

# Italian household debt: leveraging financial knowledge and digital skills to increase financial inclusion

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## Abstract

**Purpose** – This study examines the relationship between financial knowledge (FK), digital skills and indebtedness of Italian households. It also considers different types of debt and the potential impact on over-indebtedness.

**Design/methodology/approach** – We carry out an analysis based on the Bank of Italy SHIW dataset for the years 2016 and 2020, including 13,659 observations. We also look at the differences in gender, age and education of the householder to see whether a high level of FK and digital skills affect household debt.

**Findings** – Our results show that FK and digital skills affect household debt and this effect changes depending on the type of debt. FK is positively associated with household debt levels, especially through mortgage uptake, but reduces the likelihood of using costlier forms of credit. Digital skills affect household debt holding and significantly amplify the impact of FK when combined. Greater FK may mitigate household over-indebtedness and thus financial vulnerability. Conversely, digital familiarity without adequate FK may expose households to excessive or impulsive borrowing.

**Practical implications** – These findings have important implications for policymakers and the financial sector: public policies should promote digital skills particularly among economically vulnerable households, not only as a means of fostering digital inclusion but also as a tool for mitigating financial risks and over-indebtedness. Moreover, promoting education initiatives that combine economic-financial knowledge with digital skills training, particularly targeted at specific and more vulnerable segments of the population, is crucial to encouraging responsible credit use, while also increasing financial inclusion and supporting economic growth.

**Originality/value** – This study addresses a call for research on the link between financial and digital inclusion, exploring the potential interactions between indebtedness and borrower skills, with a focus on the role of knowledge management in this context. It shows that the level of debt is linked to both financial and digital skills of a household, and these may also contribute to more debt-aware management.

**Keywords** Financial knowledge, Household debt, Digital skills

**Paper type** Research article

## 1. Introduction

Credit availability and usage differ significantly across countries (Crook, 2003; Barradas and Tomás, 2023). Recent developments, including the closure of physical bank branches, the rise of fintech platforms and macroeconomic volatility, have significantly influenced households' ability to access credit and make borrowing decisions, which makes necessary a critical re-evaluation of existing knowledge and empirical evidence. In this evolving context, the accelerating digitalization of financial services, coupled with economic uncertainty, underscores the critical role of both digital and financial literacy in fostering informed financial decision-making and enhancing economic well-being (OECD, 2017; Yakoboski et al., 2018; Lyons and Kass-Hanna, 2021).

While pioneering research has highlighted the interaction between digital and financial literacy in shaping financial outcomes, significant gaps remain in the literature. Among the

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few attempts to examine this relationship, [Lo Prete \(2022\)](#) found that the use of digital payment tools correlates with higher digital literacy, regardless of financial knowledge. [Bianco et al. \(2022\)](#) emphasized how these literacies complement each other, while [Marconi et al. \(2022\)](#) explored their combined impact on attitudes toward digital payments, investment decisions and saving behaviors. Surprisingly, however, “the link between financial and digital inclusion remains under-researched” ([Vik et al., 2024](#), p. 373), as does the “link between financial literacy and financial inclusion on the borrowing side of household balance sheets” ([Bialowolski et al., 2025](#), p. 1515). There is an even more significant research gap concerning the role of digital and financial skills – either separately or jointly – in facilitating borrowing decisions ([Fornero et al., 2011](#); [Lusardi and Tufano, 2015](#); [Kass-Hanna et al., 2022](#)).

Nonetheless, financial and digital education are increasingly recognized as fundamental to empowering consumers and advancing financial inclusion across its three core dimensions: access, usage and quality ([Signorini, 2024](#)). In this regard, recent policy approaches reflect a clear shift: from merely expanding access to financial services toward fostering effective use and understanding the conditions under which financial inclusion can genuinely improve financial well-being. As a result, policymaker attention is now turning to the actual outcomes of inclusion, with growing emphasis on how financial services are used and their impact on users in a broader framework of financial health ([Bianco et al., 2022](#); [Signorini, 2024](#)).

When it comes to credit – the financial service at the heart of our study – it is widely acknowledged that debt is not equally accessible to all, nor experienced in the same way. As [Bialowolski et al. \(2025, p. 1514\)](#) note, identifying the appropriate level of financial inclusion on the liability side of the household balance sheet is considerably less straightforward than on the asset side, “where the simple rule of ‘more is better’ generally applies”. In contrast, inclusion via borrowing raises more nuanced questions concerning which levels and structures of debt within household financial portfolios are truly beneficial. Indeed, the impact of debt on financial well-being depends heavily on the broader context, including both social and individual factors ([Kang and Rhee, 2024](#)). While income is certainly important ([Xiao et al., 2021](#)), other elements such as personal skills and human capital also shape how debt influences financial health. In other words, what ultimately matters is not merely whether someone holds debt, but the type of debt, how it is managed and the extent to which individuals feel confident in their ability to repay it. These factors are crucial in determining whether debt becomes a source of financial stress or a constructive financial tool ([Tay et al., 2017](#); [Liu et al., 2019](#); [Bialowolski and Weziak-Bialowolska, 2021](#)).

Building on these insights and consistent with [Lusardi et al. \(2020\)](#), this study focuses on the need to learn more about how people borrow and manage debt in the modern economy. In particular, this paper aims to fill existing research gaps by exploring the relationship between financial and digital skills and household debt, measured as the relationship between debt and assets (real and financial assets), in a specific national context ([Lo Prete, 2022](#); [Seldal and Nyhus, 2022](#)). The study also considers the potential role of financial knowledge and digital skills in influencing household over-indebtedness and pays particular attention to gender and generational differences. Our paper differs from recent studies that focus on financial literacy and credit usage patterns ([Feng et al., 2019](#); [Bialowolski et al., 2025](#)) in introducing the novel dimension of digital skills, which are increasingly being recognized both as essential for accessing and managing financial services and as core life competences in today’s society ([European Commission, 2006](#); [OECD, 2017](#)). It further departs from earlier contributions ([Robb, 2011](#); [Fornero et al., 2011](#); [Liu and Zhang, 2021](#); [Aristei and Gallo, 2021](#); [Bialowolski et al., 2022a, b](#)), which predominantly focus on either mortgages or consumer credit, by offering a more comprehensive analysis of household indebtedness through consideration of total debt exposure, disaggregation of liabilities by type (mortgages, consumer credit and personal loans), and deeper examination of household debt composition. The analysis draws on data from the Bank of Italy’s Survey on Household Income and Wealth (SHIW) for 2016 and 2020.

This study offers two key contributions. First, it complements the recent work of [Marconi et al. \(2022\)](#) by focusing on borrowing behavior and the interplay between financial knowledge and digital skills in shaping it, as well as considering the impact on over-indebtedness. To the best of the authors' knowledge, this is one of the first studies exploring this specific relationship in developed countries, and thus differs from the work of [Kass-Hanna et al. \(2022\)](#), who investigated the link between these same skills and resilience-building financial behaviors in South Asian and Sub-Saharan African populations. Second, it contributes to the literature by showing that the effect of digital competencies on household debt is context-dependent. When paired with financial knowledge, they contribute to greater household indebtedness and amplify its beneficial effects on responsible borrowing, while in isolation they appear to be positively associated with over-indebtedness.

Italy provides a particularly relevant case study. Credit access in the country is closely tied to economic development and remains a central policy priority for financial inclusion ([Bank of Italy, 2019, 2024c](#)). As one of the Eurozone's largest economies, Italy exhibits a bank-dominated financial system, pronounced wealth disparities and distinctive household financial patterns ([Bank of Italy, 2024a](#)). Italian households hold a substantial share of national wealth and play a crucial role in sustaining domestic consumption. They are traditionally characterized by high savings rates, but recent trends indicate an increase in household debt, particularly among affluent groups, although overall debt levels remain below the European average ([Magri et al., 2022; Bank of Italy, 2024b](#)).

Despite government emphasis on household welfare and the adoption of a national strategy for financial literacy since 2017 ([Bianco et al., 2022](#)), Italy lags behind other advanced economies in financial literacy and digital skills and also shows lower levels of financial well-being ([OECD, 2023; Benecchi et al., 2023; Helliwell et al., 2024; OECD, 2024a](#)). Without adequate financial and digital literacy, the ongoing shift toward financial digitalization risks exacerbating financial vulnerability by increasing exposure to over-indebtedness, fraud and impulsive spending, worsening inequalities and restricting access to financial services ([OECD, 2017; Panos and Wilson, 2020; Cantú et al., 2024](#)). To mitigate these risks and equip consumers with the skills needed to navigate financial innovations, targeted policies and educational initiatives are essential for creating a virtuous cycle between economic growth and individual well-being ([Llena-Nozal et al., 2019](#)).

In this regard, understanding the interplay between financial knowledge, digital skills and household debt is essential for both financial institutions and policymakers. For lenders, these insights support the development of more inclusive and responsible credit allocation strategies, balancing short-term profitability with long-term financial stability. For policymakers, they provide a foundation for designing interventions that promote financial inclusion, enhance economic resilience and reduce social inequalities.

