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Fintech governance and performance: Implications for banking and financial stability

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ABSTRACT

This paper explores the relationship between governance and performance of Fintech firms recalling Resource-Based View and Upper Echelons Theory principles. Using a pooling model, we identify key characteristics of Chief Executive Officers (CEOs) and Boards of Directors (BoDs) that can improve profitability and lower risk in Fintech firms. The findings highlight that an older BoD increases risk and profitability, while a larger BoD reduces returns and risk. Furthermore, having a female CEO impacts the likelihood of default, while CEOs with expertise in management or law are associated with lower profitability. The study provides empirical evidence that governance structures can decrease Fintech risk and increase financial stability, addressing a previously overlooked research area. Informed decisions by banks about Fintech partnerships, based on enhanced governance, can mitigate risks, and improve the overall stability of the financial system.

1. Introduction

Financial Technology (Fintech) firms have been transforming the financial industry, innovating the banking system, and supporting the spread of new business models, processes, and financial products (FSB, 2017). Fintech firms operate within an evolving environment characterized by technological advances, regulatory complexity, and high competition (BCBS, 2018). This challenging scenario presents a threat to financial stability and underscores the importance of monitoring the emerging risks associated with the process of financial innovation (FSB, 2019).

The revised G20/OECD Principles of Corporate Governance (OECD, 2022) acknowledge the potential of digitalization and Fintech for the reorganization of traditional financial systems and the creation of new challenges in corporate governance structures. Financial institutions and Fintech companies are required by the intergovernmental organisation to adopt effective governance structures that can respond to a changing environment. In pursuit of this objective, Fintech firms attempt to reduce their risk vulnerability and enhance their profitability by establishing alliances with incumbent banks or listed companies (EBA, 2018; Hornuf et al., 2021). Given the growing collaboration between Fintech firms and incumbent banks or other financial entities, ensuring effective corporate governance is essential to safeguard the rights of shareholders and to protect the banking system from emerging risks. Policymakers

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and regulators aim to maximise the advantages of Fintech firms in the financial sector, while also mitigating potential risks to the financial system through the promotion of good governance practices (FSB, 2017).

In the same perspective, supervisory banking authorities also pay close attention to Fintech governance issues to ensure stability, risk management, and sustainable financial innovation development, as reported by BCBS (2018) and EBA (2021). The European Central Bank (hereafter ECB) credit guidelines on Fintech governance (European Central Bank ECB, 2018) confirms this growing attention in compliance with the European Commission (2018) principle of technological neutrality. In this framework, the ECB assigns a key role to the Fintech board of directors (hereafter BoD), defining its structure, functions, and responsibilities in compliance with the ECB (2021) Capital Requirements Directive IV. Furtherly, the corporate governance principles suggest companies should clearly disclose the different roles and responsibilities of both members of the BoD and CEO figure (OECD, 2015). The BoD has ordinary and extraordinary management powers and a monitoring role over the CEO's activities. In contrast, the CEO is responsible for setting the firm's overall direction, including its multifaceted and often uncertain innovation agenda (Finkelstein et al., 2009). As a result, increasing attention has been paid to the personal and professional characteristics of both BoDs and CEOs, including age, gender, and area of specialization (Sannino et al., 2020). Existing literature has shown as the collaborative nature of the BoD and CEO roles, driven by personal traits and principles (Berson et al., 2008), plays a crucial role in shaping and managing organisational culture (Wally and Baum, 1994), in influencing the effectiveness of the decision-making process and managerial strategy and, lastly, on improving firm performance.

We analyse the governance characteristics of Fintech firms jointly the theoretical perspective of the Resource-Based View (RBV) by Wernerfelt (1984) and the Upper Echelons Theory (UET) by Hambrick and Mason (1984). An original conceptual model that links these theories to all governance variables support our empirical analysis.

Existing governance literature has mostly focused on the link between governance and performance in the banking sector (e.g., Srivastav and Hagendorff, 2016; Martín-Oliver et al., 2017) by examining the impact of board size (Grove, 2011), gender diversity or directors' educational training (Issa, 2021) on performance. In this extensive literature body, Ujunwa (2012) highlights the positive influence of directors' specialization on financial performance, Skała and Weill (2018) find a positive impact of female CEO on firm risk exposure, while Bhatia and Gulati (2021) exhibit a positive relationship between larger boards and firms' performance. To the best of our knowledge, no empirical studies have investigated the relationship between governance structure and performance of Fintech firms. To fill this academic gap, the paper investigates which governance characteristics can improve Fintech profitability and/or reduce their probability of default.

We discern the effect on Fintech performance jointly analysed: (i) the BoD's characteristics (i.e., board size, age, gender diversity, and specialization), and (ii) CEO characteristics (i.e., CEO gender and specialization). We hand-collected a sample of 255 Italian unlisted Fintech firms from 2017 to 2019 to test our hypotheses. We focused on an Italian sample to explore the specific determinants and challenges faced by Fintech firms operating within a highly bank-centric financial environment. The increasing of bank-Fintech partnerships motivates us to understand the dynamics underneath the transfer of managers and BoD members from incumbent banks to Fintech players and examine the impact of BoD and CEO characteristics on Fintech firms' performance. Results of regression models reveal that an older BoD increases riskiness and profitability, while a larger BoD reduces profitability and riskiness. Moreover, female CEO produces an increase in Fintech default probabilities. Conversely, CEO specialization in managerial and law, more focused on expertise that diverges from digital and technologies capabilities, reduces profitability. These findings are robust when employing an instrumental variables specification for the BoD structure and CEO characteristics.

It is crucial to highlight the unique characteristics and relevance of Fintech firms compared to innovation-driven firms. Fintech firms are defined by their use of technology to provide disruptive, innovative products in the financial services industry. This sets them apart from other innovative companies because of their direct influence on financial systems, services, and the regulatory environment. The unique aspect of the Fintech sector lies in its provision of innovative solutions that traditional financial institutions might not offer or could implement with longer time horizons. These include improved access, tailored services, and greater efficiency in financial transactions and management.

The focus on Fintech firms in this study is based on the understanding that their governance structures, including the roles of CEOs and BoDs, significantly impact their operational performance and risk profiles. In contrast to other innovative firms, for example, big techs and tech-fin, that may function in industries facing different regulatory and competitive challenges, Fintech firms operate within a complex and integrated financial ecosystem. In this environment, governance mechanisms are crucial for ensuring regulatory compliance, managing risks, and promoting innovation.

Our findings provide several contributions to governance literature. In line with the OECD's attention to "digitalization of managerial processes and corporate governance", this study provides empirical evidence how the distinctive governance characteristics enhance performance in the financial technology sector. Furthermore, in line with ECB (2023) financial stability expectations, our results could provide support to established banks when selecting Fintech firms as strategic partners. Indeed, the interplay between Fintech governance and riskiness has implications for the broader financial ecosystem. When established banks seek Fintech firms for strategic partnerships, effective governance within new financial firms can mitigate inherent risks, ensuring operational resilience and reducing the potential for systemic vulnerabilities. By selecting Fintech partners with robust governance structures, banks can ensure continuity of service, safeguard against operational disruptions, and maintain the trust of stakeholders. Consequently, a deeper comprehension of how Fintech governance influences riskiness not only aids banks in their strategic decision-making but also strengthens the overall stability of the financial system.

It follows that implementing rigorous governance mechanisms in Fintech firms is directly correlated with reduced industry risk, thereby fostering an environment conducive to financial stability. Moreover, our findings hold relevance for banking regulators as they manage the complex opportunities and challenges inherent in the Fintech sector. The study's empirical evidence can help to

understand strategic progress and provide valuable perspectives for designing policies to enhance the inherent resilience of the financial system.

Our research contributes to the growing literature stream on the strategic interactions between banks and Fintech companies. Specifically, it aims to assess the interconnections between these two financial institutions and the spillover into the banking industry. Recent studies, such as those conducted by Bussoli et al. (2023) and Cappa et al. (2022), illustrate the advantages banks gain from engaging with Fintech companies. These benefits are primarily seen in the rapid acquisition of digital capabilities, which are crucial for banks to stay competitive in the financial sector. By merging with or acquiring Fintech firms, traditional banks can quickly integrate advanced technological tools and expertise, leading to improvements in operational efficiency and profitability. Furthermore, establishing partnerships or acquiring Fintech firms serves as a strategic response to the digital disruption process facing the banking sector. Additional research, including that by Wang et al. (2021), Zhao et al. (2022), Lee et al. (2021), and Li et al. (2022), provides evidence of the positive impact of bank-Fintech collaborations on performance metrics. These collaborations have been shown to improve profitability cost efficiency, and reduce systemic risk within the banking sector. Therefore, a thorough analysis of the governance structures of Fintech companies could assist banks in evaluating these partnerships. This would increase awareness of the key areas that define each strategic relationship. This approach could aid in risk management by providing insights into the risk profiles and operational resilience of Fintech companies, which is essential for banks to manage their own risk exposure. Governance compliance ensures that Fintech firms meet regulatory requirements, reducing legal and compliance risks for banking partners. Additionally, governance structure influences innovation processes within Fintech companies, offering banks opportunities for competitive advantages through access to novel products and services (Katsiampa et al., 2023). Assessing the financial health and performance outcomes of Fintech firms through their governance practices enables banks to make informed decisions regarding investments and collaborations. Strong governance in Fintech firms enhances confidence among all stakeholders, including regulators, customers, and partners, which is crucial for the sustainability of these collaborations.

The remainder of the paper proceeds as follows. Section two presents the theoretical background and explains the hypothesis development. Section three describes the research design. Section four analyses the empirical findings and reports robustness checks results. Section five provides an analytical discussion. Finally, Section six contains our concluding remarks.

2. Theoretical background and hypothesis development

The emergence of Fintech players has reshaped the financial intermediation dynamics and intensified competition in financial markets (BIS, 2019, BIS, 2021a). Many business opportunities are connected to Fintech development, such as faster and more affordable services (Wang et al., 2021). Likewise, new operational, cyber, and macro-financial risks have emerged in the financial sector (FSB, 2017) as a consequence of technological innovation and financial globalisation (Arestis and Basu, 2004).

