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ESG, governance variables and Fintech: An empirical analysis

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A B S T R A C T

The paper consists of an empirical analysis on a sample of 180 listed banks by verifying four different hypotheses: (*H1) The development of fintech contributes positively to the ESG performance of banks; (H2) Board size is negatively related to ESG performance of banks; (H3) The percentage of independent board members is positively related to ESG performance of banks; (H4) Gender diversity is positively related to ESG performance of banks.* The fintech index has been developed by using the annual reports of companies included in the sample by adopting 10 keywords. Our approach is original because none of the extant contributions on the topic proposed any methodology to measure the level of fintech and define whether a bank is more fintech than another. Results indicates that a great level of fintech in banking sector improves significantly ESG performance. The relationship with board size is negative but not statistically significant, while are positive and relevant the relationships with the level of independence of the board and gender diversity.

1. Introduction

In recent years, the financial sector has undergone a rapid evolution thanks to the emergence of financial technologies (Maslennikov et al., 2017) known as Fintech (Takeda and Ito, 2021), which have influenced the business models of financial intermediaries (Allen and Santomero, 2001), with the development of new products and services (Gomber et al., 2018) which have revolutionized the way people and companies interact with financial services. A relevant number of technologies would be suitable to be embedded in the definition of fintech industry. Indeed, those that might be conveniently mentioned are the blockchain (Son and Jang, 2023), artificial intelligence (Ahmed et al., 2022), big data (Wang et al., 2021), and the internet of things (Palmaccio et al., 2021).

The Fintech sector has proven to have a significant impact on the adoption and integration of ESG in the financial sector (El Khoury et al., 2023; Atayah et al., 2023). Thanks to the ability of Fintechs to leverage digital technology to improve the efficiency, transparency and personalization of financial services, these technologies are contributing to the creation of solutions that facilitate the involvement of investors and companies in the ESG area.

We performed an empirical analysis on a sample of 180 listed banks by verifying four different hypotheses: (*H1) The development of fintech contributes positively to the ESG performance of banks; (H2) Board size is negatively related to ESG performance of banks; (H3) The percentage of independent board members is positively related to ESG performance of banks; (H4) Gender diversity is positively related to ESG performance of banks.* The fintech index has been developed by using the annual reports of companies included in the sample. Annual reports have been analysed with the AntConc corpus processing software (https://www.laurenceanthony.net/software/antconc/) by adopting 10 keywords applied in the study by (Kharrat et al., 2023, p.6): Technology, Digital Banking, Network, Internet Banking, Online Services, FinTech, AI, Blockchain, E-payment and Mobile Banks.

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Several previous contributions focused on ESG scores within the banking sector, but only few of them analysed the relationship between fintech and ESG performances (Galletta et al., 2022; Bitetto and Cerchiello, 2023; El Khoury et al., 2023; Wang et al., 2022; Du et al., 2022). However, none of such contributions proposed an approach to measure the level of fintech and define whether a bank is more fintech than another. Therefore, we believe that our methodological approach fills the research gap in an original manner.

Results indicates that a great level of fintech in banking sector improves significantly ESG performance. The relationship with board size is negative but not statistically significant, while are positive and relevant the relationships with the level of independence of the board and gender diversity. The paper is organized as follows: the next section contains the literature review about extant contributions on the topic; section three defines the research hypotheses, section four describes the empirical analysis, section five exposes the results of the analysis, while section six offers the discussion of the results and conclusions.

2. Literature review

In recent years, the financial sector has undergone a rapid evolution thanks to the emergence of financial technologies (Maslennikov et al., 2017) known as Fintech (Takeda and Ito, 2021), which have influenced the business models of financial intermediaries (Allen and Santomero, 2001), with the development of new products and services (Gomber et al., 2018) which have revolutionized the way people and companies interact with financial services. Given the relevance of the topic, Schueffel (2016) performed specific research to propose a definition arising from the most often mentioned commonalities of the scholarly definitions of Fintech: *"Fintech is a new financial industry that applies technology to improve financial activities"* (Schueffel, 2016, p.45).

Therefore, a relevant number of technologies would be suitable to be embedded in the definition of fintech industry (Pandey et al., 2023). Indeed, those that might be conveniently mentioned are the blockchain (Son and Jang, 2023), artificial intelligence (Ahmed et al., 2022), big data (Wang et al., 2021), and the internet of things (Palmaccio et al., 2021).

