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Preferences for ethical intermediaries and sustainable investment decisions in micro-firms: The role of financial literacy and digital financial capability

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ABSTRACT

This study analyses the effects of financial literacy and digital financial capabilities in shaping entrepreneurs' preferences for ethical financial intermediaries and sustainable investment decisions. Exploiting novel survey data on Italian micro-enterprises, we find that more financially literate business owners have higher preferences for intermediaries with a strong ethical stance, are more likely to make investments inspired by environmental and social criteria and have a higher awareness of sustainable financial products. Moreover, digital financial competencies are found to play a significant role in enhancing preferences for ethical intermediaries and sustainable investment decisions. Finally, we show that the beneficial effect of financial literacy is mostly direct, while the indirect effect operating through higher digital financial abilities, despite being statistically significant, impacts firms' sustainable financing and investing decisions only to a lower extent.

1. Introduction

In recent years, the market of sustainable financial products, i.e. investment products accounting for environmental, social, and governance (ESG) criteria, has shown exceptional growth rates, expanding the range of investment and financing tools available for individuals and enterprises (Meira et al., 2023; Cosma et al., 2024). Advancements in digital finance have also created new investment opportunities, offering tailored financial products, facilitating access to financial services, and improving the efficiency of the financial system (Telukdarie and Mungar, 2023). On the one hand, these developments have allowed to satisfy the most sophisticated needs of investors and to reach a higher level of financial inclusion; on the other, they have contributed to the growing complexity of financial choices, requiring greater financial knowledge and skills to make informed decisions (Yang et al., 2023). At the same time, a growing number of financial companies have implemented sustainable practices (La Torre et al., 2024) and recent research has focused on the analysis of the determinants of investors' preferences for ethical financial intermediaries, i.e. financial companies adopting ESG strategies and offering sustainable financial products (Cucinelli and Soana, 2023).

Extant literature suggests that firms' investments in corporate social responsibility (CSR) have positive effects on cost savings, risk mitigation, access to capital, competitiveness, and brand value (Hermundsdottir and Aspelund, 2022; Siedschlag and Yan, 2023; Caballero-Morales, 2021; D'Apolito et al., 2024) and that sustainable firms are more likely to match with banks having similar

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sustainable profiles (Houston and Shan, 2022). Enterprises engaged in environmentally and socially responsible activities may in fact expect that sustainability-committed banks are more able to recognize their social vocation and offer better lending conditions (Degryse et al., 2023a). Financial intermediaries, by enhancing access to credit of more sustainable businesses, may thus contribute to the pursuit of environmental and social sustainability objectives.

Recent studies have shown that individuals' preferences for ethical financial intermediaries and attitudes towards sustainable investment choices significantly increase with financial literacy (Gutsche et al., 2023; Aristei and Gallo, 2024). However, even though higher financial competencies improve investors' ability to select and elaborate financial information, reducing participation costs and fostering socially responsible investments, some researchers have also pointed out that financial literate individuals could tend to limit sustainable investments, being aware that sustainable strategies might restrict investment opportunities and reduce portfolio diversification (Gutsche et al., 2021). Furthermore, only few studies have so far provided evidence on the role played by financial literacy in shaping individuals' preferences for ethical financial intermediaries (Aristei and Gallo, 2021; Cucinelli and Soana, 2023). Prior literature has also highlighted that financial literacy significantly improves the use of digital financial services by individuals (Hasan et al., 2023), suggesting that limited financial competencies curtail digital finance adoption and represent a barrier for achieving financial inclusion (Yang et al., 2023).

Despite extant literature has extensively assessed the role of financial literacy on individuals' sustainable financial behaviour, to the best of our knowledge, there are no studies on the effect of financial competencies and digital financial abilities on firms' preferences for ethical financial intermediaries and attitudes towards environmentally responsible (ER) and socially responsible (SR) investments (i.e., investment strategies taking into account their environmental and social impact, respectively). Nevertheless, especially for micro-entrepreneurs, who usually cannot rely on skilled employees, an adequate level of financial and digital competencies may be crucial for business performance and survival, especially when they need to quickly react to unexpected shocks, like those induced by the COVID-19 pandemic (D'Ignazio et al., 2022). Research on firms' financial literacy has mainly taken into account the effect on business performance (Eniola and Entebang, 2017), access to finance (Hussain et al., 2018), innovation activities (Tian et al., 2020), risk attitude and entrepreneurship (Riepe et al., 2022). As observed by Molina-García et al. (2023), despite the growing relevance that environmental and social factors have assumed in corporate economic and financial decision-making, there are no works that analyse the relationship between financial literacy and firms' sustainable financial choices. Furthermore, digital financial capabilities (i.e., the abilities to properly use digital financial services) are usually analysed in relation to firms' financial behaviour and performance (Luo et al., 2021), but a research gap exists on their impact on the adoption of sustainable financing and investing strategies.

Exploiting novel data from the Bank of Italy's survey on "Financial literacy and digitalization of small businesses in Italy", this paper investigates for the first time the impact of financial literacy and digital financial capabilities on micro-entrepreneurs' preferences for ethical intermediaries and attitudes towards ER and SR investments. The Italian context is particularly relevant to the aim of our analysis. Even though Italy is one of the fastest-growing markets for sustainable investments in Europe (Eurosif, 2021), Italian micro- and small-sized enterprises still lag behind in terms of engagement in sustainable activities and investments (Istat, 2023a). However, as micro enterprises account for more than 95 % of Italian firms, employ about 44 % of the total workforce, and generate nearly 27 % of value added (Istat, 2023b), they are essential for the transition towards a more sustainable economy. Moreover, Italy is characterized by a bank-based financial system, where financial intermediaries play a leading role in capital allocation for enterprises (European Commission, 2023) and might also strongly contribute to their sustainable investment strategies. Finally, both financial and digital literacy of entrepreneurs in Italy are quite limited (D'Ignazio et al., 2022), making the Italian context ideal for investigating the consequences of inadequate competencies on firms' sustainable financial choices and for assessing the potential of financial education initiatives.

The remainder of the paper is organised as follows. In Section 2, we propose a review of the literature and formulate our research hypotheses. Section 3 describes data and variables, while Section 4 illustrates the econometric methods. The main empirical findings are presented and discussed in Section 5, while Section 6 presents additional analyses and robustness checks. Section 7 concludes with a discussion of the contributions, limitations, and future extensions of the study.

2. Literature review and research hypotheses

2.1. Financial literacy in small and medium enterprises

The topic of financial literacy has been extensively investigated in studies on individuals and households, while it is still understudied in the context of firms.

Research on financial literacy in small and medium enterprises (SMEs) is an emerging field and there is still no consensus regarding its definition. A great variety of constructs has been proposed in the literature (Singla and Mallik, 2021; Trombetta, 2023), giving rise to significant heterogeneity in empirical findings and often leading to incorrect interchangeability of concepts. Researchers tend to include in the definition of financial literacy dimensions that go beyond the actual knowledge of basic financial concepts and embrace financial behaviour, attitudes, and awareness (Eniola and Entebang, 2017), as well as self-assessed knowledge and confidence in one's own financial competencies (Huston, 2010; Rostamkalaei et al., 2022). An attempt to provide a comprehensive definition has been recently proposed by the OECD and its International Network on Financial Education (OECD/INFE), which define the financial literacy of owners and managers of micro, small and medium enterprises (MSMEs) and of potential entrepreneurs as "*the combination of awareness, knowledge, skills, attitudes and behaviour that a potential entrepreneur or an owner or manager of a micro, small or medium sized enterprise should have in order to make effective financial decisions to start a business, run a business, and ultimately ensure its sustainability and growth*". This definition stresses that the competencies being measured encompass financial knowledge, behaviour, and attitudes,

refer to the firm owner/manager, and are specific to business issues (OECD, 2020). Despite the recognized validity of the approach proposed by the OECD/INFE, empirical studies still adopt heterogeneous definitions of firms' financial literacy. Graña-Alvarez et al. (2022) point out the need for further research to consolidate the conceptualization of financial literacy in the context of SMEs, since it is now widely recognized as a key determinant of business performance.

Molina-García et al. (2023) provide a systematic review of the emerging literature on financial literacy in SMEs and point out that studies in this research field have primarily focused on the role of business owners/managers' financial competencies on firms' performance, access to finance, innovation, risk attitude and entrepreneurship. In particular, Eniola and Entebang (2017) and Hossain et al. (2023) show that financial literacy represents an essential intangible resource that enables small businesses to obtain superior performance and higher resilience. Hussain et al. (2018) also point out that financial literacy improves access to finance, enables enterprises to optimize capital structure, and promotes growth potentials. Fatoki (2021) find that financial literacy moderates the relationship between access to finance and performance of MSMEs, while Basha et al. (2023) highlight that financial literacy is negatively associated with the leverage of small firms. Tian et al. (2020), Liu et al. (2021) and Duréndez et al. (2023) further show that managers' financial literacy significantly enhances firm innovation activities, by alleviating financial constraints and improving risk management.

2.2. *Financial literacy and firms' sustainable investing and financing*

In their review, Molina-García et al. (2023) identify several research gaps on the role of financial literacy in SMEs. In particular, they underline that there are still no contributions about the influence of financial literacy on SMEs' sustainable financing and investing. Our paper aims to bridge this gap.

Prior literature provides extensive evidence that firms' adoption of CSR initiatives significantly contributes to achieve sustainable competitive advantage (Sen and Bhattacharya, 2001; McWilliams and Siegel, 2011) and improves access to external capital (Cheng et al., 2014). Finance has in turn become a key driving force of corporate socially responsible behaviour, since the credit channel and private equity exert a substantial influence on firm's non-financial policies and performance (Scholtens, 2006). Moreover, sustainable investing generates positive social impact, leading firms to become greener and inducing more real investment by green firms (Pástor et al., 2021; Arco-Castro et al., 2023).