Supervisory banking authorities and regulators increasingly focus on governance matters within the Fintech sector to safeguard business continuity and effectively address potential risks arising from technological advancements (Masciandaro et al., 2013). Ensuring quality corporate governance is crucial in addressing three key challenges: (i) the rising number of bank-Fintech alliances; (ii) the growing investments in global Fintech markets; and (iii) the implications of digital players on the banking industry (EC, 2021; Bank of Italy, 2021).

To this aim, the EBA (2021) has defined guidelines to monitor access to the Fintech market and harmonise these financial players' organizational and governance structures. The board of directors must possess adequate knowledge, as well as professional and banking expertise to comply with CRD IV (EU Directive 2013/36 / EU and EU Regulation 575/2013; ECB, 2021). Information technology (IT) skills are also essential, given that technology is a critical asset in Fintech. Digital risks must be managed by fair governance to avoid the death of Fintech firms (European Central Bank (ECB), 2018; OECD, 2019; 2022; 2023). Therefore, supervisory rules require good governance practices to ensure the financial sustainability of these start-ups (Langfield-Smith, 2008) and build an environment of trust towards customers (OECD, 2015). Therefore, policymakers must monitor the bank-Fintech alliance both to ensure a level playing field in the financial sector and to safeguard the financial stability of the system (BIS, 2021b). Since the purpose of a company's existence is to create or increase the wealth of its stakeholders through its economic activities, it is important to identify governance characteristics that could improve performance.

Previous managerial and governance literature has mainly focused on bank governance issues, suggesting a correlation between governance structure and financial intermediaries' performance (e.g., Srivastav and Hagendorff, 2016). Studies show that directors' specialization (Ujunwa, 2012), board size (Bhatia and Gulati, 2021) and board gender diversity (Issa et al., 2021) are positively correlated with bank performance. In this literature stream, Grove et al. (2011) find a concave relationship between performance and board size or the average age of directors. Other studies specifically examine the link between corporate performance and CEO characteristics (Shen, 2021), showing, as in the Nelson study (2005), an endogenous relationship between governance, CEO characteristics, and long-term performance. Likewise, our analysis investigates the relationship between governance structure and performance on a sample of unlisted Fintech firms. Apart from a limited number of studies examining the impact of Fintech players on bank performance (Zhao et al., 2022) or bank efficiency (Wang et al., 2021), this area remains largely unexplored. To address this gap, we undertake an evaluation encompassing two aspects of the governance structure: the BoD and the CEO.

This study goes beyond the limited perspective of the Agency Theory (AT) (Jensen and Meckling, 1976) by integrating the views of the Resource-Based View (RBV) and Upper Echelons Theory (UET) to establish a comprehensive theoretical framework that supports our analysis. The AT mainly underscores the role of managers and executives on the board, neglecting the value of diversity in terms of skills and expertise among board members for operational effectiveness. Differently, the UAT highlights the significance of objectively measurable traits of administrators and CEOs in comprehending their impact on firm performance. Conversely, the RBV, which is

based on the AT framework, maintains that a firm's performance depends on its ability to connect with the external environment through the ownership of resources. The BoD operates as the link between the firm and the external environment, with administrators and CEOs contributing resources in the form of information, skills, and key components. Ultimately, the individual traits of administrators and CEOs may have substantial impacts on company performance. By examining the governance characteristics of fintech firms, including the board of directors and the CEO, this study aims to comprehensively analyse their impact on Fintech performance and provide an extensive rationale for the use of RBV and UET theories. Fig. 1 illustrates our conceptual model, which recalling RBV and UET, summarizes and connects all our governance variables used to examine the impact on Fintech performance (e.g., profitability and riskiness).

2.1. Board characteristics and Fintech performance

2.1.1. Board size

The BoD characteristics, like size and average age of directors, are fundamental to defining the organisations' rules (Jensen and Meckling, 1976; Eisenberg et al., 1998;). According to Anderson et al. (2004) and Coles et al. (2008), a large board is likely to possess specialized skills that are prerequisites for firm efficiency and risk mitigation. Similarly, the Resource Dependence Theory (Pfeffer and Salancik, 1978) posits that having many directors increases the depth and breadth of expertise on the board, improves the board's decision-making ability and expands the pool of resources accessible to the organization (Dalton et al., 1999).

In contrast, Yermack (1996) point out that small board size facilitates communication and decision-making and thus improves performance. This thesis aligns with Jensen's (1993) viewpoint that having multiple directors raises agency issues, consequently decreasing the effectiveness of the board in supervising managerial behaviour, and ultimately reducing firm profitability. Based on this literary evidence, we formulate the following hypotheses:

H1a. . An increase in board size reduces Fintech riskiness.

H1b. . An increase in board size reduces Fintech profitability.

2.1.2. Board age

The literature presents mixed results regarding board age and Fintech performance. Scholars such as Wiersema and Bantel (1992) suggest that older decision-makers may struggle to adjust to new business paradigms and engagement methods. Hildebrand, Anterasian, and Brugg (2021) found that the prior business experiences of older officers could obstruct significant changes. Consequently, the impact of the COVID-19 pandemic on Fintech and e-commerce, as discussed in studies by Bao and Huang (2021), Berg et al. (2021), Fuster et al. (2021), Ozik et al. (2021), underscores the importance of adapting to such shifts. Additionally, the literature indicates a tendency among senior board members to favour steady, although slower, returns from organic growth, as Yim (2013) noted. Additionally, Kim and Lim (2010) viewed age as a double-edged sword. While age increases experience, it is also associated with losing vigour and productivity (Adams et al., 2018). Therefore, older boards tend to be riskier for the Fintech business model because slow adaptability to environmental changes could affect their probability of survival when exogenous and unpredictable events occur. These literature contributions support the development of Hypothesis 2a.

Besides these empirical findings, some scholars, such as Mahadeo et al. (2012), have highlighted a positive relationship between the high average age of directors and firm profitability. In fact, greater labour market experience comes with age, resulting in better interpersonal skills and networking capabilities (Medoff and Abraham, 1980). Besides this perspective, Katsiampa et al. (2023) empirically demonstrate that publicity-listed Fintech firms with lower board age divergence exhibit better financial performance. While scholars such as Ali et al. (2014) and Cumming and Leung (2021) show that all types of board diversity (e.g., age, gender, and expertise) facilitate firm innovation processes and profitability. Therefore, the experience and skills that come with older board members positively impact firm profitability, which supports the development of hypothesis (H2b).The hypothesis 2 are exhibit as

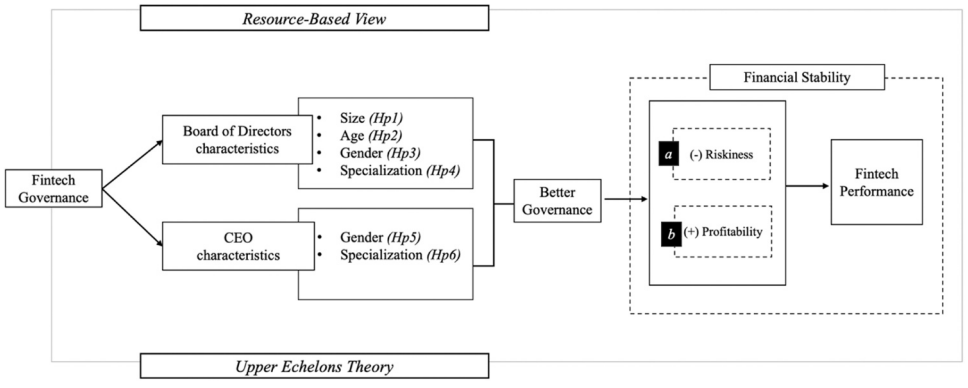

Fig. 1. Conceptual model of the study. **Note**: Graphical representation of the conceptual framework of the study. The framework summarizes all the hypotheses and dependent variables analysed.

follows.

H2a. . An increase in board age increases unlisted Fintech riskiness.

H2b. . An increase in board age increases unlisted Fintech profitability.

2.1.3. Female board

In recent years, gender diversity on corporate boards has received great political and economic attention (Kim and Starks, 2016; McGuinness et al., 2017). Some studies confirm the positive relationship between board gender diversity and corporate performance (Erhardt et al., 2003), finding that women can increase the effectiveness of board control as they are more intellectually rigorous and reliable than men. According to Byrness et al. (1999), women's participation on the board can help avoid risky projects, as women are generally more financially risk-averse than men. Instead, Manetti and Toccafondi (2012) state that gender diversity in the BoD could enhance the credibility of corporate disclosures through the reinforcement mechanisms facilitated by stakeholder engagement. The studies of Dezsö and Ross (2012) and Griffin et al. (2021) are interesting to explore within an innovative context, such as Fintech one. The authors find that female representation in top management is associated with a corporate culture more oriented towards innovation processes, reflected in better corporate profitability. Unlike, Minguez-Vera and Martin (2011) found a negative relationship between female directors and firm profitability. On the risk side, Adams and Funk (2012), empirically proved that women are also more risk loving than male directors; thus, female directors on the BoD need not lead to more risk-averse decision-making. The literature examined shows as the results on gender issues appear mixed, so we formulate the following hypotheses:

H3a. . A rise in female directors increases unlisted Fintech riskiness.

H3b. . A rise in female directors increases unlisted Fintech profitability.

2.1.4. Board specialization

Directors are responsible for management and supervision on behalf of the shareholders, requiring them to satisfy specific requirements, including an adequate level of education. The literature proves that directors' educational specialization is important for effective decision-making, efficient firm management, and a better understanding of the complexity of the business environment (e.g., Herrmann and Datta, 2005). Some scholars have found a positive relationship between a director's qualification and firm performance, that intensifies when directors have a professional management education (Hambrick and Mason, 1984) or a Ph.D. qualification (Ujunwa, 2012).

According to Crook et al. (2011), in a global knowledge-based economy, human capital with its levelof education and type of specialization plays an important role in the effectiveness of organizations (Becker, 1983). Hitt and Tayler (1991) find that the type of academic degrees owned by executives influences the strategic decision-making and how science and engineering specialization are more oriented towards change, innovation and improvement. Contrarily, Wiersema and Bantel (1992) discovered that heterogeneous groups (i.e., perspectives and knowledge), contribute to higher-quality decision-making, assessing a wider range of solutions, engaging in more robust debates and benefiting from different viewpoints. Starting from these literature contradictions, we analyse the relationship between directors' specialization and Fintech performance, assuming whether these companies require more heterogeneous skills (e.g., managerial/legal capabilities and not exclusively digital and technological ones) both to improve their profitability and monitor the risks, related to their peculiar business model. Therefore, we expect that:

H4a. . A rise in directors with economics or law specialization increases unlisted Fintech riskiness.