The Fintech sector has proven to have a significant impact on the adoption and integration of ESG in the financial sector (El Khoury et al., 2023; Atayah et al., 2023). Thanks to the ability of Fintechs to leverage digital technology (Lin et al., 2023) to improve the efficiency, transparency and personalization of financial services, these technologies are contributing to the creation of solutions that facilitate the involvement of investors and companies in the ESG area. The main ESG implications of fintech can be summarized as follows:

- creation of sustainable investment platforms (Devine et al., 2022): Fintechs are developing investment platforms that incorporate ESG criteria in the selection and evaluation of investments, allowing, on the one hand, investors to easily access sustainable portfolios and to monitor the environmental and social impact of their financial choices, on the other hand to direct capital towards investments that generate a positive impact on society and the environment, accelerating the transition to a low-carbon economy and promoting the creation of green infrastructures;
- blockchain and traceability (Shahzad et al., 2023): blockchain technologies, often associated only with cryptocurrencies, can be used to trace and verify the origin and sustainability of products, promoting transparency and corporate responsibility along the supply chain;
- digital payments and financial inclusion (Rastogi et al., 2023): Fintechs offer digital payment solutions that allow a greater number of people, even in remote or disadvantaged geographical areas, to access financial services. This helps reduce poverty and promote sustainable economic growth;
- data analytics and ESG assessment (Semenova and Hassel, 2015): the use of tools based on artificial intelligence and machine learning by Fintechs allows for the analysis of large quantities of data to identify and assess the risks and opportunities associated with ESG financial instruments, improving quality investment decisions;
- energy efficiency and emissions reduction (Tao et al., 2022): Fintechs can also play a role in optimizing energy use and reducing carbon emissions. For example, blockchain-based energy management platforms can help businesses and consumers monitor and control their energy consumption in real time, promoting energy efficiency and reducing their carbon footprint.

The relationship between fintech and sustainability offers a unique opportunity to drive positive change in the financial sector and beyond (Costa-Climent and Martínez-Climent, 2018). Fintech can leverage their innovation and agility to develop solutions that address environmental and social challenges, promoting a more sustainable and inclusive future. Collaborations between fintech, traditional businesses, governments and international organizations will be key to unlocking the full potential of fintech to support sustainability.

While the fintech industry has been largely investigated respect to the contribution of digital technologies on financial (Liua et al., 2017; Kharrat et al., 2023) and operational performances (Wang et al., 2021), only few contributions investigated the impact of fintech on ESG performances (Wang et al., 2022; Du et al., 2022; El Khoury et al., 2023; Atayah et al., 2023). Indeed, as Takeda and Ito (2021, p. 72–79) ague, extant studies mainly focused on (1) the provision of new value-added by existing financial institutions, (2) improved efficiency by existing financial institutions, (3) provision of new value-added by new entrants and (4) Improved efficiency by new entrants.

Several previous contributions focused on ESG scores within the banking sector, but only few of them analysed the relationship between fintech and ESG performances (Bitetto and Cerchiello, 2023; El Khoury et al., 2023; Wang et al., 2022; Du et al., 2022). However, none of such contributions proposed an approach to measure the level of fintech and define whether a bank is more fintech than another. Therefore, we believe that our methodological approach fills the research gap in an original manner.

3. Research hypotheses

3.1. ESG and fintech

Wang et al. (2022) empirically examine the effect of fintech development on corporate ESG performance by using a sample of Chinese listed companies. Findings demonstrate that the alleviation of corporate financing constraints is a channel through which fintech development influences corporate ESG performance. Overall, the paper reveals the impact and mechanism of fintech on corporate ESG performance, providing empirical evidence on the development of fintech and corporate ESG performance in emerging markets. Du et al. (2022) examines the relationship between regional FinTech development and corporate ESG performance and its underlying mechanisms from internal and external perspectives, using data from Chinese A-share listed companies from 2011 to 2020, find that the level of regional FinTech development significantly contributes to firms' ESG performance, enhances the external government subsidies and tax rebates of firms and that in eastern region corporate ESG performance is more pronounced when CEOs have an unbanked financial backgrounds. Atayah et al. (2023) provide empirical evidence on the suitability of a Bloomberg ESG disclosure index designed for companies from the USA and to investigate the sustainability quality and stock performance of FinTech companies. Findings indicate that the Bloomberg ESG disclosure index is a valid proxy for sustainability and has a direct relationship with stock performance. The study suggests that non-FinTech firms outperform FinTech firms in sustainability and stock performance and support stakeholder theory, suggesting that increased disclosure of ESG information mitigates the agency problem and protect shareholders' interests.

