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Do Youths Use Fintech or Banks in North Africa?

Complementary vs Substitution Effect

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Do Youths Use Fintech or Banks in North Africa? Complementary vs Substitution Effect.

Imène Berguiga[1] & Philippe Adair[2]

Abstract

North African youths lack financial inclusion with respect to account holding and the use of financial services. The supply of Fintech services has increased. Do these enhance youth financial inclusion by building on traditional banking services, or do they replace banking services with competing alternatives?

We address a representative sample of five North-African countries: Algeria, Egypt, Mauritania, Morocco and Tunisia. Five pooled samples drawn from the Global Findex Database cover over a decade from 2011-2024. Univariate and bivariate probit regressions test three hypotheses related to age gap according to workforce status, and to the nature of relationship (including unidirectional causality) between traditional banking and Fintech services use, with respect to financial inclusion as for youth.

Three main results are noteworthy: (i) No Age gap exists as for Fintech services use. (ii) Fintech adoption among youths improves their traditional financial inclusion. (iii) Conversely, the use of traditional banking services among youths influences positively their adoption of Fintech solutions. These results suggest a complementary (with positive and unidirectional causality) relationship between traditional and Fintech services.

Collaboration between banks and Fintech companies enhances youth financial inclusion by leveraging the strengths of both sectors. However, it is crucial to address challenges such as regulatory compliance and cybersecurity to ensure the success of these partnerships.

Keywords: Financial inclusion**;** Fintech services; North Africa; Probit regressions; Youth.

JEL: D14; G21; G51; O33

Introduction

Financial inclusion is often first defined as account holding at a financial institution (i.e., bank). Global Findex (2024) reports low proportions of North African populations holding bank accounts: Egypt (35%), Tunisia (38%), Algeria (35%), Morocco (42%) and Mauritania (27%). These figures encapsulate inequalities, particularly between age groups: mature individuals over 25 years vs. youths aged 15-24 years. Age gap is quite remarkable especially in Tunisia and Egypt: Tunisia displays a clear worsening gap in 2024, which exceeds 0.3, whereas the gap in Egypt reaches around 0.27 in 2017 before declining slightly in 2024 (Figure A1 in Appendix).

One third of unbanked population in North Africa is young, including 39% from Algeria and 36% from Mauritania. Noteworthy is that youths who are not in employment, education or training (NEET), are little concerned with financial inclusion, unlike those who participate in the labour force, being employees and self-employed, in as much as they earn income, save it and spend it.

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With the COVID-19 pandemic, the use of digital services (henceforth Fintech) has increased and becomes a key policy tool for achieving the United Nations Sustainable Development Goals (SDGs), including reducing inequality (particularly the age gap) and promoting digital financial inclusion (SDG 5). The growth in digital use has outpaced the growth in the number of account holders in developing economies (Demirgüç-Kunt et al. 2022). Given the considerable efforts made in digital transformation and the high rates of mobile phone penetration and internet usage, unbanked adults in North African countries are considered as more digitally connected than the unbanked in other African sub-regions (Global Findex, 2025). Digital payment usage among account owners ranges around 75 percent in North African (Global Findex, 2025).

The rate of digital payments across age groups (15–24 years and over 25 years) varies according to time-period and country: age gaps are generally significant in Algeria, Egypt, and Tunisia. In Egypt, a decline in the gap is noticeable between 2017 (20%) and 2024 (12%), suggesting an improvement in the digital inclusion of young people. Conversely, after decreasing in 2021, the gap rises again in 2024 in Tunisia and Morocco (Figure A2 in Appendix).

It is, therefore, relevant to study the role of this technological transformation in youth financial inclusion and to examine how these countries are progressing in their digital financial inclusion.

The pandemic has facilitated and accelerated access to mobile money accounts among young people aged 15 to 24 in Egypt and Tunisia, replacing more and more financial institution accounts (Berguiga, 2023). Furthermore, the use of Fintech has catalysed the use of other formal financial services (savings, loans, etc.) for individuals excluded from the conventional financial system, including youths, thus enabling them to improve their standard of living (Khalaf and Wadi, 2023). Banking activities may have an impact on access to and use of digital payment systems (Zins and Weill, 2016). Hence, it is worth investigating the relationship between the two types of traditional and digital financial inclusion, especially for youths, enabling policymakers to implement appropriate financial services.

