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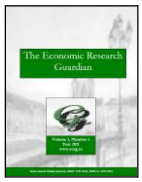

Impacts of Digital Financial Literacy and Usage of Digital Finance on Financial Inclusion in Vietnam

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Abstract
In light of Vietnam's shift toward a cashless society and the rapid advances brought by Industry 4.0, this research investigates how digital financial literacy and digital finance contribute to financial inclusion. Using a structured questionnaire grounded in established international standards, the research collects detailed individual-level data from diverse regions in Vietnam. To mitigate issues like reverse causality and endogeneity, two instrumental variables are integrated into the analysis framework. Results reveal a strong, positive: relationship that higher digital financial knowledge and wider access to digital financial services significantly enhance people's capacity to use and benefit from financial products, a trend accentuated during the COVID-19 pandemic and throughout Vietnam's economic expansion. These results support global evidence and underscore the necessity of strengthening digital skills and financial technologies to foster inclusive economic growth. The research implementable recommendations for policymakers and organizations seeking to broaden financial inclusion and enrich the academic conversation on this topic in Vietnam.

Keywords: Financial inclusion, Digital financial literacy, Digital finance, Customer accessibility, Financial products

JEL classification : G53, G51, O16, O33

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1. Introduction

Amidst the sweeping changes brought about by the Fourth Industrial Revolution, Vietnam's rapid embrace of digital technologies, ranging from artificial intelligence and big data to blockchain and IoT across various sectors has created a dynamic environment for economic growth and productivity. In

this context, the country offers a particularly rich setting for exploring issues related to digital financial inclusion. Recognizing the importance of digitalization, the Vietnamese government has launched ambitious national initiatives such as Resolution No. 52-NQ/TW (2019) and Decision 749/QĐ-TTg - that lay the foundation for its National Digital Transformation Program, targeting milestones by 2025 and beyond. These policies aim to position Vietnam among the top 50 countries in the e-Government Development Index and to build a robust digital economy and smart governance system. This digital push has led to a surge in demand for non-cash payments, accelerated by the COVID-19 pandemic, during which platforms like MoMo, VietQR, and ZaloPay experienced substantial growth. The State Bank of Vietnam has reinforced this momentum by targeting a reduction in cash transactions to below 10% by 2030. However, while digital finance is expanding, access and literacy remain uneven, especially among rural, older, or low-income populations, raising concerns about financial exclusion in a rapidly digitizing society.

Given this context, Vietnam becomes an important case study for understanding how digital financial literacy and digital finance influence financial inclusion. Research in this setting not only addresses local challenges but also offers broader insights into how developing economies can balance innovation with inclusivity in the digital age.

Defining financial inclusion is challenging because practices differ significantly across countries. Dev (2006) describes it as delivering affordable banking services to marginalized and low-income populations, whereas Sahay et al. (2015) highlight individuals' ability to access and utilize formal financial services. OECD/INFE (2016) broadens the concept to cover ethical, sustainable access to a full suite of appropriate financial products—payments, savings, credit, and insurance. Its 2020 update adds both the customer's view of accessibility and the provider's view of availability. Embracing this holistic definition, the present study underscores financial inclusion as a powerful driver of economic growth, poverty alleviation, crisis resilience, and better human-development outcomes (Grohmann et al., 2018; Morgan & Long, 2020; Ozili, 2018, 2021).

Both researchers and practitioners agree that establishing clear definitions and metrics for financial literacy is crucial for linking it with other financial outcomes, thus informing effective policy. The swift rise of financial technology (fintech) and the upheaval caused by COVID-19 have accelerated the uptake of digital financial services (DFS) such as online banking, mobile payments, and peer-to-peer lending (Lyons et al., 2022). In Vietnam, social distancing and lockdowns prompted banks and businesses to launch user-friendly digital platforms, making electronic payments and digital wallets part of everyday life. Within this digital landscape, traditional financial literacy on its own is insufficient; proficiency in digital financial literacy is now critical for accessing and effectively using contemporary digital financial products and services.

Digital financial literacy and traditional financial literacy are closely related, both involving a blend of knowledge, skills, attitudes, and behaviors required to make informed financial choices and achieve personal financial well-being (Atkinson & Messy, 2012; OECD/INFE, 2022). Digital finance refers to providing financial services through electronic channels, including smartphones, computers, the Internet, and advanced payment cards (Al-Smadi, 2023; Ozili, 2018). This approach offers benefits to users, providers, governments, and the overall economy by enhancing stability and efficiency. Prior studies show that digital finance can reach people excluded from conventional banking through the

deployment of big data analytics and cloud computing, which cut information gaps and transaction expenses, enabling economies of scale (Lu et al., 2022; Yang et al., 2020; Leong et al., 2017; Xu, 2017; Huang & Wang, 2017).

This study makes three main contributions. First, it provides empirical evidence on the impact of digital financial literacy and digital finance: two emerging but underexplored dimensions on financial inclusion in a developing country. Second, it adopts a micro-level approach using data collected from both rural and non-rural areas in Vietnam, offering insights into regional disparities. Third, it addresses potential endogeneity by employing an instrumental variable estimation model, enhancing methodological robustness. These contributions aim to support both academic inquiry and policymaking by offering evidence-based insights to help the government and institutions foster inclusive digital finance. Furthermore, to reduce bias and avoid conflicting outcomes from potential reverse causality in the data, two instrumental variables are applied within the estimation model.The study also addresses potential biases and conflicting results in observational data by employing two instrumental variables and an instrumental variable estimation model to ensure robust findings.