Considering the scarce number of papers deepening the relationship between fintech and ESG performances, our research aims to contribute to such non mature field by focusing on banks and financial institutions of the US and EU. Particularly, we aim to understand if the introduction of fintech technologies in the banking sector can influence the ESG rating of such companies. Therefore, according to the extant literature and the emerging business trends, fintech development should contribute to improve the ESG performance to drive positive change in the financial sector. Based on the above analysis, this paper proposes the following research hypothesis:

H1. The development of fintech contributes positively to the ESG performance of banks.

3.2. ESG and corporate governance

Extant literature argues that the effectiveness and efficiency of oversight and risk monitoring by the board of directors may be influenced by the level of responsibility and workload assigned to them, and by their personal and professional skills, therefore "*the effectiveness and efficiency of these functions are dependent on the size of the board of directors*" (Miranda et al., 2023, p.6). Larger boards should consist of members with different skills; however, larger boards are subject to a higher level of bureaucracy with slower decision-making processes (Bătae et al., 2021) and a greater variety in terms of stakeholder representation. Therefore, greater boards are supposed to be more effective when they have a higher workload and more responsibilities (Birindelli et al., 2018).

Smaller boars could be more efficient and effective in monitoring and controlling executives (Ahmed et al., 2006), creating a higher level of accountability and mitigating possible opportunistic behavior my managers (Birindelli et al., 2018). Considering that previous studies find a negative association between board size and the ESG performance, this paper proposes the following research hypothesis:

H2. Board size is negatively related to ESG performance of banks.

Another relevant issue related to ESG performance is the level of independence. As per the stakeholder theory, a greater independence should reduce conflicts of interest and encourage the maximization of the company's market value and greater transparency (Ahmed et al., 2006; Cheng and Courtenay, 2006). Therefore, boards composed of more independent members should have a higher level of disclosure and should undertake socially responsible investments (Cheng and Courtenay, 2006). On the relationship between board independence and ESG performance there are studies with contradictory results. For instance, Birindelli et al. (2018) and Lu and Wang (2021) showed that there is a negative relationship between board independence and ESG performance; nevertheless, there are also studies that have presented a positive relationship (Haque and Ntim, 2018; Cucari, 2018). For such a reason, the following hypothesis is developed:

H3. *The percentage of independent board members is positively related to ESG performance of banks.*

As argued in Birindelli et al. (2018) and in García-Sánchez et al. (2018) women and men are characterized by different values, beliefs, experiences, perspectives and ways of working, with women, almost unquestionably, being more oriented toward ESG practices. Therefore, it is believed that female directors are more likely to perform ESG responsible management choices that, consequently, should legitimate the banks. In other words, banks that have gender diversity in their boards (Venturelli et al., 2024) are more prudent in dealing with socially responsible activities and adopt more legitimate ESG practices (Bear et al., 2010; Torchia et al., 2011; Shakil et al., 2021).

However, extant studies on the relationship between the proportion of women on the board of directors and ESG performance present contradictory results, and there is still need to deepen such relationship. Indeed, some studies highlight a positive relationship (Birindelli et al., 2018; Galletta et al., 2022; Lu and Wang, 2021; Shakil et al., 2020), negative (Harjoto et al., 2015; Husted and de Sousa-Filho, 2019) or inconclusive relationships (Khan, 2010; Manita et al., 2018). However, a positive influence is mostly evidenced. Due to the above, the following hypothesis is formulated:

H4. *Gender diversity is positively related to ESG performance of banks.*

4. Empirical analysis

4.1. Sample selection

For the definition of the sample, we began with a population of 1551 listed banks in 2022 available from Refinitiv database and we selected those located in Europe and the USA. The initial dataset was of 829 financial institutions. Then, we deleted: a) 587 banks for the lack of the ESG data; b) 61 banks for other missing data; c) 1 bank with annual report not available from its website. Therefore, the final sample is composed of 180 financial institutions, as indicated in the Table 1. Selected banks belong to 15 different countries with a prevalence of USA banks.

ESG performance, corporate governance (board size, independent directors and gender diversity) and bank-specific financial data was collected from Refinitiv Eikon. The annual reports of banks, downloaded from their websites, were used to construct the fintech index.

4.2. Dependent variable

To test our hypotheses, we used as dependent variable Refinitiv ESG scores as a proxy of ESG performance. These scores have replaced the former ASSET4 ESG ratings, reflecting a new strategic ESG framework. To define the score, Refinitiv collects over 630 company-level ESG measures. The ESG score is the result of three sub-scores related to the three pillars (environmental, social, and corporate governance) grouped into 10 categories.

