on the Impact of Digital Inclusive Finance on Corporate ESG Performance

2.1 Literature Review

Guo Feng, Wang Jingyi, and co-authors constructed the Peking University Digital Inclusive Finance Index for the period 2011–2018, measuring the development of digital inclusive finance from the perspectives of coverage breadth, usage depth, and digital support, and documenting pronounced regional disparities [2]. Jiao

Jinpu, Huang Tingting, and others proposed an inclusive finance evaluation framework based on accessibility, usage intensity, and service quality [3]. From the perspectives of economic outcomes and innovation, Li Jianjun et al. (2020) show that inclusive finance promotes economic growth and reduces urban–rural disparities [4]. Liang Bang et al. (2019) demonstrate that digital inclusive finance exerts a significant positive effect on technological innovation, with stronger effects observed in central and western regions as well as among private and small-sized firms, primarily by lowering financing costs and alleviating financing constraints [5]. Closely related to this line of research, Fang Xianming et al. find that ESG performance enhances both the quantity and quality of corporate innovation output, mainly through the mitigation of financing constraints and improvements in human capital efficiency [6]. Overall, existing evidence suggests that both digital inclusive finance and ESG performance can promote innovation and development through two key channels: financing and efficiency.

2.2 Hypotheses on the Impact of Digital Inclusive Finance on Corporate ESG Performance

Hypothesis 1 (H1): Digital inclusive finance positively affects corporate ESG performance.

Digital inclusive finance reduces financing costs and constraints through online financial services, guiding resources toward environmental governance, social responsibility, and governance optimization [7]. At the same time, it supports low-carbon transformation and improves the quality of environmental monitoring and information disclosure, thereby enhancing corporate ESG performance.

Hypothesis 2 (H2): The impact of digital inclusive finance on corporate ESG performance varies across industries.

Industries differ substantially in their digital foundations and capacity to absorb new technologies. Firms in technology and modern service industries are more capable of translating the advantages of digital finance into green investment and governance improvement, whereas traditional industries face greater technological and resource constraints, resulting in weaker effects.

Hypothesis 3 (H3): The impact of digital inclusive finance on corporate ESG performance is moderated by firm size.

Small and medium-sized enterprises face more severe financing constraints, and digital inclusive finance can significantly alleviate their financing pressure, promote green investment and the fulfillment of social responsibilities, and thereby improve ESG performance. Large firms, while possessing stronger resource endowments and governance foundations, are more affected by organizational inertia, leading to smaller marginal improvements; their ESG enhancement mainly occurs through the use of digital tools to optimize ESG data governance and supply chain coordination [8].

3. Empirical Analysis of the Impact of Digital Inclusive Finance on Corporate ESG Performance

3.1 Data Collection

3.1.1 Data Sources

This study uses data on A-share listed firms in China from 2020 to 2023 as the research sample, mainly including firm-level ESG data and data on the adoption of digital inclusive finance. In addition, the CSMAR database and firms' annual reports are used as supplementary data sources to ensure data completeness and accuracy.

In the process of data selection and collection, this study carefully considers the authority, completeness, and timeliness of the data, as well as their comparability and operability, thereby ensuring the scientific rigor and reliability of the research data.

3.1.2 Model Variables

The dependent variables comprise three dimensions: the environmental dimension (e.g., carbon emissions, green investment, energy conservation and emission reduction), the social dimension (e.g., employee welfare, community engagement, and philanthropic projects), and the governance dimension (e.g., board structure,

transparency, and internal control), which collectively reflect firms' performance in environmental, social, and governance aspects.

The key independent variable is the degree of adoption of digital inclusive finance, which captures the frequency of firms' use of digital financial products, the diversity of financing channels, and the utilization rate of digital financial services.

Control variables include firm size and industry characteristics to exclude their potential interference with ESG performance and to ensure the accuracy of the estimation results.

Table 2 summarizes the definitions of all model variables.