The paper is organized as follows: Section 2 surveys the literature, Section 3 describes the data and methodology, Section 4 presents and discusses the findings, and Section 5 concludes with policy implications.

2. Literature review

2.1. Financial inclusion

Financial inclusion has become a central focus for scholars and policymakers because of its demonstrated capacity to spur economic growth, alleviate poverty, and promote social equity. Conceptually, it is often framed as a public good: universal access to formal financial services produces widespread societal benefits without depleting shared resources. Consequently, the expansion of formal financial services is associated with improved living standards and narrower income inequalities (Ozili, 2020; Lal, 2018).

Empirical studies reinforce these theoretical underpinnings. Studies indicate that expanding financial inclusion helps alleviate poverty, shrink income gaps, and bolster the stability of financial institutions (Omar & Inaba, 2020; Swamy, 2014; Ahamed & Mallick, 2019). For instance, access to savings, credit, and investment products has helped marginalized groups, particularly women and low-income households, escape poverty and improve their economic prospects (Ozili, 2021; Ofosu-Mensah Ababio et al., 2021). Systems theory adds that financial inclusion strengthens the interconnected sub-systems of an economy - economic, financial, and social - contributing to macroeconomic stability and long-term, balanced growth (Vo et al., 2019; Gul et al., 2018).

Despite these benefits, several barriers hinder the realization of full financial inclusion, especially in developing countries. These include the prioritization of profitable customer segments by financial service providers, which often excludes low-income individuals, and the complexity of financial products that can be daunting for those with limited financial knowledge (Ozili, 2018; Gilenko &

Chernova, 2021). Furthermore, the gap in digital connectivity, especially between urban and rural areas, continues to pose a major obstacle, deepening the unequal access to financial services.

2.2. Digital financial literacy and financial inclusion

The swift shift toward digital financial services has elevated digital financial literacy (DFL) to a critical driver of financial inclusion. DFL blends practical know-how with the skills needed to manage money online, equipping people to thrive in the digital economy (Lyons & Kass-Hanna, 2021). As mobile payments, e-wallets, and online banking proliferate, users must not only master these technologies but also guard against digital threats (Choung et al., 2023; Koskelainen et al., 2023).

Empirical studies consistently show that stronger DFL leads to greater uptake and more effective use of digital financial tools, which translates into better financial health and wider inclusion (Prasad et al., 2018; Shen et al., 2018). Higher DFL, for instance, can empower women, boost consumer confidence, and cultivate favorable attitudes toward formal financial services (Hasan et al., 2023; Lyons & Kass-Hanna, 2021). By contrast, inadequate DFL leaves individuals vulnerable to fraud and platform misuse, eroding trust and deterring engagement with the formal financial sector (Engels et al., 2021; Wei et al., 2021).

In Vietnam, COVID-19 accelerated the move to digital finance, spurring widespread use of digital payments and online banking. Yet disparities in digital access and differing DFL levels across socio-economic groups continue to hamper the goal of universal financial inclusion.

2.3. Digital finance and financial inclusion

Digital finance delivers monetary services via digital platforms such as smartphones, computers, and the Internet. By cutting transaction costs, broadening service reach, and bringing formerly unbanked groups into the formal system, it has reshaped financial inclusion (Al-Smadi, 2023). Adoption patterns are frequently analyzed with the Technology Acceptance Model, which stresses that individuals adopt digital technologies when they deem them both beneficial and user-friendly (Davis, 1989).

Evidence from diverse settings reinforces digital finance's inclusive power. Studies in Sri Lanka and sub-Saharan Africa show that it widens access to financial products—especially for small- and medium-sized enterprises and low-income households (Bede Uzoma et al., 2020; Thathsarani & Jianguo, 2022). The swift expansion of fintech and digital banking in Vietnam has boosted account ownership and opened new lending avenues for people left out of traditional banking. By harnessing technology, fintech firms now offer tailored payment, savings mechanisms and lending products tailored to people with little or no formal banking access, increasing efficiency and transparency in financial transactions.

2.4. Vietnamese context: empirical findings

A substantial body of research in Vietnam highlights that traditional financial literacy positively shapes individuals' financial actions and their inclusion in the financial system. For example, Morgan (2021) and Morgan & Trinh (2020) find that those possessing higher levels of financial knowledge are more

apt to notice and make use of fintech services. Further, Morgan & Trinh (2019) identified a notable association between financial literacy, educational attainment, saving habits, and financial inclusion in both Cambodia and Vietnam. Doan (2020) also found that factors such as financial knowledge, finance-oriented education, marital status, and advanced financial management behaviors encourage personal saving, whereas being a student, gender, and reliance on basic financial practices may have an inhibiting effect.

In terms of participation in financial markets, Nguyen and Nguyen (2020) show that individuals with solid financial literacy are considerably more inclined to invest or otherwise engage with financial markets, whereas those whose knowledge is only basic tend to stay on the sidelines. Although most studies link financial literacy to broader financial inclusion (Morgan & Trinh, 2019), Nathan et al. (2022) contend that very high literacy can dampen fintech uptake, suggesting these technologies chiefly advantage consumers with more modest financial know-how. Savvy users, by contrast, often continue to favor traditional services. Tam and Hanh (2018) likewise stress that fintech expands inclusion by providing cheaper, more convenient access to finance.

Internationally, digital finance has been widely explored, yet Vietnamese scholarship still focuses mainly on fintech. While the two overlap, digital finance refers to the sector-wide shift to digital channels, whereas fintech centers on innovation-driven solutions (Gomber et al., 2017). Many fintech firms originate in the IT industry and bring novel answers to longstanding financial problems.