The literature review on digital financial inclusion of youth in the Middle East and North (MENA) region or in Africa is deficient with respect to North Africa, only a few countries are included, without a focus on youth and the relationship between digital and traditional use of financial services.

In this regard, our research questions are threefold: (i) Has Fintech use narrowed the age gap in favour of youth financial inclusion in North African countries? (ii) Does Fintech promote

traditional financial inclusion for youth as a complement? (iii) Or does it challenge traditional banking services tailored for youths as a substitute.?

Our study analyses the impact of age on digital financial inclusion among North African individuals and explores the causal relationship between traditional and digital financial inclusion for youth, from a dynamic perspective, namely before, during and after the pandemic. To the best of our knowledge, no paper has addressed this relationship regarding North African youth.

Section 1 provides a literature review devoted to the relationship between Fintech and financial inclusion with respect to age in North Africa, and hypotheses. Section 2 presents the descriptive statistics regarding five pooled samples drawn from the Global Findex Database covering a decade from 2011 to 2024 (over 25,000 households) for five North African countries: Egypt, Tunisia, Algeria, Morocco, and Mauritania. Probit regressions (univariate and bivariate) test the relationship between young age and Fintech use, as well as the relationship between Fintech and traditional services use. We focus on young adults (15-34 years old) who participate in the labour force. Section 3 displays the estimates from these probit regressions before, during and after the pandemic, especially for the youth sub-sample. Section 4 is dedicated to the conclusion and policy implications.

1. Literature review and hypothesis development

1.1. Theoretical background

Financial inclusion is defined as the ease of access to, and the availability of, basic financial services (Ozili, 2020) while Fintech is an innovation in technology-enabled financial services that is dramatically transforming financial products, payment methods, business models, market players and structure, and even money itself (Feyen et al*.,* 2023).

Financial inclusion theories belong to three broad categories: (i) vulnerable beneficiaries (such as poor people, youth and women); (ii) delivery processes (community echelon, public service or special agent) and (iii) funding (Ozili, 2020).

Technology acceptance theories (Ajzen and Fishbein, 1980; Venkatesh et al., 2003) examine the factors influencing individual user behavior with regard to Fintech services (demand side), while institutional theory (Scott, 2005; DiMaggio and Powell, 1983) explores how institutional pressures influence financial organizations' decisions regarding technology adoption (supply side).

1.2. Hypothesis development

Research focusing on the age gap in Fintech is limited in North African countries. Özşuca (2024) examines the factors explaining variation in access to digital finance across different

age groups upon a sample of 79 developing countries, including North African countries. He finds that the working-age population experiences the largest gap. The main part of the gap is attributable to employment, while secondary education and income level are also significant. Noteworthy is that tertiary education helps closing the gap for youth.

Berguiga (2023) finds that determinants of Fintech use in five MENA countries, including Egypt and Tunisia, over 2014-2021 are similar irrespective of the age group, but also prove distinct according to the survey period: Fintech use requires a higher level of education, a higher income, and employment. During the pandemic, young people increased their Fintech use, which became a substitute for traditional services. The pandemic has led to more intensive use of the Internet and digital financial services, especially by young people under 35 years, thus highlighting the importance of this demographic group in the digital transformation of the financial sector (Ljumović and Pavlović, 2021). Hence, we formulate our hypothesis H_1 testing the relationship between age and Fintech use:

H_1: There is an inverted age gap (for youth) in Fintech use during and after the pandemic

With regard to the literature review, financial inclusion (process) and Fintech (tools) are two distinct concepts that may appear as complementary.

Fintech aims to offer financial services to excluded populations from the traditional financial system, making these services accessible in real-time and at a lower cost (Elouaourtia and Ibourk, 2024). Its use can generate significant employment benefits and enhances entrepreneurship (Festa et al., 2023); It allows unbanked individuals to access the formal financial system for the first time, open their own financial account (Global Findex, 2025), use other financial services such as savings or borrowing, and subsequently promote their financial inclusion.