H4b. . A rise in directors with economics or law specialization increases unlisted Fintech profitability.

2.2. CEO characteristics and Fintech performance

2.2.1. Female CEO

The current literature has extensively examined the topic of gender and leadership on corporate firms (Fletcher, 2004; Schopohl et al., 2021), although the World Economic Forum (2022) highlights that there is still a significant gender imbalance in leadership positions (WEF, 2022).

Several studies have analysed the relationship between the female CEO and firm performance, such as identifying a positive influence of females in top positions (Peni, 2014) arising from a better definition of the firm strategic outcomes (Manner, 2010). Instead, other authors have tested the relationship between female CEOs and firm riskiness, showing mixed results. In this perspective, Faccio et al. (2016) and Skała and Weill (2018) found that firms run by female CEOs make less risky financing and investment decisions, while Palvia et al. (2015) tested that banks with female CEOs exhibit lower default risk. Differently, Abou-El-Sood (2021) show that female CEO has a better risk-taking mindset when they perceive the positive rewards of risky investments. Starting from this literature-divergent view, we formulate the following hypotheses:

H5a. . The presence of a female CEO increases unlisted Fintech riskiness.

H5b. . The presence of a female CEO increases unlisted Fintech profitability.

2.2.2. CEO specialization

Educational background is an important element of investigation also for the CEO figure as well. Prior research (e.g., King et al.,

2016; Zhang, 2017; Sannino et al., 2020) has shown that higher levels of education may contribute to the ability of top executives to produce and implement innovative solutions for complex problems. Additionally, a diverse range of educational qualifications, including excellent grades, have been linked to a higher propensity for innovation adoption (Kimberly and Evanisko, 1981).

Looking at the activity of Fintech firms, it is believed that a high level of specialisation in a particular field of knowledge affects the level of innovation and improves the firm's performance, in line with previous literature evidence (Wiersema and Bantel, 1992). In this research area, authors such as Islam and Zein (2020) demonstrate that CEOs with hands-on innovation experience, or hard technical skills, possess an improved ability to assess, select, and implement innovative investment initiatives, ultimately enhancing firm performance. Drawing from this evidence, we propose the following research hypothesis:

H6a. . The presence of a CEO with a specialization in economics or law increases unlisted Fintech riskiness.

H6b. . The presence of a CEO with a specialization in economics or law decreases unlisted Fintech profitability.

3. Research design: sample, variables and method

3.1. Data sample

We analyse a sample of 592 Italian Fintech-year observations during the period 2017–2019, which are drawn from the Italian Fintech Observatory Report (PWC, 2020). Our sample includes start-ups with different business models according to the BIS (2020) Taxonomy (i.e., Payments, Lending, Regtech, Insurtech, Cybersecurity, and Asset Management), that are the most adopted Fintech solutions in the global market (IMF, 2019). The phenomenon of Fintech in Italy is a peculiar case, in fact, despite the delay in the adoption of digitalisation (EC, 2021), this country is characterized by the growth of innovative start-ups, which are fundamental both in promoting competition and innovation in banking and youth entrepreneurship, employment, and economic development (Ferrucci et al., 2021).

The choice to focus on the period from 2017 to 2019 in this study is strategically placed between two significant events that dramatically impacted the Fintech industry. The former occurs in 2017, when Italy has incorporated the Payment Services Directive 2 (PSD2) (EU Regulation 2015/751) into its legal framework through Legislative Decree No. 218/2017. This innovation represents a significant regulatory shift that propelled the European Fintech industry into a new era of open banking (BCBS, 2019). The latter is represented by COVID-19 pandemic. Therefore, the global crisis induced by the pandemic led to a radical shift in business and financial industry worldwide, and incorporating this period could have significantly distorted our analysis. The volatile business environment and the emergency measures implemented during the pandemic could have artificially influenced both governance practices and performance indicators, thereby obscuring the true nature of the relationships we aim to explore in a normal business environment.

The choice to build an Italian dataset for this study is primarily driven by the unique characteristics of the Italian financial system, which is heavily bank-centric (Barbieri et al., 2021). The dominance of banking institutions in the Italian financial context has inevitably impacted the dynamics of the Fintech industry in the country. The latter will in turn has alternated the condition in which the financial system - which comprises financial intermediaries, markets, and market infrastructures - is capable of absorb shocks and financial imbalances. Notably, the banking sector's influence significantly transfers managers and board members from traditional banks to emerging Fintech firms. This distinctive setting provides an interesting backdrop against which to examine the impact of BoD and CEO characteristics on Fintech firm performance. Within this context, the expertise, abilities, and strategies that these individuals bring from their banking backgrounds could have a significant impact on the riskiness and profitability profiles of the Fintech firms they now lead and, consequently, oversee the financial stability of the system.

Table 1
Variable Description.

Variable	Description	Type	Source
ROA	Return on Asset	Dependent Variable	AIDA
PD	Probability of Default	Dependent Variable	AIDA
Board Size	Board Size (number of members)	Board of Directors Regressor	AIDA
Board Age	Board Average Age (members' age)	Board of Directors Regressor	AIDA
Female Board	% of Women on the board of directors	Board of Directors Regressor	AIDA
Managerial/Law Board	% of Directors with a degree in Economics and Law	Board of Directors Regressor	AIDA
Managerial/Law CEO	Dummy for CEO with a degree in Economics and Law	CEO Regressor	AIDA
Female CEO	Dummy for woman CEO	CEO Regressor	AIDA
Fintech Size	Fintech Size expressed by Total Asset	Fintech Control	AIDA
Fintech Leverage	Fintech Debt Level (leverage)	Fintech Control	AIDA
Fintech Turnover	Fintech Debt Turnover on Sales	Fintech Control	AIDA
Fintech Age	Fintech Age	Fintech Control	AIDA
Region Age	Average Regional Age (NUTS 2)	Instrumental Variable	Eurostat
HRST	% of Human Resources in Science and Technology (NUTS 2)	Instrumental Variable	Eurostat
Employment	Employment Rate (NUTS 2)	Instrumental Variable	Eurostat
Lecturers	N. Lecturers per University (NUTS 2)	Instrumental Variable	Eurostat
R&D	Research & Development by Region (NUTS 2)	Instrumental Variable	Eurostat
Flights	N. of yearly flights by Region (NUTS 2)	Instrumental Variable	Eurostat

Note: The table represents all the variables used in the study, the types of variables and the source from which they have been gathered.

Table 2
Summary statistics.

Statistic	ROA	PD	Board Size	Board Age	Female Board	Managerial/Law Board	Fintech Size	Fintech Leverage	Fintech Turnover	Fintech Age
Minimum	-25,71	0,00	1	28,50	6,25	62,50	6,19	0,02	0,54	1
1st Quartile	-13,10	0,15	2	45,67	12,15	62,50	183,21	0,57	25,95	3
Median	0,20	0,96	3	49,80	15,48	75,00	490,92	1,52	73,57	5
Average	-3,11	1,94	4	49,37	21,76	75,00	2384,88	3,75	106,69	6
3rd Quartile	8,67	3,22	6	53,36	33,33	87,50	1480,90	4,54	132,84	8
Maximum	85,03	9,70	29	64,50	66,67	87,50	85,980,80	45,30	1068,24	34

Note: The table exhibits the summary statistics of the variables implemented in the study: minimum; 1st quartile; median; average; 3rd quartile and maximum.

3.2. Variables and data construction

We use two dependent variables to investigate how Fintech performance is affected by BoD and CEO characteristics (Table 1). We used the return on assets (ROA) as a proxy of Fintech profitability and the probability of default (PD) as a proxy of Fintech idiosyncratic risk. Various sources are utilised to build the dataset. We retrieve the economic and financial balance sheet information, as well as the boards' structure and gender information from the AIDA databank (Bureau Van Dijk). Additionally, we retrieved information on directors' and CEOs' personal and professional specialisations from the social platform LinkedIn. Finally, the instrumental variables were obtained by the EUROSTAT database. Table 2 presents summary statistics of our variables, and Table 3 shows their correlations.

The analysed Fintech firms are currently in the initial stage of business development, with a lifespan of less than seven years, and demonstrate an average return of −3.11 %, indicating a negative performance. Boards are generally experienced, as reflected by the average Board Age of 49.37 years, potentially influencing their strategic decision-making processes. Additionally, the moderate average PD of 1.94 implies a median risk of default among the firms. Still, the broad span from the lowest to the highest PD reveals a highly diversified risk profile among the entities. Interestingly, the data reveal relatively small boards, with an average Board Size of 4.

The Female Board and Managerial/Law Board statistics highlight the demographic composition of the boardrooms, with women making up 21.76 % of the board membership on average and those from managerial or legal backgrounds forming a more substantial proportion of 75 %.

The firms demonstrate moderate leveraging, with an average Fintech Leverage of 3.75, albeit with notable variation in financial strategies among firms. With an average Fintech Turnover of 106.69, these firms, overall, exhibit efficient asset utilization for revenue generation. Lastly, the average Fintech Age of 6 years underscores the relatively nascent state of these firms, indicative of the burgeoning nature of the Fintech industry.

The correlation matrix provides interesting evidence about the relationships between variables such as Return on Assets (ROA), Probability of Default (PD), Board Size, Board Age, Female Board status, Managerial/Law Board constitution, Fintech Size, Fintech Leverage, Fintech Turnover, and Fintech Age. One of the noteworthy observations is the moderate negative correlation ($r = -0.23$) between ROA and PD, which posits that as a firm's return on assets augments, there is a concomitant decrease in the likelihood of default. Similarly, the positive correlation between ROA and Fintech Age ($r = 0.24$) could be interpreted as a suggestion that more established Fintech enterprises tend to manifest superior returns on assets, potentially owing to factors such as improved operational efficiencies and established market presence. Furthermore, the connection between Board Size and Fintech Size ($r = 0.24$) infers that larger Fintech firms are likely to constitute larger boards, perhaps as a response to increased organizational complexity and the consequent need for an expanded pool of expertise in the decision-making processes. On another note, the negative correlation between Fintech Turnover and Fintech Leverage ($r = -0.24$) suggests that firms exhibiting higher turnover rates could maintain a lower leverage ratio. In addition, the substantial positive correlation between Board Age and Fintech Age ($r = 0.32$) suggests that older Fintech enterprises are likely to be steered by boards with more accumulated experience.