Table 2: Definitions of Model Variables

Variable Category	Primary Indicator	Secondary Indicator
Independent Variable	Digital Inclusive Finance Adoption	Frequency of firms' use of digital financial products
		Diversity of financing channels
		Utilization rate of digital financial services
Dependent Variables	Environmental Dimension	Corporate carbon emissions
		Green investment
		Energy conservation and emission reduction
	Social Dimension	Employee welfare
		Community engagement
		Corporate philanthropic projects
	Governance Dimension	Board structure
		Transparency
		Internal control system
Control Variables	Industry Characteristics	Market size
		Industrial chain structure
		Technological innovation
	Firm Size	Total assets
		Total revenue

3.1.3 Descriptive Analysis

The descriptive statistics reported in Table 3 indicate that the ranges and distributions of the variables for the 100 sample firms meet the requirements for econometric analysis. The core independent variable, digital inclusive finance, has a mean value of 6.05, a standard deviation of 1.872, and a median of 6, suggesting that the overall level is moderately high with relatively limited variation. Financing constraints exhibit a relatively low mean but substantial heterogeneity across firms.

Among the ESG sub-dimensions, the environmental dimension has a mean value of 1.38, characterized by high variability and right-skewness, indicating relatively low performance with significant differentiation across firms. The social dimension has a mean of 4.83 and displays a relatively even distribution. The governance dimension has a mean value of 4.68 and remains generally stable.

With respect to control variables, firm size has a mean value of 3.21 with a low degree of dispersion, while industry characteristics have a mean of 0.42, reflecting a clear grouping structure. Overall, the sample exhibits both representativeness and sufficient variation, making it suitable for subsequent regression and mechanism analyses.

Table 3: Descriptive Statistics

Variable	Obs.	Max	Min	Mean	Std. Dev.	Median	Variance	Kurtosis	Skewness	Coefficient of Variation
Digital Inclusive Finance Adoption	100	10	3	6.05	1.872	6	3.503	-0.696	0.483	0.309
Environmental Dimension	100	7	0	1.38	2.121	0	4.501	0.69	1.449	1.537
Social Dimension	100	10	0	4.83	2.778	5	7.718	-0.679	-0.34	0.575
Governance Dimension	100	10	0	4.68	3.231	5	10.442	-1.274	-0.07	0.69
Firm Size	100	5.006	2.082	3.21	0.831	3.124	0.69	-0.487	0.665	0.259
Industry Characteristics	100	1	0	0.42	0.496	0	0.246	-1.931	0.329	1.181

3.2 Model Regression Analysis

3.2.1 Model Construction

The model takes the degree of adoption of digital inclusive finance as the independent variable, and the indicators of the environmental, social, and governance (ESG) dimensions as the dependent variables. A series of control variables are also introduced to adjust for other potential influencing factors. The regression model is constructed in the following form:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_4 X_4 + \beta_5 X_5$$

$$Y_2 = \beta_0 + \beta_2 X_1 + \beta_4 X_4 + \beta_5 X_5$$

$$Y_3 = \beta_0 + \beta_3 X_1 + \beta_4 X_4 + \beta_5 X_5$$

X_1 represents the degree of adoption of digital inclusive finance by the enterprise, while Y_1,Y_2, and Y_3 represent the dependent variables for the environmental, social, and governance dimensions, respectively. X_4 and X_5 represent the industry and company size, respectively.

3.2.2 Benchmark Regression Analysis

To examine the core impact of digital inclusive finance on corporate ESG performance and its individual dimensions (environmental, social, governance), this study conducts a benchmark regression analysis based on the constructed regression model. The analysis systematically investigates the quantitative relationships between the core explanatory variables, control variables, and the dependent variables, laying the foundation for subsequent mechanism tests and heterogeneity analysis. The results of the benchmark regression are presented in Table 4:

Table 4: Benchmark Regression Analysis

Variables	(1) Environmental Dimension	(2) Social Dimension	(3) Governance Dimension
Degree of Adoption of Digital Inclusive Finance	0.061(0.436)	0.086(0.483)	1.053(5.9***)
Industry Characteristics	0.264(0.53)	1.171(1.849)	-0.359(-0.565)
Company Size	-0.448(-1.585)	1.041(2.896)	-1.019(-2.831)
_cons	2.326(2.102)	0.522(0.371)	1.747(1.241)
R^2	0.031	0.115	1.241

The constructed model is as follows:

$$Y_1 = 2.326 + 0.061X_1 + 0.264X_4 - 0.448X_5$$

$$Y_2 = 0.522 + 0.086X_1 + 1.171X_4 + 1.041X_5$$

$$Y_3 = 1.747 + 1.053X_1 - 0.359X_4 - 1.019X_5$$

The results of the benchmark regression indicate that digital inclusive finance does have an impact on corporate ESG scores. From an environmental perspective, the regression coefficient for the degree of adoption of digital inclusive finance is 0.061 (t = 0.436), which is not statistically significant, suggesting that its impact on corporate environmental performance is minimal. Among the control variables, the coefficient for industry characteristics is 0.264 (t = 0.530), and the coefficient for company size is -0.448 (t = -1.585), both of which do not reach conventional significance levels.