Morgan and Trinh (2020) find that greater financial literacy boosts awareness and use of internet- and mobile-based fintech products. Dang and Vu (2020) note that fintech has sharpened microfinance performance by enhancing both access and service quality, and Loo (2019) identifies Vietnam as a market with both pressing inclusion needs and strong fintech growth potential.

Even so, the broader domain of digital finance - separate from fintech and more closely tied to incumbent financial institutions - remains under-researched in Vietnam. Closing this gap is therefore a key aim of the present study.

2.5. Research gaps

Although global research on digital financial literacy, digital finance, and financial inclusion is expanding, Vietnamese researches have predominantly concentrated on traditional financial literacy and fintech adoption, leaving the digital dimensions of financial inclusion largely unexamined. Most local research has prioritized supply-side considerations, such as the availability of services and the development of technological infrastructure, often overlooking demand-side elements like digital skills and consumer behavior.

This research gap is especially relevant as Vietnam's financial sector undergoes rapid digital transformation, while socioeconomic inequalities continue to restrict access for disadvantaged populations. To overcome these gaps, comprehensive research is urgently required that examines the combined effect of digital financial literacy and digital finance on enhancing financial inclusion, employing rigorous methods that account for endogeneity and demographic diversity. Such comprehensive research would inform the design of targeted interventions and policies aimed at

narrowing the digital divide, thereby enabling every socioeconomic group to reap the benefits of accessible financial services.

Two main hypotheses are concluded:

- H1: Digital financial literacy has a positive impact on financial inclusion;
- H2: Digital finance has a positive impact on financial inclusion.

3. Data & methodology

3.1. Data collection

The study adopted the OECD/INFE 2022 questionnaire to gauge both financial inclusion and digital financial literacy and drew on Yang et al. (2023) to measure digital finance. The questionnaire also included socio-demographic details like gender, age, income, occupation, and family background, along with levels of financial inclusion, digital financial literacy, and digital finance. Furthermore, two instrumental variables were used to address endogenous problems possibly arising from observational data collected.

Data were gathered between November 2023 and January 2024 using a convenience sampling method across various regions of Vietnam, categorized into rural and non-rural areas. A total of 374 responses were collected, with 359 deemed valid for analysis.

3.2. Construction of financial inclusion, digital financial literacy, and digital finance measures

Following the framework established by OECD/INFE (2022), the financial inclusion index is structured around two primary elements: ownership of financial products and active engagement with those products. The ownership component assesses whether individuals possess any of four categories of financial products: (1) payment instruments, which include checking or payment accounts, mobile money, and debit or payment cards; (2) savings, investment, or retirement accounts; (3) various forms of insurance; and (4) credit products such as loans, mortgages, or credit cards.

The active engagement aspect of the index is measured through three indicators: (1) the respondent's familiarity with available financial products; (2) recent, deliberate decisions to use financial products; and (3) dependence on relatives or friends for saving money or managing daily expenses.

The financial inclusion index runs from 0 to 7, calculated by summing the product ownership score (0–4) and the active engagement score (0–3). The computation of financial inclusion and its components score will be summarized in Table 1 in the Appendix.

Digital financial literacy is evaluated along three dimensions—financial knowledge, financial behavior, and financial attitudes. Points from these dimensions are summed, producing an overall score between 0 and 10.

The knowledge dimension captures a respondent's ability to apply quantitative reasoning in financial contexts, enabling an accurate appraisal of their financial position. It also involves comparing various financial products and services to support more informed and rational decisions (Morgan & Long, 2020). When evaluating digital financial literacy, this component focuses specifically on knowledge relevant to digital finance and its application in everyday contexts. The assessment uses three targeted questions to measure financial knowledge, with scores ranging from 0 to 3. The computation of the financial knowledge score will be summarized in Table 2 in the Appendix.

The financial behavior score reflects the number of "financially savvy" actions an individual takes when navigating digital financial situations or when choosing to use - or avoid - digital financial products and services. This score is calculated from answers to four specific questions that address practices such as managing passwords, checking the credibility of providers before making purchases, and the extent to which individuals share personal financial details online. The possible score for this section ranges from 0 to 4.

Financial attitudes, the final aspect of digital financial literacy, are captured through three questions that examine respondents' perceptions of digital financial products and services, their sense of security when transacting online, and similar factors. This component yields a score ranging from 0 to 3. Details of the computation of the financial attitude score will be summarized in Table 4 in the Appendix.

The composite digital financial literacy score is obtained by summing the points for financial knowledge, behavior, and attitudes, resulting in a possible total ranging from 0 to 10.

Digital Finance is captured with a binary variable that takes the value 1 when a respondent has used any of the three services - Mobile_Payments, Online_FPs, or Online_Borrowing - and 0 if none has been used. Each of these services is also coded as a separate binary variable, where a value of 1 denotes usage and 0 indicates non-use by the respondent. The computation of the digital finance score will be provided in Table 5 in the Appendix.

Demographic variables, encoded in binary for computational efficiency, are obtained through questions regarding respondents' age, geographical location, educational background, and marital status, among others. Each component of the demographic questions is associated with base variables and dummy variables to prevent multicollinearity.

3.3. Empirical approach

After defining the core variables - financial inclusion, digital financial literacy, digital finance, and demographics - the coding framework was aligned with OECD 2022 standards and the digital finance measurement framework proposed by Yang et al. (2023).