3.3. Methodology

The present study tests our hypotheses using a pooling OLS model with the Partially Corrected Standard Errors (PCSE) method. This approach is a well-established technique to account for serial correlation and heteroscedasticity issues, thus leading to more accurate and reliable results. More specifically, we estimate:

$$Performance_{it} = \alpha + \sum_{k=1}^{4}\sum_{j=1}^{2} \partial_{kj} * board_{kit} * CEO_{jit} + \sum_{c=1}^{4} \delta_{kj} * Fintech_{Controls_{cit}} + \gamma_i + \phi_t + u_{it}$$

Table 3
Correlation Matrix.

Variable	ROA	PD	Board Size	Board Age	Female Board	Managerial/Law Board	Fintech Size	Fintech Leverage	Fintech Turnover	Fintech Age
ROA	1.00	-0.23	-0.08	0.08	0.04	-0.05	0.11	0.05	0.20	0.24
PD		1.00	-0.10	0.03	0.02	0.03	-0.10	-0.13	-0.14	-0.16
Board Size			1.00	0.01	-0.07	-0.01	0.24	-0.10	0.02	0.22
Board Age				1.00	0.05	0.06	0.12	0.03	-0.06	0.32
Female Board					1.00	0.04	-0.02	0.10	-0.05	-0.03
Managerial/Law Board						1.00	0.03	0.05	-0.09	0.02
Fintech Size							1.00	0.03	0.02	0.42
Fintech Leverage								1.00	-0.24	0.04
Fintech Turnover									1.00	0.11
Fintech Age										1.00

Note: The table depicts the correlation matrix between the variables of interest.

Table 4
Results table of the regression models of board size on default probabilities and return on assets.

	Dependent Variable: PD				Dependent Variable: ROA			
Board Size	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**
Constant	2.215***	4.045***	4.240***	3.768***	-0.456	-26.417**	-24.433**	-22.781***
	(0.147)	(0.361)	(0.895)	(0.433)	(1.650)	(3.956)	(9.823)	(4.773)
Board Size	-0.062**	-0.045*	-0.286*	-0.062	-0.574**	-1.086***	-0.760	-1.081
	(0.026)	(0.026)	(0.169)	(0.069)	(0.291)	(0.287)	(1.850)	(0.758)
Fintech Size		-0.210***	-0.228***	-0.193***		1.658**	1.721***	1.634**
		(0.059)	(0.060)	(0.059)		(0.644)	(0.656)	(0.650)
Fintech Leverage		-0.069***	-0.070***	-0.074***		0.299*	0.303*	0.303*
		(0.016)	(0.016)	(0.016)		(0.175)	(0.177)	(0.176)
Fintech Turnover		-0.004***	-0.003***	-0.003***		0.041***	0.040***	0.039***
		(0.001)	(0.001)	(0.001)		(0.008)	(0.008)	(0.008)
Fintech Age		0.050	-0.045	0.003		7.587***	7.748***	7.938***
		(0.141)	(0.149)	(0.141)		(1.544)	(1.635)	(1.555)
Board Age			0.003				-0.009	
			(0.016)				(0.173)	
Female Board			0.001				-0.001	
			(0.006)				(0.061)	
Managerial/Law Board			-0.002				-0.028	
			(0.005)				(0.050)	
Board Size * Board Age			0.004				-0.006	
			(0.003)				(0.034)	
Board Size * Female Board			0.0002				0.012	
			(0.002)				(0.018)	
Board Size * Managerial/Law Board			0.001				-0.002	
			(0.001)				(0.011)	
Managerial/Law CEO				0.165				-4.751
				(0.344)				(3.793)
Female CEO				1.681***				-5.432
				(0.506)				(5.585)
Board Size * Managerial/Law CEO				0.033				-0.007
				(0.073)				(0.810)
Board Size * Female CEO				-0.196**				0.880
				(0.095)				(1.049)
Fintech Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	592	592	592	592	592	592	592	592
F Statistic	5.814**	10.940***	5.413***	7.741***	3.883**	17.646***	8.183***	10.410***
	(df = 1; 590)	(df = 5; 586)	(df = 11; 580)	(df = 9; 582)	(df = 1; 590)	(df = 5; 586)	(df = 11; 580)	(df = 9; 582)

Note: The table exhibits the econometric regression on probability of default (PD) and return on assets (ROA) assessing the impact of board size as main regressor.

$$Performance\left\{\begin{array}{c} Probability\ \ of\ \ Default(\mathrm{PD}) \\ Return\ \ on\ \ Assets(\mathrm{ROA}) \end{array}\right\}\quad Board\left\{\begin{array}{c} Board\ \ Size \\ Board\ \ Age \\ Board\ \ Specialisation \\ Female\ \ Board \end{array}\right\}$$

$$CEO\left\{\begin{array}{c} CEO\ \ Specialisation \\ CEO\ \ Gender \end{array}\right\}\quad FinTech_{Controls}\left\{\begin{array}{c} FinTech\ \ Size \\ FinTech\ \ Leverage \\ FinTech\ \ Turnover \\ FinTech\ \ Age \end{array}\right\}$$

In the model, the dependent variable is $Performance_{it}$ of a specific FinTech *i* at a given time *t*. The performance is measured in two distinct ways, firstly through the Probability of Default (PD), which is the likelihood that a company will not be able to meet its financial obligations. Secondly, the Return on Assets (ROA) is the proxy of profitability.

Among the independent variables, we have those related to the board of directors, denoted as *Board*. They include (i) *Board Size*, indicating the number of members on the board; (ii) *Board Age*, calculated as the average age of BoD members; (iii) *Board Specialisation*, which expresses the percentage of directors with expertise in managerial and law; (iv) *Female Board*, which represents the percentage of female members on the board. The CEO-related variables are denoted as *CEO*. These include (i) *CEO Specialisation*, which expresses whether the CEO presents expertise in managerial and law; (ii) *CEO Gender*, which identifies the gender of the CEO.

Lastly, we use as $FinTech_{Controls}$ variables: (i) *FinTech Size*, represented by total assets; (ii) *FinTech Leverage*, which measures the debt-to-equity ratio of the FinTech operations; (iii) *FinTech Turnover*, which measures the revenue generated by FinTech operations; (iv) *FinTech Age*, as the proxy of firm years of activity. The model also includes γ_i and ϕ_t as firm-specific and time-specific fixed effects, respectively, and u_{it} is the error term.

To confirm our results, the two-stage least-squares instrumental variable (2SLS-IV) methodology was used in robustness analyses, investigating possible endogeneity of the variables Board Size and Board Age. The first instrument considered is the logarithm of the average age of the population in the province where the FinTech is located (Almeida and Kogut, 1997) because regions with older populations may encourage the formation of boards with older and potentially more experienced members, thus influencing board age. The second instrument used is the percentage of human resources employed in science and technology (HRST) in the Fintech Region (Burrus et al., 2018), as it is assumed that areas with a higher concentration of people with technical skills are more likely to have larger boards due to the availability of qualified human resources. The third instrument used is the regional employment rate (Jacoby et al., 2005) which may reflect the general socio-economic conditions, which may, in turn, impact the board composition and age. Regions with higher employment rates may attract more mature and experienced professionals, which could influence both Board Size and Board Age. We also use the average number of lecturers (Lin, 2019) and the amount of R&D investment per region (Patel et al., 2018; Jin et al., 2022) as a proxy for the intellectual and innovative capacity of the Region. In fact, areas with higher levels of intellectual capital and R&D investment may have larger and older boards, as these areas are likely to attract experienced professionals. The last instrument is the logarithm of the number of passengers disembarking and embarking in the region of the Fintech by air per 100 inhabitants (Jones and Evans, 2006) as a proxy for the logistical efficiency of a geographic area and thus for the flourishing economic environment and consequently it can affect board composition expressed in terms of age and size.

4. Results

According to the hypothesis development introduced in Section 2, results are split into board structure and CEO regression result tables. The board characteristics analysed are divided into (i) board size; (ii) board age; (iii) board gender; (iv) board specialization. Conversely, CEO characteristics are detailed in (i) CEO specialization; (ii) CEO gender. In the first model of each group of regressions, we will explore the direct relationship between the variable of interest (board or CEO regressor) and dependent variables (ROA and default probabilities). The second model implements Fintech control variables: (i) size; (ii) leverage; (iii) turnover. The third model exhibits evidence concerning the interaction between the regression coefficient of interest among board-level characteristics. Finally, the fourth model analyses the interaction between the independent variable of interest and CEO-level characteristics.

4.1. Board structure

The first dimension of analysis concerns the effect of board size on Fintech riskiness and profitability. Board size is significant and exhibits a negative regression coefficient for both the dependent variables analysed (Table 4). More specifically, an increase in the number of board director members reveals a reduction of Fintech riskiness (-0.045*) and a coherent profitability contraction (-1.086***). Therefore, we can verify hypotheses 1a and 1b.

Fintech control variables, namely size, leverage and turnover, remain statistically significant, with a 99 % confidence interval, showing a negative regression coefficient for the econometric model based on default probabilities. Regarding profitability performance, Fintech controls are positively associated with return on assets. When we consider the Fintech age, there is a remarkable enhancement in firm profitability (7.587 ***), but from a risk analysis perspective, there is no statistical significance.

Additionally, we propose in model 3 and model 4 the interaction results. The coexistence of a female CEO and an increase in board size leads to a reduction of Fintech default probabilities (-0.196 **). No other interaction presents statistical significance for both the dependent variables assessed. The presence of a female CEO generally increases Fintech risk profile (1.681 ***). Still, when we

consider the coeval occurrence of larger boards, we observe a default risk mitigation effect, as shown in the interaction results above.

A second level of analysis is focused on the board average age. As exhibited in Table 5, an increase in Board Age leads to a slight improvement in Fintech riskiness (0.018) with a 90 % confidence interval. The effect of this dimension of profitability is positive in model 1 (0.221*), expressing a more attitude of eldest boards in achieving a better ROA. Consequently, we can verify hypotheses 2a and 2b.

Fintech controls are negatively associated and statistically significant (99 % statistical significance except to Fintech Age) with

Table 5
Results table of the regression models of board age on default probabilities and return on assets.