Environment pillar (E) includes the following categories:

- Emission, which measures the commitment towards reducing environmental emissions in its production and operational processes;
- Innovation, which refers to the ability to exploit technologies and new processes with the aim to reduce the environmental costs and to create new market opportunities;
- Resource use, which measures the ability in reducing the use of resources, such as materials, water or energy, and to identify eco-efficient solutions in operational processes.

Social pillar (S) considers the following categories:

- Workforce, which measures the ability to create satisfaction for its employees, as well as healthy and safe workplace, maintaining gender diversity and ensuring equal opportunities;
- Human rights, which assess the respect of fundamental human rights conventions;
- Community, which measures the involvement in the protection of public health and respect for business ethics;
- Product responsibility, which reflects the ability to offer goods and services integrating customer health, safety, integrity and privacy.

Finally, Corporate governance (G) pillar contains the following categories:

- Management, which assess the commitment and effectiveness towards following best practice corporate governance principles;
- Shareholder protection, which reflects the ability to ensure fair treatment for shareholders;
- Corporate social responsibility strategies, which assess the ability to integrate economic, financial, social and environmental dimensions into business management.

The overall ESG score is the arithmetic mean of the three sub-scores and is expressed as a percentage ranging from 0 to 100.

Table 1
Sample selection.

	N
Listed banks	1551
- headquarters not in Europe or in the USA	-722
- ESG data not available	-587
- other data not available	-61
- annual report not available	-1
N. observations	180

4.3. Independent variables

4.3.1. The construction of the fintech index

The first independent variable is fintech index, developed by using the annual reports of companies included in the sample. Annual reports have been analysed with the AntConc corpus processing software (https://www.laurenceanthony.net/software/antconc/). AntConc is a free, multi-platform, multi-purpose corpus analysis software developed by Professor Laurence Anthony. It deals with the automatic identification of text structure, which can be applied to research in general. The approach with this software goes from general to specific. It is widely used in corpus analysis in linguistics and can be applied in all fields. AntConc can be used with Windows, Macintosh and Linux (Kharrat et al., 2023).

In our methodology AntConc provides the frequency of any search item. Our task is to measure the frequency related to the occurrence of keywords in the annual report of banks in the sample. We adopted the same 10 keywords applied in the study by (Kharrat et al., 2023, p.6): Technology, Digital Banking, Network, Internet Banking, Online Services, FinTech, AI, Blockchain, E-payment and Mobile Banks. The construction of the fintech index can be summarized in the following steps:

- download of the pdf format of the annual reports (FY 2022) of companies in the sample;
- convert of the pdf files of annual report in the txt format through the software AntFileConverter https://www.laurenceanthony.net/software/antfileconverter/;
- creation of the corpus file with txt files of the annual reports within the software AntConc;
- processing of the corpus file with AntConc by using the "Plot" tool provided by the application;
- cleaning of the data by removing keywords that contain negative words, namely, "no" or "none";
- collection in excel spreadsheet of the processing results;
- calculation of the fintech index for every company in the sample as a sum of frequencies of keywords.

4.3.2. Corporate governance variables

To test the hypotheses of the relationship between ESG and corporate governance characteristics we included the three explanatory variables. BOARD SIZE is defined as the total number of directors on the bank's board. BOARD INDEP is defined as the percentage of independent board members on the board of directors. WOMEN is defined as the percentage of women on the board of directors.

We expected a positive relationship between ESG and the three explanatory variables. Panel A of Table 2 presents a summary of the measurements of explanatory variables.

4.3.3. Control variables

The following variables were chosen as control variables after analysis of current research literature. To avoid model specification errors, we checked for additional variables that could have an influence on the ESG score. In particular, we controlled for SIZE as the natural logarithm of total assets (Wang et al., 2022), leverage (LEV) calculated as total debts divided by total assets (Gurol and Lagasio, 2023; Ellili, 2022), ROA (the ratio of net profit to total assets) as a proxy of profitability (Gao and Liu 2023) and finally for AGE as the number of years the company has been in existence (Wang et al., 2022).

Panel B of Table 2 presents a summary of the measurements of control variables and the expected relationships with ESG score.

4.4. The research model

The analysis was carried out using an OLS regression model, which tests the relationship between ESG performance and independent variables. More specifically, the estimation model is as follows:

Table 2
Description of independent variables.