Al-Smadi (2023) confirms the role of digitalisation on financial inclusion in 12 MENA countries (including Algeria, Egypt, Morocco and Tunisia), over 2004–2020. Noteworthy is the strong bias towards oil-rich countries, mostly from the Arabian Peninsula.

Selka and Benaini (2024) analyse the influence of Fintech on financial inclusion in North African countries (Algeria, Tunisia, and Morocco) over 2004-2022, using a quantile regression method. They find a significant positive correlation between Fintech, measured by the number of ATMs per 100,000 adults, and financial inclusion, represented by the number of commercial bank branches per 100,000 adults.

Khalaf and Wadi (2023) highlight that Fintech significantly enhances financial inclusion in 11 MENA countries over 2011-2014, providing broader access to financial services. Digital

payment systems and lending platforms have become essential tools that facilitate access to previously unavailable services.

Al Rifai and AlBaker (2025) emphasise the importance of collaboration, noting that Fintech has improved access for previously underserved groups, including the youth. Hypothesis H_2 is stated as follows:

H_2: The use of Fintech promotes the youths' financial inclusion.

On the other hand, Fintech companies have fostered new competitive dynamics with traditional banks and have encouraged banked customers to demand more efficient and accessible services. Traditional banks have been compelled to innovate and adapt their services to their customers by increasingly including Fintech solutions into their existing services. This integration through online banking influences customers' choice, as customers perceive these services to be easier and worth using, thus promoting the use of digital payment systems (Carranza et al. 2021). Rani et al. (2025) analyse the determinants of the intensity of digital payments in the MENA region (including four North African countries), over 2011-2021. They find that the percentage of accounts and deposits held in financial institutions positively impacts digital payments, while household savings exert a negative effect. Conversely, digital payments received are positively influenced by accounts, deposits, retirement savings, and borrowing levels, but negatively influenced by household ~~savings~~ and entrepreneurial savings. Although there is limited research suggesting that traditional banking services can serve as a gateway to the adoption of financial technologies, particularly for young people, we formulate hypothesis H_3 as follows:

H_3: Youths' use of traditional financial services has a positive impact on their Fintech use.

To the best of our knowledge, no paper has used bivariate probit and addressed the causality issue with respect to financial inclusion in North Africa.

2. Data: descriptive statistics and methodology

We investigate pooled household samples in five North Africa countries: Algeria, Egypt, Tunisia, Morocco[3] and Mauritania. Samples selected from the Global Findex Database consist of 5,065 households in 2011, 4,056 in 2014, 9,115 in 2017, 5,003 in 2021 and 5,022 in 2024. We split the dataset into five sub-samples: Three before the pandemic (2011, 2014 and 2017), and two during and after the pandemic (2021 and 2024).

2.1. Descriptive statistics

[3] Morocco was selected despite unavailable data for 2014.

Table 1 presents descriptive statistics regarding the use of Fintech and traditional services of our samples for each year and according to age groups. We measured the use traditional services from savings and borrowings while Fintech use from various transactions such as withdrawals, check accounts, pay bills, send or receive money, wages and public or private transfers, digital savings or/and borrowings and other digital services.

Youths have fewer bank accounts than mature people (aged over 35 years). They use accounts to save rather than to borrow. Their exclusion from financial institutions has prompted them to increasingly use mobile money accounts over 2014-2024. Almost one-third of youths use mobile banking and 46,32% to pay bills, including school fees, through their mobile money account or financial institution. The use of digital services to receive payment for the sale of an agricultural product remains the lowest for youths in North Africa.