The paper is organized as follows: [Section 2](#) presents the literature review and research hypothesis. [Section 3](#) describes the sample, the data and the empirical methods. [Section 4](#) provides the findings and [Section 5](#) discusses the results and concludes with policy recommendations.

## 2. Literature review and hypothesis development

### 2.1 Main determinants of household credit market participation

Access to credit refers to the availability of financial resources borrowed by individuals and businesses and is essential for planning and achieving long-term goals, such as investments, consumption smoothing and entrepreneurship ([Zinman, 2010; Karlan and Zinman, 2010](#)). Credit can allow day-to-day spending, facilitate significant purchases, foster entrepreneurship and even address unexpected emergencies ([Kempson and Whyley, 1999; Caskey, 2002](#)). There is a rich body of literature exploring credit access for individuals and businesses in both developed and developing countries ([Affinito et al., 2023; Barradas and Tomás, 2023](#)), from both demand ([Ongena and Popov, 2016](#)) and supply sides ([Beck et al., 2018](#)), and analyzing it

from microeconomic and macroeconomic perspectives (Tay *et al.*, 2017; Damane and Ho, 2024).

Focusing on microeconomics, Anderloni and Vandone (2011) have highlighted that household credit market participation is influenced by a variety of economic, sociodemographic and behavioral factors (Klapper and Lusardi, 2020; Chikeya and Ntsalaze, 2025). Wealth, income, savings and consumption habits are economic factors that significantly shape borrowing decisions (Vacca *et al.*, 2013; Affinito *et al.*, 2023). For instance, empirical evidence demonstrates that income levels and their stability, as well as employment status, are key factors influencing the likelihood of accessing credit, affecting both loan demand and the probability of approval (Cox and Jappelli, 1993; Magri, 2007).

Sociodemographic characteristics of the borrower, such as age, gender, education, occupational status, marital status, family size and housing tenure, also play a crucial role in household credit market participation (Kempson *et al.*, 2004; Crook, 2006; Magri, 2007). Age in fact proves to be a critical factor influencing credit access; several studies show that younger households, typically with limited wealth and savings, face greater liquidity constraints (Hayashi, 1985; Zeldes, 1989; Chantararat *et al.*, 2020). Gender is another critical factor in determining credit behavior, with women often encountering more significant challenges in accessing formal banking services than men (Ongena and Popov, 2016; de Andrés *et al.*, 2021). Research also finds that certain household characteristics, such as size, composition, marital status and the presence of children, further influence borrowing behavior (Fang *et al.*, 2022). Finally, creditworthiness is also affected by educational attainment; generally, higher education enhances employability, income levels and occupational stability, which reduces barriers to credit access and serves as a proxy for future earnings in the eyes of lenders. It is thus no surprise that higher levels of education correlate with increased debt accumulation (Magri, 2007; Xiao and Yao, 2020).

Not only education, but more broadly, borrower human capital, consisting of knowledge, skills, education and experience, impacts access to credit and finance (Becker, 2002; Hj Talip and Wasiuzzaman, 2024). Research has noted its importance and generally revealed positive associations, although there is also evidence of insignificant or even negative associations (Hj Talip and Wasiuzzaman, 2024). These conflicting findings highlight the need for further investigation. Given the rise of digital finance, research should focus on specific forms of human capital that are becoming increasingly important for inclusion and successful navigation of the current financial landscape, particularly financial and digital skills (Van Laar *et al.*, 2017; Bialowolski *et al.*, 2022a, b).

## 2.2 Financial knowledge

According to the OECD definition (2020), “financial literacy is a combination of awareness, knowledge, skills, attitudes, and behaviors necessary to make sound financial decisions and ultimately achieve individual financial well-being”. In the OECD framework, financial knowledge is only the cognitive component of the overall construct and specifically refers to understanding essential economic and financial principles, such as interest rates, diversification benefits and the impact of inflation on purchasing power (Lusardi and Mitchell, 2011). As noted by Atkinson and Messy (2011), in recent years, there has been a growing tendency to use financial knowledge as a measure of financial literacy (see, e.g. Fornero *et al.*, 2011; Lo Prete, 2022).

Available empirical evidence consistently shows that higher levels of financial knowledge (or financial literacy, given that the two concepts are often used interchangeably) are generally found among males, middle-aged individuals and those with higher education levels and incomes (Van Rooij *et al.*, 2011; Lusardi and Tufano, 2015; Bottazzi and Oggero, 2023).

Previous studies have extensively explored the beneficial effects of financial knowledge and financial literacy across various financial domains such as saving behavior (van Rooij *et al.*, 2012), participation in the stock and insurance markets (Bucher-Koenen *et al.*, 2021;

Bongini *et al.*, 2023), retirement planning (Lusardi and Mitchell, 2007) and entrepreneurship (Oggero *et al.*, 2020). Research into credit, however, is less widespread, and there is still relatively little evidence available (Fornero *et al.*, 2011; Lusardi and Tufano, 2015; Hu *et al.*, 2024; Bialowolski *et al.*, 2025). Existing literature presents mixed findings on the role of financial knowledge in the initial stage of credit access. For instance, Charalambakis *et al.* (2025) find that financial literacy is negatively associated with credit applications but positively associated with credit approval. On the other hand, Calcagno *et al.* (2024) suggest that while financial knowledge may not have a decisive impact on initial loan approval decisions, it helps alleviate concerns about rejection, thereby facilitating the credit-seeking process. Finally, the study by Goedde-Menke *et al.* (2017), which focuses on German adolescents, shows that financial literacy has no significant effect on the propensity to take on debt.

Similarly, evidence of the impact of financial knowledge on the size and composition of household borrowing remains, in some respects, inconclusive and shows a need for further investigation. For example, Disney and Gathergood (2013), focusing on the UK market, and Feng *et al.* (2019), examining the Chinese context, show that financial literacy drives a selective preference for some credit types. In the same vein, Bialowolski *et al.* (2025), using evidence from the United States, find that financial literacy increases the likelihood of borrowing, particularly in the form of mortgages and multiple loans, without significantly affecting the use of other types of credit, such as credit card debt, auto loans, medical debt or student loans. In other words, they show that higher financial literacy is associated, on the one hand, with more informed credit decisions and a broader, more diversified use of credit, especially through forms traditionally viewed as “good debt” (e.g., mortgages). On the other hand, however, it may also contribute to increased indebtedness, as financially literate individuals are more likely to hold multiple debts simultaneously, thereby potentially heightening their financial vulnerability. By contrast, Thorp *et al.* (2023), analyzing the Australian mortgage market, report that financially literate individuals tend to experience greater discomfort with mortgage debt. This finding aligns with earlier studies that associate financial literacy with increased caution and more conservative borrowing behavior (Bucks and Pence, 2008; Cox *et al.*, 2015; Van Ooijen and Van Rooij, 2016).

That said, it is well established that financial literacy exerts a significant positive influence across different areas of debt management. A substantial body of literature in fact consistently suggests that financial knowledge plays a positive role in shaping debt decision-making strategies (Lusardi and Tufano, 2015; Allgood and Walstad, 2016; Van Ooijen and van Rooij, 2016), enabling individuals to make informed borrowing choices, negotiate favorable terms and manage debt responsibly (Robb *et al.*, 2015; Bialowolski *et al.*, 2022a, b). Typically, strong financial knowledge is associated with positive outcomes such as more thorough comparisons of debt options, increased likelihood of taking out a mortgage, lower interest rates, reduced default risks, lower overspending and, in terms of well-being, lower levels of financial anxiety (Fornero *et al.*, 2011; Garðarsdóttir and Dittmar, 2012; French and McKillop, 2016; Bialowolski *et al.*, 2022a, b; Hu *et al.*, 2024). A somewhat more controversial issue is the impact of financial literacy/knowledge on over-indebtedness. Several studies (Fornero *et al.*, 2011; Lusardi and Tufano, 2015; French and McKillop, 2016) suggest that financial literacy/knowledge tends to reduce the risk of over-indebtedness, but there is also evidence pointing in the opposite direction (e.g. Aristei and Gallo, 2021; Bialowolski *et al.*, 2025). In particular, Białowolski *et al.* (2025) suggest that financial literacy may have ambiguous effects: while it generally promotes more informed credit decisions, it can also increase vulnerability when it fosters overconfidence and greater risk-taking.

In light of the above, we propose the following hypothesis:

**H1.** Financial knowledge is associated with household borrowing behavior.

### 2.3 Digital skills

In today's tech-driven world, the ability to effectively use digital technologies, which provide access to services, jobs and social interactions, is essential for societal participation (Van Deursen *et al.*, 2016; UNESCO, 2017). Digital literacy enables effective use of online tools like banking and social networks (Scholz *et al.*, 2017; van Deursen, 2020) and, alongside Internet access, is key to digital engagement (Eshet-Alkalai, 2004; Marconi *et al.*, 2022). Digital inclusion, supported by adequate skills, access and engagement, is becoming a critical global consumer policy priority alongside financial inclusion (Helsper, 2012; Vik *et al.*, 2024).