	Dependent Variable: PD				Dependent Variable: ROA			
Board Age	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**
Constant	1.584***	3.276***	5.811***	3.167***	-13.649**	-27.474***	-32.855**	1.040
	(0.525)	(0.569)	(1.435)	(1.074)	(5.881)	(6.306)	(15.770)	(11.857)
Board Age	0.007	0.018*	-0.035	0.016	0.221*	0.002	0.176	-0.558**
	(0.011)	(0.011)	(0.029)	(0.024)	(0.120)	(0.122)	(0.319)	(0.260)
Fintech Size		-0.240***	-0.227***	-0.228***		1.157*	1.728***	1.383**
		(0.058)	(0.060)	(0.059)		(0.640)	(0.656)	(0.646)
Fintech Leverage		-0.065***	-0.070***	-0.069***		0.375**	0.290	0.358**
		(0.016)	(0.016)	(0.016)		(0.176)	(0.177)	(0.175)
Fintech Turnover		-0.003***	-0.003***	-0.003***		0.041***	0.040***	0.038***
		(0.001)	(0.001)	(0.001)		(0.008)	(0.008)	(0.008)
Fintech Age		-0.041	-0.053	-0.096		6.984***	7.716***	6.917***
		(0.146)	(0.149)	(0.146)		(1.615)	(1.638)	(1.617)
Board Size			-0.227				-0.635	
			(0.145)				(1.596)	
Female Board			0.009				0.111	
			(0.026)				(0.288)	
Managerial/Law Board			-0.023				0.068	
			(0.015)				(0.169)	
Board Age * Board Size			0.004				-0.010	
			(0.003)				(0.034)	
Board Age * Female Board			-0.0001				-0.002	
			(0.001)				(0.006)	
Board Age * Managerial/Law Board			0.001				-0.002	
			(0.0003)				(0.004)	
Managerial/Law CEO				0.229				-42.884***
				(1.215)				(13.418)
Female CEO				-2.430				29.098
				(2.334)				(25.773)
Board Age * Managerial/Law CEO				-0.001				0.809***
				(0.026)				(0.290)
Board Age * Female CEO				0.072				-0.646
				(0.049)				(0.542)
Fintech Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	592	592	592	592	592	592	592	592
F Statistic	0.468	10.882***	5.588***	7.368***	3.380*	14.428***	8.187***	9.884***
	(df = 1; 590)	(df = 5; 586)	(df = 11; 580)	(df = 9; 582)	(df = 1; 590)	(df = 5; 586)	(df = 11; 580)	(df = 9; 582)

Note: The table exhibits the econometric regression on probability of default (PD) and return on assets (ROA) assessing the impact of board age as main regressor.

default probabilities. On the other side, they present significance and positive association with the proxy of profitability. As observed for board size, Fintech Age is consistent for ROA with a remarkable contribution to performance.

The interaction among board age and the presence of a CEO with a degree in economics and law is able to increase Fintech return on

Table 6
Results table of the regression models of board gender on default probabilities and return on assets.

	Dependent Variable: PD				**Dependent Variable: ROA**			
Board Gender	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**
Constant	1.921***	3.981***	3.256***	3.679***	-3.464***	-27.781***	-23.557***	-22.791***
	(0.101)	(0.363)	(0.628)	(0.397)	(1.131)	(4.014)	(6.881)	(4.388)
Female Board	0.002	0.002	0.005	0.003	0.042	0.037	0.146	-0.056
	(0.004)	(0.004)	(0.029)	(0.008)	(0.043)	(0.041)	(0.315)	(0.086)
Fintech Size		-0.230***	-0.220***	-0.212***		1.173*	1.714***	1.176*
		(0.058)	(0.059)	(0.058)		(0.637)	(0.650)	(0.641)
Fintech Leverage		-0.066***	-0.069***	-0.070***		0.360**	0.294*	0.354*
		(0.016)	(0.016)	(0.016)		(0.176)	(0.177)	(0.180)
Fintech Turnover		-0.003***	-0.003***	-0.003***		0.041***	0.040***	0.039***
		(0.001)	(0.001)	(0.001)		(0.008)	(0.008)	(0.008)
Fintech Age		0.021	-0.014	-0.028		6.929***	7.652***	7.482***
		(0.141)	(0.148)	(0.142)		(1.555)	(1.619)	(1.571)
Board Size			-0.042				-1.215***	
			(0.032)				(0.348)	
Board Age			0.017				-0.019	
			(0.012)				(0.130)	
Managerial/Law Board			0.001				-0.030	
			(0.003)				(0.034)	
Female Board * Board Size			0.00004				0.011	
			(0.002)				(0.018)	
Female Board * Board Age			-0.0001				-0.002	
			(0.001)				(0.006)	
Female Board * Managerial/Law Board			-0.00001				-0.001	
			(0.0001)				(0.001)	
Managerial/Law CEO				0.271				-6.908***
				(0.236)				(2.610)
Female CEO				0.916**				-3.730
				(0.392)				(4.333)
Female Board * Managerial/Law CEO				-0.003				0.106
				(0.009)				(0.098)
Female Board * Female CEO				-0.001				0.078
				(0.010)				(0.111)
Fintech Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	592	592	592	592	592	592	592	592
F Statistic	0.166	10.370***	5.192***	6.805***	0.953	14.608***	8.207***	9.101***
	(df = 1; 590)	(df = 5; 586)	(df = 11; 580)	(df = 9; 582)	(df = 1; 590)	(df = 5; 586)	(df = 11; 580)	(df = 9; 582)

Note: The table exhibits the econometric regression on probability of default (PD) and return on assets (ROA) assessing the impact of board gender as main regressor.

assets (0.809***). Finally, the regression coefficient of Managerial/Law CEO is negative with a 99 % confidence interval.

The percentage of women on the board of directors (Female Board) does not present any statistical significance for either default probability or return on assets (Table 6).

At a 99 % confidence interval, Fintech controls are significantly and negatively associated with the riskiness proxy. Conversely, the profitability proxy has a positive but significant association with this set of firm-level controls.

In terms of interactions, we do not observe any relevant regression coefficient, although individual regressors such as Female Board and Managerial/Law CEO can respectively increase Fintech riskiness (0.916*) and diminish the return on assets (-6.908***).

Board specialization is the last dimension of analysis concerning board characteristics. We observe that the prevalence of board members with a degree in economics and law has no statistical relevance with default probabilities if considered as a stand-alone

Table 7
Results table of the regression models of board specialization on default probabilities and return on assets.

	Dependent Variable: PD				**Dependent Variable: ROA**			
Board Specialization	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**
Constant	1.798***	3.881***	5.135***	4.422***	0.205	-25.013***	-30.457**	-25.315***
	(0.240)	(0.417)	(1.277)	(0.552)	(2.692)	(4.608)	(14.026)	(6.153)
Managerial/ Law Board	0.002	0.002	-0.024	-0.010*	-0.043	-0.033	0.070	0.029
	(0.003)	(0.003)	(0.016)	(0.006)	(0.033)	(0.031)	(0.171)	(0.063)
Fintech Size		-0.232***	-0.216***	-0.218***		1.181*	1.697***	1.182*
		(0.058)	(0.059)	(0.058)		(0.637)	(0.650)	(0.642)
Fintech Leverage		-0.066***	-0.070***	-0.065***		0.380**	0.294*	0.360**
		(0.016)	(0.016)	(0.016)		(0.175)	(0.176)	(0.178)
Fintech Turnover		-0.003***	-0.003***	-0.003***		0.040***	0.040***	0.038***
		(0.001)	(0.001)	(0.001)		(0.008)	(0.008)	(0.008)
Fintech Age		0.025	-0.029	-0.033		6.971***	7.696***	7.471***
		(0.141)	(0.147)	(0.140)		(1.553)	(1.618)	(1.564)
Board Size			-0.111				-0.916	
			(0.087)				(0.956)	
Board Age			-0.018				0.106	
			(0.026)				(0.287)	
Female Board			0.004				0.072	
			(0.010)				(0.113)	
Managerial/Law Board * Board Size			0.001				-0.002	
			(0.001)				(0.012)	
Managerial/Law Board * Board Age			0.0005				-0.002	
			(0.0003)				(0.004)	
Managerial/Law Board * Female Board			-0.00002				-0.001	
			(0.0001)				(0.001)	
Managerial/ Law CEO				-0.696				-0.659
				(0.509)				(5.677)
Female CEO				-0.575				1.442
				(0.826)				(9.208)
Managerial/Law Board * Managerial /Law CEO				0.013**				-0.070
				(0.006)				(0.072)
Managerial/Law Board * Female CEO				0.019*				-0.040
				(0.010)				(0.112)
Fintech Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	592	592	592	592	592	592	592	592
F Statistic	0.400 (df = 1; 590)	10.363*** (df = 5; 586)	5.493*** (df = 11; 580)	7.772*** (df = 9; 582)	1.662 (df = 1; 590)	14.670*** (df = 5; 586)	8.188*** (df = 11; 580)	8.969*** (df = 9; 582)

Note: The table exhibits the econometric regression on probability of default (PD) and return on assets (ROA) assessing the impact of board specialization as main regressor.

regressor (Table 7). Similarly, return on assets does not present any significant association with managerial/law board composition.

Fintech controls, for the default probabilities, are negatively associated with a significance of 99%, except for Fintech age. Analogously, firm controls have a positive effect on Fintech performance.

We found that the interaction among the prevalence of board members and a CEO with a degree in economics and law increases riskiness with a 95% confidence interval (0.013**). Similarly, a Managerial/Law Board with the coeval presence of a female CEO produce an increase in riskiness (0.019*) with a 90% confidence interval.

Table 8
Results table of the regression models of CEO gender on default probabilities and return on assets.

