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Digital Financial Inclusion and Socioeconomic Sustainability in Saudi Arabia: Drivers, Disparities, and Policy Pathways

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ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية

Working Paper No. 1783
July 2025

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July 2025

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First published in 2025 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Abstract

This study explores the evolution, determinants, and disparities of digital financial inclusion (DFI) in Saudi Arabia from 2011 to 2021, with a focus on the post-COVID-19 period. Using micro-level cross-sectional data from the World Bank's Global Findex database, we apply a multivariate Probit regression to examine the drivers of DFI across demographic, socioeconomic, and infrastructural dimensions. While Saudi Arabia has made notable progress in digital finance, gaps persist among women, the less educated, low-income groups, and the unemployed. Access to mobile phones and internet connectivity significantly enhances DFI, underscoring the role of digital infrastructure. As the first systematic analysis of DFI in Saudi Arabia using Global Findex data, this study provides timely insights into the inclusive digital transformation process. Importantly, it highlights how expanding equitable access to digital financial services can support broader goals of socioeconomic sustainability, reduce structural inequalities, and contribute to the Vision 2030 agenda. The findings offer practical guidance for policymakers seeking to design sustainable, inclusive financial ecosystems in the digital era.

Keywords: Digital Financial Inclusion (DFI), Saudi Arabia, Probit model, Socio-demographic characteristics, Saudi Vision 2030.
JEL classification: G21; O33; I38; D63; O53; C35

ملخص

تتناول هذه الدراسة تطوّر الشمول المالي الرقمي في المملكة العربية السعودية خلال الفترة من 2011 إلى 2021، مع التركيز على مرحلة ما بعد جائحة كوفيد-19. بالاعتماد على بيانات مقطعية على المستوى الفردي من قاعدة بيانات المؤشرات العالمية للشمول المالي (Global Findex) التابعة للبنك الدولي، تستخدم الدراسة نموذج بروبيت متعدد المتغيرات لتحليل محددات الشمول المالي الرقمي عبر الأبعاد الديموغرافية والاجتماعية والاقتصادية والبنية التحتية. على الرغم من التقدّم الملحوظ الذي أحرزته المملكة في مجال التمويل الرقمي، لا تزال هناك فجوات قائمة بين النساء، وذوي المستويات التعليمية المنخفضة، وذوي الدخل المحدود، والعاطلين عن العمل. ويُظهر التحليل أن الوصول إلى الهواتف المحمولة والاتصال بالإنترنت يعزز بشكل كبير الشمول المالي الرقمي، مما يبرز الدور الحاسم للبنية التحتية الرقمية. تُعد هذه الدراسة أول تحليل منهجي للشمول المالي الرقمي في السعودية باستخدام بيانات Global Findex، وتوفر رؤى حديثة حول مسار التحول الرقمي الشامل. وتُبرز النتائج كيف يمكن لتوسيع الوصول العادل إلى الخدمات المالية الرقمية أن يدعم أهداف الاستدامة الاجتماعية والاقتصادية، ويقلّص أوجه عدم المساواة الهيكلية، ويسهم في تحقيق مستهدفات رؤية السعودية 2030. كما تقدم الدراسة توصيات عملية لصنّاع السياسات لتصميم منظومات مالية رقمية مستدامة وشاملة في العصر الرقمي.

1. Introduction

Digital financial inclusion (DFI) refers to the provision of accessible and affordable formal financial services to those who would otherwise be excluded, facilitated by digital technology. DFI utilizes digital tools such as mobile phones and internet services to enable transactions, savings, borrowings, and insurance. The aim is to offer these services in a way that is affordable for consumers and sustainable for providers, ultimately integrating more people into the formal economy (IFG, 2024; World Bank, 2022).

Globally, DFI has attracted growing interest from academics and policymakers due to its impact on sustainable development, poverty reduction, and the promotion of inclusive growth by bringing unbanked populations into formal financial systems through digital means (Inoue, 2024). Financial inclusion, particularly its digital dimension, is crucial for Saudi Arabia as it attempts to achieve the ambitious goals set by Vision 2030, which include diversifying the economy, reducing dependency on oil, and enhancing the quality of life for all citizens. Also, financial inclusion is vital for ensuring that everyone, including the unbanked, can fully participate in the economy, making it essential for inclusive growth and empowerment (Saudi Vision 2030, 2024). Achieving nationwide digital financial inclusion aligns with Vision 2030's broader objectives of economic diversification and sustainable development by fostering an inclusive and resilient Saudi financial system.

While extensive literature examines the determinants of financial inclusion across various countries (see, e.g., Nandru et al., 2021; Anakpo et al., 2023; Al Khub et al., 2024), there remains a gap in empirical research on DFI determinants specific to Saudi Arabia. This study seeks to address that gap. The primary objective is to identify the key drivers of digital financial inclusion in Saudi Arabia, with a particular focus on the post-COVID-19 pandemic period. By examining the socio-demographic and infrastructural factors that influence DFI, this study offers deeper insights into Saudi Arabia's rapidly evolving digital landscape. Additionally, the study aims to trace the evolution of DFI in Saudi Arabia by analyzing cross-sectional data from the World Bank's Global Financial Inclusion (Global Findex) database for the years 2011, 2014, 2017, and 2021.

By identifying the main factors driving DFI, the study informs more targeted strategies to foster economic growth and facilitate the country's broader economic transformation. The findings are expected to help in designing strategies that enhance digital financial services and advancing the goals of Vision 2030.

The remainder of the paper is organized as follows: Section two discusses how DFI contributes to the goals of Saudi Vision 2030. Section three provides an overview of the evolution of DFI in Saudi Arabia from 2011 to 2021. Section four reviews the relevant empirical literature. Section five discusses data and econometric methodology. Section six presents empirical results. Section seven discusses the findings and concludes with policy recommendations.

2. Digital financial inclusion and Saudi Vision 2030

Digital financial inclusion is expected to support Saudi Vision 2030 in several ways, helping the Kingdom achieve economic, social, and financial objectives central to its development agenda. This section outlines the pathways through which DFI could contribute to Vision 2030's goals.

Vision 2030 aims to diversify Saudi Arabia's economy and reduce reliance on oil revenues. DFI enables individuals, unbanked populations, and small and medium enterprises (SMEs) to access financial services, facilitating business startup and growth. Digital banking, crowdfunding, and fintech platforms streamline access to loans, payments, and investments, aligns with Vision 2030's emphasis on SME expansion and job creation. This, in turn, supports the growth of sectors such as e-commerce, fintech, and tech-enabled services, contributing to a diversified economy.

SMEs are central to Vision 2030's objective of increasing the private sector's GDP contribution. DFI provides SMEs with access to financing and digital payment systems, simplifying business operations, cash flow management, and market expansion. Programs such as the Kafalah initiative and regulatory support from the Saudi Arabian Monetary Authority (SAMA) promote digital financing solutions for SMEs, in line with Vision 2030's goal of boosting SME contributions to the economy (Vision 2030, 2023).

Vision 2030 emphasizes social inclusivity, with digital finance playing a critical role in integrating unbanked populations into the financial system. Mobile banking, digital wallets, and online financial education programs make banking accessible to remote and underserved areas, supporting Vision's goal of equal opportunity for all citizens. Through DFI, more individuals gain access to basic banking, savings, and credit services, which helps families manage finances, overcome economic challenges, and contribute to the broader economy. DFI also enhances financial literacy among digital service users, increases the understanding of savings, investments, and budgeting. This increase in financial literacy strengthens economic resilience and supports an informed population, which are key to Vision 2030's aspirations (Al-Mazmoumi, 2024).

Digital inclusion of marginalized groups, youth, and women ensure that more people are financially literate and economically active. By providing women with digital access to financial tools, Saudi Arabia supports women's empowerment and economic participation which is an important critical element of Vision 2030. Digital finance enables women, particularly those in conservative areas with limited mobility, to access and manage funds independently. Digital platforms allow women entrepreneurs to start online businesses, access loans, and receive payments, aligning with Vision 2030's goal of promoting gender equality in the economy (International trade administration, 2024).