Table 1. The use of Fintech and traditional services

Year	2011	%	2014	%	2017	%	2021	%	2024	%
Account at financial institution										
Youth	706	46.8	616	47.06	1,274	38.65	876	40.31	797	38.13
Mature	804	53.2	693	52.94	2,022	61.35	1,297	59.69	1,293	61.86
Total	1,510	100	1,309	100	3,296	100	2,173	100	2,090	100
Mobile Money account[a]										
Youth			46	52.27	47	45.63	159	56.99	132	53.77
Mature			42	47.73	56	54.37	120	43.01	113	46.12
Total			88	100	103	100	279	100	245	100
Use of traditional services										
Youth	317	43.54	316	44.01	463	38.52	361	38.82	463	46.53
Mature	411	56.46	402	55.99	739	61.48	569		532	53.47
Total	728	100	718	100	1,202	100	930	100	995	100
Fintech use										
Youth	602	53.61	319	49.61	512	41.62	557	47.08	968	52.38
Mature	521	46.39	324	50.39	718	58.37	626	52.92	880	47.61
Total	1,123	100	643	100	1,230	100	1,183	100	1,848	100
Detailed use of traditional services by youths[b]										
Savings	211	66.56	210	66.46	364	78.62	273	75.62	381	82.29
Borrowings	137	43.22	171	54.11	150	32.40	123	34.07	463	100
Detailed use of Fintech by youths[c]										
Debit/credit card	193	32.06	164	51.41	243	47.46	206	36.98	422	43.59
Mobile banking	85	14.12	102	31.97	157	30.66	372	66.79	403	41.63
Fintech public			13	4.08	20	3.9	34	6.10	77	7.95
Fintech agriculture			19	5.96	4	0.78	24	4.31	61	6.3
Fintech wage			13	4.08	16	3.12	44	7.90	87	8.99
Fintech private			61	19.12	23	4.49			302	31.19
Fintech bill (including school fees)	76	12.62	137	42.95	160	31.25	258	46.32	467	48.24
Fintech transfer (without precision)	244	40.53								
Savings and/or loans by mobile money account							51	9.16	67	6.92

Note: [a] No information about mobile money account in 2011. [b] Percentage calculated according to the number of youths using traditional services. [c] Percentage calculated according to the number of youths using Fintech services.

Source: Authors from the Global Findex database

The decision of youth in North Africa to hold a mobile money account rather than a bank account is explained by exclusion factors from banks and self-exclusion (Table 2). On the supply side, the main factors are the cost of financial bank services ('Too expensive') in 2017, 2021 and 2024, as well as obstacles related to opening a bank account such as documents required ('Lack of documentation') and distance from a branch ('Too far away'). Youths are using mobile money accounts via Fintech platforms during and since the pandemic because it is more accessible and does not require documents. On the demand side, self-exclusion is mainly due to insufficient income ('Lack of money') and using an account from a family member.

Table 2. Factors of holding a mobile money account for youths (15-34)*

Year	2014	%	2017	%	2021	%	2024	%
Supply side								
Too far away	5	10.87	3	6.38	15	9.43	3	2.27
Too expensive	7	15.22	7	14.89	23	14.47	11	8.33
Lack of documentation	9	19.57	4	8.51	15	9.43	6	4.54
Cannot get one	11	23.9						
Demand side								
Distrust	3	6.52	4	8.51	15	9.43	11	8.33
Religious reasons	2	4.35	3	6.38	13	8.18		
Lack of money	15	32.61	15	31.91	42	26.42	36	27.27
Family member already has an account	5	10.87	5	10.64	15	9.43	15	11.36
No need for formal financial services	6	13.04	9	19.15	27	16.98		
Total mobile money accounts	46	100.00	47	100.00	159	100.00	132	100.00

Note: *No information about mobile money accounts in 2011. Percentage calculated according to the number of mobile money accounts. Some data are unavailable in 2024.
Source: Author from the Global Findex database

According to Table 3, the use of Fintech in North African countries on the demand side depends on macroeconomic and institutional factors on the supply side, such as income level (GDP per capita) and Government infrastructure policy (Government's Telecommunication Infrastructure and Government's Online Service).

The percentage of individuals using the Internet has increased dramatically throughout the period 2011-2024, especially since 2017, the last survey before the pandemic outburst, reaching 91% in Morocco, 77% in Algeria, 72.69% in Egypt and 72.35% in Tunisia, whereas it remains low (3738%) for Mauritania (ITU, 2025). On the supply side, telecom infrastructure has expanded throughout the region, the index standing over 80% in Morocco, Algeria and Tunisia, whereas it lags behind in Egypt and Mauritania as of 2024 (ITU, 2025). Only Egyptian authorities have established full regulatory sandbox initiatives that enable the Fintech industry to test new services and grow in a controlled environment. Algeria remains cautious, while Morocco, Tunisia and Mauritania are currently working on their regulatory projects

(Datasphere Initiative 2025). Digitalisation is experiencing a faster or slower improvement, which depends at last on the use of Fintech from the demand side.