The digital transformation in the financial sector is revolutionizing banking, investment and payment services; improving personal finance management; and creating new opportunities for financial democratization and inclusion (Gomber *et al.*, 2017; Milian *et al.*, 2019). On the one hand, the rise of fintech has the potential to expand access to financial services, enhancing quality of life (Bollaert *et al.*, 2021; Billari *et al.*, 2023). On the other hand, the shift brings risks, including exclusion due to insufficient infrastructure and low digital literacy, security threats and privacy concerns (OECD, 2017, 2018). Digital transactions may also promote impulsive spending, leading to a higher risk of financial mismanagement and over-indebtedness (Carlsson *et al.*, 2017; Panos and Wilson, 2020).

Consequently, there is an increasing consensus that, in order to safely use fintech services and make informed financial decisions in a digitalized economy, it is essential to combine traditional financial literacy with digital literacy (OECD, 2017; Yakoboski *et al.*, 2018; Lyons and Kass-Hanna, 2021). Available evidence however highlights significant risks of digital exclusion for older adults, women, individuals with lower education levels and those in lower income brackets (OECD, 2024b). The digital divide is particularly pronounced among the elderly (OECD, 2024b), with notable gender disparities in digital skills persisting even among younger age groups (Martínez-Cantos, 2017; West *et al.*, 2019).

Currently, although some studies explore the role of fintech credit in addressing the credit gap for consumers and businesses (Bazarbash and Beaton, 2020; Cornelli *et al.*, 2024), there is a lack of research on the link between digital skills and financial inclusion (Vik *et al.*, 2024), and more specifically, on the role digital skills play in credit market participation. This is all the more surprising given the extent to which online and digital interfaces permeate modern life, where digital literacy indispensable for full participation in society.

Indeed, in today's financial landscape, Internet proficiency is increasingly indispensable for carrying out even the simplest banking operations, such as accessing a bank account or making and receiving payments, and this is also true for clients of traditional financial institutions. Strikingly, Vik *et al.* (2024) argue that digital skills, measured as self-rated Internet proficiency, not only drive active engagement with banking services, but may even outweigh household income as a determinant of the use of certain financial services. Yet despite these compelling findings, the specific role of digital literacy in credit use and its interaction with borrowers' financial knowledge remains largely overlooked, with only a few notable exceptions. Although some pioneering research has shown a close link between digital and financial literacy in shaping financial outcomes, this connection remains underexplored, particularly in the area of credit. For example, Lo Prete (2022) finds that the use of digital payment tools correlates with higher digital literacy, regardless of financial knowledge. Bianco *et al.* (2022) highlight how these literacies complement each other, while Marconi *et al.* (2022) explore their combined impact on attitudes toward digital payments and finance, investment decisions and saving. Their findings suggest that digital skills complement financial knowledge in enhancing budget management and saving, and influence the adoption of digital financial services, but, unlike financial knowledge, do not affect investment decisions.

Other researchers have focused on Internet access rather than Internet literacy, with results that are not always consistent. In this regard, Dalla Pellegrina *et al.* (2017) suggest that businesses using ICT receive larger credit offers, while Phan *et al.* (2024) report that Internet

use can reduce loan approvals in rural areas of developing countries. Finally, [Kass-Hanna et al. \(2022\)](#) is among the few to demonstrate the potential of digital and financial skills in promoting positive borrowing behavior among the populations of South Asian and Sub-Saharan African countries.

Finally, [Carlsson et al. \(2017\)](#) note that the links between digitalization, credit behavior and over-indebtedness remain underexplored in the literature, despite growing attention to the topic. They stress the urgent need for interdisciplinary research to examine how digital transformation may heighten exposure to predatory lending, particularly among vulnerable groups.

In order to specifically explore the relationship between digital skills, financial knowledge and household participation in the credit market, we propose the following hypotheses:

*H2.* Digital skills are associated with household borrowing behavior.

### 3. Research design

#### 3.1 Sample and variables

Italian households directly or indirectly own almost all of the national wealth, receive almost all the national income, are responsible for most of the global domestic demand and give rise to a substantial part of the financial flows ([Bank of Italy, 2015](#)). Our analysis is based on data from the SHIW (Survey on Household Income and Wealth), conducted every 2 years by the Bank of Italy. The SHIW dataset includes household composition and characteristics, wealth, income, employment of family members and other aspects of financial and digital knowledge, skills and behavior [[1](#)].

In this study, which investigates the relationship between financial knowledge, digital skills and household debt, we use aggregated data from recent two SHIW surveys, 2016 and 2020. The 2016 survey covers 7,420 households [[2](#)], a total of 16,462 individuals and the 2020 survey covers 6,239 households [[3](#)], a total of 15,198 individuals. The final sample thus includes 13,659 observations. All our data processing is done using sample weights [[4](#)].

The survey questions were answered by one reference person for each household (i.e., the householder). We consider the number of family members, home ownership and sociodemographic variables relating to the householder: gender, region of residence, age, marital status, educational attainment, wealth, income, consumption and employment status. Our variables of interest are the possession of basic *Financial Knowledge (FK)* and *Digital skills*. To define basic financial knowledge, we follow [Lusardi and Mitchell \(2008\)](#) in using an indicator of 1 if the respondent answers correctly questions capturing the three basic economic concepts of *compound interest*, *inflation* and *risk diversification*. The questions are the following:

- (1) *Compound interest*: Imagine leaving 100 euros on a current account that yields you an interest rate of 2% per year and that has no expenses. After 5 years, how much do you imagine is available? *Possible answers*: Less than 102 euros. Exactly 102 euros. Over 102 euros. Don't know. No answer.
- (2) *Inflation*: Suppose you leave 1,000 euros on a current account that yields you an interest rate of 1% and has no management fees. Imagine that inflation is 2%. Do you think that, in a year's time, when you withdraw the money, you will be able to buy the same amount of goods that you could buy by spending 1,000 euros today? *Possible answers*: Yes. No, I can buy less. No, I can buy more. Don't know. No answer.
- (3) *Risk diversification*: In your opinion, does the purchase of shares in a single company usually provide a more secure return than the purchase of shares in more than one company through a mutual fund? *Possible answers*: True. False. Don't know. No answer.

The questions on *compound interest* and *inflation* reveal whether respondents have knowledge of basic economic concepts and basic numbering; *risk diversification* assesses whether respondents know a key concept for making informed investment decisions.

Basic *Digital skills* are proxied by the following question:

- (1) *Digital skills*: During the year, did you or any of your family use any form of remote connection (telephone, computer, SMS, smartphone or tablet) with banks or financial companies (home banking, online account, etc.)? *Possible answers*: Yes. No.

We follow previous literature (Kyndt *et al.*, 2009; Falck *et al.*, 2016; Oggero *et al.*, 2020) stating that digital skills are developed through learning by doing and using several types of technological devices.

Table 1 reports detailed variable explanations.

### 3.2 Descriptive statistics

Table 2 shows descriptive statistics. The analysis of the overall data of the Bank of Italy SHIW for the years 2016 and 2020 reveals that only about 29% of households answered the three questions on basic economic concepts correctly, and that about 37% of households have basic digital skills.

Table 3, Panel A, shows that if the answers to the three questions are considered separately, the compound interest question has a 52% correct response rate, the inflation question has a higher correct response rate of 63% and the risk diversification question has a 57% correct response rate. Table 3, Panel A, also reports the correct response rate by gender, age and educational attainment. For all three questions, male householders have a higher correct response rate than female; younger householders have a higher correct response rate than

**Table 1.** Variable description

Variable	Description
Household debt ( <i>dependent variable</i> )	Banking-financial debt/(real assets + financial assets)
FK	Dummy: 1 if the respondent answered correctly compound interest, inflation and risk diversification questions, 0 otherwise
Digital skills	Dummy: 1 if a member of the household used telephone, computer, SMS, smartphone or tablet for contact with banks or financial companies in the year of the interview, 0 otherwise
Mortgage	Dummy: 1 if the household has contracted a mortgage and 0 otherwise
Personal loan	Dummy: 1 if the household has contracted a personal loan and 0 otherwise
Consumer credit	Dummy: 1 if the household has accessed consumer credit and 0 otherwise
Gender	Dummy: 1 if male, 0 if female
North	Dummy: 1 if living in northern Italian regions, 0 otherwise
South	Dummy: 1 if living in southern Italian regions or islands, 0 otherwise
Age	Age
Married	Dummy: 1 if married, 0 otherwise
Degree	Dummy: 1 if the respondent has a 3-year university degree/higher education diploma, or 5-year university degree, or postgraduate qualification (degree: high), 0 otherwise (degree: low)
Employee	Dummy: 1 if employee, 0 otherwise
Self-employed/entrepreneur	Dummy: 1 if self-employed/entrepreneur, 0 otherwise
Retired	Dummy: 1 if retired, 0 otherwise
Log(y)	Logarithm of the household net disposable income
Log(w)	Logarithm of the household net wealth
Log(c)	Logarithm of the household consumption
No. of members	Number of household members
Home ownership	Dummy: 1 if the home is owned, 0 otherwise