A digitally inclusive financial ecosystem attracts international investors and fintech companies seeking to establish operations in Saudi Arabia. Vision 2030 seeks to position the Kingdom as a leading investment hub in the region. By building a strong digital finance environment, Saudi

Arabia can attract foreign investment, partnerships, and technological expertise to stimulate economic growth.

Fintech and digital financial services also generate new employment opportunities in high-growth sectors such as technology, data analytics, cybersecurity, and financial services, in alignment with Vision 2030's goal of reducing unemployment and creating sustainable jobs (Khard, 2024).

DFI also contributes to poverty reduction by improving welfare distribution. Digital financial services facilitate the efficient distribution of welfare benefits and government subsidies, reaching recipients directly and reducing administrative costs, supporting Vision 2030's aim to reduce poverty and promote economic stability (International trade administration, 2024).

DFI can further enhance government efficiency. By digitizing financial transactions, the Saudi government can simplify subsidy distribution, welfare payments, and tax collection. Digital finance reduces inefficiencies in government spending and improves fiscal management, aligning with Vision 2030's goal to improve the quality and effectiveness of government services (Vision 2030, 2021).

Vision 2030 also aims to transform Saudi Arabia into a cashless society by 2030. Digital payment infrastructure, driven by initiatives such as Mada (Saudi Arabia's domestic payment network), is essential to this shift. A cashless society reduces cash handling costs, increases financial transparency, and mitigates fraud risks, aligning with Vision 2030's goal of fostering a more efficient and transparent economy.

Vision 2030 encourages the growth of the tech sector, including fintech innovation. DFI initiatives often utilize advanced technologies, such as blockchain and AI-driven financial tools, promoting a culture of innovation. Government support for fintech hubs, such as the Fintech Saudi initiative, aligns with Vision 2030's ambition to build a technology-driven economy (Khard, 2024).

As DFI expands, cybersecurity gains more importance. Enhanced cybersecurity measures protect individuals, businesses, and the financial ecosystem, aligning with Vision 2030's commitment to a safe and reliable digital infrastructure.

Recognizing the significance of DFI, the Saudi government has launched several initiatives to promote DFI under Vision 2030. One such initiative is the SAMA Fintech Sandbox, which allows companies to test innovative financial products in a controlled environment. Additional initiatives include digital payment infrastructure (e.g., Mada, SADAD, and Apple Pay), which expand digital payment options nationwide. The Fintech Saudi initiative supports fintech sector growth and enhances digital financial literacy. Additionally, Saudi Arabia's Khazna program provides underserved communities with financial literacy education and financial management tools, supporting Vision 2030's inclusivity goals.

In summary, DFI is integral to Vision 2030's objectives of economic transformation, diversification, and improved quality of life. By expanding access to digital financial services, Saudi Arabia is creating a more inclusive, transparent, and resilient economy, laying the foundation for sustainable growth.

3. Evolution of digital financial inclusion disparities in Saudi Arabia

In this section, we analyze the evolution of DFI and its disparities across socio-economic groups in Saudi Arabia using cross-sectional data from the World Bank's Global Financial Inclusion (Global Findex) database for the years 2011, 2014, 2017, and 2021.

Figures 1 to 9 show the trends in a set of financial inclusion indicators from 2011 to 2021 across different socio-demographic groups. All figures display an upward trend, indicating progress in digital financial inclusion as reflected by various indicators. For instance, the percentage of adults in Saudi Arabia with an account at a financial institution increased from 46% in 2011 to 74% in 2021. Figure 2 reveals a significant rise in the percentage of females with a financial institution account, from 15% in 2011 to 63% in 2021, reflecting government efforts to promote women's empowerment in Saudi Arabia. However, Figure 2 also indicates a persistent gender gap in financial inclusion, as the proportion of females holding financial institution accounts remains lower than that of males.

Figure 1.
Financial institution account (% age 15+)

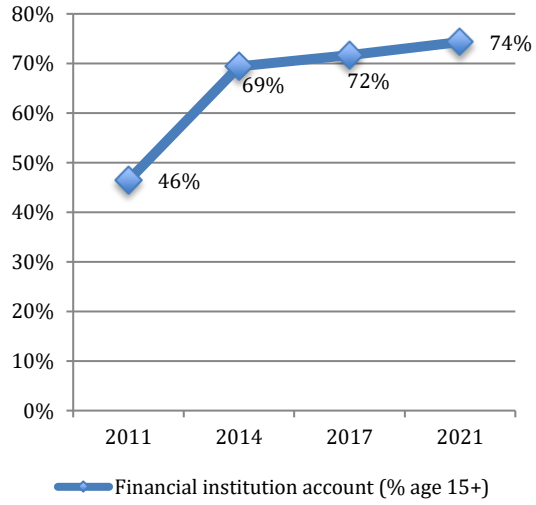
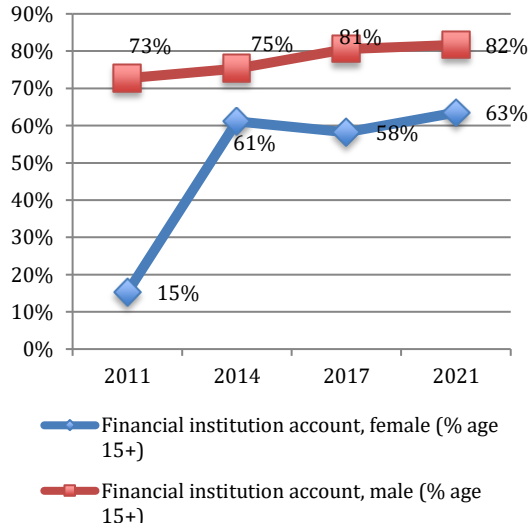


Figure 2.
Financial institution account by Gender



Source: Authors' calculation based on Global Findex Database.

Figures 3 and 4 highlight some persistent inequalities in financial inclusion based on education and income levels. Specifically, the wealthiest 60% of Saudi adults are more financially included than the poorest 40%, though this inequality has lessened over time. In 2011, while only 33% of

the poorest 40% of Saudi adults had a financial institution account, 55% of the wealthiest 60% did. By 2021, 67% of adults in the poorest 40% held an account, compared to 79% in the wealthiest 60%.

Figure 3.
Financial institution account by education level

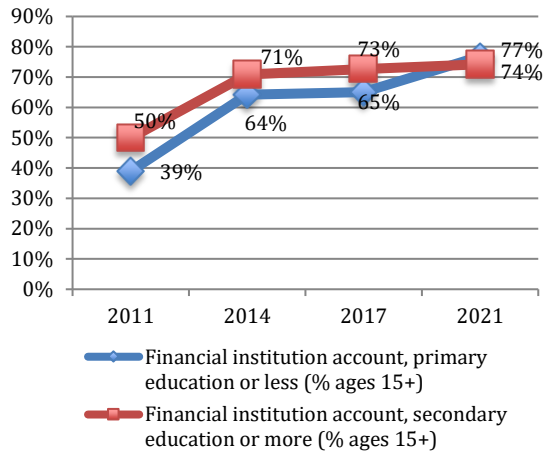
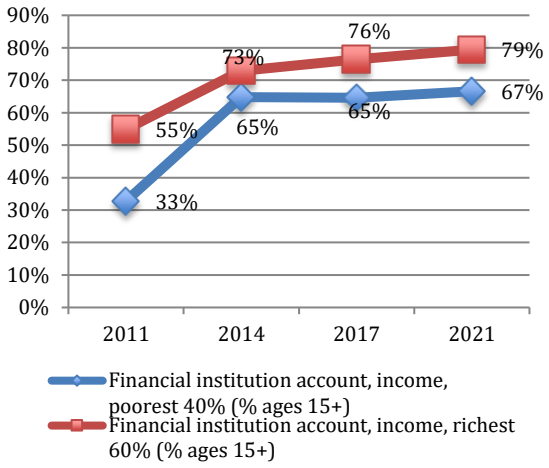


Figure 4.
Financial institution account by income level



Source: Authors' calculation based on Global Findex Database.