Recent studies have provided evidence on the positive impact of financial literacy on firms' sustainable management practices and sustainability performance (Cantele and Zardini, 2018; Siddik et al., 2023). An adequate level of financial literacy is also deemed as essential for firms' use of financial instruments, such as derivatives, that allow managing climate-related exposures (Hsiao and Tsai, 2018; European Central Bank, 2021) and for their access to sustainable financial instruments like green bonds and loans (Bhatnagar and Sharma, 2022). The use of this type of financing can help firms to reduce their dependence on the issuing of equity instruments and to improve their reputation (Harrison and Muething, 2021). Furthermore, Newton et al. (2022) point out that bank and non-bank financial intermediaries play a key role in the transition to a sustainable economy by funding and supporting responsible investment projects and enterprises. They also find that firms' ESG risk reduces after borrowing from banks, due to tight monitoring, demonstrating that banks are more effective than public bond markets in shaping borrowers' ESG performance. Degryse et al. (2023a) provide further evidence that the environmental consciousness of banks play a positive role in the green transition and show that sustainability-committed banks reward firms for being green by granting cheaper loans. Similarly, Houston and Shan (2022) show that lenders tend to match with borrowers that have similar ESG profiles and positively influence the evolution of firms' ESG performance over time. Hasan et al. (2021) also find that the presence of affiliated banker directors on corporate boards significantly improves firms' CSR investments, and this positive effect is even stronger for affiliated banker directors from lending banks with higher CSR orientation. All these findings clearly suggest that bank lending plays and effective role in promoting corporate ESG activities and responsible investments, especially when firms are more bank-dependent and when banks have stronger environmental and social consciousness.

The relationship between financial literacy and preferences for sustainable financing and investing has been so far analysed only in the context of individual retail investors. However, the empirical evidence is still ambiguous: although several studies highlight a positive impact of financial knowledge on sustainable investment strategies (Aristei and Gallo, 2021; Gutsche et al., 2023), others find no impact (Filippini et al., 2024) or even a negative impact (Gutsche et al., 2021), stressing the need for more in-depth analyses. Recently, Meunier and Ohadi (2022) find that less financially literate individuals in the US are more likely to display misconceptions about sustainable investments, which in turn reduce their likelihood to invest responsibly. Cucinelli and Soana (2023), based on a sample of Italian adults, show that individuals characterized by high financial literacy and high self-reported orientation towards sustainable investments are more likely to choose financial intermediaries adopting ESG strategies and offering sustainable financial products. Similarly, Aristei and Gallo (2024) show that individuals' preferences for ethical intermediaries and sustainable investments significantly increase with financial knowledge, suggesting that inadequate financial competencies represent an important barrier to responsible financing and investing. The authors also point out that lack of confidence in one's own financial knowledge significantly hampers individual attitudes towards sustainable finance.

To date, there are no studies analysing the relationship between financial literacy and sustainable financial choices in the context of firms. We thus aim to contribute to the extant literature by providing first empirical evidence on the effect of financial literacy on firms' preferences for ethical financial intermediaries and responsible investment decisions.

2.3. Digital financial abilities and firms' sustainable financial choices

Over the last years, advances in financial technology (FinTech) and the accelerated digitization of financial intermediation driven by the COVID-19 pandemic have resulted in an increased availability and use of digital financial services (Fu and Mishra, 2022; Ferilli et al., 2024).

Prior studies have provided evidence on the relevance of financial literacy in promoting the use of digital financial services by individuals and households. Yang et al. (2023) find that knowledge of basic financial concepts significantly boosts the use of digital finance in China. The positive impact of financial literacy increases with the complexity of digital financial services and is more pronounced in encouraging the use of digital financial services among disadvantaged groups. Accordingly, Hasan et al. (2023) provide support to the significant role of financial literacy in enhancing access to FinTech services by individuals living in rural areas.

However, effective use of digital financial services and products not only depends on the level of financial literacy, but also requires adequate digital skills. A growing literature has thus stressed the need to redefine financial literacy within a digital context (Lyons and Kass-Hanna, 2021a). This has led to the emerging concept of digital financial literacy to indicate "a combination of knowledge, skills, attitudes and behaviours necessary for individuals to be aware of and safely use digital financial services and digital technologies" (OECD, 2022). Digital financial literacy is a multidimensional concept that involves elements of financial and digital literacy, as well as additional elements related to access and use of digital financial services (Lyons and Kass-Hanna, 2021b). Recently, Kass-Hanna et al. (2022) and Choung et al. (2023) have shown that both financial literacy and digital literacy are key determinants of households' financial resilience and well-being. These findings further emphasize the need to properly measure digital financial literacy and to incorporate metrics related to digital competencies into traditional indicators of financial literacy.

To date, only few studies have analysed the digital financial abilities of enterprises. Luo and Zeng (2020) show that digital financial capability, together with financial literacy, significantly enhances the probability of business innovation. Similarly, Luo et al. (2021) point out that the abilities to manage digital financial services of entrepreneurs in China have a significant and positive influence on business entry, innovation, and financial performance. D'Ignazio et al., (2022) find that financial literacy facilitates the transition of Italian micro-enterprises to more digitalized business models and increases their resilience to external shocks. Conversely, digital competencies, including those related to digital financial services, do not affect firms' performance during the COVID-19 pandemic. Previous studies have also assessed the role of digital skills in enhancing business adoption of green technologies and sustainable practices (Santoalha et al., 2021), while more recent research has focused on the role of digital technologies in promoting the ESG performance of enterprises, demonstrating that FinTech adoption significantly improves firms' sustainable activities. (Siddik et al., 2023; Trotta et al., 2024). However, to the best of our knowledge, there are still no contributions on the impact of digital financial capabilities on firms' attitudes towards sustainable financing and investing. Our study thus attempts to fill this research gap in the literature.

2.4. Theoretical background and hypothesis development

From a theoretical perspective, several theories have been considered to explain the influence of financial literacy on business performance and strategic behaviour and can be useful also to analyse the links between financial literacy, digital financial capability, and firms' sustainable financial choices. First, the *resource-based view* argues that valuable, inimitable, and non-substitutable resources enable firms to achieve sustainable competitive advantage and superior performance (Barney, 1991). Business owners/managers' financial literacy and digital financial abilities can be thus seen as a crucial intangible resource that not only allows firms to attain better economic performance, but also improves their access to finance and their sustainability (Adomako et al., 2016; Khan et al., 2019; Siddik et al., 2023). Moreover, in line with the *upper echelon theory* (Hambrick and Mason, 1984), firms' strategic choices, as well as their performances, are partially determined by the managerial background characteristics. In this respect, financial literacy and attitudes towards digital financial services can be considered as one of the business owner/manager's upper echelon attributes, which may affect firms' strategic decisions and outcomes (Tian et al., 2020; Molina-García et al., 2023). Drawing from the *human capital theory* (Becker, 1975), Liu et al. (2021) also argue that financial literacy can be a way to enhance a firm's human capital endowment and, especially in SMEs, higher financial competencies allow owners/managers to make more responsible and informed investment decisions. Furthermore, according to the *planned behaviour theory,* firms' behaviours are determined by intentions, attitudes, and subjective norms (Ajzen, 1991). In this regard, financial literacy can be considered an important factor that affects entrepreneurs' intentions and attitudes and therefore their decision-making processes, including those related to sustainable financing and investing (She et al., 2024).

Building on these theoretical frameworks and on the considerations discussed in previous Sections, financial literacy and digital financial capability can be considered as crucial factors shaping the attitudes and intentions of business owners/managers and can also contribute to their sustainable financing and investing choices. We thus propose and empirically test the following research hypotheses:

H1. *Financial literacy has a beneficial effect on micro-entrepreneurs' preferences for financial intermediaries with a strong ethical stance and attitudes towards responsible investments.*

H2. *Entrepreneurs' digital financial capabilities contribute to enhance their preferences for ethical financial intermediaries and sustainable investment choices.*

Furthermore, since access to digital finance can be influenced by financial competencies (Hasan et al., 2023; Yang et al., 2023),

financial literacy may enhance micro-entrepreneurs' preferences for ethical financial intermediaries and sustainable investment decisions also indirectly, by increasing their abilities to manage digital financial services. For this reason, to disentangle the direct and indirect effects of financial literacy, we further assess the potential mediating role of digital financial capability and formulate the following additional research hypothesis:

H3. *The use of digital financial services mediates the impact of entrepreneurs' financial literacy on preferences for sustainable financial companies and on responsible investments.*

3. Data and measurement

We use data from the "Financial literacy and digitalization of small businesses in Italy" survey, carried out by the Bank of Italy on a representative sample of 1998 non-financial firms with less than 10 employees. The sample is representative of the population of non-financial micro enterprises in Italy and firms were chosen according to a stratified sampling design with random selection of units within the strata and proportional allocation. Data were collected between March and May 2021 through computer assisted web interviews (CAWI) to owners of micro enterprises, as well as to CEOs with responsibilities in taking financial decisions in the case of limited liability companies. The survey focuses on measuring financial literacy and digitalization among owners of microenterprises in Italy, based on the harmonized methodology developed by the OECD/INFE, and provides detailed information on firm and owner characteristics (OECD, 2020; 2021). The estimation sample reduces to 1948 firms for which we have complete data for all the variables used in the empirical analysis.

In this study, in line with Cucinelli and Soana (2023) and Aristei and Gallo (2024), we analyse preferences for ethical financial intermediaries and attitudes towards sustainable investments reported by firm owners. To this aim, we first define a binary variable (*Ethical intermediaries*) identifying respondents who prefer dealing with ethical financial intermediaries, as those who "*Agree*" or "*Strongly agree*" with the statement "*I prefer to use financial companies that have a strong ethical stance*".[1] We then define two other dichotomous variables (*ER investments* and *SR investments*) identifying respondents who prefer sustainable investments, as those that "*Agree*" or "*Strongly agree*" with the statements "*When I make an investment for the business, I take into account its environmental impact*" and "*When I make an investment for the business, I take into account its social impact*", respectively. In order to gauge firm owners' awareness of sustainable financial products, we also consider an additional dummy variable (*Sustainable finance awareness*) identifying respondents who have heard of sustainable (social or green) bonds or loans.[2] From Table A1 in the Appendix, we noticed that 42.8 % of the firm owners in the sample prefer dealing with ethical financial companies, while 74.4 and 70 % report to take into account the environmental and social impact of business investments, respectively. Furthermore, about 36.5 % of the firm owners in the sample have heard of sustainable financial products.