**Table 2.** Descriptive statistics – full sample (13,659 households)

Variable	Frequency/mean	Std.dev.	Min	Max	Median
FK	<i>0.289</i>				
FK ( <i>n.</i> correct answers)	1.665	2.465	0	19.497	0.824
Digital skills	<i>0.371</i>				
Household debt	0.059	0.352	0	13.872	0
<i>N.</i> of household debts	0.229	0.865	0	17.585	0
Mortgage	<i>0.105</i>				
Personal loan	<i>0.052</i>				
Consumer credit	<i>0.087</i>				
Gender (male)	<i>0.548</i>				
North	<i>0.469</i>				
South	<i>0.329</i>				
Age	58.396	65.879	0.005	610.917	33.865
Married	<i>0.532</i>				
Degree	<i>0.147</i>				
Employee	<i>0.376</i>				
Self-employed/entrepreneur	<i>0.112</i>				
Retired	<i>0.415</i>				
Log( <i>y</i> )	10.165	11.416	0.002	73.959	5.911
Log( <i>w</i> )	11.298	12.849	0.001	90.667	6.543
Log( <i>c</i> )	9.908	11.140	0.002	70.320	5.756
No. of members	2.351	3.285	0.0002	38.995	1.202
Home ownership	<i>0.722</i>				

**Note(s):** *Frequency* and *Mean* refer to dummy variables and continuous variables, respectively. *Frequency* expresses the percentage frequency values, which are shown in italics. Sample weights are used

**Table 3.** Financial knowledge: correct, incorrect response rate and DK

	Full sample	Female	Male	Age > 50	Age ≤ 50	Degree: low	Degree: high
<i>Panel A: correct responses</i>							
Compound interest rate	52.35%	43.94%	58.48%	50.51%	58.38%	47.87%	71.15%
Inflation	63.02%	55.99%	68.14%	62.13%	65.95%	59.84%	76.36%
Risk diversification	56.78%	47.91%	63.25%	55.55%	60.82%	51.63%	78.37%
<i>Panel B: incorrect responses and DK</i>							
Compound interest rate							
<i>Incorrect</i>	27.27%	27.59%	27.04%	27.27%	27.27%	28.39%	22.58%
<i>DK</i>	18.37%	26.20%	12.66%	20.07%	12.82%	21.68%	4.48%
Inflation							
<i>Incorrect</i>	7.86%	11.40%	17.80%	11.78%	14.73%	12.20%	13.61%
<i>DK</i>	22%	29.45%	16.57%	23.37%	17.51%	23.35%	7.94%
Risk diversification							
<i>Incorrect</i>	9.15%	8.91%	9.32%	8.65%	10.79%	9.70%	6.84%
<i>DK</i>	30.69%	39.22%	24.48%	32.12%	26.02%	35.03%	12.50%

older; and householders with a higher level of education have a higher correct response rate than householders with a lower level. We further distinguish between those respondents who gave an incorrect answer or responded “Don’t know” (DK). Table 3, Panel B, shows that the proportion of incorrect or DK responses varies according to the question. Regarding interest compounding, about 27% of the respondents gave an incorrect answer and about 18% did not

know. On the inflation question, about 8% of the respondents gave an incorrect answer and about 22% did not know. On the risk diversification question, about 9% of the respondents gave an incorrect answer and about 31% did not know. Interestingly, the incorrect response rate of women interviewed is lower than that of men for questions on inflation and risk diversification, while the DK rate of women is much higher than that of men for all three questions. [Table 3](#), Panel B, also shows that:

- (1) The incorrect response rate of respondents over 50 years is lower than that of younger respondents for questions about inflation and risk diversification, while their DK rate is higher for all three questions;
- (2) The incorrect response rate of respondents with a higher level of education is lower than that of less-educated respondents for questions on compound interest and risk diversification, while the DK rate of respondents with a lower educational attainment is much higher than those with a higher level of education.

Given that previous literature (e.g. [Aristei and Gallo, 2016](#); [de Andrés et al., 2021](#)) highlights potential differences in household debt by gender, age and level of education, [Table 4](#) presents the descriptive statistics separately for sub-samples of individuals by gender, age and level of education and shows the *t* test for the significance of differences. [Table 4](#) shows that men are more indebted than women, young people are more indebted than older people, and people with a higher level of education are more indebted than people with a lower level of education and the differences are significant. FK and digital skills, measured as specified in [Table 1](#), are higher among: men (about 32%, and almost 40%, respectively) compared to women (about 24.5%, and about 33%, respectively); individuals up to 50 years old (about 49%, and almost 81%, respectively) compared to individuals older than 50 (almost 23%, and 24%, respectively); individuals with a higher level of education (about 39%, and almost 59%, respectively) compared to individuals with a lower level of education (about 26%, and almost 32%, respectively).

[Appendix A \(Table A.1\)](#) reports the Spearman correlation matrix for the variables used in our study. The results are consistent with the literature on household indebtedness (e.g. [Klapper and Lusardi, 2020](#); [Chikeya and Ntsalaze, 2025](#)).

### 3.3 Empirical methods

Household debt may be affected by the level of FK. The relationship is examined through a multivariate analysis, in which we include the level of digital skills because we believe that this variable can increase the impact of FK. The equation of the model is the following:

$$\text{Household debt}_{it} = \beta_0 + \beta_1 \text{FK}_{it} + \beta_2 \text{Digital skills}_{it} + \beta_3 X_{it} + \varepsilon_{it} \quad (1)$$

where *Household debt*, *FK* and *Digital skills* are the variables of interest; *i* and *t* = 2016 and 2020 are household and year identifiers, respectively; *X* is a vector of the covariates described in [Table 1](#). Finally,  $\varepsilon_{it}$  is the error term.

To address potential endogeneity concerns, we undertake an Instrumental Variable (IV) analysis for our key explanatory variable (*FK*). Possible endogeneity problems related to financial knowledge may exist because of the probable linkage between the independent variables and the error term ([Lusardi et al., 2017](#)). Furthermore, IV regression makes it possible to consider the possible reverse causality related to financial knowledge (e.g. [Cupák et al., 2019](#)): *FK* could favor household debt and the household debt could contribute to improving *FK*. Previous studies (e.g. [Lusardi and Mitchell, 2014](#)) demonstrate that results obtained from non-instrumented estimates of financial knowledge underestimate the true effect, which makes the use of IV regression appropriate. The first step of IV regression examines the determinants of households' financial knowledge. The equation of the model is the following:

**Table 4.** Descriptive statistics for subsamples

Variable	Frequency/ mean	Std. dev.	Frequency/ mean	Std. dev.	$\Delta$	Test
<i>Panel A</i>		<i>Women</i>	<i>Men</i>			<i>T-test/Pearson <math>\chi^2</math> test</i> <i>Women vs. Men</i>
FK	0.245		0.321		-0.076***	(261.532)
FK (no. of correct answers)	1.560	2.459	1.742	2.467	-0.181***	(-4.252)
Digital skills	0.331		0.400		-0.069***	(292.566)
Household debt	0.048	0.246	0.067	0.413	-0.019***	(-3.146)
No. of household debts	0.198	0.759	0.252	0.934	-0.054***	(-3.610)
Mortgage	0.101		0.109		-0.008***	(24.874)
Personal loan	0.043		0.059		-0.015***	(7.615)
Consumer credit	0.074		0.096		-0.022***	(35.614)
North	0.464		0.473		-0.009***	(42.867)
South	0.375		0.295		0.080***	(29.879)
Age	63.605	70.673	54.603	61.887	9.002***	(7.903)
Married	0.386		0.638		-0.252***	(1.5e+03)
Degree	0.142		0.151		-0.009***	(89.693)
Employee	0.366		0.384		-0.017***	(27.617)
Self-employed/entrepreneur	0.060		0.150		-0.090***	(394.029)
Retired	0.463		0.380		0.084*	(2.726)
Log(y)	10.711	11.639	9.767	11.235	0.944***	(4.765)
Log(w)	11.835	13.148	10.905	12.614	0.927***	(4.083)
Log(c)	10.493	11.389	9.481	10.937	1.012***	(5.249)
No. of members	2.288	3.140	2.396	3.386	-0.108*	(-1.891)
Home ownership	0.744		0.706		0.038***	(87.549)
<i>Panel B</i>		<i>Age &gt; 50</i>	<i>Age <math>\leq</math> 50</i>			<i>T-test/Pearson <math>\chi^2</math> test</i> <i>Age &gt; 50 vs. Age <math>\leq</math> 50</i>
FK	0.227		0.491		-0.263***	(26.389)
FK (no. of correct answers)	1.345	2.074	2.713	3.232	-1.368***	(-28.262)
Digital skills	0.238		0.807		-0.569***	(454.050)
Household debt	0.025	0.234	0.170	0.579	-0.146***	(-20.730)
No. of household debts	0.123	0.555	0.574	1.425	-0.451***	(-26.477)
Mortgage	0.044		0.306		-0.263***	(657.626)
Personal loan	0.037		0.103		-0.066***	(34.192)
Consumer credit	0.057		0.184		-0.126***	(94.420)
Gender (male)	0.460		0.838		-0.378***	(11.418)
North	0.382		0.754		-0.372***	(6.698)
South	0.285		0.470		-0.185	(0.546)
Married	0.449		0.801		-0.352**	(4.047)
Degree	0.082		0.360		-0.278***	(162.775)
Employee	0.189		0.989		-0.800***	(2.1e+03)
Self-employed/entrepreneur	0.070		0.251		-0.180***	(104.503)
Retired	0.536		0.019		0.517***	(3.9e+03)
Log(y)	8.612	9.921	15.297	14.192	-6.684***	(-29.760)
Log(w)	9.793	11.443	16.437	15.734	-6.645***	(-25.408)
Log(c)	8.350	9.615	15.004	13.921	-6.655***	(-30.555)
No. of members	1.823	2.638	4.056	4.419	-2.226***	(-35.011)
Home ownership	0.661		0.921		-0.260***	(376.671)
<i>Panel C</i>		<i>Degree: Low</i>	<i>Degree: High</i>			<i>T-test/Pearson <math>\chi^2</math> test</i> <i>Low vs. High</i>
FK	0.265		0.391		-0.126***	(652.705)
FK (no. of correct answers)	1.650	2.481	1.729	2.396	-0.079	(-1.484)
Digital skills	0.320		0.586		-0.266***	(1.9e+03)
Household debt	0.054	0.356	0.077	0.336	-0.022***	(-2.951)