The study then employed Ordinary Least Squares (OLS) regression on the continuous outcome variables to estimate the impact of digital financial literacy and digital finance on financial inclusion. This methodology draws on prior studies by Doan (2020), Morgan & Long (2020), and Uddin (2020), which establish foundational approaches for modeling financial behaviors and inclusion.

$$FI_i = \gamma_0 + \gamma_1 DFL_i + \gamma_2 X_i + \omega_i \quad (1)$$

$$FI_i = \gamma_0 + \gamma_1 DF_i + \gamma_2 X_i + \omega_i \quad (2)$$

FIi is the Financial Inclusion score - the scores of its two components; DFLi is the Digital Financial Literacy score - the scores of its three components; DFi is the Digital Finance score - the scores of its three components Xi is a vector of control variables; and ε_i is the error term.

Similarly, the other equations showing the impacts of Digital Financial Literacy and its components, Digital Finance on Holding product by Type take the forms:

$$HP_i = \gamma_0 + \gamma_1 DFL_i + \gamma_2 X_i + \omega_i \quad (3)$$

$$HP_i = \gamma_0 + \gamma_1 DF_i + \gamma_2 X_i + \omega_i \quad (4)$$

HPi is the Holding product subscore – and its four components; DFLi is the Digital Financial Literacy score - the scores of its three components; DFi is the Digital Finance score – the scores of its three components Xi is a vector of control variables; and ε_i is the error term.

Using Ordinary Least Squares (OLS) in this analysis may yield biased or inconsistent estimates due to reverse causality - where financial inclusion could influence digital financial literacy and digital finance - and unobserved variables affecting these relationships. To resolve these endogeneity concerns, the study employs an Instrumental Variables (IV) framework, utilizing two instruments tied to digital financial literacy: "Better Math" and "Financial Shock.".

The first instrument captures a respondent's math aptitude in school, assigning a value of 1 for respondents who indicated they outperformed their classmates in mathematics during their final school year, and 0 for all others. Because numeracy underlies financial literacy - especially financial knowledge - math ability is closely linked to overall financial literacy. Morgan and Long (2020) contend that mathematics influences financial inclusion indirectly, through its effect on financial literacy: it is financial understanding, rather than raw math skills, that ultimately drives choices like saving or opening an account.

The latter instrumental variable, "Financial Shock," is a binary measure asking whether the respondent's parents or siblings faced significant financial difficulties in the past year (coded as 1 if yes, 0 otherwise). While individuals cannot control their family members' financial circumstances, exposure to such challenges within the household may motivate them to seek financial knowledge, as noted by Van Rooij et al. (2011). These experiences could also prompt changes in financial attitudes or decision-making behaviors.

Both instruments -"Better Math" and "Financial Shock" - have been extensively applied in earlier research to address endogeneity in financial literacy studies (Gilenko & Chernova, 2021; Morgan & Long, 2020; Van Rooij et al., 2011). Because these instruments mirror traditional financial literacy metrics and correspond to the core dimensions of digital financial literacy, though with a stronger

emphasis on digital settings, they are expected to effectively mitigate endogenous biases in this study. Consequently, the first-stage equations are formulated as follows:

$$FL_i = \alpha_0 + Z_i\alpha_1 + X_i\,\alpha_3 + \varepsilon_i \quad (5)$$

In this equation, Zi represents a vector of the given instrumental variables; Xi is a vector of control variables; and ε_i is the error term.

4. Results and discussion

4.1. Descriptive statistics

Table 6 provides a summary of the descriptive statistics for all key variables used in the study. It includes independent variables such as digital financial literacy (comprising financial knowledge, behavior, and attitudes) and digital finance components (e.g., mobile payments, online borrowing). The table also presents the dependent variables capturing financial inclusion and its subcomponents, as well as control variables related to demography. For each variable, the table reports the number of observations, mean, standard deviation, minimum, and maximum values.

Table 1 - Summary of key variables

		N	Mean	St. Dev	Min	Max
Independent Variable	Digital Financial Literacy	359	5.613	2.167	2	10
	Financial Knowledge	359	1.769	1.123	0	3
	Financial Behavior	359	2.242	0.900	0	4
	Financial Attitudes	359	1.671	0.757	0	3
	Digital Finance	359	0.571	0.496	0	1
	Mobile_Payments	359	0.574	0.495	0	1
	Online_FBs	359	0.301	0.459	0	1
	Online_Borrowing	359	0.187	0.390	0	1
Dependent Variable	Financial Inclusion	359	4.056	1.781	1	7
	Holding Product Subscore	359	2.056	1.254	0	4
	Payment Products	359	0.683	0.466	0	1
	Saving, Investment, Retirement Products	359	0.412	0.493	0	1
	Insurance Products	359	0.479	0.500	0	1
	Credit Products	359	0.479	0.500	0	1
	Active Consumption Subscore	359	2.003	0.789	0	3
Control Variable	Male	178	0.496	0.501		
	Female	181	0.504	0.501		
	Non-rural Area	160	0.554	0.498		
	Rural Area	199	0.446	0.498		
	18 - 30 Years Old	164	0.457	0.499		

31 - 60 Years Old	128	0.357	0.480
7.2 - 12 Million VND	99	0.276	0.448
> 12 Million VND	120	0.334	0.472
Secondary Education	55	0.153	0.361
Higher Education	202	0.563	0.497
Secondary Education (Parents)	93	0.259	0.439
Higher Education (Parents)	134	0.373	0.484
Married	168	0.468	0.500
Unmarried	191	0.532	0.500
Parental Job (Finance or related)	142	0.396	0.490
Personal Job (Finance or related)	146	0.407	0.492
Better Math	133	0.371	0.484
Financial Shock	205	0.571	0.496

As evident from Table 6 and Table 7, individuals identified as male, residing in non-rural locales, aged between 18 and 30, earning more than 12 million VND monthly, attaining higher educational levels, and maintaining unmarried status exhibit elevated scores when compared to their counterparts within the various demographic categories.