Similarly, financial inclusion disparities based on education level are evident. In 2011, 39% of Saudi adults with a primary education or less reported having a financial institution account, compared to 50% of those with secondary education or higher. Notably, by 2021, this educational gap in financial inclusion had disappeared, as the inclusion rates for both educational groups reached parity.

Figure 5 shows a substantial increase in the percentage of Saudi adults making or receiving digital payments, from 51% in 2011 to 73% in 2021. Additionally, the proportion of adults making utility payments via mobile phones rose almost eightfold from 6% in 2014 to 43% in 2021. Figure 6 similarly displays a marked increase in the percentage of adults using mobile phones or the internet to pay bills, from 31% in 2017 to 62% in 2021.

Figure 5.
Made or received a digital payment (% age 15+)

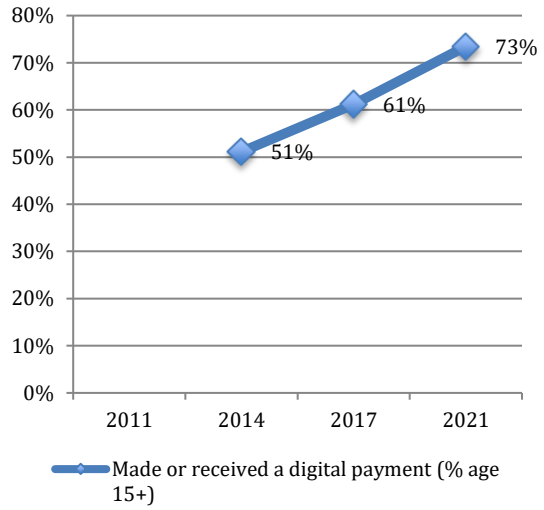
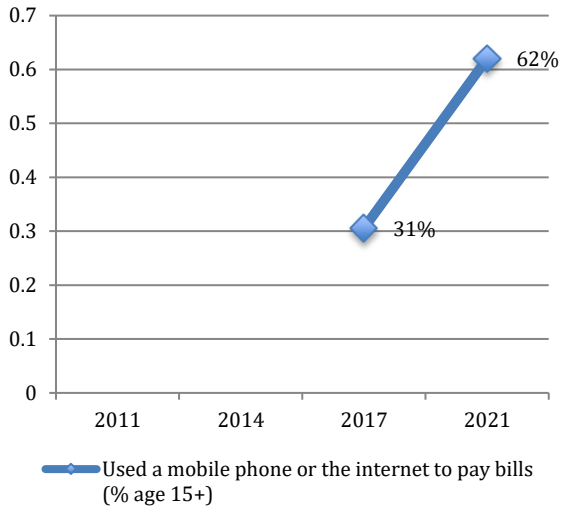


Figure 6.
Used a mobile phone or the internet to pay bills (% age 15+)



Source: Authors' calculation based on Global Findex Database.

Figures 10 to 16 reveal notable disparities in DFI by employment status, education level, income level, Internet access, and mobile phone ownership. Employed individuals and those with tertiary education levels are more engaged in digital financial activities, especially in advanced transactions like online bill payments and money transfers.

The data indicates that individuals in higher income quintiles, those with internet access, and mobile phone owners are more likely to participate in digital financial services. Among age groups, those aged 25-35 are the most active in digital transactions. Gender comparisons show that, overall, men engage more in digital financial transactions than women, although the gender gap has narrowed in specific areas, such as digital merchant payments.

Figure 7.
Made a utility payment: using a mobile phone (% age 15+)

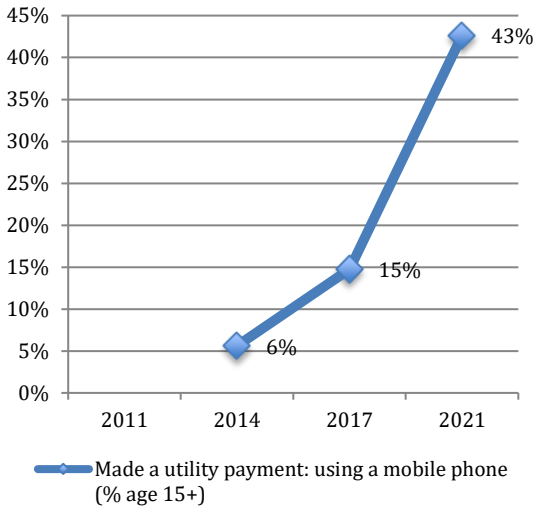
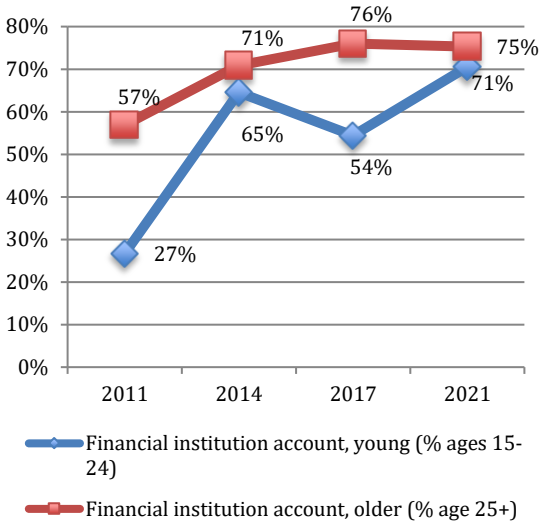
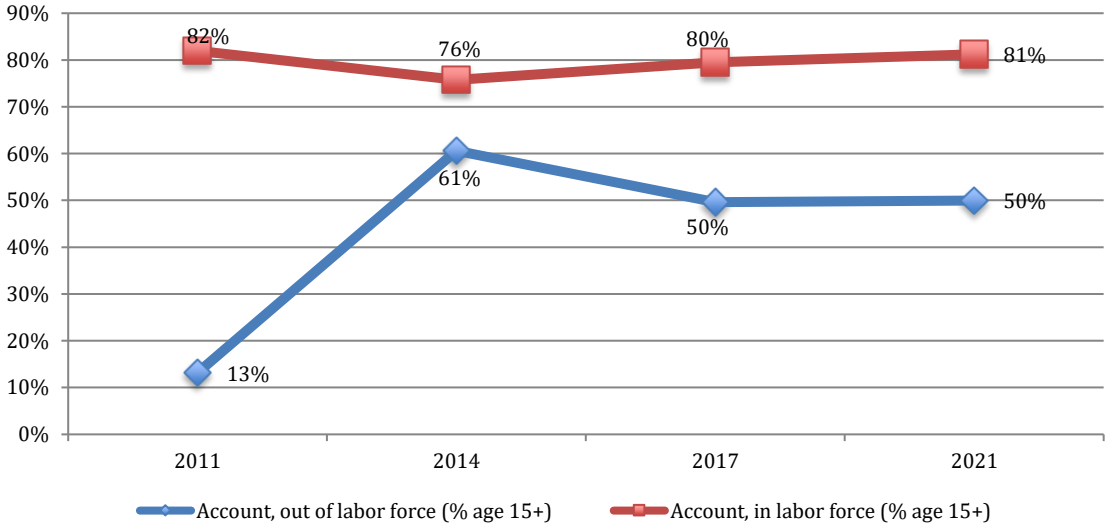