(continued)

**Table 4.** Continued

Variable	Frequency/ mean	Std. dev.	Frequency/ mean	Std. dev.	Δ	Test
No. of household debts	0.203	0.810	0.339	1.057	-0.136***	(-7.277)
Mortgage	<i>0.086</i>		<i>0.187</i>		-0.101***	(423.127)
Personal loan	<i>0.052</i>		<i>0.054</i>		-0.002	(0.005)
Consumer credit	<i>0.088</i>		<i>0.085</i>		0.003**	(6.319)
Gender (male)	<i>0.571</i>		<i>0.453</i>		0.118***	(89.693)
North	<i>0.484</i>		<i>0.408</i>		0.076***	(37.027)
South	<i>0.364</i>		<i>0.178</i>		0.187***	(60.303)
Age	63.286	69.485	37.899	42.132	25.386***	(17.968)
Married	<i>0.555</i>		<i>0.433</i>		0.122***	(80.236)
Employee	<i>0.362</i>		<i>0.437</i>		-0.075***	(210.209)
Self-employed/entrepreneur	<i>0.092</i>		<i>0.197</i>		-0.105***	(954.121)
Retired	<i>0.482</i>		<i>0.134</i>		0.349***	(358.498)
Log(y)	10.138	11.687	11.029	9.980	-0.891***	(-53.418)
Log(w)	11.410	13.183	12.830	11.184	-1.419***	(-34.591)
Log(c)	10.383	11.402	7.917	9.720	2.466***	(10.241)
No. of members	2.452	3.392	1.927	2.751	0.524***	(7.374)
Home ownership	<i>0.745</i>		<i>0.624</i>		0.121***	(211.165)

**Note(s):** *Frequency* and *Mean* refer to dummy variables and continuous variables, respectively. *Frequency* expresses the percentage frequency values, which are shown in italics. The column “test” reports the value of the *t*-test and the Pearson  $\chi^2$  test for the continuous variables and the dummy variables, respectively. Sample weights are used. \*, \*\*, \*\*\* indicate 10%, 5% and 1% significance levels, respectively

$$FK_i = \beta_0 + \sum_i^n \beta_i X_i + \sigma_i FinCourse_i + \varepsilon_i \tag{2}$$

where *X* is a vector of control variables included in Eq. (1) and  $\varepsilon_i$  is the error term. *FinCourse* is the instrumental variable included in the first step of our IV regression. Existing literature (e.g. Kaiser et al., 2022; van Rooij et al., 2012; Kim et al., 2021) shows that financial education programs are critical in improving individual financial knowledge, so following an economics-finance course at school or university is a good proxy for financial knowledge. The variable *FinCourse* indicates whether the householder has followed a course on the subject. The first step makes it possible to obtain instrumented financial knowledge (*IFK*), which is a significant determinant of financial knowledge and which we include in the second step of the IV regression, as follows:

$$Household\ debt_{it} = \beta_0 + \beta_1 IFK_{it} + \beta_2 Digital\ skills_{it} + \beta_3 X_{it} + \varepsilon_{it} \tag{3}$$

We test the validity of the instrumented variables and the regression model through the Durbin test, to verify the hypothesis that “variables are exogenous”; the Underidentification test (Anderson canonical correlation LM statistic), to test the underidentification; the Weak identification test (Cragg–Donald Wald F statistic), to verify whether the instruments are only weakly correlated with the endogenous regressor (in which case the instrumental variable regression may perform poorly); the Sargan test, to test the overidentifying restrictions.

#### 4. Estimation results

##### 4.1 Relationship between household debt, financial knowledge and digital skills

Table 5 reports the results: Models 1 and 2 show the regression results and Model 3 shows the IV regression results. Model 1 shows that household debt is positively affected by financial knowledge and digital skills, the level of education and the employment status, household net

**Table 5.** Multivariate regressions and IV regression

	Model 1 reg. (1)	Model 2 reg. (2)	Model 3 IV reg. (3)
FK/IFK	0.028 <sup>***</sup> (0.002)	0.017 <sup>****</sup> (0.003)	0.350 <sup>***</sup> (0.061)
Digital skills	0.029 <sup>***</sup> (0.003)	0.022 <sup>***</sup> (0.003)	0.011 (0.013)
FK*Digital skills		0.022 <sup>***</sup> (0.005)	
Gender (male)	-0.001 (0.002)	-0.001 (0.002)	-0.017 (0.012)
North	0.001 (0.003)	0.001 (0.003)	-0.017* (0.010)
South	-0.021 <sup>***</sup> (0.003)	-0.021 <sup>***</sup> (0.003)	-0.029 <sup>**</sup> (0.013)
Age	-0.002 <sup>***</sup> (0.0001)	-0.002 <sup>***</sup> (0.0001)	-0.003 <sup>***</sup> (0.001)
Married	0.005 <sup>*</sup> (0.003)	0.005 <sup>*</sup> (0.003)	0.0002 (0.014)
Degree	0.014 <sup>***</sup> (0.003)	0.013 <sup>***</sup> (0.003)	
Employee	0.007 <sup>**</sup> (0.003)	0.007 <sup>**</sup> (0.003)	-7.97e-06 (0.016)
Self-employed/entrepreneur	0.036 <sup>***</sup> (0.004)	0.035 <sup>***</sup> (0.004)	0.023 (0.016)
Retired	0.007 (0.004)	0.007* (0.004)	-0.025 (0.026)
Log(y)	0.015 <sup>***</sup> (0.002)	0.015 <sup>***</sup> (0.002)	0.044 <sup>***</sup> (0.012)
Log(w)	-0.037 <sup>***</sup> (0.001)	-0.036 <sup>***</sup> (0.001)	-0.087 <sup>***</sup> (0.005)
Log(c)	0.027 <sup>***</sup> (0.002)	0.027 <sup>***</sup> (0.002)	0.038 <sup>***</sup> (0.011)
No. of members	-0.003 <sup>***</sup> (0.001)	-0.003 <sup>***</sup> (0.001)	-0.001 (0.005)
Home ownership	0.159 <sup>***</sup> (0.004)	0.158 <sup>***</sup> (0.004)	0.305 <sup>***</sup> (0.016)
Const	-0.002 (0.002)	-0.002 (0.002)	0.330 <sup>***</sup> (0.108)
Observations	13,082	13,082	2,603
R squared	0.283	0.284	
Durbin test			0.000
Anderson canon.corr. LM statistic			0.000
Cragg-Donald Wald F statistic			57.589
Sargan test			0.000

**Note(s):** This table presents the results for multivariate analysis and IV regression with Household debt as a dependent variable, obtained through Eq. (1) and Eq. (3). The standard errors are in parentheses. The independent variable is FK and IFK in Models 1 and 2 and Model 3, respectively. \*, \*\*, \*\*\* indicate the level of significance at 0.1, 0.05 and 0.01, respectively

disposable income and consumption and home ownership. There is a negative relationship between household debt and living in the South of Italy, the number of household members and the household net wealth. The relationship between household debt and age also appears negative, but it must be taken into account that almost 77% of the sample is made up of householders over 50.