Specifically, demographic cohorts surpassing the mean score of financial inclusion (4.056, as indicated in Table 6) include males (4.49); individuals in non-rural areas (4.55); those aged 18 to 60 (5.05 and 4.10 respectively); those earning more than 12 million VND per month (5.03); those with higher educational attainment (5.32); and unmarried individuals (4.45).

In terms of digital financial literacy (mean = 5.613), male (6.20); non-rural areas (6.30); age between 18 and 60 (6.70 and 5.70 respectively); earning more than 12 million VND monthly (7.06); receiving higher education (7.09); and people in unmarried status (5.80) are groups that score higher.

Similarly, the digital finance score (mean = 0,571) exhibits lower values compared to males (0.66), individuals in non-rural areas (0.70), those aged 18 to 30 (0.85), those earning more than 12 million VND per month (0.78), individuals with higher educational attainment (0.92), and those in a single marital status (0.64).

Table 2 - Descriptive statistics

	Male	Female	Rural	Non-rural	Age 18 - 30
Digital Financial Literacy	6.20	5.03	4.76	6.30	6.70
Financial Knowledge	2.04	1.50	1.50	1.98	2.34
Financial Behavior	2.39	2.09	1.90	2.52	2.52
Financial Attitudes	1.82	1.52	1.42	1.87	1.84
Financial Inclusion	4.49	3.62	3.44	4.55	5.05
Holding Product Subscore	2.44	1.68	1.46	2.34	2.66
Active Consumption Subscore	2.06	1.95	1.73	2.22	2.40
Digital Finance	0.66	0.49	0.41	0.70	0.85

Mobile_Payments	0.66	0.49	0.40	0.71	0.86
Online_FPs	0.31	0.29	0.23	0.36	0.45
Online_Borrowing	0.21	0.16	0.16	0.21	0.24

	Age 31 - 60	7.2 – 12 mil VND	> 12 mil VND	Primary
Digital Financial Literacy	5.70	5.00	7.06	3.31
Financial Knowledge	1.77	1.47	2.18	0.83
Financial Behavior	2.37	2.02	2.73	1.72
Financial Attitudes	1.75	1.51	2.12	1.22
Financial Inclusion	4.10	3.62	5.03	2.00
Holding Product Subscore	2.13	1.82	2.68	0.81
Active Consumption Subscore	1.98	1.80	2.35	1.19
Digital Finance	0.52	0.45	0.78	0.05
Mobile_Payments	0.51	0.48	0.75	0.06
Online_FPs	0.27	0.18	0.37	0.00
Online_Borrowing	0.21	0.18	0.34	0.00

	Secondary	Higher education	Married	Unmarried
Digital Financial Literacy	4.80	7.09	5.40	5.80
Financial Knowledge	1.36	2.45	1.55	1.96
Financial Behavior	1.82	2.67	2.20	2.28
Financial Attitudes	1.55	1.97	1.65	1.69
Financial Inclusion	3.60	5.32	3.61	4.45
Holding Product Subscore	1.71	2.85	1.77	2.31
Active Consumption Subscore	1.89	2.48	1.85	2.14
Digital Finance	0.31	0.92	0.49	0.64
Mobile_Payments	0.33	0.91	0.48	0.65
Online_FPs	0.16	0.49	0.23	0.37
Online_Borrowing	0.11	0.30	0.20	0.17

4.2. Effects of digital financial literacy on financial inclusion & its components

The analysis examining the link between digital financial literacy and financial inclusion - alongside its sub-dimensions (holdings products and active consumption) - reveals a statistically meaningful and favorable relationship. To mitigate endogeneity concerns, the analysis employed a two-stage instrumental variables (IV) strategy using "better math" and "financial shock" as instruments. Validation checks, including the Sargan test, confirmed the instruments' exogeneity and reliability, with no evidence of under-identification or insufficient instrument strength except in the case of the active engagement subscore.

Results from both the OLS and instrumental-variables regressions consistently show that greater digital financial literacy markedly boosts overall financial inclusion and all of its sub-indices. The IV coefficients are larger than the OLS estimates, indicating that correcting for endogeneity uncovers an even stronger effect. These findings emphasize that digital financial competence broadens access to digital financial services and, in turn, stimulates economic engagement and bolstering financial resilience. They are consistent with earlier evidence on traditional financial literacy and inclusion (Hasan et al., 2023; Morgan & Long, 2020).

The demographic analysis reveals that gender has little effect on overall financial inclusion. Men are more likely to own financial products but are less active users of digital financial services. In contrast, age and education matter more: older individuals and those with advanced educational qualifications are more inclined to adopt digital financial tools, probably because of their wider experience and earlier exposure to technology. On the other hand, being married is linked to lower levels of financial inclusion, which may be attributed to increased household financial responsibilities.

These findings highlight several strategies the Vietnamese government can adopt to improve financial inclusion. First, raising public familiarity with digital financial services while highlighting the importance of online security can strengthen digital financial literacy and safeguard individuals against financial risks. Second, encouraging higher educational attainment - especially among ethnic minorities - by supporting school attendance and investing in educational infrastructure can further promote financial inclusion. Lastly, offering targeted financial support or incentives to married households, who often face greater economic challenges, can enable them to save, invest, and open the door to a broader array of financial services, ultimately improving their overall financial health.