Figure 8.
Financial institution account by age



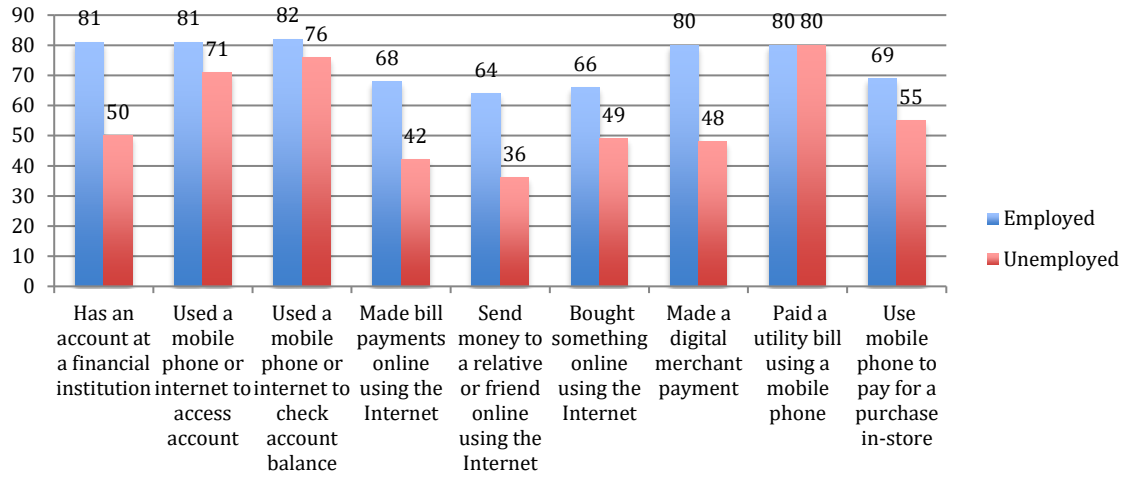
Source: Authors' calculation based on Global Findex Database.

Figure 9. Financial institution by employment status



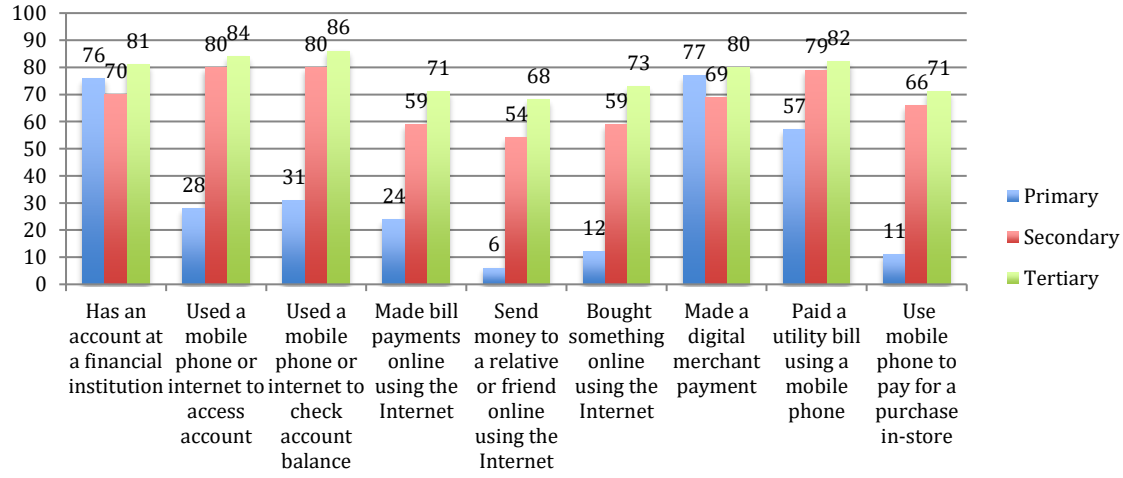
Source: Authors' calculation based on Global Findex Database.

Figure 10. Financial inclusion by employment status



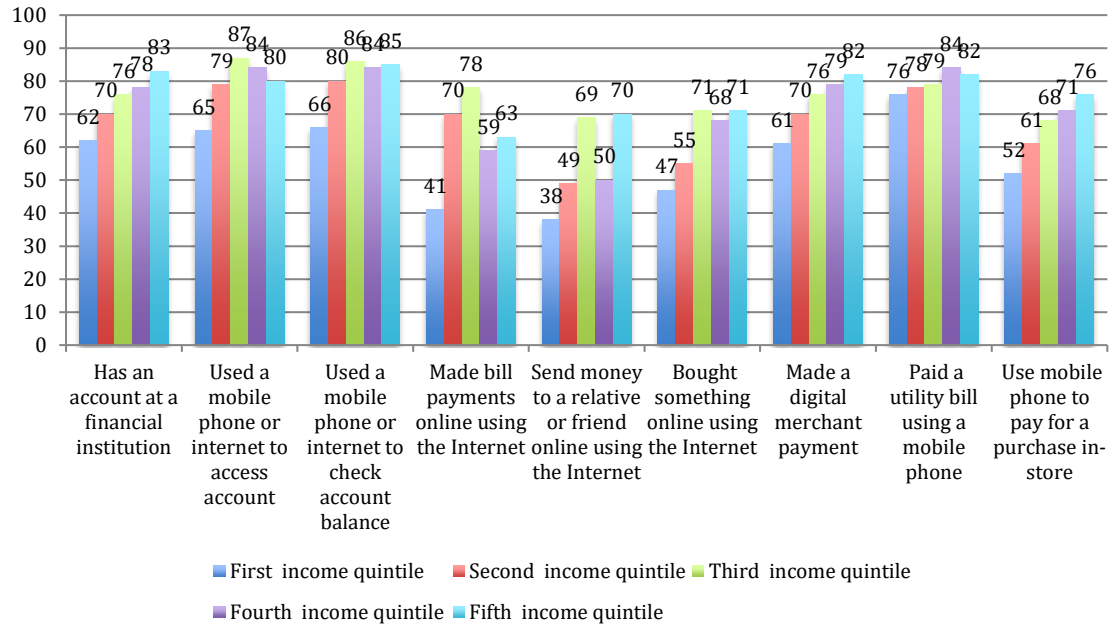
Source: Authors' calculation based on 2021 Global Findex Database.

Figure 11. Financial inclusion by education level



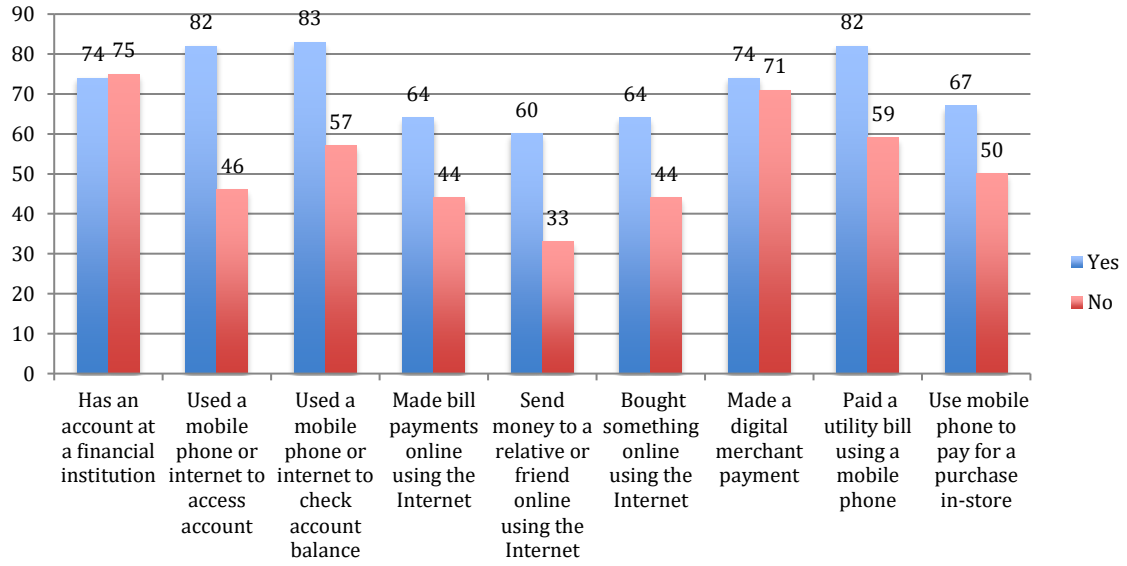
Source: Authors' calculation based on 2021 Global Findex Database.