Our main explanatory variables relate to firm owners' level of financial literacy and use of digital financial services.

We measure the overall financial literacy of business owners/managers based on the scores of three components related to financial knowledge, behaviour, and attitudes, in line with the approach proposed by the OECD/INFE (OECD, 2020; 2021). The financial knowledge (FK) score is equal to the number of correct responses to five test-based questions, aimed at assessing knowledge of business finance (i.e., dividends, meaning of equity) and basic financial concepts widely considered as essential for financial decision-making (i.e., inflation, risk-return relationship, interest on loans).[3] The financial behaviour (FB) score is computed as the number of "financially savvy" behaviours. These behaviours are assessed using nine questions, which refer to whether entrepreneurs: manage strictly separate accounts for personal and business finances; considered several options and shop around before choosing financial products or services for the business; keep track of the financial records of the business formally; thought about how to fund their own retirement; have thought ahead of a way of insuring the equipment in the case of theft; keep data and information about the business secure; compare the cost of different sources of finance for the business; forecast the profitability of the business regularly; adjust their planning according to the changes in economic factors. Finally, the financial attitudes (FA) score is defined as the count of "financially savvy" attitudes, assessed through three questions appraising whether firm owners/managers: set long term financial goals for the business and strive to achieve them; are confident to approach banks and external investors to obtain business finance; prefer to make detailed financial plans for their business rather than to follow their instinct. These three scores are then normalized to vary between 0 and 10. Following the approach proposed by D'Ignazio *et al.* (2023), we define the overall financial literacy (FL) score as the sum of the normalized scores of the three components. Differently from the methodology suggested by the OECD/INFE, where the FL score is computed as the sum of raw scores of knowledge, behaviour, and attitudes, this approach allows us to give equal importance to the three components of financial literacy in defining the overall score. The FL score ranges between 0 and 3 and is normalized once more to vary between 0 and 10. From Table A1 in the Appendix, we notice that business owners in Italy are characterized by a FL score equal to 7.161, while the average values of the financial knowledge, behaviour and attitudes are equal to 7.188, 7.869 and 6.427, respectively.

[1] Complete variable definitions are reported in Table A1 in the Appendix, together with average values.

[2] It is worth remarking that the use of direct survey questions to assess preferences for ethical intermediaries and attitudes towards sustainable investments may be problematic, as they do not necessarily reflect actual choices and may be biased by the tendency to give socially desirable answers. Nevertheless, Bauer et al. (2023) point out that hypothetical responses and real choices concerning sustainable investments are strongly correlated, providing support to the use of survey questions to elicit true preferences for sustainable investing.

[3] The exact wording of the financial knowledge, behaviour and attitudes questions is reported in Table S1 in the Supplementary Appendix.

As in Luo et al. (2021), we define a digital financial capability (DFC) score based on firm's activities related to digital financial services and products. Specifically, we exploit questions assessing whether, either before or during the COVID-19 pandemic, entrepreneurs: opened a bank account completely online; signed a financing contract completely online; signed an insurance contract completely online; have a large/very large percentage of online payments from customers on total payments from customers; have a large/very large percentage of online payments to suppliers on total payments to suppliers; have a large/very large percentage of operations on current account conducted online on total operations on the current account.[4] The raw sum of digital financial activities ranges between 0 and 6 and is then normalized to vary between 0 and 10. On average, business owners in Italy are characterized by a DFC score equal to 4.844 (see Table A1 in the Appendix).

Table 1 reports average values of the binary indicators of preference for ethical financial intermediaries and sustainable investments by quartiles of the FL and DFC scores. From the Table we notice that all the indicators present an increasing pattern across quartiles, providing support to the beneficial effect of financial literacy and digital financial capabilities on firms' preferences for sustainable investments. In particular, the proportion of firms preferring ethical intermediaries increases from 25.2 % for those in the first quartile of FL to 61.6 % for those in the fourth quartile. The proportion of firms that accounting for the environmental and social impact of their business investments increases from 62 and 54.6 % in the first quartile of FL to 83.3 and 83.6 % in the fourth quartile, respectively. Accordingly, the proportion of owners aware of sustainable financial products increases from 22 % in the first quartile of FL to 54 % in the fourth. Similar increasing patterns also emerges for all the indicators with respect to the level of digital financial capability.

To properly assess the effect of financial literacy and digital financial capabilities, and mitigate as much as possible omitted variable bias, we control for a large set of both firm and owner characteristics. We include in the empirical specification firm age (in logarithmic terms) and binary indicators for business type (*Autonomous firm*), turnover classes (*€100,000-€500,000*; *€500,000-€1 million*; *More than €1 million*), and number of employees (*One-person firm*). We also consider an indicator variable referring to whether the business exports products or offer services abroad (*Exporter*) and a dummy for the overall impact of the COVID-19 crisis on firm activities (*Adverse pandemic impact*). Moreover, we account for the socio-demographic characteristics of the owner of the firm. In particular, we control for the owner's self-reported gender (*Female owner*), age (in logarithmic terms), and include binary indicators for educational attainment (*Lower secondary, Upper secondary*, *Tertiary education*). We also control for entrepreneurial experience by means of a dummy indicating whether the owner has more than 10 years of experience and include an indicator variable referring to whether the owner received helped from a financial advisor external to the business in taking financial decisions (*External financial advice*). Finally, we account for geographical and sectoral heterogeneities by means of macro-regional dummies (*North-East*; *Centre*; *South-Islands*) and sector fixed effects.

Table S3 in the Supplementary Appendix presents the composition of the estimation sample with respect to the firm and owner characteristics, together with disaggregated descriptive statistics for the four dependent variables considered in the analysis and for the financial literacy and digital financial capability scores. We report the pairwise correlation matrix for all the explanatory variables in Table S4 in the Supplementary Appendix. From this Table, we notice that the estimated correlation coefficients are generally low, suggesting no collinearity issues in the empirical models.

4. Methods

Previous literature has emphasized that financial literacy may be endogenously determined with respect to the financial behaviour of individuals and firms, due to omitted variable bias, reverse causality, and measurement error (see Lusardi and Mitchell, 2014; Tian et al., 2020; Basha et al., 2023). Recent studies have also pointed out that digital financial capability might be an endogenous determinant of financial decisions (Yin et al., 2019; Luo et al., 2021; Lyons and Kass-Hanna, 2021b). To account for these potential endogeneity concerns and allow for a causal interpretation of the effects of financial literacy and digital financial abilities, we consider a probit model with two endogenous continuous regressors, which can be formalized as the following three-equation system:

$$\begin{cases} y_i = 1(\beta_1 FL_i + \beta_2 DFC_i + \boldsymbol{x}_i'\boldsymbol{\beta_3} + \varepsilon_i > 0) \\ FL_i = \boldsymbol{x}_i'\boldsymbol{\alpha_1} + \boldsymbol{z}_{1i}'\boldsymbol{\alpha_2} + u_i \\ DFC_i = \boldsymbol{x}_i'\boldsymbol{\gamma_1} + \boldsymbol{z}_{2i}'\boldsymbol{\gamma_2} + v_i \end{cases} \tag{1}$$

where $1(\cdot)$ is an indicator function (equal to 1 if the expression in parentheses is true and 0 otherwise), y_i represents the alternative binary indicators of preferences for ethical financial intermediaries and sustainable investment choices presented in Section 3, and $\boldsymbol{x}_i$ is a set of exogenous regressors. The second and third equations in (1) define two linear reduced form equations for FL_i and DFC_i as functions of $\boldsymbol{x}_i$ and of two sets of additional exogenous instrumental variables $\boldsymbol{z}_{1i}$ and $\boldsymbol{z}_{2i}$, assumed to directly affect financial literacy and digital financial capabilities, but not to directly impact attitudes towards sustainable finance. Specifically, we consider as instruments for FL_i a dummy indicating whether the firm owner received education in subjects related to business, economics, or finance as part of her/his school or university education (*Financial education at school*) and a dummy indicating whether any of the owner's parents currently own a business or owned a business in the past (*Parents' business ownership*). Both these instruments are assumed to positively affect the financial competencies of the business owner. As discussed in Kaiser et al. (2022) and Ansar et al. (2023), financial

[4] The exact wording of the survey questions on the digital financial activities used to define the digital financial capability score is reported in Table S2 in the Supplementary Appendix.

Table 1
Financial literacy, digital financial capability, and preferences for sustainability.

	Ethical intermediaries	ER investments	SR investments	Sustainable finance awareness
	(%)	*(%)*	*(%)*	*(%)*
a) Financial literacy (FL)				
1st quartile	25.18		54.01	22.02
		62.28		
2nd	40.73		69.80	28.30
		74.81		
3rd	44.91		73.65	42.40
		78.04		
4th quartile	61.60		83.61	54.55
		83.33		
b) Digital financial capability (DFC)				
1st quartile	34.07		64.40	30.30
		68.41		
2nd	43.98		69.24	37.87
		77.15		
3rd	50.18		75.96	38.61
		78.48		
4th quartile	51.34		76.26	44.88
		79.02		
Total	42.76		69.99	36.45
		74.42		

Notes: percentage proportions are computed on the estimation sample, using sample weights.

education programmes at school are effective in increasing individuals' knowledge of basic financial concepts, thus enhancing their ability make effective financial decisions and improving an efficient and effective use of financial services. Firm owners may also benefit from the entrepreneurial experience of their parents and acquire managerial skills in the family (Zapkau et al., 2017). At the same time, both these variables can be safely assumed to affect preferences for ethical intermediaries and sustainable investment decisions only indirectly, through their impact on financial literacy. With respect to DFC_i, our identification strategy is based on two binary indicators referring to whether the firm, before the pandemic, used social media for business activity such as advertising or networking (*Social networks for business*) and had a high or very high share of sales of products or services through its website on total sales (*High online sales share*). The choice of these two instruments is based on the idea that firms' use of Internet and digital activities related to sales and other business operations directly affect their use of digital financial services, as pointed out in recent empirical studies (Yin et al., 2019; Luo et al., 2021), but do not directly impact on their attitudes towards ethical intermediaries and sustainable investments.