Table 3. Key data on digitalisation, infrastructure and Fintech regulation in North Africa (2011-2024)

	Year	Individuals using the internet (%)	Cellular subscriptions per 100 inhabitants	Government Online Service Index*	Government Telecommunication Infrastructure Index*	Regulation for Fintech
Algeria	2011	14.9	96.5113	0,2549	0,1812	Absence of a regulatory sandbox.
	2014	29.5	110.44	0,0787	0,1989	
	2017	47.6911	109.97	0,2153	0,3889	
	2021	72.2124	105.037	0,3743	0,6133	
	2024	76,9081	111.606	0.33	0.81	
Egypt.	2011	25.6	91.5823	0,6013	0,2232	
	2014	33.8946	97.7313	0,5906	0,3571	The Central Bank of Egypt regulatory sandbox was officially launched in May 2019.
	2017	44.9502	99.2884	0,5347	0,3222	
	2021	72.056	84.0866	0,573	0,5579	Law No. 5 of 2022 is dedicated to the development of non-banking financial services through technology.
	2024	72.6899	92.8262	0.70	0.69	
Mauritania	2011	4.5	94.6316	0,0784	0,1123	
	2014	11.8	97.5267	0,0472	0,1626	Absence of a regulatory sandbox.
	2017	21.0172	96.7595	0,1597	0,1878	
	2021	29.9707	137.54	0,0952	0,4648	
	2024	37.3809	90.7725	0.17	0.58	
Morocco	2011	46.1075	111.064	0,5425	0,2772	
	2014	56.7746	128.972	0,6929	0,335	Regulatory sandbox was officially launched in 2019 to allow Fintech startups to test their products in a regulated environment (Bank Al-Maghrib Circular No. 1/W/2019).
	2017	61.7622	123.894	0,6667	0,3697	
	2021	88.1303	138.911	0,4721	0,6676	
	2024	91	148.155	0.56	0.88	
Tunisia	2011	39.1	113.794			Regulatory sandbox project of the Tunisian Central Bank was launched in 2020.
	2014	46.16	126.692	0,6378	0,3074	
	2017	55.5002	123.034	0,8056	0,4066	
	2021	68.3155	129.846	0,6031	0,6646	
	2024	72.3542	134.136	0.60	0.84	

Note: * ITU (2025), World Bank (World Development indicators 2024).
Source: Author from ITU the Global Findex database

2.2. Methodology

Two econometric models, each expressing a type of financial services used, were designed. The dependent variable of the first is measured by using traditional services provided by a financial institution (*Traditional Use*) vs. No Use (Model 1), while that of the second model refers to using digital services from a financial institution and/or a mobile money service provider (*Fintech Use*) vs. No Use (Model 2) (see Box 1).

First, to test the age gap (H_1) hypothesis, *Age* is designed as an independent variable in each model, with other variables regarding household characteristics, external funding sources, and *country dummies* as control variables for the overall sample (See Table A2 in the Appendix). Second, *Age* is used to extract the youth subsample, whereupon we test the relationship between traditional use and digital use (H_2 and H_3), although the matrix shows there is little correlation (Table A1 in the Appendix).

Both dependent variables are binary, and both models are estimated jointly using a bivariate probit (seemingly unrelated probit) (Box1). The coefficient rho ρ allows us to identify the nature of the fundamental relationship between these two types of use (traditional or fintech): A significant positive *rho* (ρ) value indicates a complementarity between the decision to use traditional services and the decision to use Fintech services, and otherwise a substitution effect. However, this estimation method makes it possible to study the correlation of error terms between the two decisions, without a direct causal relationship, whereas it is highly likely that the two decisions influence each other.