Figure 12. Financial Inclusion by income level



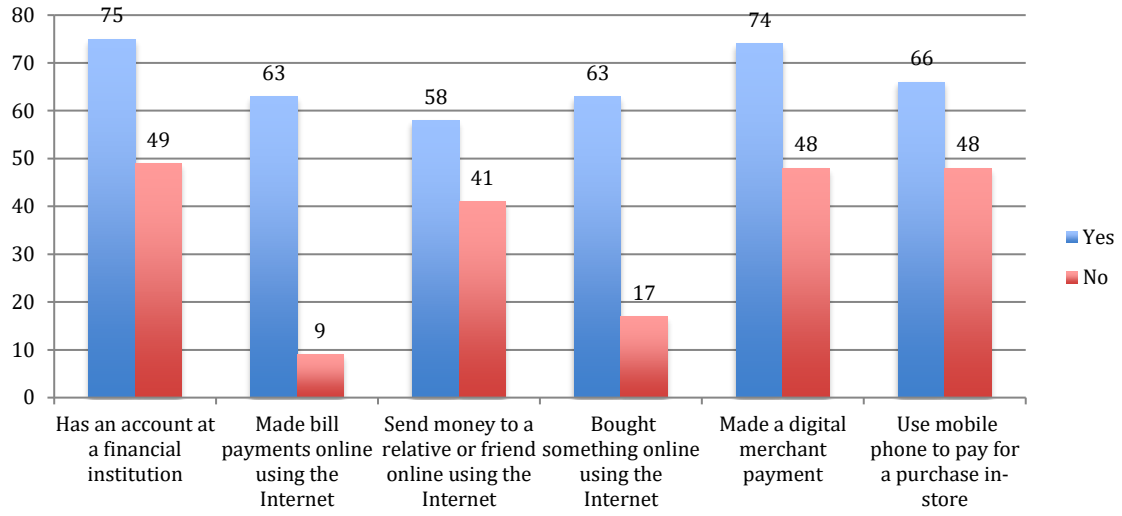
Source: Authors' calculation based on 2021 Global Findex Database.

Figure 13. Financial inclusion by internet access



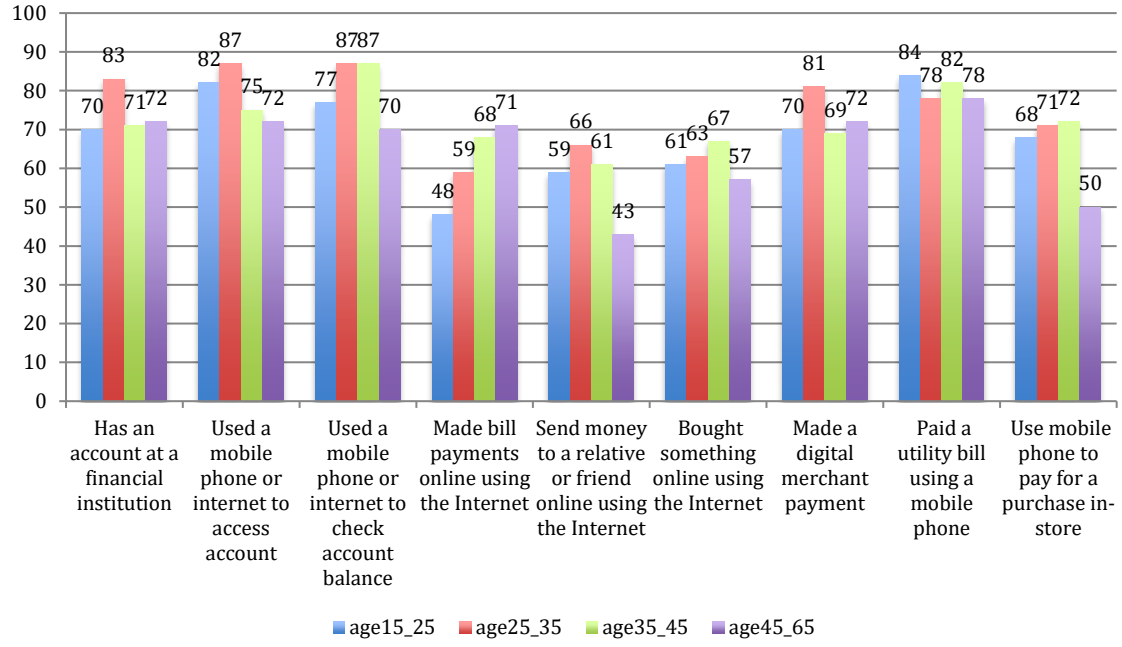
Source: Authors' calculation based on 2021 Global Findex Database.

Figure 14. Financial inclusion by owning a mobile phone



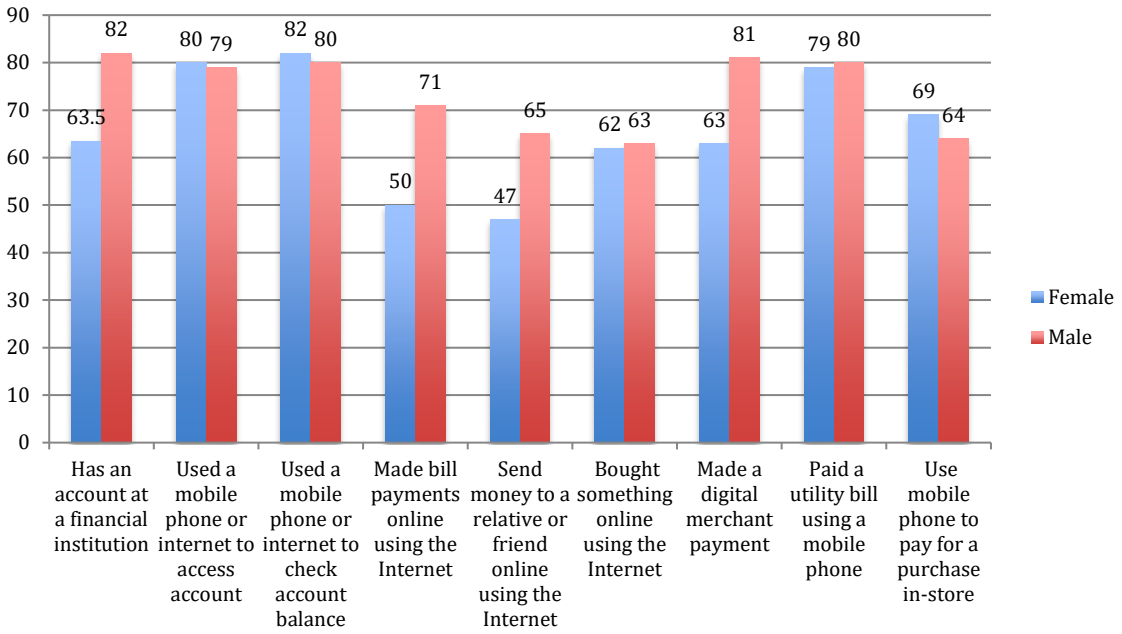
Source: Authors' calculation based on 2021 Global Findex Database.

Figure 15. Financial inclusion by age groups



Source: Authors' calculation based on 2021 Global Findex Database.

Figure 16. Financial inclusion by gender



Source: Authors' calculation based on 2021 Global Findex Database.