Name of variable (acronym)	Measurement	Expected relationship with ESG score	Sources
Panel A: Explanatory variables			
Fintech (FINTECH)	Fintech index calculated with AntConc software	Positive	Kharrat et al. (2023) Wang et al. (2022)
Board Size (BOARD SIZE)	Total number of directors on the bank's board	Positive	Birindelli et al. (2018)
Board Independence (BOARD INDEP)	The percentage of independent board members on the board of directors	Positive	Birindelli et al. (2018)
Women on the board of directors (WOMEN)	The percentage of women on the board of directors	Positive	Birindelli et al. (2018)
Panel B: Control variables			
Bank Size (SIZE)	The natural logarithm of total assets	Positive	Wang et al. (2022)
Leverage (LEV)	Total debts divided by total assets	Positive	Gurol and Lagasio (2023); Ellili (2022)
Profitability (ROA)	The ratio of net profit to total assets	Positive	Gao and Liu (2023)
Age (AGE)	The number of years the company has been in existence	Positive	Wang et al. (2022)

$$ESG_i = \beta_0 + \beta_1 FINTECH_i + \beta_2 BOARD \quad SIZE_i + \beta_3 BOARD \quad INDEP_i + \beta_4 WOMEN_i + \beta_5 SIZE_i + \beta_6 LEV_i + \beta_7 ROA_i + \beta_8 AGE_i + \varepsilon_i$$

where the i represent the bank identifier.

FinTech is the explanatory variable, and its coefficient reflects the impact of financial technology level on the ESG performance of banks. We expected a positive relationship with ESG score.

5. Findings

5.1. Descriptive statistics

Table 3 shows descriptive statistics for dependent and independent variables. The descriptive statistics include the minimum, maximum, mean and standard deviation. The average level of ESG score of banks was 44, with a minimum of 10,95 and a maximum of 92,25. Fintech index presents a mean of 42,69 with a minimum of 0 and a maximum of 266, demonstrating a considerable variability in the sample. The descriptive statistics for control variables are close to those of the extant literature.

5.2. Correlation analysis

To assess the correlation of a variable simultaneously with two or more variables, we performed a multiple correlation analysis (Pearson correlation). The correlation matrix (Table 4) highlights a positive relationship between the dependent variable and the explicative independent variable. ESG was found to be positively associated with BOARD SIZE, WOMEN, SIZE, LEV, AGE.

Furthermore, we performed the variance inflation factor (VIF) test to check for multicollinearity among the variables. Chatterjee and Hadi (2013) indicated a VIF value of 10 as a cut-off for considering high correlations between variables. In the present study, the VIFs were all less than 3, suggesting the absence of multicollinearity.

5.3. Results

Table 5 reports the results of linear regression analysis. The coefficient of FINTECH on ESG is 0072 and it is statistically significant at% level (t-value=3642). This indicates that a great level of fintech in banking sector improves significantly ESG performance, confirming our research hypothesis.

The coefficient of BOARD SIZE is negative but not significantly. This result does not surprise since in previous studies the evidence is mixed. Our findings are in line with Miranda et al. (2023), according to which the larger the board, the more complicated the monitoring and supervision of banks' decisions may become.

In terms of the level of independence of the board (BOARD INDEP) the results show a positive and significant relationship at 5% level (t-value=2144) with ESG. This indicates that the presence of independent directors has a positive influence on the ESG performance since they can encourage socially responsible practices.

The gender variable on corporate governance is positively related with ESG score, demonstrating that the presence of women fosters the improve of ESG performance.

The coefficient of other control variables are in line with previous literature.

6. Discussion and conclusions

The results of the analysis support the hypothesis that the ESG performance is positively influenced by financial technologies known as Fintech (Takeda and Ito, 2021). Therefore, the research confirms the aptitude of financial technologies in favouring the adoption and integration of ESG practices in the financial sector (El Khoury et al., 2023; Atayah et al., 2023). The relationship between the fintech field and ESG practices deserves further attention in future studies, in order to verify the financial technologies impact in driving positive changes in the financial sector and beyond (Costa-Climent and Martínez-Climent, 2018). Fintech can leverage their innovation and agility to develop solutions that address environmental and social challenges, promoting a more sustainable and inclusive future. Collaborations between fintech, traditional businesses, governments and international organizations will be key to

Table 3
Descriptive statistics.