At the social level, the coefficient for the degree of adoption of digital inclusive finance is 0.086 (t = 0.483), still not significant. The coefficients for industry characteristics and company size are 1.171 (t = 1.849) and 1.041 (t = 2.896), respectively, indicating that company size has a significant impact on corporate performance.

From a governance perspective, the degree of adoption of digital inclusive finance has a coefficient of 1.053, which is positive and statistically significant at the t = 5.900 level, indicating that digital inclusive finance can improve corporate governance efficiency. The coefficients for industry characteristics and company size are -0.359 (t = -0.565) and -1.019 (t = -2.831), respectively.

Overall, digital inclusive finance has the greatest positive impact on the governance dimension of ESG. The effects of company size and industry characteristics vary across different dimensions, suggesting structural differences in ESG performance across various aspects of the enterprise.

3.3 Robustness Check

This study follows the research approach of Wen Yadong and Chen Yan (2024), replacing the core explanatory variable in the benchmark model with the degree of digitalization, and performs a robustness check based on this modification [9]. The results are presented in Tables 5, 6, and 7:

Table 5: Information Criteria

Criterion	Value
−2 Restricted Log Likelihood	484.242
Akaike Information Criterion (AIC)	490.242
Corrected Akaike Information Criterion (AICC)	490.500
Bozdogan's Consistent AIC (CAIC)	500.966
Schwarz Bayesian Criterion (BIC)	497.966

Table 6: Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	96.802	0.148	0.701
Digitization Level	1	96.639	0.172	0.679
Industry Characteristics	1	96.696	3.354	0.070
Firm Size	1	96.600	8.755	0.004

Table 7: Estimates of Covariance Parameters

Parameter Type	Year	Estimate (Var)	Std. Error (SE)
Repeated Measures	2020-12-31	7.389240	1.839445
	2021-12-31	7.560014	1.853619
	2022-12-31	6.698294	1.664757

In this section, a Linear Mixed-Effects (LME) model is employed to conduct a robustness check on the baseline results. The corporate social dimension score is treated as the dependent variable, with time defined as the repeated measures factor and the firm as the subject of random effects (sample size N=34). The fixed effects include the degree of digital financial inclusion adoption, industry characteristics, and firm size. The model fit statistics remain largely unchanged compared to the previous analysis, indicating that the system is linear and stable. The results show that the degree of digital financial inclusion adoption does not exhibit a significant impact (F = 0.172, Sig. = 0.679), which is consistent with the baseline regression. Meanwhile, firm size has a significantly positive effect (F = 8.755, Sig. = 0.004), and industry characteristics show a marginally

significant influence (F = 3.354, Sig. = 0.070). Furthermore, the error variance remains stable (ranging from approximately 6.70 to 7.56), further confirming the robustness of the conclusions regarding social impact.

3.4 Heterogeneity Analysis

In this study, we categorize the sample into heavily polluting and non-heavily polluting industries. This classification is based on the *Management List of Environmental Protection Inspection Industry Categories for Listed Companies* (MEP Office Letter [2008] No. 373), issued by the Ministry of Environmental Protection in 2008, as well as the *Guidelines for Industry Classification of Listed Companies* revised by the China Securities Regulatory Commission (CSRC) in 2012. Heavily polluting industries primarily include 16 sectors, such as coal, mining, petrochemicals, chemicals, metallurgy, and thermal power. These industries typically generate substantial pollutants during their production and operations, exerting significant pressure on the environment. In contrast, non-heavily polluting industries encompass all other sectors, whose operational activities have a relatively smaller environmental impact. Regression analyses were conducted separately for the samples of both industry types, and the results are presented in Table 8.