Table 3 - Digital financial literacy affects financial inclusion & its components

	OLS Model		
	(1) Financial Inclusion Score	(2) Holding Products Subscore	(3) Active Consumption Subscore
Digital Financial Literacy	0.402***	0.336***	0.062**
	[0.038]	[0.037]	[0.027]
Male	0.024	0.250	- 0.235***
	[0.079]	[0.078]	[0.056]
Non-rural Area	0.027	- 0.078	0.109*
	[0.080]	[0.079]	[0.057]
Age	0.175***	0.145**	0.031
	[0.059]	[0.058]	[0.042]
Income	0.050	0.005	0.052
	[0.055]	[0.054]	[0.039]
Personal Education	0.634***	0.315***	0.323***
	[0.063]	[0.063]	[0.045]
Parental Education	0.112**	0.038	0.078*
	[0.055]	[0.054]	[0.039]
Marital Status (Married)	- 0.233***	- 0.161*	- 0.078
	[0.085]	[0.084]	[0.061]
Parental Job (Finance or related)	- 0.012	- 0.164*	0.161**
	[0.090]	[0.088]	[0.064]
Personal Job (Finance or related)	- 0.038	- 0.140	0.097
	[0.094]	[0.092]	[0.067]
R - squared	0.8530	0.7109	0.6207
N	359	359	359

*Note: Figures in brackets are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The dependent variables are coefficient scores. Source: Author's work.

	IV (2nd stage)		
	(1) Financial Inclusion Score	(2) Holding Products Subscore	(3) Active Consumption Subscore

Digital Financial Literacy	0.451***	0.323***	0.123***
	[0.054]	[0.053]	[0.038]
Male	0.019	0.252***	- 0.241***
	[0.078]	[0.077]	[0.056]
Non-rural Area	0.012	- 0.074	0.092
	[0.079]	[0.078]	[0.057]
Age	0.164***	- 0.148	0.017
	[0.059]	[0.058]	[0.042]
Income	0.030	0.010	0.028
	[0.056]	[0.055]	[0.040]
Personal Education	0.589***	0.326***	0.266***
	[0.072]	[0.071]	[0.051]
Parental Education	0.092	0.043	0.053
	[0.057]	[0.056]	[0.040]
Marital Status (Married)	- 0.244***	- 0.158**	- 0.092
	[0.084]	[0.083]	[0.060]
Parental Job (Finance or related)	- 0.043	- 0.156*	0.123*
	[0.092]	[0.090]	[0.066]
Personal Job (Finance or related)	- 0.076	- 0.130	0.049
	[0.097]	[0.096]	[0.069]
Durbin (Score) Chi2(1) (P value)	0.1963	0.7420	0.0249
Wu - Hausman F(1,410) (P value)	0.2038	0.7464	0.0271
Sargan (Score) Chi2(1) (P value)	0.0967	0.2637	0.3413
Basman Chi2(1) (P value)	0.1012	0.2710	0.3489
R - squared	0.8522	0.7108	0.6150
N	359	359	359

*Note: Figures in brackets are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The dependent variables are coefficient scores. Source: Author's work.

4.3. Effects of digital finance on financial inclusion & its components

The table offers a detailed overview of how digital finance shapes financial inclusion and its various facets. Since previous studies lacked suitable instruments to correct for potential endogeneity, this analysis relies solely on Ordinary Least Squares (OLS) estimation.

Table 9 shows that every variable - overall financial inclusion as well as its sub-dimensions of product ownership and active usage - has a positive impact. This evidence underscores how digital finance promotes inclusion: the broad uptake of mobile devices, computers, internet access, and smart payment cards has quickly widened the availability of financial products and services for both providers and consumers. These results echo prior studies by Ozili & Peterson (2018), Thathsarani & Jianguo

(2022), and Li, Wu & Xiao (2019), all of which highlight the central role of digital technologies in accelerating financial inclusion.

Analysis of demographic factors reveals that men, compared with women, have a higher propensity to use tech devices and engage on financial platforms, resulting in more frequent and informed engagement with financial services. Older individuals also demonstrate a greater tendency to hold a diverse range of financial products, suggesting increased participation in payment, investment, and credit activities. Higher-income levels are associated with greater use of technology for investment and savings purposes. Furthermore, individuals with higher level of education achieved are more inclined to utilize financial products and services, and those with personal or parental backgrounds in the financial sector are more likely to adopt inclusive finance practices and engage in active financial consumption.

Table 4 - Digital finance affects financial inclusion & its components

	OLS Model		
	(1) Financial Inclusion Score	(2) Holding Products Subscore	(3) Active Consumption Subscore
Digital Finance	0.689***	0.700***	0.290**
	[0.147]	[0.144]	[0.096]
Male	0.090	0.303***	- 0.221***
	[0.085]	[0.084]	[0.056]
Non-rural Area	0.121	0.004	0.121**
	[0.085]	[0.084]	[0.056]
Age	0.285***	0.235***	0.051
	[0.063]	[0.062]	[0.041]
Income	0.183***	0.120**	0.069*
	[0.057]	[0.056]	[0.037]
Personal Education	0.801***	0.480***	0.320***
	[0.065]	[0.063]	[0.042]
Parental Education	0.089	0.043	0.049
	[0.064]	[0.062]	[0.042]
Marital Status (Married)	- 0.174*	- 0.108	- 0.073
	[0.092]	[0.090]	[0.060]
Parental Job (Finance or related)	0.192**	0.012	0.186**
	[0.094]	[0.092]	[0.061]
Personal Job (Finance or related)	0.202**	0.069	0.124**
	[0.097]	[0.095]	[0.063]
R - squared	0.8279	0.6667	0.6247
N	359	359	359

*Note: Figures in brackets are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The dependent variables are coefficient scores. Source: Author's work.