Box 1. Bivariate Probit regressions

Two models estimate for every household *i* located in country *k*.:

$$\boldsymbol{Model\ 1}: \boldsymbol{E}\left(Traditional\ Use\ = 1/X_{ikj}\right) = P_{ikj} = \sum_j \alpha_j X_{ikj} + \sum_j \mu_j W_{ikj} + \sum_j \beta_j T_{ikj} + \varepsilon_j$$

$$\boldsymbol{Model\ 2}: \boldsymbol{E}\left(Fintech\ Use\ = 1/X_{ikj}\right) = P_{ikj} = \sum_j \alpha_j X_{ikj} + \sum_j \mu_j W_{ikj} + \sum_j \beta_j T_{ikj} + \varepsilon_j$$

$$\boldsymbol{Corr(\varepsilon_1, \varepsilon_2) = \rho}$$

Traditional services: Savings and borrowings at financial institutions
Fintech services: Digital services from a financial institution *(Debit card, Credit card and Mobile banking) and* Digital services from a financial institution and/or a Mobile money service provider *(Mobile payment, Savings and Borrowings)*
Xj = Households characteristics *(Age, gender, job status, education level, and income);*
Wj = External funding sources (informal loans);
Tj =Country dummies;
ε_j = Error term.

Source: Authors

In order to test the presence of endogeneity of these decisions, the bivariate was used for our two models with an equation, which includes the dependent variable of the other model as an explained variable (Box 2).

Box 2. Univariate Probit or Bivariate Probit regressions with endogeneity

Two models estimate for every household *i* located in country *k*.:

Model* 1*a:

$$\boldsymbol{E}\left(Traditional\ Use\ = 1/X_{ikj}\right) = P_{ikj} = \sum_j \pi_j Fintech\ Use_{ikj} + \sum_j \alpha_j X_{ikj} + \sum_j \mu_j W_{ikj} + \sum_j \beta_j T_{ikj} + \varepsilon_j$$

Model* 2*a:

$$\boldsymbol{E}\left(Fintech\ Use\ = 1/X_{ikj}\right) = P_{ikj} = \sum_j \pi_j Traditional\ Use_{ikj} + \sum_j \alpha_j X_{ikj} + \sum_j \mu_j W_{ikj} + \sum_j \beta_j T_{ikj} + \varepsilon_j$$

Xj = Characteristics of households *(**Age**, gender, job status, education level, and income);*
Wj = External funding sources (informal loans);
Tj =Country dummies;
ε_j = Error term.

Source: Authors

The Wald test of *rho* (p-value < 0.1) validates the choice of a bivariate estimation, due to the presence of endogeneity. The error term in the *Traditional Use* model (model 1a) is correlated with that in the *Fintech Use* model. This correlation between the error term in the two models is a form of endogeneity, because for instance *Fintech Use* in model 1a is correlated with the error term, thus estimation in a simple probit model is biased.

The significant sign of the explanatory variable *Fintech Use* (in model 1a) or *Traditional Use* (in model 2a) enables to test their impact on the explained variable (unidirectional causality).

If the value of ρ is not statistically different from zero, the estimation of the dependent variable could be done using a standard (univariate) probit model.

3. Results

According to the full sample regressions in Table 4, Age variable (*Youth*) is negative and significant as for the first model and insignificant as for the second model before during and since the pandemic: There is an age gap only with respect to the use of traditional services (Borrowing and savings). This result confirms our previous descriptive statistics in Table 1 but rejects our Hypothesis H_1.

Table 5 presents the two models for each year on the youth subsample. The Wald test for *rho* (ρ) being significant for all years, validates the use of a bivariate probit model.

In 2011, there was a substitution relationship between traditional services and Fintech ($\rho<0$). There are unobserved factors, not measured by our model variables, that led young people to use either Fintech or traditional services, but rarely both simultaneously.

Over 2014-2024 period, the relationship clearly becomes one of complementarity. The positive and increasing correlation means that young people use both types of financial services together. This complementarity strengthens in 2024 (ρ=0.476), suggesting an increasingly strong integration of Fintech services into the financial landscape, not as a substitute, but as a complement to traditional services.

A low (*Primary*) or medium (*Secondary*) education level and a low-income level (*Poorest* Q1) reduce probabilities of these two kinds of financial uses (model 1.14, 2.14, 1.17 and 2.17, 1.21 and 2.21) but these hurdles along with that of *Gender* have disappeared (not significant) in 2024.

Table 4. Estimation of Traditional and Fintech models on the full sample (Bivariate probit).