In Model 2, we include the interaction term between *FK* and *Digital skills* (*FK\* digital skills*), whose coefficient is positive and significant, indicating that digital skills increase the positive impact of financial knowledge on household debt: as digital skills increase, household debt increases where financial knowledge is higher. Since the digital revolution is increasingly transforming financial services, individuals need to acquire new skills, update their financial knowledge and adapt their financial behavior to digital financial products and services, so that they can manage their personal finances effectively (Koskelainen *et al.*, 2023). In fact, in recent studies (e.g. Lyons and Kass-Hanna, 2021) “digital literacy” includes using online and mobile banking, opening a digital financial services menu, and initiating and completing a digital financial services transaction. The OECD also includes questions related to digital financial literacy in its recent questionnaires (OECD, 2022). The findings of Model 1 also hold true in Model 2.

Model 3 reports the results of IV regression (Eq. 3). Since financial knowledge seems to be affected by endogeneity problems (the *p*-value of the Durbin test is lower than 0.005), the findings of IV regression should be more robust and larger than the OLS estimates (Lusardi and Mitchell, 2014). The Cragg-Donald weak identification test is above the critical value tabulated by Stock and Yogo (2005) of 13.43. The results show that a statistically significant relationship exists between financial knowledge and household indebtedness (Column 3).

However, no statistically significant relationship exists between digital skills and household debt. On the one hand, these findings confirm previous findings that financial literacy can be a strong indicator of consumer attitudes toward debt (e.g. [Bialowolski et al., 2020](#)) and that digital skills complement financial skills in managing personal budgets and help families realize the benefits of using digital financial services (e.g. [Marconi et al., 2022](#)). On the other hand, our results extend previous evidence on households showing that financial knowledge affects debt decisions.

4.2 Financial knowledge, digital skills and over-indebtedness

In view of the results in terms of the positive association between FK and household debt, we further expand our investigation by considering household over-indebtedness. The literature (e.g. [Gathergood, 2012](#)) in fact notes an important relationship between over-indebtedness and financial illiteracy. In particular, since financial literacy has been associated with aspects such as lower arrears of subprime mortgages ([Gerardi et al., 2010](#)), lower credit card fees ([Lusardi and Tufano, 2009a, b](#)), lower high-cost loans ([Disney and Gathergood, 2013](#)), we verify whether FK affects household over-indebtedness ([Table 6](#)). There is no consensus in the literature on the definition of over-indebtedness or how to measure it (e.g. [Betti et al., 2007](#); [Marron, 2012](#); [Schicks, 2014](#)). Here, we follow [Balestra and Tonkin \(2018\)](#) in determining the level of household over-indebtedness on the basis of two measures: debt-to-asset ratio above 75% and debt-to-income ratio exceeding 3. When the first ratio is high, households are clearly exposed to the impact of falling asset prices. Consider for example the fall in real estate prices

**Table 6.** Household over-indebtedness

	Model 1 reg. (1)	Model 2 reg. (2)	Model 3 IV reg. (3)
FK/IFK	-0.082 (0.297)	0.479 (0.549)	-0.080** (0.034)
Digital skills	-0.208 (0.366)	0.062 (0.484)	0.031*** (0.007)
FK Digital skills		-0.730 (0.617)	
Gender (male)	0.205 (0.299)	0.241 (0.313)	0.016** (0.007)
North	0.146 (0.473)	0.148 (0.491)	0.025*** (0.006)
South	-0.945 (0.730)	-0.902 (0.741)	-0.001 (0.007)
Age	-0.002 (0.018)	-0.004 (0.019)	-0.001** (0.0003)
Married	-0.664 (0.410)	-0.653 (0.402)	-0.029*** (0.008)
Degree	1.130** (0.515)	1.371** (0.531)	
Employee	2.296*** (0.656)	2.248*** (0.639)	-0.004 (0.009)
Self-employed/entrepreneur	1.694*** (0.580)	1.694*** (0.584)	-0.013 (0.009)
Retired	0.073 (0.832)	-0.077 (0.805)	0.024 (0.015)
Log(y)	1.099*** (0.304)	1.039*** (0.311)	0.012* (0.006)
Log(w)	-2.579*** (0.303)	-2.607*** (0.304)	-0.031*** (0.003)
Log(c)	-0.778** (0.329)	-0.697** (0.337)	0.018*** (0.006)
No. of members	0.575*** (0.157)	0.572*** (0.164)	0.009*** (0.003)
Home ownership	20.409*** (2.902)	20.408*** (2.919)	0.118*** (0.009)
Const	-4.095*** (0.272)	-4.043*** (0.248)	-0.001 (0.004)
Observations	13,082	13,082	2,603
Pseudo R squared	0.453	0.456	
Durbin test			0.000
Anderson canon.corr. LM statistic			0.000
Cragg-Donald Wald F statistic			57.589
Sargan test			0.000

**Note(s):** This table presents the results for analysis with Household over-indebtedness as a dependent variable, obtained through [Eq. \(1\)](#) and [Eq. \(3\)](#). Since it is a dummy variable, we use a logistic regression (Models 1 and 2) and we show the Pseudo R squared; Model 3 presents results for IV regression. The standard errors are in parentheses. The independent variable is FK and IFK in Models 1 and 2 and Model 3, respectively. \*, \*\*, \*\*\* indicate the level of significance at 0.1, 0.05 and 0.01, respectively

for Italian households, whose main type of debt is mortgage loans. A situation of over-indebtedness in relation to this ratio could make it impossible to sell the property, with a mortgage higher than its value, and also make it impossible to renegotiate the mortgage to obtain better interest rates, making the cost of debt service potentially higher. And when debt-to-income ratio is high, households are also exposed to higher risk. Sudden rate hikes can make debt more expensive and affect households' ability to repay. In fact, consistently with recent data showing that Italy's household debt is significantly lower than the European average [5], our sample show a lower percentage of over-indebted households, with fewer than 1% in terms of debt-to-asset ratio and about 3% in terms of debt-to-income ratio. In the uncertain economic and geopolitical context, the issue of over-indebtedness is important because although debt can have a positive effect on economic well-being, where it is excessive, the consequences for the economic strength of the household can be significant. It is important for policy intervention to be effective (Balestra and Tonkin, 2018). In Table 6 the debt-to-asset ratio above 75%, which is an expression of over-indebtedness, is used as a dependent variable (dummy variable equal to 1 when the ratio is above 75% and 0 otherwise). Models 1 and 2 show that household over-indebtedness is not affected by financial knowledge, digital skills or their interaction. Model 3 reports the results of IV regression: the results are consistent with the literature which finds that high financial knowledge is negatively associated with household over-indebtedness (e.g. Gathergood, 2012; Lusardi and Tufano, 2015; French and McKillop, 2016; Han *et al.*, 2025) [6]. Digital skills seem to be positively associated with over-indebtedness, and this finding is in line with those of recent reports on technological innovation and the increase in online transactions. These have accelerated the use of online credit, which can be useful for consumers facing a temporary income deficit or in managing payments over time, if they are used correctly. However, their use can lead to over-indebtedness and contribute to the normalization of debt accrual (OECD, 2025).

#### 4.3 Financial knowledge, digital skills and types of debt

To further explore the impact of FK and digital skills on household debt, we examine, as dependent variables, the types of debt. Table 7 shows the results of the analysis, obtained by distinguishing between mortgage (Column 1), personal credit (Column 2) and consumer credit (Column 3), defined as reported in Table 1, for the full sample. Column 1, IV Reg., shows that being financially informed and digitally qualified has a positive impact on mortgage taking. From the results of Columns 2 and 3, sub-column IV Reg, it would seem that increased FK reduces the use of personal loans and consumer credit. Specifically, FK may be associated with a lower likelihood of using cash-advance loans and a lower likelihood of taking out high-cost consumer loans (e.g. Martin *et al.*, 2021; ECB, 2024) [7].

#### 4.4 Robustness checks

As a robustness check, we consider FK as the number of correct answers to the three questions on basic economic concepts: regression and IV regression results are reported in Appendix, Table B.1 Column 1. A further robustness check considers the *number of household debts* as a dependent variable, instead of the variable household debt calculated as shown in Table 1. Regression and IV regression results are reported in Table B.1 Column 2. In general, results reported are consistent with those of Table 5.