The data from 2011 to 2021 demonstrate a significant upward trend in DFI across various socio-demographic groups in Saudi Arabia, with large growth in digital payments and mobile-based activities. Despite these improvements, disparities based on gender, income, and education continue to limit financial service access for significant segments of the population. While these gaps have narrowed over time, they suggest that targeted efforts could further reduce financial inclusion inequalities.

In summary, Saudi Arabia's DFI statistics highlight that socio-demographic, geographic, and institutional factors interact complexly to influence DFI. Although substantial progress has been made in DFI overall, challenges remain, particularly concerning inequalities based on gender, rural-urban divides, and the digital gap affecting underserved populations. These observations underscore the need for a deeper econometric analysis of these disparities, which the current study aims to provide. Such analysis can guide policymakers in designing targeted interventions to address these inequalities and so promote broader access to digital financial services in alignment with Saudi Vision 2030.

4. Empirical literature

A growing literature has emerged to examine the determinants of financial inclusion across a wide range of countries, employing various data sets and methodologies. Early studies, such as those by Abel et al. (2018), Ezzahid and Elouaourti (2021), Ozili (2021, 2022), and Zins and Weill (2016), focused on the determinants of traditional financial inclusion. These studies identified factors such as education, income, gender, and access to banking infrastructure as

critical for enabling people to use formal financial services. For example, Abel et al. (2018) found that education and income levels are major contributors to increasing financial inclusion in Zimbabwe. Similarly, Ezzahid and Elouaourti (2021) highlighted that improvements in educational attainment and labor market participation are vital for financial inclusion in Morocco. In another study, Ozili (2021) observed that individuals with at least a secondary education in Nigeria were more likely to own a bank account, hold a debit card, and engage in formal borrowing. The author also emphasized the relevance of informal financial systems, particularly for women and individuals with lower levels of education. Zins and Weill (2016) reported that in 37 African countries, gender, wealth, education, age, and mobile banking were significant determinants of financial inclusion. In a similar manner, Ozili (2022) identified formal account ownership, financial literacy, mobile phones, and access to banking infrastructures such as ATMs and bank branches as key drivers of financial inclusion.

A common feature of these earlier studies is that they did not consider the changing background in which digital financial services were becoming increasingly important. The development of mobile banking, internet access, and other digital payment platforms necessitated a shift in focus toward DFI, rather than solely traditional financial inclusion. Recent studies have begun to recognize that, in addition to the traditional drivers, components such as digital literacy, mobile phone penetration, and regulatory environments are now crucial for facilitating digital financial services. Consequently, the concept of financial inclusion has evolved from its traditional elements to containing new, digital determinants.

Recent studies identify various factors that influence the level of DFI across different demographics and regions. Socio-demographic factors have been identified as key drivers in the development of DFI in several studies. For instance, Nandru et al. (2021) investigated how demographic factors such as gender and age, along with socio-economic factors such as income, education, and employment status, influence the use of digital financial services in India. They found that higher income and educational attainment were positively associated with greater DFI. Similarly, Ghosh and Hom Chaudhury (2022) discovered that men, wealthier individuals, and those with higher levels of education were more likely to use digital financial services in India. The authors also argued that India's demonetization policy spurred the adoption of digital financial services, with more educated and wealthier individuals benefiting the most.

In terms of geographic and economic disparities in DFI, Liu et al. (2021) examined the inequality between urban and rural areas in China and found that industrial economy and education were stronger determinants of DFI in urban areas, while these factors had less impact in rural regions. Al Khub et al. (2024) studied DFI in Jordan during the COVID-19 pandemic and observed significant differences between urban and rural areas. Apart from rural women, low-income classes were notably disadvantaged, prompting calls for special policies to enhance the financial inclusion of unbanked segments of society.

Social and institutional factors also play a critical role in shaping DFI. Evans (2022) reported that higher literacy rates, better infrastructure, and good governance positively affected DFI in Africa, while high unemployment and poor institutional quality acted as barriers to financial inclusion. In

another study, Bathula and Gupta (2021) found that education and workforce participation were major drivers of both traditional and DFI, although women and poorer individuals were still less likely to use digital financial services due to social and institutional barriers.

Several studies have examined the role of mobile technology and banking behavior in driving DFI. Anakpo et al. (2023) found that mobile phone ownership and engagement in banking activities were significant drivers of DFI in India. They also noted that men with higher education, higher income, and active participation in banking activities were more likely to use digital financial services. The authors emphasized that mobile technology was particularly effective in boosting financial inclusion in regions with strong mobile phone penetration.

Despite the apparent macroeconomic benefits of DFI, many challenges still hinder the widespread adoption of digital financial services (DFS). Several studies have examined the barriers to the greater diffusion of DFS, particularly in developing economies. For example, Nizam and Rashidi (2024) identified reliance on family members for financial decision-making, skepticism about digital platforms due to security concerns, and widespread financial and digital illiteracy. Inadequate digital infrastructure, restrictive regulations, and cultural preferences for cash further impede the adoption of DFS in emerging economies. Anakpo et al. (2023) similarly noted that inadequate digital infrastructure, limiting policies, and strong preferences for cash transactions hinder the growth of DFS in emerging markets.

Few studies have focused on the determinants of financial inclusion in the MENA region. For instance, Berguiga and Adair (2024) found that job status, income, education, gender, and age were key determinants of financial inclusion among youth in the MENA region. Their study highlighted that, while gender and income were important factors before the COVID-19 pandemic, the usage gap in digital services narrowed between age groups during the pandemic, and the financial inclusion of women improved. Elouaourti and Ibourk (2024) suggested that FinTech could enhance financial inclusion in the MENA region, where education, labor force participation, and access to information technologies are major drivers of DFI, though digital gaps remain, particularly for women and the elderly.

In conclusion, although literature is abundant with studies examining the determinants of traditional financial inclusion across various countries, very few have focused on the digital aspect of financial inclusion. To date, there is a lack of empirical evidence regarding the determinants of DFI in Saudi Arabia. This study aims to fill this gap in the literature.

5. Data and methods

This paper utilizes individual-level cross-sectional data from the 2021 Global Findex for Saudi Arabia. The Global Findex Database is a key source of data on global access to financial services, derived from nationally representative surveys of approximately 128,000 adults across 123 economies conducted during the COVID-19 pandemic. The survey is administered by the World Bank. For Saudi Arabia, the 2021 Global Findex data include a broad range of variables collected

from a nationally representative sample of 1,019 Saudi citizens. All respondents are Saudi nationals. The individual-level data from the 2021 Global Findex is publicly available through the World Bank Microdata Library for legitimate academic use, with proper citation. For further details on the survey methodology, refer to Demirgüç-Kunt et al. (2022).

In the literature, financial inclusion at the individual level is typically measured using self-reported data, where respondents indicate whether they participate in specific financial inclusion activities. These self-reported measures have been well-documented as reliable and valid for national-level analyses.

The determinants of DFI are analyzed using a multivariate probit regression model. Equation (1) presents the model which will be estimated:

$$Digital\ Financial\ Inclusion\ Indicator_{ik} = \beta_{0,k} + \beta_{1,k}Female_i + \beta_{2,k}age_i + \beta_{3,k}age_i^2 + \beta_{4,k}Income\ quantile\ 2_i + \beta_{5,k}Income\ quantile\ 3_i + \beta_{6,k}Income\ quantile\ 4_i + \beta_{7,k}Income\ quantile\ 5_i + \beta_{8,k}Tertiary\ education_i + \beta_{9,k}Employed_i + \beta_{10,k}Internet\ access_i + \beta_{1,k}Mobile\ ownership_i + \varepsilon_{ik} \quad (1)$$

Nine binary indicators derived from the 2021 Global Findex survey for Saudi Arabia capture DFI which is our dependent variable. These indicators include: 1) Having an account at a financial institution, 2) Using a mobile phone or internet to access an account, 3) Using a mobile phone or internet to check account balance, 4) Making bill payments online, 5) Sending money to a relative or friend online, 6) Buying something online, 7) Making a digital merchant payment, 8) Paying a utility bill using a mobile phone. Each of these nine indicators is coded as a binary variable.