The error terms ε_i, u_i and v_i in (1) are assumed to follow a trivariate normal distribution with zero means, variances respectively equal to 1, σ_u^2, and σ_v^2, and arbitrary correlations $\rho_{\varepsilon u}$, $\rho_{\varepsilon v}$ and ρ_{uv}. Endogeneity of financial literacy and digital financial capability arises from error correlation: when $\rho_{\varepsilon u} \neq 0$ and/or $\rho_{\varepsilon v} \neq 0$, FL_i and/or DFC_i are correlated with ε_i and a standard probit regression for y_i will lead to inconsistent parameter estimates.

Estimation of the three-equation system (1) can be carried out by means of full-information maximum likelihood (FIML) methods. Wooldridge (2015) points out that a two-stage residual inclusion (i.e., control function) approach can be also adopted to consistently estimate parameters of probit models with continuous endogenous regressors.

5. Empirical results

5.1. Preferences for ethical financial intermediaries

Table 2 presents the results on the determinants of firms' preferences for ethical financial intermediaries, in terms of average marginal effects (AMEs) estimated from the endogenous probit defined by the three-equation system (1).

Before commenting the estimated AMEs, we assess the appropriateness of the additional instruments considered and the potential endogeneity of the financial literacy and digital financial capability scores. To evaluate the validity of our identification strategy, we first test the exogeneity of the instruments discussed in Section 3 by means of the Amemiya-Lee-Newey overidentification test. The

Table 2
The determinants of firms' preferences for ethical financial intermediaries.

Dependent variable:	Ethical intermediaries (1)	FL (2)	DFC (3)
Financial literacy (FL)	0.1015***		
	(0.0247)		
Digital financial capability (DFC)	0.0239***		
	(0.0083)		
Age of the firm (in logs)	-0.0070	-0.1331**	0.0740
	(0.0180)	(0.0584)	(0.0992)
Autonomous firm	0.0133	1.3404***	0.9168***
	(0.0590)	(0.1972)	(0.2561)
One-person firm	-0.0764**	-0.4912***	-0.3196***
	(0.0325)	(0.1140)	(0.0797)
Turnover: €100,000-€500,000	-0.0206	0.6336***	0.5475***
	(0.0356)	(0.1125)	(0.1609)
Turnover: €500,000-€1 million	-0.0268	0.7793***	0.3944**
	(0.0349)	(0.1054)	(0.1874)
Turnover: More than €1 million	-0.0375*	1.1165***	0.4602***
	(0.0223)	(0.1632)	(0.1486)
Exporter	-0.0019	0.0622	0.4407***
	(0.0232)	(0.0866)	(0.1096)
Female owner	-0.0045	-0.0654	0.0545
	(0.0251)	(0.0941)	(0.1614)
Age of the owner (in logs)	-0.0350	0.7363***	0.2829
	(0.0493)	(0.2052)	(0.3625)
More than 10 years of experience	-0.0121	-0.0416	0.1411
	(0.0237)	(0.1090)	(0.1352)
Lower secondary education	0.1535	0.8495***	0.1368
	(0.1507)	(0.2977)	(0.7911)
Upper secondary education	0.1582	1.0932***	0.8384
	(0.1573)	(0.3728)	(0.7320)
Tertiary education	0.1463	1.4852***	1.1939
	(0.1847)	(0.3938)	(0.7554)
External financial advice	0.0314	0.4040***	0.1503*
	(0.0329)	(0.1140)	(0.0830)
Adverse pandemic impact	-0.0182	-0.2747***	-0.2652***
	(0.0310)	(0.1058)	(0.0974)
North-East	0.0439	-0.0575	-0.3944**
	(0.0323)	(0.1870)	(0.1565)
Centre	0.0272	-0.1365	-0.2745**
	(0.0204)	(0.0888)	(0.1155)
South-Islands	0.0453*	-0.2458**	-0.1753
	(0.0242)	(0.1071)	(0.1585)
Financial education at school		0.4179***	
		(0.0614)	
Parents' business ownership		0.2395***	
		(0.0898)	
Social networks for business			1.1764***
			(0.1669)
High online sales share			1.0484***
			(0.2022)
Sector fixed effects	Yes	Yes	Yes
Wald test of exogeneity:			
$\rho_{\varepsilon u} = 0$	[0.0871]		
$\rho_{\varepsilon v} = 0$	[0.0917]		
Overidentification test	[0.1630]		
Weak-instrument F test		[0.0000]	[0.0000]
Observations		1948	

Notes: the Table reports estimated average marginal effects on the probability of preferring ethical financial intermediaries and on the financial literacy and digital financial capability scores, estimated from the endogenous probit model in (1). Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates. The p-values of the Wald test of exogeneity, of the overidentification test, and of the F test for weak instruments are reported in square brackets.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

results, reported in the bottom part of Table 2, clearly indicate that the instruments are exogenous (p-value equal to 0.1630). Furthermore, the F tests for the joint significance of the instruments in the reduced form equations of FL_i and DFC_i suggest that the instruments are not weak. After having provided support to instruments' validity, we assess the exogeneity of financial literacy and

digital financial capability by testing the significance of the cross-equation error correlations $\rho_{\varepsilon u}$ and $\rho_{\varepsilon v}$. The test results indicate that both FL_i and DFC_i cannot be considered as exogenous regressors (p-values equal to 0.0871 and 0.0917, respectively), suggesting that the endogenous probit in (1) should be preferred against a standard (univariate) probit to consistently estimate the causal effect of financial literacy and digital financial abilities on preferences for ethical financial intermediaries.

Table 3
The determinants of firms' preferences for environmentally responsible investments.

Dependent variable:	ER investments (1)	FL (2)	DFC (3)
Financial literacy (FL)	0.1108***		
	(0.0202)		
Digital financial capability (DFC)	0.0355***		
	(0.0088)		
Age of the firm (in logs)	-0.0007	-0.1329***	0.0738
	(0.0111)	(0.0510)	(0.0883)
Autonomous firm	-0.1400**	1.3403***	0.9168***
	(0.0672)	(0.3144)	(0.2647)
One-person firm	0.0501*	-0.4913***	-0.3197**
	(0.0304)	(0.1435)	(0.1395)
Turnover: €100,000-€500,000	-0.0585***	0.6337***	0.5478***
	(0.0209)	(0.1588)	(0.1492)
Turnover: €500,000-€1 million	-0.0790***	0.7793***	0.3944*
	(0.0230)	(0.1762)	(0.2188)
Turnover: More than €1 million	-0.0951***	1.1164***	0.4605***
	(0.0264)	(0.3093)	(0.1658)
Exporter	-0.0239	0.0622	0.4407***
	(0.0239)	(0.0953)	(0.1476)
Female owner	-0.0052	-0.0654	0.0550
	(0.0117)	(0.0925)	(0.1535)
Age of the owner (in logs)	-0.0202	0.7344***	0.2825
	(0.0385)	(0.1790)	(0.2698)
More than 10 years of experience	-0.0006	-0.0412	0.1410
	(0.0140)	(0.0954)	(0.1371)
Lower secondary education	-0.0679	0.8501***	0.1372
	(0.0679)	(0.2339)	(0.7536)
Upper secondary education	-0.1150*	1.0929***	0.8388
	(0.0672)	(0.3002)	(0.7285)
Tertiary education	-0.1416*	1.4846***	1.1944
	(0.0814)	(0.3049)	(0.7349)
External financial advice	-0.0273	0.4042***	0.1503*
	(0.0240)	(0.0821)	(0.0881)
Adverse pandemic impact	0.0073	-0.2747***	-0.2653**
	(0.0160)	(0.0865)	(0.1289)
North-East	-0.0041	-0.0575	-0.3943***
	(0.0255)	(0.1598)	(0.0930)
Centre	-0.0179	-0.1365	-0.2744**
	(0.0178)	(0.0918)	(0.1103)
South-Islands	0.0317*	-0.2458**	-0.1752
	(0.0172)	(0.1063)	(0.1123)
Financial education at school		0.4204***	
		(0.0701)	
Parents' business ownership		0.2360***	
		(0.0528)	
Social networks for business		0.0000	1.1725***
			(0.1229)
High online sales share			1.0556***
			(0.1513)
Sector fixed effects	Yes	Yes	Yes
Wald test of exogeneity:			
$\rho_{\varepsilon u} = 0$	[0.0050]		
$\rho_{\varepsilon v} = 0$	[0.0000]		
Overidentification test	[0.5058]		
Weak-instrument F test		[0.0000]	[0.0000]
Observations		1948	

Notes: the Table reports estimated average marginal effects on the probability of preferring environmentally responsible investments and on the financial literacy and digital financial capability scores, estimated from the endogenous probit model in (1). Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates. The p-values of the Wald test of exogeneity, of the overidentification test, and of the F test for weak instruments are reported in square brackets.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

From column 1 of Table 2, we notice that both financial literacy and digital financial capabilities significantly increase preferences for ethical intermediaries, providing support to our research hypotheses H1 and H2. Specifically, a one-unit increase in the business owner's financial literacy score raises the probability of preferring ethical financial companies by 10.15 percentage points, while a one-unit increase in the digital financial capability score increases the likelihood of dealing with ethical intermediaries by 2.39. In line with

Table 4
The determinants of firms' preferences for socially responsible investments.