4.4. Effects of digital financial literacy's components on financial inclusion & its components

Table 10 reports OLS estimates showing how each facet of digital financial literacy - financial knowledge, behavior, and attitudes - influences overall financial inclusion and its components. All three dimensions are strongly associated with both total financial inclusion and the product-holding subscore. However, only financial knowledge appears to have a strong connection with the Active consumption subscore.

Looking more closely at the four indicators within the Holding products subscore, financial knowledge is positively related to the ownership of savings, investment, retirement, and credit products. Financial behavior, significant at the 5% level, influences the holding of savings, investment, retirement, and insurance products. Additionally, financial attitudes are positively associated with insurance product ownership. None of the digital financial literacy components, however, show a relationship with holding payment products. These results should be viewed cautiously, as the three literacy measures may suffer from multicollinearity.

Table 5 - Digital financial literacy's components affect financial inclusion & its components

	OLS Model		
	(1) Financial Inclusion Score	(2) Holding Products Subscore	(3) Active Consumption Subscore
Financial Knowledge	0.455***	0.331***	0.125***
	[0.057]	[0.056]	[0.039]
Financial Behavior	0.252***	0.237***	0.002
	[0.059]	[0.058]	[0.040]
Financial Attitude	0.296***	0.307***	- 0.008
	[0.073]	[0.071]	[0.049]
Male	0.003	0.240***	- 0.252***
	[0.082]	[0.081]	[0.056]
Non-rural Area	0.066	- 0.065	0.137**
	[0.083]	[0.082]	[0.057]
Age	0.129**	0.111*	0.020
	[0.062]	[0.061]	[0.042]
Income	0.149***	0.068	0.088**
	[0.056]	[0.055]	[0.038]
Personal Education	0.736***	0.416***	0.320***
	[0.063]	[0.061]	[0.043]
Parental Education	0.065	- 0.002	0.071*
	[0.060]	[0.058]	[0.041]
Marital Status (Married)	- 0.185**	- 0.117	- 0.075
	[0.088]	[0.086]	[0.060]
Parental Job (Finance or related)	0.043	- 0.121	0.169***
	[0.093]	[0.091]	[0.063]
Personal Job (Finance or related)	0.008	- 0.128	0.130
	[0.099]	[0.097]	[0.067]
R - squared	0.8426	0.6969	0.6279
N	359	359	359

*Note: Figures in brackets are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The dependent variables are coefficient scores. Source: Author's work.

4.5. Effects of digital financial literacy on holding products by type (IV estimation)

Table 11 assesses how digital financial literacy (DFL), together with the control variables, influences four product groups - payment instruments, savings/investment and retirement vehicles, insurance policies, and credit products. Using the IV (2nd stage) approach, the study reveals nuanced relationships between these variables and product preferences. Diagnostic tests (Cragg-Donald Wald F, Durbin, Wu–Hausman, Basman) confirm the robustness of instrumental variables, except for insurance products. The Sargan test validates the exclusion restriction, ensuring instrument exogeneity. Estimation results indicate that DFL significantly influences payment, savings/investment/retirement, and credit products (1%–10% significance levels), but exhibits no discernible effect on insurance ownership. Demographic analysis further highlights distinct patterns. Men demonstrate a stronger preference for investment and insurance products, while gender disparities are negligible for payment and credit products. Residents in affluent regions prioritize payment products over frugal financial behaviors. Older individuals show greater engagement with payment, insurance, and credit products. Higher-income correlates with increased insurance ownership (e.g., life, physical insurance) but reduced interest in credit products. Individuals with advanced education exhibit heightened usage of all products except savings/investment/retirement, while those with personal or familial ties to the financial sector display lower engagement with credit and insurance products.

Table 6 - Digital financial literacy affects holding products by type (IV estimation)

	IV (2nd stage)			
	(1) Payment Products	(2) S, I, R Products	(3) Insurance Products	(4) Credit Products
Digital Financial Literacy	0.047*	0.155***	0.012	0.115***
	[0.024]	[0.031]	[0.033]	[0.033]
Male	0.008	0.160***	0.161***	- 0.069
	[0.035]	[0.046]	[0.048]	[0.048]
Non-rural Area	0.097***	- 0.126***	- 0.032	- 0.018
	[0.035]	[0.046]	[0.048]	[0.049]
Age	0.110***	- 0.083**	0.060*	0.060*
	[0.026]	[0.034]	[0.036]	[0.036]
Income	- 0.040	- 0.052	0.160***	- 0.066**
	[0.025]	[0.033]	[0.034]	[0.034]
Personal Education	0.163***	- 0.064	0.111**	0.112**
	[0.032]	[0.042]	[0.044]	[0.044]
Parental Education	0.036	0.046	0.003	- 0.047
	[0.025]	[0.033]	[0.034]	[0.035]
Marital Status (Married)	- 0.067*	- 0.153***	0.145***	- 0.076
	[0.038]	[0.049]	[0.051]	[0.052]
Parental Job (Finance or related)	0.004	- 0.065	0.107*	- 0.211***
	[0.041]	[0.053]	[0.056]	[0.056]
Personal Job (Finance or related)	0.024	0.036	- 0.199***	0.014
	[0.043]	[0.057]	[0.059]	[0.060]
Durbin (Score) Chi2(1) (P value)	0.5699	0.0123	0.0001	0.1989
Wu - Hausman F(1,410) (P value)	0.5766	0.0135	0.0001	0.2064
Sargan (Score) Chi2(1) (P value)	0.0412	0.9555	0.3413	0.3308
Basman Chi2(1) (P value)	0.0435	0.9563	0.3555	0.3384
R - squared	0.5697	0.3437	0.3631	0.2915
N	359	359	359	359

*Note: Figures in brackets are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The dependent variables are coefficient scores. Source: Author's work.