	Dependent Variable: PD				**Dependent Variable: ROA**			
CEO Gender	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**
Constant	1.867***	3.867***	3.289***	3.750***	-2.850***	-27.048***	-2.850***	-25.030***
	(0.095)	(0.362)	(0.614)	(0.389)	(1.070)	(4.030)	(1.070)	(4.072)
Female CEO	0.940***	0.944***	-0.939	-0.917	-2.014	-2.485	-2.014	-0.975
	(0.343)	(0.335)	(2.653)	(1.092)	(3.879)	(3.730)	(3.879)	(3.777)
Fintech Size		-0.210***	-0.216***	-0.206***		1.101*	1.101*	2.431***
		(0.058)	(0.059)	(0.058)		(0.643)	(0.643)	(0.582)
Fintech Leverage		-0.071***	-0.067***	-0.067***		0.388**	0.388**	0.404**
		(0.016)	(0.016)	(0.016)		(0.177)	(0.177)	(0.179)
Fintech Turnover		-0.003***	-0.003***	-0.003***		0.041***	0.041***	0.047***
		(0.001)	(0.001)	(0.001)		(0.008)	(0.008)	(0.008)
Fintech Age		-0.011	-0.058	-0.048		7.011***	7.084***	7.082***
		(0.140)	(0.146)	(0.141)		(1.556)	(1.610)	(1.560)
Board Size			-0.024				-1.194***	
			(0.027)				(0.300)	
Board Age			0.016				-0.013	
			(0.011)				(0.124)	
Female Board			0.001				0.015	
			(0.004)				(0.046)	
Managerial /Law Board			-0.0002				-0.032	
			(0.003)				(0.033)	
Female CEO * Board Size			-0.225**				1.243	
			(0.100)				(1.115)	
Female CEO * Board Age			0.026				-0.344	
			(0.054)				(0.595)	
Female CEO * Female Board			-0.007				0.115	
			(0.011)				(0.121)	
Female CEO * Managerial/Law Board			0.023**				-0.066	
			(0.011)				(0.117)	
Managerial /Law CEO				0.172				-5.688**
				(0.219)				(2.433)
Female CEO * Managerial/Law CEO				2.014*				-3.235
				(1.145)				(12.724)
Fintech Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	592	592	592	592	592	592	592	592
F Statistic	7.507*** (df = 1; 590)	12.012*** (df = 5; 586)	5.920*** (df = 13; 578)	9.239*** (df = 7; 584)	0.269 (df = 1; 590)	14.527*** (df = 5; 586)	7.182*** (df = 13; 578)	11.297*** (df = 7; 584)

Note: The table exhibits the econometric regression on probability of default (PD) and return on assets (ROA) assessing the impact of CEO gender as main regressor.

4.2. CEO characteristics

We exhibit that the presence of a female CEO increases Fintech riskiness (0.944***) with a 99% confidence interval. Conversely, this CEO regressor does not affect the profitability dimension (Table 8). Therefore, we can verify hypothesis 5a.

Fintech controls consistently reduce firm default probabilities with a 99 % confidence interval; meanwhile, they increase ROA with statistical confidence greater or equal to 95 % for leverage, turnover and age.

For this CEO dimension, we observe several significant interactions among regressors. More specifically, we confirm the significance of the joint effect of female CEO with a board size (-0.225**) and Managerial/Law Board composition (0.023**) in affecting

Table 9
Results table of the regression models of CEO specialization on default probabilities and return on assets.

	Dependent Variable: PD				**Dependent Variable: ROA**			
CEO Specialization	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**	**Model 1 Regressor Stand Alone**	**Model 2 Fintech Controls**	**Model 3 Board Interactions**	**Model 4 CEO Interactions**
Constant	1.696***	3.803***	4.184***	3.750***	0.928	-23.407***	2.076	-23.301***
	(0.196)	(0.389)	(1.220)	(0.389)	(2.195)	(4.289)	(13.286)	(4.322)
Managerial/ Law CEO	0.310	0.296	-0.916	0.172	-5.026**	-5.899**	-6.604**	-5.688**
	(0.221)	(0.216)	(1.378)	(0.219)	(2.482)	(2.378)	(15.006)	(2.433)
Fintech Size		-0.233***	-0.215***	-0.206***		1.191*	1.844***	1.144*
		(0.058)	(0.060)	(0.058)		(0.634)	(0.649)	(0.642)
Fintech Leverage		-0.065***	-0.069***	-0.067***		0.361**	0.292*	0.365**
		(0.016)	(0.016)	(0.016)		(0.175)	(0.175)	(0.177)
Fintech Turnover		-0.003***	-0.003***	-0.003***		0.039***	0.039***	0.039***
		(0.001)	(0.001)	(0.001)		(0.008)	(0.008)	(0.008)
Fintech Age		0.003	-0.022	-0.048		7.411***	7.284***	7.500***
		(0.141)	(0.148)	(0.141)		(1.556)	(1.610)	(1.568)
Board Size			-0.060				-1.078	
			(0.070)				(0.758)	
Board Age			0.008				-0.585**	
			(0.024)				(0.266)	
Female Board			0.005				-0.022	
			(0.008)				(0.088)	
Managerial/ Law Board			-0.009				0.014	
			(0.006)				(0.063)	
Managerial/Law CEO * Board Size			0.016				0.093	
			(0.074)				(0.805)	
Managerial/Law CEO * Board Age			0.005				0.778***	
			(0.027)				(0.295)	
Managerial/Law CEO * Female Board			-0.003				0.075	
			(0.009)				(0.099)	
Managerial/Law CEO * Managerial /Law Board			0.014**				-0.066	
			(0.007)				(0.072)	
Female CEO				-0.917				1.278
				(1.092)				(12.130)
Managerial/Law CEO * Female CEO				2.014*				-3.235
				(1.145)				(12.724)
Fintech Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	592	592	592	592	592	592	592	592
F Statistic	1.958 (df = 1; 590)	10.697*** (df = 5; 586)	4.879*** (df = 13; 578)	9.239*** (df = 7; 584)	4.100** (df = 1; 590)	15.810*** (df = 5; 586)	8.046*** (df = 13; 578)	11.297*** (df = 7; 584)

Note: The table exhibits the econometric regression on probability of default (PD) and return on assets (ROA) assessing the impact of CEO specialization as main regressor.

Fintech riskiness, as already observed in Table 4. Additionally, we provide empirical evidence on the default risk increase that occurs in the presence of a female CEO with a degree in economics and low (2.014*), with 90 % significance. This last interaction effect is not consistent for Fintech profitability.

The last dimension of analysis is represented by CEO specialization, as shown in Table 9. We empirically demonstrate the absence of any effect of a CEO with a degree in economics and law on Fintech riskiness. Still, we observe a remarkable contraction of return on assets with a 95 % confidence interval. Consequently, we can verify hypothesis 6b.

Fintech level controls reduce default probabilities with a 99 % confidence interval except for Fintech age and increase ROA with a confidence greater than 90 %.

In this table, we confirm our previous results, a CEO with managerial or law background when a female (2.014*) or in interaction with a prevalence of economics and law degrees in directors board increase Fintech riskiness (0.014*). Additionally, we confirm that CEO specialization in interaction with board age improves profitability performance (0.778***).

4.3. Robustness checks

Following the presentation of our primary results, we perform a robustness check to reinforce the validity of our findings and further investigate our models' reliability. We utilize a two-stage least squares (2SLS) regression approach to achieve this, deploying a series of instrumental variables to address potential endogeneity issues. These instrumental variables, encompassing average region age, the proportion of human resources in science and technology, the employment rate, the number of lecturers per university, research and development expenditures by region, and the number of yearly flights for each region, were selected to isolate exogenous changes and facilitate a deeper understanding of the causal relationships between our predictors and dependent variables.

The validation of our instrumental variables was achieved through econometric testing. As detailed in Appendix A, the "weak instruments" test (Stock and Yogo, 2004) highlights a significant relationship between our instrumental variables and the endogenous regressors for Board Size, Fintech Size, Fintech leverage, and Fintech age, underpinning their relevance as instruments in this model. Conversely, Fintech Turnover did not exhibit a significant relationship, questioning its instrumental validity. The non-significant results of the Wu-Hausman and Sargan tests support the validity of our chosen exogenous variables and overidentifying restrictions (Sargan, 1958; Wu, 1973).

In response to these endogeneity concerns, we employed a 2SLS-IV estimation method, coupled with the Arellano coefficient estimation (Arellano and Bover, 1995), to rectify these potential biases in our models. The adjusted models are detailed in Appendix B. The revised coefficients provide an improved estimation of the relationships between our variables of interest: Return on Assets (ROA) and default probability (PD).

Following the implementation of the 2SLS method, our Hausman tests for both the PD and ROA models showed no statistical significance (p-values of 0.96256 and 0.98328, respectively), indicating that the endogeneity issues were effectively addressed in Appendix C. The Cragg-Donald test, conducted after 2SLS implementation, corroborated this, revealing non-significant results, which indicated that our selected instruments are valid and the strength of the instruments by the First Stage F-Test (Sanderson and Windmeijer, 2016). These specifications have served to remedy the endogeneity problems, thereby bolstering the consistency of our findings.

To enhance the validity of our study, we conducted a robustness check by reapplying the baseline models used in our primary analysis to the period 2020–2022 (Appendix D). This approach aimed to assess the consistency of our findings (2017–2019) in a context marked by significant external shocks, including the COVID-19 pandemic and changes in interest rates. This step is crucial for confirming the generalizability of our results beyond the initial conditions under which they were derived. Therefore, we focused on the influence of board characteristics and leadership attributes on company performance, specifically looking at risk and profitability.

Our analysis verified that an increase in board size tends to reduce Fintech profitability (H1b), suggesting potential inefficiencies or coordination challenges that larger boards might introduce. Similarly, we found that older boards are associated with increased riskiness within Fintech firms (H2a), which may reflect a resistance to adapt to the rapidly evolving technological innovations. The study also confirmed the positive impact of gender diversity on boards, with an increase in female directors correlating with higher profitability (H3b). This outcome underscores the value of diverse perspectives in enhancing decision-making and corporate governance. Additionally, we observed that directors with backgrounds in economics or law tend to increase the riskiness of Fintech firms (H4a), possibly due to a preference for aggressive growth strategies or higher-risk financial products. Regarding leadership attributes, our findings indicated that Fintech companies led by female CEOs are associated with increased riskiness (H5a). This could reflect different leadership styles or strategic approaches emphasising innovation and market expansion. Conversely, the presence of a CEO with a specialization in economics or law was found to negatively impact profitability (H6b), suggesting that while such expertise is valuable, it may lead to more cautious or conservative strategies that do not maximize short-term profits.