Dependent variable:	SR investments (1)	FL (2)	DFC (3)
Financial literacy (FL)	0.0961***		
	(0.0203)		
Digital financial capability (DFC)	0.0314***		
	(0.0113)		
Age of the firm (in logs)	-0.0040	-0.1300**	0.0739
	(0.0102)	(0.0514)	(0.0882)
Autonomous firm	-0.0990**	1.3387***	0.9168***
	(0.0388)	(0.3132)	(0.2648)
One-person firm	0.0157	-0.4927***	-0.3196**
	(0.0580)	(0.1439)	(0.1394)
Turnover: €100,000-€500,000	-0.0474*	0.6338***	0.5476***
	(0.0250)	(0.1588)	(0.1498)
Turnover: €500,000-€1 million	-0.0468	0.7786***	0.3944*
	(0.0304)	(0.1771)	(0.2188)
Turnover: More than €1 million	-0.0648	1.1152***	0.4603***
	(0.0454)	(0.3098)	(0.1664)
Exporter	-0.0099	0.0627	0.4407***
	(0.0262)	(0.0953)	(0.1476)
Female owner	-0.0149	-0.0662	0.0547
	(0.0142)	(0.0929)	(0.1527)
Age of the owner (in logs)	-0.1014**	0.7084***	0.2828
	(0.0413)	(0.1816)	(0.2705)
More than 10 years of experience	0.0131	-0.0352	0.1411
	(0.0132)	(0.0961)	(0.1371)
Lower secondary education	-0.1402***	0.8593***	0.1369
	(0.0543)	(0.2344)	(0.7547)
Upper secondary education	-0.1599***	1.0920***	0.8385
	(0.0544)	(0.2992)	(0.7294)
Tertiary education	-0.1679***	1.4811***	1.1941
	(0.0633)	(0.3034)	(0.7360)
External financial advice	-0.0497*	0.4070***	0.1503*
	(0.0273)	(0.0824)	(0.0880)
Adverse pandemic impact	0.0044	-0.2738***	-0.2652**
	(0.0228)	(0.0871)	(0.1288)
North-East	-0.0284	-0.0573	-0.3943***
	(0.0251)	(0.1608)	(0.0930)
Centre	0.0099	-0.1371	-0.2745**
	(0.0169)	(0.0914)	(0.1103)
South-Islands	0.0517***	-0.2468**	-0.1753
	(0.0159)	(0.1064)	(0.1125)
Financial education at school		0.4481***	
		(0.0644)	
Parents' business ownership		0.1868***	
		(0.0521)	
Social networks for business			1.1752***
			(0.1168)
High online sales share			1.0506***
			(0.1427)
Sector fixed effects	Yes	Yes	Yes
Wald test of exogeneity:			
$\rho_{\varepsilon u} = 0$	[0.0640]		
$\rho_{\varepsilon v} = 0$	[0.0010]		
Overidentification test	[0.2836]		
Weak-instrument F test		[0.0000]	[0.0000]
Observations		1948	

Notes: the Table reports estimated average marginal effects on the probability of preferring socially responsible investments and on the financial literacy and digital financial capability scores, estimated from the endogenous probit model in (1). Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates. The p-values of the Wald test of exogeneity, of the overidentification test, and of the F test for weak instruments are reported in square brackets.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

the findings of Cucinelli and Soana (2023) and Aristei and Gallo (2024), this evidence provides support to the greater preference for financial intermediaries with a strong ethical stance that characterizes more financially knowledgeable business owners. This suggests that inadequate financial literacy and digital financial abilities represent a significant barrier to firms' use of ethical financial providers and thus may significantly hamper their access to credit for ER and SR investments. It is worth remarking that, by properly accounting for the endogeneity of financial literacy and digital financial capability, we avoid downwardly biased estimates of their impacts on preferences for ethical intermediaries. In fact, as reported in Table A2 in the Appendix, the AMEs of FL_i and DFC_i estimated by means of a standard (exogenous) probit model, despite being statistically significant at the 1 % level, reduce to 6.80 and 1.26 percent, respectively. As pointed out by Fort et al. (2016), this severe downward bias can be explained by the negative correlation between the two scores and the error term in the equation of preferences for ethical intermediaries, which is not modelled in the standard probit model.

With respect to the other control variables, our results show that businesses with a turnover higher than €1 million and one-person firms are respectively 3.75 and 7.64 percentage points less likely to prefer financial companies with a strong ethical stance. Micro-enterprises located in Southern Italy and in the Islands have instead a 4.53 percentage points higher probability to prefer ethical financial companies. Conversely, the business owners' demographic characteristics do not significantly affect their preferences for ethical intermediaries.

Columns (2) and (3) of Table 2 present the results on the determinants of business owners' financial literacy and digital financial capabilities. From column (2), we notice that the age and the level of education of the owner have a positive and significant effect on financial literacy. This aspect is in line with the main literature, according to which individuals' financial competencies increase with age and experience, due to dealing with daily financial issues (Lusardi and Mitchell, 2011). On average, owners having a tertiary level of education have a 1.49 points higher FL score than those with primary or no education. This evidence is consistent with previous results available in literature, according to which the level of education positively influences financial literacy (Lusardi and Mitchell, 2023). Furthermore, coherently with our identification strategy, firm owners that received financial education at school and those whose parents own a business or owned a business in the past have higher levels of financial literacy.

With regard to firm-level characteristics, the age of the enterprise has a negative effect on FL_i. One-person firms present a *FL* score of 0.49 points lower than businesses with more than one employee, while businesses that experienced a strongly negative pandemic impact display a 0.27 points lower *FL* score than those that were not affected by the Covid-19 crisis. Furthermore, owners of larger firms have a higher level of financial literacy: in enterprises with a turnover higher than €1 million the FL score is 1.12 points higher than in companies with a turnover lower than €100,000. We also provide evidence of significant geographical disparities in business owners' financial competencies. Entrepreneurs operating in Southern Italy and in the Islands are characterized by a significantly lower level of financial literacy, in line with the evidence of previous studies on the whole Italian adult population (see, e.g., D'Alessio et al., 2020).

From Column (3) we observe that firm-level characteristics are the main determinants of digital financial capability, while variables related to the demographic characteristics of the owner (i.e. age, level of education, and gender) do not show a significant impact on the *DFC* score. Specifically, autonomous firms, those that export products or offer services abroad, and enterprises that receive help from external financial advisors in taking their financial decisions have a 0.92, 0.44 and 0.15 points higher *DFC* score, respectively. Companies with higher levels of turnover are also characterized by a higher *DFC* score, suggesting a positive association between firms' performance and their digital financial abilities. On the contrary, one-person firms and enterprises that have suffered a strongly negative pandemic impact display a lower level of digital financial capability. Moreover, we find significant regional heterogeneities in the DFC score, with entrepreneurs located in North-Western Italy being characterized by a significantly higher use of digital financial services than those in Central and North-Eastern regions. Finally, enterprises that, in the pre-pandemic period, used social media for their business activities and had a large percentage of their sales through the website show a higher DFC score, coherently with our identification strategy.

5.2. Attitudes towards environmentally and socially responsible investments

Tables 3 and 4 report AMEs on the probability of preferring ER and SR investments and on the FL and DFC scores, estimated from the endogenous probit model in (1).[5]

The appropriateness of the identification strategy is clearly supported by the results reported in the bottom part of Tables 3 and 4. Additional instruments are exogenous (p-value of the overidentification tests are equal to 0.5058 and 0.2836 respectively) and the *F* tests for the joint significance of the instruments in the reduced form equations of FL_i and DFC_i suggest that the instruments are not weak. Focusing on the exogeneity of financial literacy and digital financial capability scores, the test results for the significance of cross-equation error correlations indicate that both FL_i and DFC_i cannot be considered as exogenous regressors. Thus, the endogenous probit in (1) should be preferred to a standard probit model to consistently estimate the causal effect of financial literacy and digital financial capabilities on ER and SR investment choices.

From column 1 of Table 3, we note that both FL_i and DFC_i exert a positive and significant effect on the firm's attitude towards ER investments. A one-unit increase in the financial literacy score raises the probability of preferring ER investments by 11.08 percentage points, and a one-unit increase in the digital financial capability score increases this probability by 3.55 percentage points.

[5] In the remainder of the paper, we do not discuss the estimated AMEs on FL and DFC, as they are consistent with those reported in Table 2 and discussed in Section 5.1.

Surprisingly, having a more educated owner reduces the likelihood of preferring ER investments, while the other individual characteristics of the business owner do not show any significant effects.

With respect to the firm characteristics, increasing levels of turnover correspond to a lower probability of choosing investments inspired by environmental sustainability criteria: firms with a turnover higher than €1 million are 9.51 percentage points less likely to make this kind of investment decisions than enterprises with a turnover lower than €100,000. Analogously, autonomous firms display a 14 percentage points lower attitude towards ER investments. It is also worth remarking that firms located in Southern Italy and in the Islands have a 3.17 percentage points higher probability to account for the environmental impact of their investments. This evidence might be indicative of a higher awareness and sensitivity to environmental issues in Southern Italian regions.

Column 1 of Table 4 reports estimated AMEs on the probability of carrying out SR investments. Also in this case, FL_i and DFC_i have positive and statistically significant effects on attitudes towards investments accounting for social sustainability criteria. A one unit increase in the financial literacy and digital financial capability scores raises the likelihood of SR investments by 9.61 and 3.14 percentage points, respectively, supporting our research hypotheses H1 and H2.

Differently from the evidence obtained for ER investments, the level of education of the business owner has a negative and statistically significant impact on the attitude towards SR investments. Owners having a tertiary level of education show a 16.79 percentage points higher likelihood to choose SR investments than those with primary or no education. Moreover, we find that younger owners are significantly more likely to account for the social impact of their investments. With respect to firm characteristics, we find that autonomous businesses and those that receive help from external financial advisors in taking financial decisions have a lower probability to make socially sustainable investments. Coherently with the evidence obtained for ER investments, we also show that companies located in Southern Italy and in the Islands are more likely to invest in a socially responsible manner.[6]

6. Additional analyses and robustness

6.1. Firms' awareness of sustainable financial products

To complement the analysis on preferences for ethical intermediaries and socially responsible investments, we assess the determinants of corporate awareness of sustainable financial products. Table 5 presents AMEs on the probability of being aware of sustainable (social or green) bonds or loans and on the FL and DFC scores, estimated from the endogenous probit model in (1).