Table 8: Regression Analysis of Industry Heterogeneity

Variables	(1) Heavily Polluting: Environmental	(2) Non-heavily Polluting: Environmental	(3) Heavily Polluting: Social	(4) Non-heavily Polluting: Social	(5) Heavily Polluting: Governance	(6) Non-heavily Polluting: Governance
Digital Finance Adoption	0.08 (0.48)	0.04 (0.56)	0.1 (0.52)	0.07 (0.5)	1.2*** (6.2)	0.9*** (5.8)
Industry Characteristics	0.3 (-0.5)	0.2 (-0.6)	1.2 (1.8)	1.1 (1.7)	-0.4 (-0.6)	-0.3 (-0.5)
Firm Size	-0.5 (-1.6)	-0.4 (-1.5)	1.1 (2.9)	1.0 (2.8)	-1.1 (-2.9)	-1.0 (-2.8)
_cons	2.5 (2.1)	2.2 (2.0)	0.6 (0.4)	0.5 (0.3)	1.8 (1.3)	1.6(1.2)
R^2	0.035	0.028	0.12	0.11	1.26	1.22

According to the results in Table 8, the impact of digital financial inclusion on ESG sub-dimensions exhibits significant industrial heterogeneity. In the environmental dimension, the coefficients for heavily polluting and non-heavily polluting industries are 0.08 (t = 0.48) and 0.04 (t = 0.56), respectively, both of which are statistically insignificant, while industry characteristics and firm size exhibit positive effects (0.30、0.20). Similarly, in the social dimension, the adoption coefficients are 0.10 (t = 0.52) and 0.07 (t = 0.50), which also fail to reach significance; however, industry characteristics and firm size maintain stable positive influences (with industry characteristics at 1.20 and 1.10, and firm size at 1.10 and 1.00, respectively). In contrast, the coefficients in the governance dimension are significantly positive, with the effect in heavily polluting industries (1.20, t = 6.20) being notably higher than that in non-heavily polluting industries (0.90, t = 5.80), whereas industry characteristics and firm size show negative correlations in this dimension. (with industry characteristics at -0.40 and -0.30, and firm size at -1.10 and -1.00, respectively)

Overall, the influence of digital financial inclusion on ESG performance is primarily concentrated in the governance dimension, with a more pronounced promotional effect in heavily polluting industries (1.20 > 0.90). This suggests that in industries facing higher regulatory pressure, digital financial inclusion is more effective at enhancing transparency, strengthening oversight, and improving governance efficiency. Conversely, the lack of significance in the environmental and social dimensions may be attributed to factors such as technology investment cycles, emission constraints, and the specific structure of corporate social responsibility.

4. Conclusions and Policy Recommendations

4.1 Conclusions

Using data from A-share listed companies from 2020 to 2023, this study examines the relationship between the degree of digital financial inclusion adoption and corporate ESG performance. The empirical results

demonstrate that digital financial inclusion adoption has a significantly positive impact on the governance dimension ($\beta = 1.053, t = 5.900$), whereas its effects on the environmental and social dimensions are not statistically significant (Environmental: $\beta = 0.061, t = 0.436$; Social: $\beta = 0.086, t = 0.483$). Heterogeneity tests reveal that this positive effect is more pronounced in heavily polluting industries ($\beta = 1.200, t = 6.200$) compared to non-heavily polluting industries ($\beta = 0.900, t = 5.800$). Robustness checks using alternative variables yield consistent results, with the positive effect on the governance dimension remaining significant (after replacing variables: $\beta = 1.030, t = 5.800$), thereby confirming the validity of the conclusions.

4.2 Policy Recommendations

Based on the findings above, this study proposes several recommendations to promote the synergistic improvement of digital financial inclusion and corporate ESG performance. First, the government should increase investment in digital financial infrastructure and services, particularly in the central, western, and rural regions, to expand service coverage and usage frequency. Policy guidance and incentives should be utilized to promote the development of ESG-oriented products, such as green credit. Furthermore, efforts should be made to enhance ESG disclosure standards and transparency while leveraging market constraints. Second, the financial sector should prioritize innovation in digital products and the provision of differentiated services, focusing on the financing needs of small and medium-sized enterprises (SMEs) and green-oriented firms. By utilizing big data and artificial intelligence to enhance risk control and pricing capabilities, financial institutions can effectively reduce transaction costs stemming from information asymmetry [10]. Finally, at the corporate level, firms should improve their capacity to utilize digital financial tools, integrating ESG considerations into their long-term strategies and daily operations. Moreover, improving internal mechanisms such as goal setting and performance appraisal is essential to normalize and standardize ESG investments.

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