To address the binary nature of the dependent variables, we use a probit model to estimate the regression for each of the nine DFI indicators, while holding the explanatory variables constant across models. The analysis controls for a standard set of individual-level demographic and socioeconomic characteristics commonly used in empirical studies, including the respondent's age, sex, highest level of education, employment status, and household income. Given the potential for a nonlinear relationship between age and DFI, we include the quadratic term for age. Additionally, we account for the role of digital technology by including internet access and mobile phone ownership as covariates in the model.

For a comprehensive list and definitions of the variables used in the analyses, refer to Table 1. All statistical analyses and regression results are population-weighted using the sampling weights provided in the survey, ensuring that the results accurately represent the national population.

Table 1. List of variables and their definition

Variable	Definition of the variable
Socio-demographic Characteristics	
Gender	
Male	Is a binary variable, equals 1 if the respondent is a male and equals zero otherwise
Female	Is a binary variable, equals 1 if the respondent is a female and equals zero otherwise
Age	Is a continuous variable measured in years
Employment status	
Employed	Is a binary variable, equals 1 if the respondent is employed and equals zero otherwise
Unemployed	Is a binary variable, equals 1 if the respondent is un employed and equals zero otherwise
Education level	
Primary	Is a binary variable, equals 1 if the respondent has completed primary school or less equals zero otherwise.
Secondary	Is a binary variable, equals 1 if the respondent has completed secondary school and equals zero otherwise.
Tertiary	Is a binary variable, equals 1 if the respondent has completed tertiary education or more and equals zero otherwise.
Income	Is a scale variable that ranges from 1 (the lowest income group) and 5 (the highest income group). The respondent was asked to determine the household income quintile they belong to.
Internet access	Is a binary variable, equals 1 if the respondent has access to the internet and equals zero otherwise.
Mobile phone ownership	Is a binary variable, equals 1 if the respondent owns a mobile phone and equals zero otherwise.
Financial inclusion indicators	
Having an account at a financial institution	Is a binary variable, equals 1 if the respondent has an account at a financial institution and equals zero otherwise.
Used a mobile phone or internet to access account	Is a binary variable, equals 1 if the respondent used a mobile phone or internet to access account in the past year and equals zero otherwise.
Used a mobile phone or internet to check account balance	Is a binary variable, equals 1 if the respondent used a mobile phone or internet to check account balance in the past year and equals zero otherwise.
Made bill payments online using the Internet	Is a binary variable, equals 1 if the respondent made bill payments online using the Internet in the past year and equals zero otherwise.
Send money to a relative or friend online using the Internet	Is a binary variable, equals 1 if the respondent sent money to a relative or friend online using the internet in the past year and equals zero otherwise.
Bought something online using the Internet	Is a binary variable, equals 1 if the respondent bought something online using the internet in the past year and equals zero otherwise.
Made a digital merchant payment	Is a binary variable, equals 1 if the respondent made a digital merchant payment in the past year and equals zero otherwise.
Paid a utility bill using a mobile phone	Is a binary variable, equals 1 if the respondent paid a utility bill using a mobile phone in the past year and equals zero otherwise.

Source: Table is constructed by the Authors based on the 2021 Global Findex codebook conducted by the World Bank.

6. Empirical Results

Table 2 presents the results of the multivariate probit model for the determinants of the DFI. Table 2 displays the average marginal effects of each socio-demographic determinant. The results reveal that in general, DFI is more prevalent among males, those who are more educated, richer households, and those who are employed. The results also show that access to digital technologies such as Internet access and mobile phone increase the likelihood of digital financial inclusion.

Table 2. Average marginal effects the determinants of digital financial inclusion

VARIABLES	(1) Account at a financial institution	(2) Online access	(3) Online check	(4) Online pay bill	(5) Online money transfer	(6) Online purchase	(7) Any digital payment	(8) Mobile utility bill	(9) Mobile purchase in store
Female	-0.124*	0.0397	0.0350	-0.146*	-0.120*	0.0482	-0.120*	-0.00683	0.0921
	(0.0378)	(0.0434)	(0.0398)	(0.0375)	(0.0422)	(0.0429)	(0.0384)	(0.0546)	(0.0439)
Age	-0.0133	-0.00444	0.0276	0.0182*	0.0108	0.0246	-0.0179*	0.0155	0.0269
	(0.0105)	(0.0127)	(0.0120)	(0.0111)	(0.0141)	(0.0120)	(0.0106)	(0.0158)	(0.0120)
Age squared	0.000191	-1.94e-05	-0.000414	-0.000143	-0.000229	-0.000366	0.000257*	-0.000220	-0.000430*
	(0.000143)	(0.000173)	(0.000165)	(0.000153)	(0.000197)	(0.000164)	(0.000146)	(0.000211)	(0.000166)
2.income	0.0609	0.0772	0.104	0.260*	0.0799	0.0585	0.0707	0.0259	0.0698
	(0.0656)	(0.0771)	(0.0747)	(0.0675)	(0.0708)	(0.0725)	(0.0659)	(0.0857)	(0.0733)
3.income	0.0875	0.125*	0.126*	0.324*	0.211*	0.162	0.101	0.00409	0.0964
	(0.0690)	(0.0736)	(0.0717)	(0.0671)	(0.0693)	(0.0709)	(0.0693)	(0.0874)	(0.0697)
4.income	0.154	0.0959	0.100	0.202*	0.167	0.155	0.170*	0.0670	0.124*
	(0.0626)	(0.0721)	(0.0689)	(0.0689)	(0.0685)	(0.0672)	(0.0628)	(0.0833)	(0.0688)
5.income	0.180*	0.0113	0.0881	0.226*	0.205*	0.160	0.178*	0.0295	0.152
	(0.0601)	(0.0786)	(0.0690)	(0.0638)	(0.0697)	(0.0688)	(0.0616)	(0.0877)	(0.0685)
Tertiary education	0.0401	0.0748	0.0732	0.00755	0.100	0.120*	0.0335	0.0226	0.0527
	(0.0396)	(0.0458)	(0.0454)	(0.0414)	(0.0436)	(0.0437)	(0.0401)	(0.0546)	(0.0451)
Employed	0.188*	0.0532	-0.00192	0.139*	0.140*	0.108	0.201*	-0.0282	0.115
	(0.0407)	(0.0544)	(0.0554)	(0.0468)	(0.0513)	(0.0510)	(0.0411)	(0.0628)	(0.0521)
Internet access	-0.0846	0.231*	0.130*	0.0992	0.141*	0.0886	-0.0395	0.161	0.0812
	(0.0695)	(0.0708)	(0.0675)	(0.0774)	(0.0782)	(0.0793)	(0.0664)	(0.103)	(0.0793)
Mobile ownership	0.329*			0.563*	0.141	0.471	0.297		0.0831
	(0.196)			(0.196)	(0.179)	(0.205)	(0.197)		(0.203)

*Notes: Standard errors in parentheses, * p<0.01, p<0.05, * p<0.1*

The regression results of the probit models of the determinants of DFI are discussed in more details in the following paragraphs.

The results show that sex is a key determinant of financial inclusion in Saudi Arabia. The estimated average marginal effects reveal that compared to Saudi males, Saudi females on average, are 12 percentage points less likely to have an account at a financial institution, 14.6 percentage points less likely to pay bills online, 12 percentage points less likely to transfer money online, 12 percentage points less likely to make any digital payments. However, Saudi females are 9 percentage points more likely to use mobile phones to pay for in store purchases.

The estimated model shows mixed results for the effect of age on financial inclusion. In particular, age is positively associated with checking the account online, paying bills online, and making online purchases, as well as using the mobile phone to pay for in store purchases, while age is negatively associated with making a digital payment, and no statistically significant association was found between age and having a bank account, accessing the account online, making online money transfers, and using mobile phone to pay bills. The results also show that the association between age and financial inclusion is nonlinear in four of the DFI indicators.