The results reported in the bottom part of Table 5 provide support the appropriateness of the instrumental variables considered. The Amemiya-Lee-Newey overidentification tests clearly indicate that the additional instruments are exogenous (p-value equal to 0.9572) and the *F* tests for their joint significance suggest that they are not weak. The test results for the significance of cross-equation error correlations lead to reject the null hypothesis of exogeneity for FL_i (p-value equal to 0.0000), while DFC_i can be considered as an exogenous determinant of firms' awareness of sustainable financial products (p-value equal to 0.7050).

From column 1 of Table 5, coherently with the findings of Strauß et al. (2023) and Degryse et al. (2023b), we notice that financial literacy significantly enhances firms' awareness of social or green bonds and loans: a one-unit increase in the business owner's financial literacy score raises awareness of sustainable financial products by 15.75 percentage points. Conversely, digital financial capability does not exert any statistically significant influence on firms' awareness of these financial products. The evidence obtained thus suggests that inadequate financial competencies represents a significant hurdle for owners' awareness of sustainable financial products and might hamper firms' access to sustainable financing, with harmful consequences on their performance.

With respect to the other control variables, we notice that firm owners' demographic characteristics (age, level of education, gender, years of experience) do not have significant effects on self-reported awareness of sustainable bonds and loans. One-person firms have a 7.65 percentage points higher likelihood to know sustainability-oriented financial products. Firms with a turnover between €100,000 and €500,000 show instead a lower probability to be aware of financial products incorporating environmental or social sustainability criteria than firms with lower turnover. Analogously, autonomous firms are 15.95 percentage points less likely to be aware of sustainable financial products than business belonging to corporate groups. Finally, our results suggest that there are no significant geographical differences in firms' awareness of sustainable financial products.

6.2. Robustness

In this Section, we assess the robustness of our empirical findings on the effects of financial literacy and digital financial capabilities with respect to the estimation method employed.

To this aim, we re-estimate all the empirical models using an instrumental variable linear probability model (IV-LPM) and an endogenous probit model estimated by means of a two-stage control function (CF-Probit) approach. The results of these robustness

[6] We also consider a bivariate probit specification to account for the eventuality that firms' attitudes towards environmentally and socially responsible investments might be jointly determined. Estimated AMEs from this bivariate probit model with two continuous endogenous regressors are reported in Table S5 in the Appendix. From the Table, we notice that the beneficial effects of financial literacy and digital financial capabilities are confirmed and the estimated AMEs on the probability of taking into account the environmental and social impact of business investments are nearly identical to those presented in Tables 3 and 4. It is also worth remarking that the error terms of the two probit equations are significantly and positively correlated ($\rho_{\varepsilon_1\varepsilon_2} = 0.7664$), pointing out that investment choices incorporating environmental and social criteria are jointly implemented by firms.

Table 5
The determinants of firms' awareness of sustainable financial products.

Dependent variable:	Sustainable finance awareness (1)	FL (2)	DFC (3)
Financial literacy (FL)	0.1575***		
	(0.0066)		
Digital financial capability (DFC)	-0.0051		
	(0.0101)		
Age of the firm (in logs)	0.0133	-0.1307**	0.0734
	(0.0086)	(0.0515)	(0.0883)
Autonomous firm	-0.1595***	1.3391***	0.9170***
	(0.0493)	(0.3131)	(0.2646)
One-person firm	0.0765***	-0.4923***	-0.3201**
	(0.0232)	(0.1444)	(0.1397)
Turnover: €100,000-€500,000	-0.0728***	0.6338***	0.5487***
	(0.0247)	(0.1586)	(0.1495)
Turnover: €500,000-€1 million	-0.0603	0.7788***	0.3944*
	(0.0386)	(0.1774)	(0.2187)
Turnover: More than €1 million	-0.0823	1.1154***	0.4615***
	(0.0593)	(0.3104)	(0.1663)
Exporter	0.0148	0.0626	0.4407***
	(0.0290)	(0.0952)	(0.1477)
Female owner	-0.0124	-0.0660	0.0565
	(0.0103)	(0.0926)	(0.1512)
Age of the owner (in logs)	-0.0413	0.7149***	0.2815
	(0.0418)	(0.1823)	(0.2710)
More than 10 years of experience	0.0185	-0.0368	0.1410
	(0.0213)	(0.0976)	(0.1372)
Lower secondary education	0.0221	0.8570***	0.1385
	(0.0908)	(0.2377)	(0.7546)
Upper secondary education	0.0335	1.0918***	0.8399
	(0.0960)	(0.2994)	(0.7293)
Tertiary education	0.0338	1.4814***	1.1958
	(0.1003)	(0.3029)	(0.7362)
External financial advice	-0.0076	0.4063***	0.1504*
	(0.0242)	(0.0820)	(0.0883)
Adverse pandemic impact	0.0164	-0.2739***	-0.2657**
	(0.0188)	(0.0871)	(0.1289)
North-East	-0.0008	-0.0574	-0.3941***
	(0.0332)	(0.1606)	(0.0932)
Centre	0.0140	-0.1370	-0.2742**
	(0.0166)	(0.0915)	(0.1103)
South-Islands	0.0018	-0.2466**	-0.1747
	(0.0189)	(0.1067)	(0.1121)
Financial education at school		0.4424***	
		(0.0599)	
Parents' business ownership		0.1990***	
		(0.0551)	
Social networks for business			1.1597***
			(0.1204)
High online sales share			1.0786***
			(0.1502)
Sector fixed effects	Yes	Yes	Yes
Wald test of exogeneity:			
$\rho_{eu} = 0$	[0.0000]		
$\rho_{ev} = 0$	[0.7050]		
Overidentification test	[0.9572]		
Weak-instrument F test		[0.0000]	[0.0000]
Observations		1948	

Notes: the Table reports estimated average marginal effects on the probability of firms' awareness of sustainable (social or green) bonds or loans and on the financial literacy and digital financial capability scores, estimated from the endogenous probit model in (1). Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates. The p-values of the Wald test of exogeneity, of the overidentification test, and of the F test for weak instruments are reported in square brackets.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

checks are presented in Table A3 in the Appendix. From panel a) of the Table, we notice that the beneficial impact of financial literacy on firms' preference for ethical intermediaries, attitudes towards sustainable investments and awareness of sustainable financial products, is confirmed even when we address endogeneity issues in a linear framework. The magnitude of the estimated effects is in line with the results obtained from endogenous probit models, with estimated marginal effects from IV-LPM models being slightly

larger than those reported in Tables 2 to 5. The evidence obtained on the impact of digital financial capabilities is also confirmed, with the estimated effects suggesting a positive and statistically significant impact of DFC_i on preferences for ethical intermediaries and sustainable investments and no significant impact on firm owners' awareness of sustainable financial products. Accordingly, from panel b) of Table A3 we notice that when we adopt a two-stage residual inclusion approach, instead of a full-information maximum likelihood estimation, the results remain qualitatively unchanged. In particular, the AMEs of FL_i and DFC_i estimated with a control function probit model not only confirm our main empirical findings but are nearly identical to those presented in Tables 2 to 5. This evidence provides further support to the robustness of our baseline results, suggesting that they are not overly sensitive to the estimation method employed.

6.3. Analysing the role of financial literacy components

We disaggregate the financial literacy score to assess the impact of its three components (i.e., knowledge, behaviour, and attitudes) on preferences for ethical intermediaries and sustainable investments. To this aim, we re-estimate model (1) by alternatively considering the financial knowledge, behaviour, and attitudes scores instead of the aggregate FL score. The estimated AMEs presented

Table 6
Assessing the role of financial literacy components.

Dependent variable:	Ethical intermediaries (1)	ER investments (2)	SR investments (3)	Sust. finance awareness (4)
a) Financial knowledge				
Financial knowledge (FK)	0.0668***	0.0710***	0.0558***	0.1009***
	(0.0094)	(0.0136)	(0.0152)	(0.0067)
Digital financial capability (DFC)	0.0278***	0.0381***	0.0379***	-0.0001
	(0.0057)	(0.0092)	(0.0113)	(0.0095)
Other controls	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Wald test of exogeneity:				
$\rho_{\varepsilon u} = 0$	[0.0000]	[0.0000]	[0.0120]	[0.0000]
$\rho_{\varepsilon v} = 0$	[0.0270]	[0.0000]	[0.0000]	[0.7700]
Overidentification test	[0.3885]	[0.7270]	[0.5868]	[0.3169]
Weak-instrument F test	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Observations	1948	1948	1948	1948
b) Financial behaviour				
Financial behaviour (FB)	0.1060***	0.1203***	0.1009***	0.1645***
	(0.0188)	(0.0110)	(0.0287)	(0.0067)
Digital financial capability (DFC)	0.0191**	0.0307***	0.0248***	-0.0095
	(0.0087)	(0.0100)	(0.0113)	(0.0113)
Other controls	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Wald test of exogeneity:				
$\rho_{\varepsilon u} = 0$	[0.0630]	[0.0000]	[0.2750]	[0.0000]
$\rho_{\varepsilon v} = 0$	[0.3130]	[0.0000]	[0.0010]	[0.9140]
Overidentification test	[0.2192]	[0.9142]	[0.8157]	[0.4202]
Weak-instrument F test	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Observations	1948	1948	1948	1948
c) Financial attitudes				
Financial attitudes (FA)	0.0658***	0.0882***	0.0863***	0.1009***
	(0.0134)	(0.0027)	(0.0050)	(0.0067)
Digital financial capability (DFC)	0.0250***	0.0155**	0.0171**	-0.0004
	(0.0036)	(0.0066)	(0.0087)	(0.0032)
Other controls	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Wald test of exogeneity:				
$\rho_{\varepsilon u} = 0$	[0.0288]	[0.0000]	[0.0000]	[0.0000]
$\rho_{\varepsilon v} = 0$	[0.0231]	[0.0002]	[0.0020]	[0.0580]
Overidentification test	[0.4262]	[0.6652]	[0.2067]	[0.4914]
Weak-instrument F test	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Observations	1948	1948	1948	1948

Notes: the Table reports estimated average marginal effects on the probability of preferring ethical financial intermediaries, of choosing environmentally and socially responsible investments, and of being aware of sustainable financial products, estimated from endogenous probit models. All the models include the same control variables included in the baseline specifications. Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates. The p-values of the Wald test of exogeneity, of the overidentification test, and of the F test for weak instruments are reported in square brackets.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

in Table 6 highlight that the impact of digital financial capability remains largely confirmed and suggest that all the three dimensions of financial literacy are significant in enhancing firms' sustainable financing choices. In line with the results of Cucinelli and Soana (2023) and Aristei and Gallo (2024), we find that more financially knowledgeable businesses owners are characterized by significantly higher preferences for ethical intermediaries and attitudes for ER and SR investments and are more aware of sustainable financial products (panel *a)* in Table 6).