5. Discussion

In the first instance, we highlight a significant influence of the BoD characteristics on the Fintech performance that are consistent with the theoretical assumptions of RBV (a pillar of our conceptual model). In coherence with Hypothesis (1a and 2a), we find that larger and younger BoDs perform better in terms of risk. This result supports a first line of research that associates many directors with heterogeneous skills on the BoD applying better decision-making capabilities (Dalton et al., 1999), better operational efficiency (Anderson et al., 2004), and improving risk assessment capabilities (Coles et al., 2008). In the same way, Medoff and Abraham (1980) associate older directors with more market experience, creating better interpersonal skills and networking capabilities. This vision

aligns with the nature of Fintech firms, which are often founded as spin-offs of the incumbent banks aiming to use digital innovation for traditional financial purposes. In this line, Kim and Lim (2010) state that older directors increase both experience and risk aversion. Consequently, larger and younger Fintech boards could assume fewer risks than older and smaller ones. This outcome aligns with the RBV theory, which stresses the significance of internal resources and capabilities in affecting firm performance. In particular, having a larger and younger board appears to provide Fintech firms with the necessary tools and perspectives to effectively manage risks. When applied to the whole financial environment, firms that manage their risks well contribute to a more stable and secure financial environment. This is because they are less likely to be exposed to significant losses or failures that could potentially spill over and disrupt the financial system.

From the profitability side, our analysis confirms Hypothesis 1b and 2b, finding respectively a negative influence (less return on asset) brought by smaller boards and a positive influence by older ones, especially in contexts of innovation, as in Cumming and Leung (2021) study. This evidence is based on the risk-return trade-off paradigm, which posits that larger boards tend to adopt more conservative business strategies and thus assume less risk, consequently leading to lower returns. Larger boards tend to be characteristic of more established Fintech firms, which are often larger in terms of total assets. Therefore, an increase in board size could reflect a firm's market maturity. Although such firms may witness profit growth due to their size and established market presence, this growth rate may not match the increase in their total assets. Hence, while absolute profits may grow, the firm's profitability concerning its total assets (a measure often used to assess a firm's efficiency in generating profits) could decrease, supporting hypotheses H1b and H2b. Therefore, from a governance perspective, our work could suggest implementing youth policies to promote innovation and reduce business risks. This policy can improve the governance of Fintech firms, especially in the start-up phase in which there is a struggle for survival.

Multiple noteworthy interaction effects emerged among BoD and CEO characteristics. Firstly, Fintech firms with larger boards, when led by a female CEO, demonstrate decreased riskiness. It provides empirical evidence supporting the notion that larger boards lean towards adopting more conservative strategies, which aligns with lower risk-taking behaviours. From this perspective, a female CEO could potentially capitalise on the diverse skills and perspectives inherent to a larger board, enabling more comprehensive risk management strategies (Faccio et al., 2016). Furthermore, an older board with a specialization in economics and law was found to correlate with a decrease in profitability. This interaction may indicate that a board's maturity, combined with a traditional academic focus, may lean towards conservative strategies, possibly curbing innovative potential, thus, profitability. However, a CEO with a background in economics or law is correlated with increased profitability. This suggests that an experienced CEO with an experience in traditional sectors might provide a balancing effect, potentially capitalizing on the board's age and legal-economic expertise to enhance decision-making, thus promoting profitability. The observed interaction effects between the characteristics of the BoD and the gender of the CEO in Fintech firms have substantial implications for the stability of the financial system. Fintech firms with larger boards, coupled with a female CEO at the helm, exhibit lower risk profiles. This empirical evidence supports the predominant academic understanding that larger boards tend to adopt more careful and conservative strategies, indicating lower risk-taking tendencies. These risk-averse behaviours, which are embedded in Fintech strategies, play a key role in ensuring financial system stability.

In a second level of analysis, we failed to confirm Hypotheses H6a and H4a, which posited that the presence of a CEO and an increase in directors with specializations in economics or law would elevate Fintech riskiness. The theoretical underpinning of these hypotheses was that such individuals might lack specialized knowledge in technology, leading to potential unawareness or underestimation of tech-specific risks inherent to the Fintech sector. Our data, however, do not substantiate this assumption, suggesting that these leaders may be able to comprehend and manage technological risks effectively, regardless of their academic background. Our explanation can be found in the abovementioned theory: UET suggests that soft skills are more important than hard skills in top positions, such as educational specialization. This comment is also supported by Berson et al. (2008), who argue that the CEO personal characteristics support the strategic and control role and foster an organizational culture that leads to better business results. Similarly, Hypothesis H4b, proposing that an increase in directors with economics or law specializations would enhance Fintech profitability, is not confirmed. This refutes the theoretical proposition that these directors' experience in traditional sectors and networking capabilities in the financial sector would lead to higher profitability in Fintech firms. Such outcomes accentuate the complex relationship between leadership characteristics, academic backgrounds, and firm performance in the dynamic and innovative context of the Fintech industry. Following Crook et al. (2011), we consider this aspect very crucial in a knowledge-based economy, where acquiring highly skilled human capital is essential to a firm's viability and success.

On the other hand, Hypothesis H6b was confirmed: the presence of a CEO with a specialization in economics or law indeed decreases Fintech profitability. This finding is consistent with the risk-return trade-off principle and the likelihood of these CEOs having significant experience in traditional sectors. Despite their probable expansive networks within the financial industry and their capabilities to navigate conventional business environments efficiently, their conservative approach, favouring lower-risk and, consequently, lower-return strategies, could curtail the firm's profitability (Herrmann and Datta, 2005). Corroborating the hypothesis, it is suggested that CEOs with backgrounds in economics or law may prefer to adopt a more cautious and analytical approach to decision-making, prioritising long-term stability and sustainable growth over short-term profits. This prudence could be attributed to their rigorous academic grounding, which might help develop a profound appreciation for systemic risks and the cascading repercussions of unaware speculative activities (Ellis et al., 2022). From a macro-financial perspective, firms that prioritize sustainable growth over profit contribute to a more stable and resilient financial ecosystem. Given the crucial role that Fintech entities are progressively assuming in the global financial architecture, their operational and strategic decisions can have ripple effects. Therefore, the propensity of economically or legally-trained CEOs to avoid aggressive profit-maximising strategies for more judicious approaches can act as a safeguard against potential systemic risks and foster an environment of lasting stability within the financial framework.

In addition to the previously mentioned effects, an interaction was found between boards and CEOs with managerial or law

specializations, which was associated with an increase in default probabilities. This suggests that when both the board and CEO come from these backgrounds, a lack of competencies and capabilities is needed to assess Fintech riskiness properly. Second, an interaction between boards with managerial or law specializations and a female CEO/BoD also increased default probabilities. This effect could potentially be ascribed to the unique challenges women may face in top leadership positions in tech-driven industries or to their potentially novel approach to governance in a traditionally male-dominated sector.

We confirm Hypothesis H5a, which posited that the presence of a female CEO increases Fintech riskiness. This result supports the gender redemption thesis, suggesting that female CEOs may be more inclined towards risk-taking behaviours due to their aspirational roles. This dynamic might be driven by a desire to substantiate their leadership capabilities in traditionally male-dominated sectors, consequently leading to increased riskiness in their firms. Our results contrast previous studies (Palvia et al., 2015), in which a higher incidence of risk aversion exists among women compared to men, mainly in leadership positions. This aspect must be monitored by regulators' action, given the high-risk exposure that characterizes Fintech players. We contribute to the literature stream suggesting that CEO gender matters in terms of strategic choices and, thus, firm performance (Manner, 2010; Peni et al., 2014). The confirmation of this hypothesis implies that Fintech firms managed by female CEOs are more likely to pursue aggressive strategic ventures or innovative and untested business models, possibly influenced by a range of factors including leadership style and market positioning.

Although such a bias can result in rapid growth and competitive advantages in the short term, it may also render the company, and therefore, the financial system, more vulnerable if these initiatives were to fail. While such a predisposition could lead to accelerated growth and competitive advantages in the short term, it could also expose the firm, and hence the financial system, to increased vulnerability should these ventures fail.

Conversely, the assumption that an increase in female directors might lead to greater risk-taking (H3a) or spur profitability due to potential competitive decision-making dynamics within the board (H3b) is also not substantiated by our data. Our findings are important both for the current focus on gender policies in governance and for the extensive literature investigating a positive relationship between women on board and corporate performance (Erhardt et al., 2003). This could suggest that in Fintech boards, hard skills and technical competencies may play a more prominent role than gender-related aspects in determining the firm's performance, as outlined by the European Central Bank ECB (2018) and OECD (2023) governance guidelines, the need to promote an adequate composition of the BoD in terms of skills, knowledge, and experience.

6. Conclusion

Through the integration of the theories RBW and UET, this study investigates the relationship between governance (i.e., BoD and CEO dimensions) and performance (i.e., riskiness and profitability) of Fintech firms. The study also provides significant insights into the financial stability of the system, which has been disrupted by new technologies and digital players.

Our results confirm a strong relationship between governance characteristics and firm performance, highlighting the effectiveness of the theories used in a governance-performance studies. Specifically, the findings highlight the crucial role assumed of board size, age, and educational specialisation of key decision makers in the riskiness and profitability of Fintech firms.

Corroborating our initial hypotheses (H1a, H2a, H1b, and H2b), we discovered that board size and board age affect Fintech firms' riskiness and profitability. Specifically, larger boards, though often found in mature Fintech firms, have been observed to lead to a reduced ROA, possibly due to a more conservative approach in business strategies. Similarly, we discovered that BoD with a background in economics and law, while beneficial in terms of risk management capabilities, might constrain a firm's innovation potential and profitability. Nevertheless, a CEO with a similar academic background could utilize the board's expertise to enhance decision-making, thus boosting profitability. However, we could not validate the assumption that a CEO or a predominance of directors with a background in economics or law would inherently increase a Fintech firm's risk profile (H6a, H4a) or its profitability (H4b). These results underscore the non-linear relationship between top decision-makers academic backgrounds and firms' performance in an innovative environment like Fintech. On the other hand, our data substantiate the hypothesis (H6b) that a CEO with an academic specialization in economics or law might lower a Fintech firm's profitability due to their tendency for a more conservative business approach.