Variable name	N	Mean	Std Dev.	Min.	Max
ESG	180	44.51	16.02	10.95	92.25
FINTECH	180	42.69	44.56	0	266
BOARD SIZE	180	11.42	2.85	5	21
BOARD INDEP	180	80.21	14.55	11	100
WOMEN	180	26.33	12.65	0	62.5
SIZE (€/milion)	180	87,539	333,566	889	2,755,813
LEV	180	0.06	0.09	0	1
ROA	180	1.25	0.75	-0.84	9.19
AGE	180	32.86	23.93	0	148

Table 4
Pearson's correlation coefficients.

Variable name	ESG	FINTECH	BOARD SIZE	BOARD INDEP	WOMEN	SIZE	LEV	ROA	AGE
ESG	1								
FINTECH	0.558 **	1							
BOARD SIZE	0.101	0.115	1						
BOARD INDEP	-0.157 *	-0.239 **	0.013	1					
WOMEN	0.635 **	0.288 **	-0.106	-0.205 **	1				
SIZE	0.731 **	0.573 **	0.346 **	-0.273 **	0.484 **	1			
LEV	0.442 **	0.204 **	-0.083	-0.380 **	0.499 **	0.511 **	1		
ROA	-0.066	-0.018	-0.074	-0.019	-0.107	-0.162 *	-0.015	1	
AGE	0.296 **	0.229 **	0.297 **	-0.081	0.195 **	0.386 **	0.249 **	-0.122	1

Notes: n = 180; *** significant at the 1% level; ** significant at 5% level; * significant at 10% level.

Table 5
Linear regression results.

Variables	Coefficient	Standard error	t-test	p-value	
Constant	-88.870	15.183	-5.853	0000	***
FINTECH	0.072	0.020	3.642	0000	***
BOARD SIZE	-0.327	0.295	-1.107	0.270	
BOARD INDEP	0.113	0.053	2.144	0.033	**
WOMEN	0.448	0.069	6.492	0000	***
SIZE	4.814	0.719	6.696	0000	***
LEV	0.440	10.774	0.041	0.967	
ROA	1.180	0.953	1.238	0.217	
AGE	0.015	0.033	0.460	0.646	
N	180				
Adj R^2	0.663				

Notes: *** significant at the 1% level; ** significant at 5% level; * significant at 10% level.

unlocking the full potential of fintech to support sustainability.

Interesting, even if not statistically relevant, is the negative relationship between ESG performances and the board size. Such result does not surprise since in previous studies the evidence is mixed. Our findings are in line with Miranda et al. (2023), according to which the larger is the board, the more complicated the monitoring and supervision of banks' decisions may become. A further improvement of the analysis might be directed to improve the statistical relevance of the analysis to verify if our study might contribute to a minority branch of studies that argue that larger boards are subject to a higher level of bureaucracy with slower decision-making processes (Bătae et al., 2021) and a greater variety in terms of stakeholder representation.

We confirm the evidence pointed out by most of the extant contribution: the level of independence of the board positively influences ESG performances. The stakeholder theory is still working, and boards composed of more independent members have a higher level of disclosure and should undertake socially responsible investments (Cheng and Courtenay, 2006; Haque and Ntim, 2018; Cucari, 2018).

The same goes for the gender variable: the presence of women fosters the improve of ESG performance (Birindelli et al., 2018; García-Sánchez et al., 2018). Women and men are characterized by different values, beliefs, experiences, perspectives and ways of working, with women, almost unquestionably, being more oriented toward ESG practices. Therefore, we confirm that female directors are more likely to perform ESG responsible management choices that, consequently, should legitimate the banks.

Our research offers theoretical and practical implications: on one hand it is relevant for financial institutions that aims to improve their ESG performances; indeed, results demonstrate that an higher level of fintech is associated with a better ESG score; on the other hand such a positive relationship is relevant for the intellectual capital theory by demonstrating that structural capital (fintech) is able to positively impact ESG performances.

Our research is not free of limitations. Indeed, we performed our analysis by measuring the fintech index through a text analysis of annual report. The future availability of more detailed information about fintech of the elaboration of more accurate fintech indexes could influence the result. Furthermore, governance factors need to be investigated more in deep. Future development of the research might be in the direction of expanding the sample and the number and quality of variables.

CRediT authorship contribution statement

While the paper is the result of a joint effort by the authors, the individual contributions are as follows: Grazia Dicuonzo wrote "Introduction", "Findings" and "Discussion and conclusions", Matteo Palmaccio wrote "Literature review" and "Research hypotheses" and Matilda Shini wrote "Empirical analysis".

Data availability

Data will be made available on request.

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