Furthermore, a one unit increase in the financial behaviour score raises the probability of preferring ethical financial companies by 10.6 percentage points and increase the likelihood of making investment choices that incorporate environmental and social criteria by 12 and 10 percentage points, respectively. Accordingly, owners adopting sound financial behaviours are also characterized by a higher awareness of sustainable financial products.

Finally, differently from the evidence of Cucinelli and Soana (2023), we find that business owners with "financially savvy" attitudes have significantly higher preferences for financial intermediaries with a strong ethical stance and are more aware of sustainable bonds and loans. At the same time, owners with stronger attitudes towards planning and setting long term financial goals are also 8.8 and 8.6 percentage points more likely to account for the environmental and social impact of their business investments, respectively.

6.4. Assessing the direct and indirect effects of financial literacy

We have so far considered the joint direct impact of financial literacy and digital financial capability on preferences for ethical intermediaries and responsible investments. However, the effect of financial literacy may be mediated also by its impact on digital financial abilities, as higher levels of financial literacy may lead business owners to engage in activities related to digital financial services and products (Yang et al., 2023). To account for both direct and indirect effects of financial literacy, we extend our baseline model and define the following three-equation system:

$$\begin{cases} y_i = 1(\beta_1 FL_i + \beta_2 DFC_i + \boldsymbol{x_i}'\boldsymbol{\beta_3} + \varepsilon_i > 0) \\ DFC_i = \gamma_1 FL_i + \boldsymbol{x_i}'\boldsymbol{\gamma_2} + \boldsymbol{z_{2i}}'\boldsymbol{\gamma_3} + \nu_i \\ FL_i = \boldsymbol{x_i}'\boldsymbol{\alpha_1} + \boldsymbol{z_{1i}}'\boldsymbol{\alpha_2} + u_i \end{cases} \quad (2)$$

where FL_i now also enters the equation for DFC_i, making system (2) fully recursive and allowing us to analyse and compare the direct effect of financial literacy on preferences for ethical intermediaries and responsible investment choices with the indirect one passing through the increased level of digital financial abilities. From the first equation in (2), we can assess the direct impact of FL_i on firm preferences for ethical intermediaries and sustainable investments by means of the AME of FL_i on the probability that y_i is equal to one. The indirect effect of FL_i can be instead computed by multiplying the AME of FL_i on DFC_i, obtained from the second equation in (2), by the AME of DFC_i on the probability that $y_i = 1$.

The estimation results of the fully recursive equation system (2) for all the indicators of firms' attitudes towards sustainable finance considered are presented in Table 7. From columns 1a, 2a, 3a and 4a of the Table, we first point out that the estimated marginal effects of FL_i on preferences for ethical intermediaries and attitudes towards ER and SR investments are consistent with the baseline results (reported in Tables 2 to 5). We still find a positive and significant direct impact of financial literacy on firms' preferences for ethical intermediaries and sustainable investments, as well as on their awareness of sustainable financial products. Similarly, the impact of digital financial capabilities is in line with the evidence obtained from the baseline models: DFC_i significantly increases preferences for ethical intermediaries and attitudes towards ER and SR investments, while it does not affect firms' sustainable finance awareness. However, estimated marginal effects, especially those on ER and SR investments, are characterized by a lower magnitude associated with FL_i and a higher one associated with DFC_i. This evidence may be explained by the fact that the mediated impact of financial literacy on digital financial abilities is properly taken into account in the fully recursive equation system (2), while in the baseline

Table 7
Assessing the direct and indirect effects of financial literacy.

Dependent variable:	Ethical intermediaries (1a)	DFC (1b)	ER investments (2a)	DFC (2b)	SR investments (3a)	DFC (3b)	Sust. finance awareness (4a)	DFC (4b)
Financial literacy (FL)	0.1009***	0.8094**	0.0901***	0.7849**	0.0635**	0.7524**	0.1562***	0.7274**
	(0.0269)	(0.3640)	(0.0253)	(0.3093)	(0.0635)	(0.3351)	(0.0069)	(0.3258)
Digital financial capability (DFC)	0.0241***		0.0400***		0.0349***		-0.0051	
	(0.0087)		(0.0096)		(0.0123)		(0.0100)	
Indirect effect of FL	0.0195*		0.0314**		0.0262**		-0.0037	
	(0.0112)		(0.0136)		(0.0115)		(0.0073)	
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1948		1948		1948		1948	

Notes: the Table reports estimated average marginal effects on the probability of preferring ethical financial intermediaries, of choosing environmentally and socially responsible investments, and of being aware of sustainable financial products, and on the digital financial literacy score, estimated from the three-way recursive system in Eq. (2). All the models include the same control variables included in the baseline specifications. Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

models it is confounded in the effect of FL_i on preferences for sustainable finance and responsible investments.

From Table 7, we also notice that financial literacy significantly increases the level of digital financial capability: the estimated AME of FL_i on DFC_i ranges between 0.73 and 0.81 and is statistically significant at the 5 % level in all the models considered. Coherently with the recent empirical findings of Yang et al. (2023), this evidence provides support to the crucial role of financial literacy in promoting the use of digital financial services and products. Moreover, by multiplying the estimated AME of FL_i on DFC_i by the marginal effect of DFC_i on preferences for sustainable finance and responsible investments, we can quantify the indirect effect of financial literacy passing through digital financial capabilities. Coherently with our research hypothesis H3, the indirect effect on preferences for ethical intermediaries is equal to 0.0195 and statistically significant at the 10 % level, while those on attitudes towards ER and SR investments are respectively equal to 0.0314 and 0.0262 and statistically significant at the 5 % level. Instead, financial literacy does not exert any statistically significant indirect effect on firms' awareness of sustainable financial products.

Overall, the evidence obtained suggests that financial literacy significantly enhances, directly and indirectly, firms' preferences for ethical intermediaries and responsible investments. Nevertheless, the beneficial effect of financial literacy is mostly direct, while the indirect effect operating through higher digital financial abilities, despite being statistically significant, influences attitudes towards sustainable finance only to a lower extent.

7. Concluding remarks

In this paper, we shed light on the role of entrepreneurs' financial literacy and digital financial capability on firms' sustainable financing and investing decisions. To this aim, we exploit novel data from the Bank of Italy's survey on "Financial literacy and digitalization of small businesses in Italy" and, using binary choice models and controlling for potential endogeneity issues, we assess preferences for ethical financial intermediaries and responsible investment decisions of micro-enterprises.

Our empirical results suggest that more financially literate business owners have higher preferences for financial intermediaries with a strong ethical stance, make investments inspired by environmental and social criteria, and have a higher awareness of sustainable financial products. These findings support our first research hypothesis and provide a novel contribution about the relevance of financial literacy on micro-enterprises' orientation towards sustainable finance. Moreover, digital financial abilities also play a significant role in enhancing firms' preferences for ethical intermediaries and attitudes towards ER and SR investments. When we disaggregate financial literacy into its three components, we find that high financial knowledge, sound financial behaviour, and strong attitudes towards financial planning are associated with a greater preference for ethical intermediaries and a higher likelihood of making sustainable investment decisions. These empirical results stress the relevance of financially savvy behaviours and attitudes, in addition to basic financial knowledge, to improve firms' engagement in sustainable financial activities. Finally, we show that the beneficial effect of financial literacy is mostly direct, while the indirect effect operating through higher digital financial abilities, despite being statistically significant, impacts firms' preferences for ethical intermediaries and sustainable investment decisions only to a lower extent.

Our study has some limitations that suggest future research directions. A first potential limitation is related to the self-reported nature of the survey questions on preferences for ethical intermediaries and sustainable investment decisions. Additional research efforts should be made to assess whether firms' self-reported behaviours match their actual sustainable financing and investment choices. Furthermore, despite the Italian context is particularly interesting to the aim of our analysis, the availability of comparable firm-level data would allow extending the analysis to provide international evidence on the determinants of firms' attitudes towards sustainable finance and investments. Future research should explore cross-country heterogeneity in the effect of entrepreneurs' financial literacy on preferences for ethical intermediaries and sustainable investment decisions.

From a policy perspective, our results suggest that education initiatives aimed at improving the level of financial knowledge of entrepreneurs may have positive implications on their ability to make sound financial decisions and may contribute to enhance their digital financial capabilities. At the same time, these policy interventions could have beneficial effects not only on firms' economic and financial performance, but also on their sustainable financing and investing choices. Furthermore, as micro-enterprises account for the largest share of the business population in most countries, strengthening the financial competencies of these companies could boost their direct involvement in sustainable practices and investments, generating a significant impact on the achievement of sustainable development goals.

CRediT authorship contribution statement

Valeria Vannoni: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Manuela Gallo:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **David Aristei:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

Data availability

The authors do not have permission to share data.