4.6. Effects of digital finance on holding products by type (IV estimation)

Table 12 depicts the correlation between digital finance and product holdings across four indicators of financial inclusion. It discerns that digital finance is significantly linked to holding all types of products except insurance ones at a 1% level. Regarding demographic variables, males exhibit a higher utilization of savings, investment, pension, and insurance products compared to other genders, while both genders display a similar frequency in the use of payment and credit products. Additionally, residents in urban areas demonstrate an increased engagement with payment products, such as Internet banking. Moreover, individuals of higher age actively embrace financial products like payment and credit products.

Likewise, individuals with moderate and high levels of education manifest a greater financial possession of all products excluding saving, investment, and retirement products. This aligns with respondents employed in the financial industry, who show a propensity for using savings, investment, and retirement products extensively. Notably, individuals whose parents work in the financial sector tend to favor insurance products while avoiding credit products.

Table 7 - Digital finance affects holding products by type

	OLS Model			
	(1) Payment Products	(2) S, I, R Products	(3) Insurance Products	(4) Credit Products
Digital Finance	0.169***	0.291***	- 0.028	0.267***
	[0.061]	[0.080]	[0.084]	[0.084]
Male	0.017	0.184***	0.162***	- 0.051
	[0.035]	[0.046]	[0.048]	[0.049]
Non-rural Area	0.107***	- 0.088*	- 0.028	0.009
	[0.036]	[0.046]	[0.049]	[0.049]
Age	0.124***	- 0.042	0.062*	0.091**
	[0.026]	[0.034]	[0.036]	[0.035]
Income	- 0.026	0.002	0.166***	- 0.028
	[0.024]	[0.031]	[0.032]	[0.033]
Personal Education	0.172***	0.019	0.128***	0.162***
	[0.027]	[0.035]	[0.037]	[0.037]
Parental Education	0.023	0.054	0.013	- 0.050
	[0.026]	[0.034]	[0.036]	[0.036]
Marital Status (Married)	- 0.062	- 0.128**	0.149***	- 0.059
	[0.038]	[0.050]	[0.052]	[0.052]
Parental Job (Finance or related)	0.025	0.017	0.116**	- 0.152***
	[0.039]	[0.051]	[0.053]	[0.054]
Personal Job (Finance or related)	0.048	0.135	- 0.188***	0.083
	[0.040]	[0.052]	[0.055]	[0.055]

R - squared	0.5659	0.3432	0.2972	0.2891
N	359	359	359	359

*Note: Figures in brackets are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The dependent variables are coefficient scores. Source: Author's work.

5. Conclusion & recommendations

Using a survey aligned with international norms and benchmarked against global data, this study seeks to uncover the primary factors shaping financial inclusion in Vietnam. The results show Vietnam has advanced markedly in financial inclusion, spurred by pandemic-related shifts and continued economic growth. A strong, positive link between digital financial literacy, digital finance, and inclusion underlies this progress: stronger digital skills allow more people to access and use a wider range of financial products and services. The evidence confirms that digital financial literacy plays a vital role in advancing financial inclusion, echoing earlier findings (Hasan et al., 2023; Morgan & Long, 2020; Bire et al., 2019). In parallel, the rapid expansion of digital finance - driven by the proliferation of mobile devices, online banking, and integrated payment platforms - has expanded both the supply of and demand for financial services, as noted by Thathsarani & Jianguo (2022) and Ozili (2018). The analysis further indicates that people with at least secondary education and those aged 18–60 more inclined to embrace digital financial services compared to individuals with less schooling or those over 60.

To promote digital financial literacy and enhance financial inclusion in Vietnam, coordinated efforts from various stakeholders are essential. For government and regulatory bodies, it is important to develop and enforce policies that ensure equitable access to digital financial services, particularly for rural and underserved populations. This includes providing subsidies for internet infrastructure and digital devices, as well as integrating digital financial education into national strategies through local-level training. Educational institutions should incorporate financial literacy into school and university curricula, emphasizing practical skills such as digital payments, budgeting, and fraud prevention. They can also partner with financial institutions to deliver workshops and experiential learning programs, while offering lifelong learning initiatives for older and rural populations. Financial service providers and fintech companies are encouraged to simplify the onboarding process for financial products, develop user-friendly digital platforms in local languages, and collaborate with public agencies to build trust and raise awareness. In parallel, research institutions and policymakers should conduct ongoing studies to assess the effectiveness of financial literacy programs, identify access barriers, and inform adaptive, evidence-based policy reforms. These actions, if implemented collectively, can accelerate the adoption of digital finance, reduce socioeconomic disparities, and ensure that Vietnam's digital transformation is inclusive and sustainable.

Despite these contributions, the study has certain limitations. The sample focused solely on Vietnamese participants, potentially limiting the extent to which the findings can be applied to other contexts. Future investigations should include cross-national comparisons involving larger and more heterogeneous participant pools. Additionally, cultural influences on digital financial literacy, such as attitudes toward risk and savings, were not thoroughly addressed and merit further exploration. The

reliance on self-reported data may also introduce bias; therefore, subsequent studies should include objective measures of financial behavior to enhance the robustness and validity of the findings.

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Conflict of interest

The authors declare no conflict of interest.

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