In order to mitigate any possible selection bias, we also use Propensity Score Matching (PSM). Table 4 shows that the means of several control variables are significantly different when segmented by gender, age and educational attainment, with a wide range of *t*-test and Pearson Chi<sup>2</sup> test values. After the PSM, the range of values of these tests is narrower. Since Age is a significant determinant of household debt (see Table 5), considering the sample composition, Table C.1 reports a comparison of variables for young and old groups of householders from the PSM in order to assess the extent of balancing achieved on the two matched samples. We assess the distribution of the propensity scores before and after the

**Table 7.** Type of debt (full sample)

	1 Reg.	IV Reg.	2 Reg.	IV Reg.	3 Reg.	IV Reg.
Financial knowledge	0.070 <sup>***</sup> (0.006)	0.551 <sup>***</sup> (0.124)	-0.018 <sup>***</sup> (0.004)	-0.231 <sup>***</sup> (0.080)	0.0003 (0.006)	-0.273 <sup>***</sup> (0.094)
Digital skills	0.065 <sup>***</sup> (0.006)	0.012 (0.025)	0.030 <sup>***</sup> (0.005)	0.061 <sup>***</sup> (0.016)	0.068 <sup>***</sup> (0.006)	0.091 <sup>***</sup> (0.018)
Gender (male)	-0.027 <sup>***</sup> (0.005)	-0.049 <sup>**</sup> (0.024)	0.016 <sup>***</sup> (0.004)	0.021 (0.015)	0.027 <sup>***</sup> (0.005)	0.008 (0.017)
North	0.008 (0.006)	-0.016 (0.021)	-0.008 (0.005)	-0.073 <sup>***</sup> (0.013)	-0.016 <sup>**</sup> (0.006)	-0.022 (0.016)
South	-0.056 <sup>***</sup> (0.007)	-0.085 <sup>***</sup> (0.027)	0.014 <sup>***</sup> (0.005)	-0.059 <sup>***</sup> (0.017)	0.013 <sup>*</sup> (0.007)	-0.012 (0.020)
Age	-0.003 <sup>***</sup> (0.0002)	-0.005 <sup>***</sup> (0.001)	0.0003 (0.0002)	0.001 (0.001)	-0.0003 (0.0002)	-0.001 (0.001)
Married	0.013 <sup>*</sup> (0.007)	0.014 (0.028)	0.010 <sup>*</sup> (0.005)	0.022 (0.018)	-0.017 <sup>**</sup> (0.007)	0.007 (0.020)
Degree	0.050 <sup>***</sup> (0.008)		0.015 <sup>**</sup> (0.006)		-0.029 <sup>***</sup> (0.008)	
Employee	0.024 <sup>***</sup> (0.008)	0.053 <sup>*</sup> (0.032)	0.049 <sup>***</sup> (0.006)	-0.010 (0.020)	0.061 <sup>***</sup> (0.008)	0.150 <sup>***</sup> (0.023)
Self-employed/entrepreneur	0.062 <sup>***</sup> (0.010)	0.080 <sup>**</sup> (0.033)	0.011 (0.008)	-0.045 <sup>**</sup> (0.021)	-0.005 (0.010)	0.018 (0.025)
Retired	0.007 (0.010)	-0.064 (0.053)	-0.025 <sup>***</sup> (0.008)	-0.131 <sup>***</sup> (0.034)	-0.017 <sup>*</sup> (0.009)	-0.013 (0.039)
Log(y)	0.035 <sup>***</sup> (0.005)	0.105 <sup>***</sup> (0.023)	-0.009 (0.004)	-0.055 <sup>***</sup> (0.015)	0.001 (0.005)	-0.094 <sup>***</sup> (0.018)
Log(w)	-0.048 <sup>***</sup> (0.002)	-0.121 <sup>***</sup> (0.011)	0.002 (0.002)	0.023 <sup>***</sup> (0.007)	-0.013 <sup>***</sup> (0.002)	0.009 (0.008)
Log(c)	0.024 <sup>***</sup> (0.005)	0.002 (0.021)	0.005 (0.004)	0.054 <sup>***</sup> (0.014)	0.012 <sup>**</sup> (0.005)	0.081 <sup>***</sup> (0.021)
No. of members	-0.0001 (0.003)	0.027 <sup>***</sup> (0.009)	0.004 <sup>**</sup> (0.002)	-0.028 <sup>***</sup> (0.006)	0.010 <sup>***</sup> (0.003)	-0.004 (0.007)
Home ownership	0.286 <sup>***</sup> (0.009)	0.564 <sup>***</sup> (0.033)	0.011 (0.007)	0.014 (0.021)	0.081 <sup>***</sup> (0.009)	0.099 <sup>***</sup> (0.024)
Const	-0.003 (0.005)	0.014 (0.014)	-0.006 (0.004)	-0.016 <sup>**</sup> (0.009)	-0.009 <sup>*</sup> (0.005)	0.010 (0.011)
Observations	13,082	2,603	13,082	2,603	13,082	2,603
R squared	0.254		0.069		0.112	
Durbin test		0.000		0.000		0.000
Anderson canon.corr. LM statistic		0.000		0.000		0.000
Cragg-Donald Wald F statistic		57.589		57.589		54.908
Sargan test		0.000		0.000		0.000

**Note(s):** This table presents the results for multivariate analysis and IV regression obtained through Eqs (1) and (3). In Columns I, II and III, the dependent variable is a dummy referring to mortgage, personal loan and consumer credit, respectively. The standard errors are in parentheses. The independent variable is financial knowledge and IFK in Column Reg. and Column IV Reg., respectively. \*, \*\*, \*\*\* indicate the level of significance at 0.1, 0.05 and 0.01, respectively

matching, which is shown in Figure C.1. After the matching, the kernel density distributions [8] of the propensity scores are nearly identical in the two groups. Table C.2 provides results for multivariate regression identical to those presented in Table 6, Model 3, but for the PSM samples. Again, the coefficients on FK and digital skills remain highly significant and most of inferences are consistent with those in Table 5, Models 1 and 3.

We also carry out analyses that take into account any differences depending on the gender and age of the householder. Tables D.1 and D.2 report results by the gender and age, respectively. Table D.1, Columns *IV Reg*, show that both for women and for men, FK is a significant determinant of household debt, while digital skills are not significant. Table D.2, Columns *IV Reg*, show that for both old and young householders, financial knowledge is a significant determinant of household debt, while digital skills are not significant.

Finally, Table 8 shows the results of a multivariate analysis which highlights the importance of the specific concept of FK for household debt. Estimates show that when households understand compound interest, their debt increases. Understanding the concept of compound interest is particularly important for younger respondents and for those with higher education. Digital skills have in general a positive impact on household debt, especially for respondents aged 50 and under. Table 8 reveals the significance of women providing “No answer” to the question on inflation (*DK inflation*), where the coefficient is negative and significant.

### 5. Discussion and conclusion

This paper investigates the role of financial knowledge and digital skills in shaping households’ debt choices. This is particularly important in a country like Italy, where householders make significant use of financial debt. In 2022, Bank of Italy (2024d) reported that 26% of households were in debt. In the face of a substantial stability in the percentage of households with debt for consumption purposes (about 10%), the number of households indebted for real estate (up to 13.9% from 12.1% in 2020) or for professional reasons (up to 2.5% from 2.1% in 2020) has grown. The impact of the debt burden on monetary income continues to increase as equivalent income declines. In 2022, financially vulnerable households accounted for 1.5% of the total. In addition, Italy is characterized by a lower level of financial knowledge and digital skills compared to other countries (Bank of Italy, 2023). As far as we know, no prior research has examined whether the possession of digital skills, defined as ability and familiarity with remote interactions with financial institutions,

**Table 8.** Multivariate regression model

	Total sample	Female	Male	Age > 50	Age ≤ 50	Degree: low	Degree: high
Correct compound interest	0.012*** (0.002)	0.012*** (0.004)	0.012*** (0.003)	0.007*** (0.002)	0.023*** (0.008)	0.009*** (0.003)	0.026*** (0.007)
Correct inflation	0.001 (0.003)	-0.005 (0.005)	0.005 (0.004)	0.003 (0.002)	-0.008 (0.09)	-0.001 (0.003)	0.008 (0.008)
Correct risk diversification	0.004 (0.003)	0.003 (0.005)	0.005 (0.004)	0.004 (0.003)	0.013 (0.010)	0.004 (0.003)	0.003 (0.010)
DK compound interest	0.003 (0.004)	0.002 (0.005)	0.002 (0.006)	-0.003 (0.003)	-0.013 (0.015)	0.0004 (0.004)	0.002 (0.017)
DK inflation	-0.002 (0.004)	-0.011* (0.006)	0.005 (0.006)	-0.001 (0.003)	-0.014 (0.014)	-0.001 (0.004)	-0.016 (0.014)
DK risk diversification	-0.001 (0.004)	0.002 (0.005)	-0.004 (0.005)	0.003 (0.003)	0.008 (0.012)	-0.002 (0.004)	0.007 (0.012)
Digital skills	0.029*** (0.003)	0.028*** (0.004)	0.029*** (0.004)	0.018*** (0.002)	0.062*** (0.08)	0.027*** (0.003)	0.028*** (0.007)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	13,082	5,506	7,576	10,134	2,948	10,479	2,603
R squared	0.163	0.161	0.166	0.099	0.207	0.139	0.231

**Note(s):** This table presents the results for multivariate analysis with Household debt as a dependent variable, obtained through Eq. (1). The standard errors are in parentheses. \*, \*\*, \*\*\* indicate the level of significance at 0.1, 0.05 and 0.01, respectively

increases the impact of financial knowledge on household debt. Moreover, the role of financial literacy in borrowing decisions remains a matter of debate in the literature. While some studies suggest it encourages more prudent credit behavior (Van Ooijen and Van Rooij, 2016; Thorp *et al.*, 2023), others argue that it may foster greater debt uptake, and the accumulation of multiple loans, potentially fueling overconfidence-driven risk-taking (Bialowolski *et al.*, 2025). Our paper tries to fill this gap by investigating whether financial knowledge and digital skills enhance households' participation in the credit market and improve their borrowing decisions.