Our results emphasise the significant impact on the stability of the financial system through various approaches: (i) appropriate risk management in Fintech organizations transmits greater overall stability in the financial system, preventing potential disruptions within it; (ii) firms with larger boards led by female CEOs tend to adopt strategies characterised by prudence and conservatism, reflecting lower risk-taking; (iii) CEOs with a background in economics or law demonstrate a noticeable propensity to make decisions that value stability over fleeting gains. Their knowledge, which is based on a solid academic background, enhances their awareness of systemic risks. Their preference for long-term and sustainable growth not only enhances the resilience of individual firms but also strengthens the broader financial architecture against cascading risks. Lastly, (iv) Fintech firms with female leadership are more likely to pursue innovative strategies. Although these strategies could lead to a firm's expansion, they entail inherent risks that, if not addressed, could threaten financial stability.

Additionally, our study contributes to the understanding of the governance characteristics of Fintech firms through the lens of RBV and UET, offering a novel perspective that goes beyond the confines of the traditional Agency Theory. Drawing from the RBV principles, our research highlights the importance of resource ownership in terms of information, skills, and access to key constituents in driving Fintech firms' success. Through an examination of Fintech governance characteristics, we have shown that a diversified BoD composition in terms of age, size and academic background plays a critical role in the performance of Fintech companies. Our outcome expands the traditional perspective of Agency Theory, which focuses mainly on the role of managers and directors without considering the richness of different BoD and the environment in which the firm operates. Simultaneously, with the support of the UET, we have

highlighted how the personal characteristics and backgrounds of CEOs and administrators have a significant impact on Fintech strategic decisions and performance levels. This perspective is particularly relevant in the context of the financial technology industry, where innovation is a core component and a CEO's experience, and academic background can either help or hinder a firm's profitability and risk taking. The study contributes to the previous literature in different ways: (i) extending the knowledge on Fintech players; (ii) investigating the effects on performance of specific two-level governance features and testing their interactions; iii) supporting the development of policy recommendations in relation to Fintech establishments operating in the banking industry.

Our findings offer implications for Fintech firms, regulators, and incumbent banks. We emphasise that identifying the optimal governance profiles for Fintech players can support the resilience of operators and, therefore, their competitiveness and growth in the banking sector. These findings can aid supervisory banking authorities in ensuring the principles of good governance and effectively evaluating the control of the risks generated by Fintech firms in the financial system. Lastly, the incumbent banks, equipped with advanced knowledge of the operational and structural features of the new players, can be further strengthened by finding solutions to the trade-off through collaboration with Fintech.

Due to the inherent limitations of our study, future research could broaden the population sample by performing a cross-country panel data analysis. The expansion of the geographical positions of Fintech players could also involve emerging countries, allowing the comparison to Fintech firms of developed economies.

CRediT authorship contribution statement

Greta Benedetta Ferilli: Conceptualization, Data curation, Methodology, Writing – original draft, Reviewing. **Yener Altunbas:** Data curation, Reviewing. **Valeria Stefanelli:** Conceptualization, Writing – original draft. **Egidio Palmieri:** Conceptualization, Data curation, Methodology, Writing – original draft, Reviewing. **Vittorio Boscia:** Conceptualization, Writing - original Draft.

Data Availability

Data will be made available on request.

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Appendix A

Table A1
Weak instruments test (Stock and Yogo, 2004).

Diagnostic tests:		df1	df2	statistic	p-value
Weak instruments	Board Size	6	585	3692	0.001308 **
Weak instruments	Fintech Size	6	585	7449	0.000966 ***
Weak instruments	Fintech Leverage	6	585	4137	0.000443 ***
Weak instruments	Fintech Debt	6	585	1468	0.186754
Weak instruments	Fintech Age	6	585	2428	0.025105 *
Wu-Hausman		5	581	1721	0.127786
Sargan for instrumental variable strength		1	585	0.933	0.334051

Note: The table represents the econometric tests to verify the strength of instrumental variables.

Table B1
Coefficient Estimation after 2SLS and Arellano coefficient estimation.

	Dependent Variable: PD		Dependent Variable: ROA	
Variables	**Pooling**	**2SLS and Arellano**	**Pooling**	**2SLS and Arellano**
Constant	2.660***	2.660***	-16.426**	-16.426***
	(0.626)	(0.684)	(6.943)	(0.684)
Managerial/Law Board	0.001	0.001	-0.034	-0.034***
	(0.003)	(0.003)	(0.031)	(0.003)
Managerial/Law CEO	0.243	0.243	-4.831**	-4.831***
	(0.222)	(0.205)	(2.457)	(0.205)

(*continued on next page*)

Table B1 (*continued*)

	Dependent Variable: PD		Dependent Variable: ROA	
Variables	**Pooling**	**2SLS and Arellano**	**Pooling**	**2SLS and Arellano**
Female Board	0.00002	0.00002	0.045	0.045***
	(0.004)	(0.004)	(0.041)	(0.004)
Female CEO	0.966***	0.966**	-1.828	-1.828***
	(0.338)	(0.435)	(3.747)	(0.435)
Board Age	0.020*	0.020	0.035	0.035***
	(0.011)	(0.013)	(0.124)	(0.013)
Board Size	-0.039	-0.039*	-0.999***	-0.999***
	(0.026)	(0.023)	(0.292)	(0.023)
Fintech Size	-0.158***	-0.158**	1.663**	1.663***
	(0.060)	(0.063)	(0.661)	(0.063)
Fintech Leverage	-0.071***	-0.071***	0.278	0.278***
	(0.016)	(0.014)	(0.177)	(0.014)
Fintech Turnover	-0.003***	-0.003***	0.039***	0.039***
	(0.001)	(0.001)	(0.008)	(0.001)
Fintech Age	-0.042**	-0.042***	0.983***	0.983***
	(0.020)	(0.015)	(0.223)	(0.015)
Observations	592	592	592	592
F Statistic (df = 10; 581)	7.200***	10.370***	8.975***	14.428***

Note: The table exhibits the result of the 2SLS model with Arellano coefficient estimation (*2SLS and Arellano*) on probability of default (PD) and return on assets (ROA) compared to baseline results (*pooling*).

Table C1
Hausman and Cragg–Donald tests for endogeneity after 2SLS Estimation (Cragg & Donald, 1993).

Test	**Statistic**	**P-value**
Cragg-Donald Test for Endogeneity	1.00	0.9625
First-stage F-Test	27.858	0.000
After 2SLS model		
PD Model - Hausman Test for Endogeneity	0.000	0.96256
ROA Model - Hausman Test for Endogeneity	0.000	0.98328

Note: The table represents the econometric tests to verify the strength of instrumental variables and the absence of heteroskedasticity in the final model.

Table D1
Robustness test of the hypotheses for the period 2020–2022.

	Hypothesis 1		Hypothesis 2	
Variable	**Risk**	**Profitability**	**Risk**	**Profitability**
Constant	3.053***	-24.701***	0.899	-26.900***
	(0.400)	(2.553)	(0.648)	(4.209)
Board Size	-0.026	-0.926***		
	(0.027)	(0.173)		
Board Age			0.052***	0.005
			(0.013)	(0.082)
Fintech Size	-0.140**	1.196***	-0.165***	0.777**
	(0.058)	(0.373)	(0.057)	(0.369)
Fintech Leverage	-0.071***	0.289**	-0.072***	0.360***
	(0.018)	(0.113)	(0.018)	(0.114)
Fintech Turnover	-0.004***	0.032***	-0.004***	0.033***
	(0.001)	(0.005)	(0.001)	(0.005)
Fintech Age	0.741***	7.512***	0.551***	7.349***
	(0.168)	(1.069)	(0.173)	(1.120)
Fintech Fixed Effect	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes
Observations	645	645	645	645
R2	0.035	0.120	0.065	0.117
Adjusted R2	0.032	0.116	0.058	0.111
F Statistic	9.401***	34.861***	9.894***	18.821***
	Hypothesis 3		**Hypothesis 4**	
Variable	**Risk**	**Profitability**	**Risk**	**Profitability**
Constant	3.045***	-27.355***	2.315***	-23.993***

(*continued on next page*)

Table D1 (*continued*)

	Hypothesis 1		Hypothesis 2	
Variable	**Risk**	**Profitability**	**Risk**	**Profitability**
	(0.398)	(2.559)	(0.471)	(3.040)
Female Board	-0.005	0.075***		
	(0.004)	(0.028)		
Managerial/Law Board			0.009***	-0.036
			(0.003)	(0.022)
Fintech Size	-0.152***	0.787**	-0.146**	0.759**
	(0.057)	(0.368)	(0.057)	(0.369)
Fintech Leverage	-0.069***	0.352***	-0.071***	0.367***
	(0.018)	(0.113)	(0.018)	(0.114)
Fintech Turnover	-0.004***	0.033***	-0.003***	0.031***
	(0.001)	(0.005)	(0.001)	(0.005)
Fintech Age	0.747***	7.215***	0.701***	7.510***
	(0.168)	(1.079)	(0.168)	(1.083)
Fintech Fixed Effect	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes
Observations	645	645	645	645
R2	0.036	0.105	0.040	0.102
Adjusted R2	0.032	0.101	0.036	0.098
F Statistic	9.516***	30.089***	10.681***	29.116***
	Hypothesis 5		**Hypothesis 6**	
Variable	**Risk**	**Profitability**	**Risk**	**Profitability**
Constant	2.809***	-26.639***	2.845***	-23.612***
	(0.398)	(2.580)	(0.428)	(2.749)
Female CEO	1.227***	-0.297		
	(0.375)	(2.430)		
Managerial/Law CEO			0.228	-4.590***
			(0.241)	(1.552)
Fintech Size	-0.125**	0.772**	-0.151***	0.780**
	(0.057)	(0.372)	(0.057)	(0.367)
Fintech Leverage	-0.073***	0.361***	-0.069***	0.349***
	(0.018)	(0.114)	(0.018)	(0.113)
Fintech Turnover	-0.004***	0.033***	-0.004***	0.032***
	(0.001)	(0.005)	(0.001)	(0.005)
Fintech Age	0.687***	7.380***	0.718***	7.751***
	(0.168)	(1.085)	(0.169)	(1.085)
Fintech Fixed Effect	yes	yes	yes	yes
Time Fixed Effect	yes	yes	yes	yes
Observations	645	645	645	645
R2	0.043	0.100	0.035	0.106
Adjusted R2	0.039	0.096	0.032	0.103
F Statistic	11.425***	28.532***	9.395***	30.473***

Note: The table represents the econometric tests to verify if the validity of the hypotheses holds for the time period 2020–2022

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