As for income level, the estimated average marginal effects show that household income is a key determinant of DFI in which on average, richer households have higher probability of being financially included than their poorer counterparts. For instance, compared to households in the first income quintile (poorest group), individuals who belong to the fifth income quintile (richest group), on average, are 18 percentage points more likely to have an account at a financial institution, 22 percentage points more likely to pay bills online, 20 percentage points more likely to transfer money online, 16 percentage points more likely to make online purchases, 17 percentage points more likely to make a digital payment, and 15 percentage points more likely to use a mobile phone to pay for in store purchases.

The results also show that the level of education is positively associated with DFI, though the estimated average marginal effects was positive across all the financial inclusion indicators, the coefficients were statistically significant for only two of the indicators. In particular, compared to those with secondary education or less, individuals with tertiary education or more, are 10 percentage points more likely to make online money transfers, and 12 percentage points more likely to purchase online.

On average, Saudi adults who are employed have higher probability of having an account at a financial institution, paying bills online, making online money transfers, and online purchase, as well as making digital payments and using mobile phone for in store purchases.

The results also show the positive role of the digital technologies in promoting the digital financial inclusion. In particular, compared to those with no mobile phone, on average, Saudi adults who own a mobile phone are 32 percentage points more likely to have an account at a financial institution, 56 percentage points more likely to pay bills online, 47 percentage points

more likely to make online purchases. Similarly, compared to those with no internet access, on average, Saudi adults who have access to internet are 23 percentage points more likely to access their account online, 13 percentage points more likely to check their account online, 14 percentage points more likely to make online money transfers.

7. Discussion and conclusion

This study provides a comprehensive analysis of the key correlates of digital financial inclusion (DFI) in Saudi Arabia. The findings, beside insights drawn from global contexts, offer valuable guidance for Saudi policymakers in designing targeted policies and interventions aimed at increasing the extent of DFI while addressing socio-economic disparities. These measures will contribute to the broader goals of Saudi Arabia's Vision 2030, which seeks to promote economic diversification and inclusivity.

The analysis highlights that DFI in Saudi Arabia is uneven across different socio-economic groups, with variables such as gender, income, education, employment, age, and access to technology playing distinct roles in shaping digital financial behaviors. Data from the World Bank's Global Financial Inclusion (Global Findex) database, covering the years 2011, 2014, 2017, and 2021, reveals significant progress in the overall prevalence of DFI. However, persistent inequalities remain, particularly along the lines of gender, educational attainment, urban-rural divides, and the digital gap among underserved populations. To better understand these disparities, a deeper econometric analysis, using multivariate probit regression, was employed to identify the main drivers of DFI in the post-COVID-19 era, when technological advancements and evolving social dynamics in Saudi Arabia have accelerated the adoption of digital financial services.

The results show that men, wealthier individuals, and those with higher educational levels are more likely to engage in digital financial activities, which is inline with global trends that suggest improved access to financial resources, technology, and financial awareness supports greater financial inclusion. The study also finds that employment status significantly influences participation in the financial system, with individuals in stable employment more likely to use digital financial services, reinforcing the idea that a stable income increases the likelihood of engaging with digital financial tools.

One of the most significant findings is the gender gap in DFI in Saudi Arabia. This gap is consistent with international trends, where women are generally underrepresented in digital financial participation. These findings are consistent with empirical studies by Elouaourti & Ibourk (2024) in the MENA region, and Nandru et al. (2021) and Ghosh & Hom Chaudhury (2022) in India. Despite Saudi Arabia’s Vision 2030 focus on empowering women, the gender gap in digital finance remains a challenge. This gap calls for targeted interventions to address societal barriers and improve digital literacy among women. Notably, women in Saudi Arabia are increasingly using mobile payment technologies for in-store purchases, suggesting that mobile technology could serve as an accessible entry point for greater female participation in digital

finance. However, closing the gender gap in digital finance will require policies that focus on enhancing digital literacy for women and expanding their access to financial services.

Household income also emerges as a key determinant of DFI, as individuals with higher income levels are more likely to engage with digital financial activities. This is consistent with global findings, such as those from India (Nandru et al., 2021; Ghosh & Hom Chaudhury, 2022) and the MENA region (Berguiga & Adair, 2024), which show that higher income correlates with greater access to technology and financial services. The income disparity in DFI underscores the need for policies that make digital financial services more accessible and affordable for low-income households. Expanding digital infrastructure and offering financial incentives could reduce this gap, fostering more inclusive financial growth. Education also plays a crucial role in facilitating digital financial inclusion, with higher educational attainment being linked to greater understanding and use of digital financial services. This finding are in general similar to studies from India (Bathula & Gupta, 2021; Nandru et al., 2021) and the MENA region (Elouaourti & Ibourk, 2024), where education significantly enhances both financial and digital literacy.

The study also emphasizes the importance of digital and financial literacy programs, particularly in rural areas, to ensure that individuals with lower education levels can access and participate in the financial system. As seen globally, higher education correlates with greater digital literacy and confidence in using financial technologies. Expanding educational initiatives, alongside increased access to affordable digital services, will help bridge the gaps in DFI caused by disparities in education and income.

Employment status is another critical factor influencing DFI. The study finds that employed individuals, particularly those in stable jobs, are more likely to engage with digital financial services. This pattern is consistent with global studies (Bathula & Gupta, 2021; Berguiga & Adair, 2024) and suggests a need to extend financial inclusion initiatives to unemployed individuals or those in informal employment. Government-backed programs for financial literacy and partnerships between financial institutions and government agencies could help address these gaps.

Age also plays a role in DFI, though its influence is mixed. Younger individuals tend to engage more actively with digital financial services, a finding consistent with studies from India (Nandru et al., 2021; Ghosh & Hom Chaudhury, 2022), where older individuals are less likely to participate in digital finance. This difference likely arises from the younger generation's greater comfort with digital technologies. However, some digital financial behaviors, such as having a bank account or transferring money online, showed no statistically significant age-based differences, indicating that targeted strategies, such as awareness campaigns and user-friendly interfaces, could increase older adults' participation in digital finance.

Access to technology, particularly mobile phones and the internet, was found to be a major enabler of DFI. This finding aligns with global evidence from Africa (Evans, 2022) and the MENA region (Elouaourti & Ibourk, 2024), where expanding digital infrastructure is seen as a

critical factor for promoting financial inclusion. In Saudi Arabia, improving access to affordable mobile technologies and expanding internet coverage in underserved areas will be essential for ensuring equal opportunities for all to engage in digital finance.

In conclusion, this study identifies the major drivers of DFI in Saudi Arabia and emphasizes the need for policy reforms to reduce gender disparities, enhance digital literacy, and improve access to technology, particularly in rural areas. These efforts will be essential in bridging the digital divide and fostering greater inclusivity in the financial system. The findings underscore the importance of socio-demographic factors such as gender, income, education, and technology access in shaping DFI. Policies should focus on empowering women, expanding digital infrastructure, and promoting digital literacy programs to reduce income and gender disparities, particularly among low-income and less-educated groups.

Addressing these issues is central to achieving the goals of economic diversification and sustainable development outlined in Vision 2030. A more inclusive digital financial system will not only benefit individuals' finances but also contribute to the broader economic development of Saudi Arabia. However, achieving success will require overcoming a range of social, economic, educational, and technological challenges.

The present study has several limitations. First, data for Saudi Arabia is only available up to 2021, as no newer data has been released in the Global Findex database. Second, the Global Findex database for Saudi Arabia has a limited number of available variables, which likely constrains the depth of analysis regarding the determinants of digital financial inclusion. These limitations may affect the comprehensiveness of the findings and highlight the need for more updated and detailed data in future years.

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