Appendix

Table A1
Variable definitions and descriptive statistics

Variable	Definition	Mean
a) Dependent variables		
Ethical intermediaries	Equals 1 if the respondent *agrees* or *strongly agrees* with the statement "I prefer to use financial companies that have a strong ethical stance"; 0 otherwise	0.428
ER investments	Equals 1 if the respondent *agrees* or *strongly agrees* with the statement "When I make an investment for the business, I take into account its environmental impact"; 0 otherwise	0.744
SR investments	Equals 1 if the respondent *agrees* or *strongly agrees* with the statement "When I make an investment for the business, I take into account its social impact"; 0 otherwise	0.700
Sustainable finance awareness	Equals 1 if the respondent has heard of sustainable (social or green) bonds or loans; 0 otherwise	0.365
b) Explanatory variables		
Financial knowledge (FK)	Normalized (between 0 and 10) score of financial knowledge (FK) defined following the OECD/INFE methodology (see Table S1).	7.188
Financial behaviour (FB)	Normalized (between 0 and 10) score of financial behaviour (FB) defined following the OECD/INFE methodology (see Table S1).	7.869
Financial attitudes (FA)	Normalized (between 0 and 10) score of financial attitudes (FA) defined following the OECD/INFE methodology (see Table S1).	6.427
Financial literacy (FL)	Score equal to the sum of the normalized scores of financial knowledge (FK), behaviour (FB), and attitudes (FA). The overall financial literacy score is then normalized to vary between 0 and 10	7.161
Digital financial capability (DFC)	Score equal to the sum of six dummies indicating that the firm: 1) has opened a bank account completely online; 2) has signed a financing contract completely online; 3) has signed an insurance contract completely online; 4) has a large/very large percentage of online payments from customers on total payments from customers; 5) has a large/very large percentage of online payments to suppliers on total payments to suppliers; 6) has a large/very large percentage of operations on current account conducted online on total operations on the current account. The score is then normalized to vary between 0 and 10	4.844
Age of the firm	Age of the firm (in logs)	2.182
Autonomous firm	Equals 1 if the firm is an autonomous profit-oriented business, making independent financial decisions; 0 otherwise	0.948
One-person firm	Equals 1 one full-time equivalent person, including the owner, is working in this business; 0 otherwise	0.095
Turnover: €100,000-€500,000	Equals 1 if the firm's turnover is more than €100,000 and up to €500,000; 0 otherwise	0.495
Turnover: €500,000-€1 million	Equals 1 if the firm's turnover is more than €500,000 and up to €1 million; 0 otherwise	0.164
Turnover: More than €1 million	Equals 1 if the firm's turnover is more than €1 million; 0 otherwise	0.120
Exporter	Equals 1 if the firm exports products or offer services abroad; 0 otherwise	0.157
Female owner	Equals 1 if the firm's owner is a woman; 0 otherwise	0.286
Age of the owner	Age of the firm's owner (in logs)	3.879
More than 10 years of experience	Equals 1 if the firm's owner has more than 10 years of entrepreneurial experience; 0 otherwise	0.566
Lower secondary education	Equals 1 if the firm's owner has a lower secondary education; 0 otherwise	0.133
Upper secondary education	Equals 1 if the firm's owner has an upper secondary education; 0 otherwise	0.563
Tertiary education	Equals 1 if the firm's owner has a tertiary education; 0 otherwise	0.289
External financial advice	Equals 1 if the firm's owner received help from an external financial advisor in taking financial decisions for the business; 0 otherwise	0.162
Adverse pandemic impact	Equals 1 if the firm suffered an overall strongly negative impact of the pandemic; 0 otherwise	0.324
North-East	Equals 1 if the firm is located in North-eastern Italy; 0 otherwise	0.217
Centre	Equals 1 if the firm is located in Central Italy; 0 otherwise	0.210
South-Islands	Equals 1 if the firm is located in Southern Italy/Islands; 0 otherwise	0.297
c) Instrumental variables		
Financial education at school	Equals 1 if the firm's owner received education in subjects related to business, economics, or finance as part of your school or university education; 0 otherwise	0.414
Parents' business ownership	Equals 1 if the parents of the firm's owner currently own a business, or owned a business in the past; 0 otherwise	0.476
Social networks for business	Equals 1 if the firm used social media for business activity (such as advertising or networking) before the COVID-19 pandemic; 0 otherwise	0.354
High online sales share	Equals 1 if the firm had a large/very large percentage of sales of products or services through its website on total sales before the COVID-19 pandemic; 0 otherwise	0.126

Notes: the average values of all the dependent and explanatory variables, computed using sample weights.

Table A2
Average marginal effects estimated from standard (exogenous) probit models

Dependent variable:	Ethical intermediaries	ER investments	SR investments	Sust. finance awareness
	(1)	(2)	(3)	(4)
Financial literacy (FL)	0.0680***	0.0500***	0.0623***	0.0554***
	(0.0063)	(0.0045)	(0.0053)	(0.0051)
Digital financial capability (DFC)	0.0126***	0.0069**	0.0046	0.0085**
	(0.0032)	(0.0032)	(0.0035)	(0.0043)
Age of the firm (in logs)	-0.0129	-0.0136	-0.0106	-0.0041
	(0.0173)	(0.0124)	(0.0075)	(0.0090)
Autonomous firm	0.0876**	-0.0086	-0.0114	-0.0075
	(0.0436)	(0.0502)	(0.0565)	(0.0543)
One-person firm	-0.1124***	-0.0022	-0.0220	0.0198
	(0.0255)	(0.0277)	(0.0589)	(0.0325)
Turnover: €100,000-€500,000	0.0138	0.0143	-0.0016	-0.0013
	(0.0326)	(0.0145)	(0.0125)	(0.0298)
Turnover: €500,000-€1 million	0.0114	-0.0057	0.0028	0.0449
	(0.0423)	(0.0294)	(0.0215)	(0.0364)
Turnover: More than €1 million	0.0154	0.0117	0.0007	0.0793**
	(0.0291)	(0.0265)	(0.0502)	(0.0330)
Exporter	0.0096	0.0012	0.0125	0.0257
	(0.0226)	(0.0396)	(0.0266)	(0.0294)
Female owner	-0.0064	-0.0110	-0.0179	-0.0320*
	(0.0255)	(0.0151)	(0.0182)	(0.0169)
Age of the owner (in logs)	-0.0171	0.0240	-0.0999***	0.0529
	(0.0527)	(0.0294)	(0.0369)	(0.0502)
More than 10 years of experience	-0.0094	0.0116	0.0244*	0.0301
	(0.0221)	(0.0178)	(0.0137)	(0.0245)
Lower secondary education	0.2073	0.0049	-0.1187**	0.2054
	(0.1320)	(0.0652)	(0.0578)	(0.1296)
Upper secondary education	0.2422*	0.0176	-0.0936	0.2950**
	(0.1283)	(0.0590)	(0.0607)	(0.1339)
Tertiary education	0.2540*	0.0468	-0.0659	0.3766***
	(0.1488)	(0.0655)	(0.0618)	(0.1388)
External financial advice	0.0558*	0.0177	-0.0295	0.0620***
	(0.0291)	(0.0278)	(0.0306)	(0.0216)
Adverse pandemic impact	-0.0334	-0.0260	-0.0135	-0.0277*
	(0.0279)	(0.0165)	(0.0221)	(0.0161)
North-East	0.0396	-0.0312	-0.0525***	-0.0073
	(0.0334)	(0.0249)	(0.0188)	(0.0238)
Centre	0.0211	-0.0504**	-0.0016	-0.0026
	(0.0198)	(0.0229)	(0.0160)	(0.0246)
South-Islands	0.0367	0.0117	0.0442***	-0.0448***
	(0.0248)	(0.0202)	(0.0137)	(0.0170)
Sector fixed effects	Yes	Yes	Yes	Yes
Observations	1948	1948	1948	1948

Notes: the Table reports estimated average marginal effects on the probability of preferring ethical financial intermediaries, of choosing environmentally and socially responsible investments, and on being aware of sustainable financial products, estimated from standard (exogenous) probit models. Standard errors, clustered at the sector-macro area level, are reported in parentheses below the estimates. The p-values of the Wald test of exogeneity, of the overidentification test, and of the F test for weak instruments are reported in square brackets.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively.

Table A3
Robustness: estimation approach

Dependent variable:	Ethical intermediaries	ER investments	SR investments	Sust. finance awareness
	(1)	(2)	(3)	(4)
a) IV-LPM				
Financial literacy (FL)	0.1107**	0.1585***	0.1099**	0.2371***
	(0.0447)	(0.0436)	(0.0446)	(0.0585)
Digital financial capability (DFC)	0.0340**	0.0575***	0.0482***	0.0019
	(0.0132)	(0.0139)	(0.0162)	(0.0139)
Other control variables	Yes	Yes	Yes	Yes

(*continued on next page*)

Table A3 (*continued*)

Dependent variable:	Ethical intermediaries	ER investments	SR investments	Sust. finance awareness
Sector fixed effects	Yes	Yes	Yes	Yes
Observations	1948	1948	1948	1948
b) CF-Probit				
Financial literacy (FL)	0.1094**	0.1504***	0.1003**	0.2281***
	(0.0520)	(0.0444)	(0.0451)	(0.0547)
Digital financial capability (DFC)	0.0250**	0.0483***	0.0358**	-0.0049
	(0.0130)	(0.0147)	(0.0169)	(0.0138)
Other controls	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Observations	1948	1948	1948	1948

Notes: the Table reports estimated average marginal effects on the probability of preferring ethical financial intermediaries, of choosing environmentally and socially responsible investments, and on being aware of sustainable financial products, estimated from instrumental variable linear probability models (IV-LPM) and from endogenous probit models estimated by a control function approach (CF-Probit). All the models include the same control variables included in the baseline specifications. Standard errors, clustered at the sector-macro area level, are reported in parentheses below the IV-LPM estimates. Bootstrapped standard errors (500 reps) are reported in parentheses below the CF-Probit estimates.
***, ** and * denote significance at the 1, 5 and 10 % levels, respectively

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ribaf.2024.102483.

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