Year	2012		2014		2017		2021		2024	
Models	**Traditional**	**Fintech**	**Traditional**	**Fintech**	**Traditional**	**Fintech**	**Traditional**	**Fintech**	**Traditional**	**Fintech**
	(1.11)	(2.11)	(1.14)	(2.14)	(1.17)	(2.17)	(1.21)	(2.21)	(1.24)	(2.24)
Age: *Youth (15-34)*	0.0247	-0.0992**	-0.2800***	-0.1273**	-0.2398***	-0.1463***	-0.3303***	0.0015	0.0369	0.0254
(ref.: *Mature ≥ 35)*	(0.5442)	(-2.0698)	(-5.3134)	(-2.3826)	(-3.5408)	(-3.3668)	(-4.1552)	(0.0197)	(0.7292)	(0.5463)
Gender: *Female*	-0.0448	0.1819***	0.2775***	0.2491***	0.0321	0.1953***	-0.0337	0.0446	0.0328	-0.0413
(ref.: *Male)*	(-1.0173)	(4.0122)	(5.3902)	(4.8463)	(0.4701)	(4.3819)	(-0.4373)	(0.5785)	(0.6763)	(-0.9237)
Education: *Primary*	0.3637***	-0.7892***	-0.6550***	-0.7987***	-0.5382***	-1.0847***	-0.6323***	-0.9976***	0.0671	-0.1950**
(ref.: *Tertiary*)	(3.4009)	(-9.1719)	(-7.3997)	(-9.1858)	(-5.5492)	(-17.2985)	(-5.5042)	(-8.9824)	(0.7830)	(-2.4539)
Education: *Secondary*	0.2225**	-0.5990***	-0.4618***	-0.6041***	-0.4114***	-0.6068***	-0.2700***	-0.3823***	0.0051	-0.2018***
(ref.: *Tertiary*)	(2.0599)	(-6.9433)	(-5.4747)	(-7.1995)	(-4.7085)	(-10.2782)	(-3.1350)	(-4.3375)	(0.0658)	(-2.8112)
Income: *Poorest Q1*	0.1133	-0.9099***	-0.3225***	-0.3647***	-0.5384***	-0.5664***	-0.4672***	-0.1732	-0.0286	-0.0746
(ref.: *Richest Q5)*	(1.5707)	(-11.5330)	(-3.6195)	(-4.1558)	(-4.7584)	(-7.5767)	(-3.3392)	(-1.3137)	(-0.3697)	(-1.0287)
Income: *Middle(Q2+Q3+Q4)*	0.0728	-0.4751***	-0.1615**	-0.3237***	-0.2931***	-0.3748***	-0.2504***	-0.1567**	-0.0799	-0.0903
(ref.: *Richest Q5)*	(1.2715)	(-8.9698)	(-2.4341)	(-4.9251)	(-4.1074)	(-8.1894)	(-3.1599)	(-1.9630)	(-1.3359)	(-1.6113)
Job status: *Self-employ.*			1.0314***	0.5205***	0.8067***	0.3082***	0.0341	-0.0519	-0.0917	0.3453***
(ref.: *Unemployed*)			(16.0205)	(7.7727)	(8.9900)	(4.9806)	(0.2079)	(-0.3340)	(-1.2804)	(5.2626)
Job status: *Employee*			0.4195***	0.1941***	0.7871***	0.4254***	0.2989***	0.1833**	-0.0675	0.3108***
(ref.: *Unemployed*)			(6.8025)	(3.0118)	(9.3200)	(8.6530)	(3.7969)	(2.3012)	(-1.2107)	(6.0858)
Informal loan:	-0.1381***	0.0236	0.1040*	0.0292	-0.1511**	-0.0180	-0.0640	-0.0633	0.0324	0.1427***
(ref.: *No informal loan*	(-2.7105)	(0.4658)	(1.7013)	(0.4724)	(-2.2080)	(-0.3729)	(-0.8328)	(-0.8297)	(0.6576)	(3.1373)
Country: *Algeria*	0.2836***	1.5258***	-0.0475	0.0136	0.3517***	-0.3960***	-0.1934**	0.0623	0.2197***	0.4678***
(ref.: *Tunisia)*	(4.1187)	(20.0472)	(-0.6343)	(0.1806)	(3.7733)	(-3.5521)	(-2.1154)	(0.6589)	(2.7642)	(6.2799)
***Country**: Egypt*	-0.4629***	-0.5902***	-0.3157***	-0.3069***	-0.6087***	-0.5617***	-0.8306***	-0.5974***	0.0054	0.1691***
(ref.: *Tunisia)*	(-5.5255)	(-5.5369)	(-4.2067)	(-4.2096)	(-8.1120)	(-6.9398)	(-7.8234)	(-6.1140)	(0.0755)	(2.6205)
***Country**: Mauritania*	0.3627***	0.8113***	-0.1576**	0.2244***	7.9409***	-0.0901	-0.0723	0.0432	0.2073***	0.5362***
(ref.: *Tunisia)*	(5.2696)	(10.4033)	(-2.1700)	(3.1522)	(93.4752)	(-1.2381)	(-0.4523)	(0.2674)	(2.5936)	(7.2279)
***Country**: Morocco*	0.4550***	0.9846***			8.0016***	-0.4816***	-0.6309***	-0.1250	0.0154	0.0617
(ref.: *Tunisia)*	(6.6963)	(12.9415)			(88.3855)	(-8.3277)	(-2.8907)	(-0.6152)	(0.2031)	(0.8950)
Constant	-1.4826***	-0.5126***	-0.4839***	-0.3250***	-0.2328**	-0.1163	0.4966***	0.6292***	-0.7960***	-0.2345***
	(-12.6424)	(-4.9521)	(-4.4915)	(-3.0473)	(-2.1841)	(-1.5029)	(4.2532)	(5.4927)	(-8.1413)	(-2.5860)
Observations	5,035	5,035	4,016	4,016	8,293	8,293	1,358	1,358	3,330	3,330
Wald test of *rho*	0.000		0.000		0.000		0.000		0.000	
Rho (ρ) value	-0.3212		0.4916		0.03741		0.3110		0.4926	