On the basis of the Bank of Italy's SHIW dataset for the years 2016 and 2020, we find support for our two hypotheses. Specifically, we find that both financial knowledge and digital skills contribute to greater household debt. This is also demonstrated when the analysis focuses on sub-samples of men and women and older and younger individuals. Consistently with previous findings (Van Rooij *et al.*, 2011; Lusardi and Tufano, 2015; Bottazzi and Oggero, 2023; OECD, 2024b), women and older people show lower levels of financial knowledge and digital skills than men and younger people. Women and the elderly also tend to have less debt than men and young people.

In more detail, our analysis (Table 6, Models 1–3) shows that financial knowledge significantly affects both the amount and the composition of household debt. It in fact increases household debt, particularly in the form of mortgages, while reducing reliance on high-cost forms of credit (i.e. personal loans and consumer credit). This aligns with findings from previous studies (e.g. Feng *et al.*, 2019; Bialowolski *et al.*, 2025). Furthermore, looking at household over-indebtedness, we find a negative and significant relationship between financial knowledge and over-indebtedness (Table 7, Model 3), which confirms the role of financial knowledge in promoting sound debt management, protecting against financial vulnerability and improving the ability to meet payments. Our research thus reveals a distinction between “healthy” debt and over-indebtedness, and provides evidence that financial knowledge helps Italian families actively exploit debt and, at the same time, protects them from exceeding the critical threshold of over-indebtedness. Thus, financial knowledge could play a significant role in reducing the trapping effect of financial fragility (Fornero *et al.*, 2011; Lusardi and Tufano, 2015; French and McKillop, 2016; Aristei *et al.*, 2025), which is closely related to over-indebtedness. Looking at digital skills, our results show that, taken alone, they exert a positive influence on household debt, but that once endogeneity is controlled for, their impact on debt levels is not significant (Table 6, Model 3). However, the interaction between digital skills and financial knowledge is positive and significant, indicating that digital competencies amplify the beneficial effects of financial knowledge on debt management, encouraging more responsible borrowing, especially among younger individuals. Households that combine both skills are thus better equipped to enter “healthy” indebtedness, in other words, to access and manage credit in an informed and sustainable manner. As shown in Table 7, the relationship between digital skills and over-indebtedness is positive, and the interaction between financial knowledge and digital skills is not significant in this case. It appears that the synergy observed for “healthy” debt does not extend to excessive debt. When taken in isolation, digital skills do not protect against financial fragility and may even promote risky behaviors. This suggests that technological familiarity in itself, without adequate financial awareness, can lead to impulsive or excessive borrowing, misuse and increased exposure to financial risks.

Our evidence thus aligns, on the one hand, with studies emphasizing that fintech can enhance consumer financial capability and decision-making (French *et al.*, 2020; Michelangeli and Viviano, 2021). On the other hand, it supports the view that technological transformation also introduces significant risks, including security threats, privacy concerns, impulsive spending and potential financial mismanagement (Carlsson *et al.*, 2017; OECD, 2017, 2018; Panos and Wilson, 2020), particularly when not accompanied by sufficient financial awareness. In this sense, financial knowledge could act as a “supervisor” for digital skills in the financial sector, a point which emerges, in fact, from the analysis the interaction

effect. Interestingly, our findings further indicate that the expansion of digital finance can either strengthen or undermine financial well-being, depending on consumers' financial competence levels.

This is particularly relevant in Italy, given its current structural context. From a social perspective, our results highlight interconnected risks arising from low levels of digital and financial competence. Individuals with limited digital skills face digital-financial exclusion, remaining disconnected from modern financial channels and unable to fully access online banking and digital credit services. Conversely, those with poor financial knowledge and a limited capacity to evaluate and manage financial options are more susceptible to over-indebtedness and suboptimal financial decisions. In the credit market, these weaknesses often manifest as greater reliance on high-cost loans and difficulties in managing debt effectively. The situation is even more critical for individuals lacking both digital and financial literacy, who face dual vulnerability: exclusion from digital finance opportunities on the one hand, and exposure to "toxic financial inclusion" on the other. By toxic inclusion, we mean access to credit or other financial contracts under unfair or unsustainable conditions, driven by limited understanding and digital inexperience. Deficiencies in either or both domains thus result in apparent or dysfunctional inclusion, which in the credit market can undermine consumer well-being and transform credit from a tool of empowerment into a source of fragility. Genuine financial inclusion requires not only access to credit but also its efficient, healthy and sustainable use (Signorini, 2024).

Our results have important implications for both policymakers and the banking sector. Echoing a large body of literature, they highlight the need to promote financial and digital literacy as complementary pillars of consumer competence in an increasingly digitalized financial system (OECD, 2017; Yakoboski *et al.*, 2018; Lyons and Kass-Hanna, 2021).

For financial institutions, we argue that a transparent and diverse credit supply to support healthy borrowing habits should be accompanied by access to high-quality professional advice, strict supervision of risk and appropriate credit sizing. Our results also suggest that fostering financial knowledge and digital skills among clients could not only enhance lender relationships with current and potential borrowers but also promote more informed credit decision-making and reduce risk, ultimately generating benefits for both parties. For policymakers, since financial education is the main safeguard against financial fragility and is enhanced by digital literacy, interventions should prioritize integrated programs combining economic-financial knowledge with digital skills and digital risk education (OECD, 2025). Strengthening both dimensions among Italian households is essential for promoting sounder and more active participation in credit markets, reducing over-indebtedness and fostering genuine financial inclusion. Digital familiarity and skills should be encouraged not only to foster financial access but also to improve risk awareness and understanding of potential hazards associated with new digital financial tools. Financial education programs could also incorporate debiasing strategies and behavioral nudges to mitigate common cognitive biases and their consequences, including excessive risk-taking driven by overconfidence (Morewedge *et al.*, 2015; Bialowolski *et al.*, 2025). Finally, initiatives should target all population groups, with particular focus on those most affected by skill gaps, such as women, older adults, individuals with lower education levels and residents of southern regions. At the macroeconomic level, effective digital financial education can align individual welfare with systemic stability. This approach should help ensure that credit expansion does not undermine financial stability – a risk vividly illustrated by the US subprime mortgage crisis – while creating interesting synergies between inclusion and stability, ultimately enhancing both consumer welfare and the resilience of the financial system (Čihák *et al.*, 2016).

Our study suffers from some limitations. First, the SHIW survey is conducted every 2 years by the Bank of Italy, so it is not possible to carry out a panel analysis. Finally, our analysis focuses on the Italian context, which is characterized by an important role of the banking market and by economic, social and cultural peculiarities. Comparing Italy's results with data from other countries could provide valuable information on how cultural and economic

contexts shape the relationship between financial knowledge, digital skills and household debt.

#### **CRedit authorship contribution statement**

*Maria Cristina Arcuri*: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data Curation, Writing – Original Draft, Writing – Review and Editing, Visualization, Supervision. *Beatrice Ronchini*: Conceptualization, Resources, Writing – Original Draft, Writing – Review and Editing, Visualization, Supervision. *Gino Gandolfi*: Supervision.

#### **Data availability**

Data are available on Bank of Italy website.

#### **Notes**

1. For methodological details, see [https://www.bancaditalia.it/pubblicazioni/metodi-e-fonti-note/metodi-note-2022/MOP\\_IBF\\_en.pdf](https://www.bancaditalia.it/pubblicazioni/metodi-e-fonti-note/metodi-note-2022/MOP_IBF_en.pdf)
2. Note that of the 7,420 households covered by the 2016 survey, 3,804 of these, called “panel families” by the Bank of Italy, were also interviewed in the previous survey.
3. Note that of the 6,239 households covered by the 2020 survey, 2,986 of these, called “panel families” by the Bank of Italy, were also interviewed in the previous survey.
4. The increasing variability caused using weighted estimators is compensated by the bias reduction (Bank of Italy, 2007).
5. [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Households\\_-\\_statistics\\_on\\_financial\\_assets\\_and\\_liabilities#:~:text=The%20share%20of%20each%20EU,of%20households%20in%20the%20EU.](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Households_-_statistics_on_financial_assets_and_liabilities#:~:text=The%20share%20of%20each%20EU,of%20households%20in%20the%20EU.)
6. The results obtained by using the debt-to-income ratio exceeding 3 are similar to those of Models 1–3.
7. For more details on the Italian context, see the monthly publication “Banks and money” by the Bank of Italy, which provides data on household interest rates (<https://www.bancaditalia.it/pubblicazioni/moneta-banche/index.html?dotcache=refresh>).
8. Kernel density estimation is a non-parametric method of estimating the probability density function of a random variable; in other words, assumptions are not made about the underlying distribution of propensity score.

#### **Supplementary material**

The supplementary material for this article can be found online.

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