Note: No information about *Job status* in 2011. *Morrocco* is omitted in 2014. *Self-employed* category includes only farmers in 2021.Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

Table 5. Estimation of Traditional and Fintech models on the youth subsample (Bivariate models)

Years	**2011**		**2014**		**2017**		**2021**		**2024**	
Models	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**
	(1.11)	(2.11)	(1.14)	(2.14)	(1.17)	(2.17)	(1.21)	(2.21)	(1.24)	(2.24)
Gender: *Female*	0.0481	0.0575	0.1583**	0.2241***	-0.1034	0.2229***	0.1643	0.0416	0.0303	-0.0794
(ref.: *Male)*	(0.7913)	(0.9348)	(2.1476)	(3.1671)	(-0.9706)	(3.4781)	(1.2985)	(0.3379)	(0.4625)	(-1.3201)
Education: *Primary*	0.3515**	-0.7967***	-0.5915***	-0.7010***	-0.3642**	-1.1844***	-0.4494*	-0.7097***	0.1626	-0.1093
(ref.: *Tertiary*)	(2.2717)	(-6.3318)	(-4.5304)	(-5.7056)	(-2.2524)	(-12.1148)	(-1.9447)	(-3.3963)	(1.3701)	(-0.9804)
Education: *Secondary*	0.3102**	-0.8129***	-0.4788***	-0.6878***	-0.3717***	-0.7144***	-0.3992***	-0.3219**	0.0095	-0.1841*
(ref.: *Tertiary*)	(2.0428)	(-6.6740)	(-4.0299)	(-5.9841)	(-2.9130)	(-8.6187)	(-2.9497)	(-2.3901)	(0.0928)	(-1.9266)
Income: *Poorest*	0.0089	-0.7623***	-0.3024**	-0.2920**	-0.5687***	-0.4796***	-0.7164***	-0.4763**	-0.0740	-0.0565
Q1 (ref.: *Richest Q5)*	(0.0880)	(-7.0149)	(-2.3541)	(-2.3892)	(-2.8090)	(-4.2757)	(-3.0565)	(-2.3021)	(-0.7047)	(-0.5759)
Income: *Middle(Q2+Q3+Q4)*	-0.0436	-0.3903***	-0.1459	-0.3428***	-0.3325***	-0.3850***	-0.4336***	-0.2500*	-0.0508	-0.0461
(ref.: *Richest Q5)*	(-0.5704)	(-5.3529)	(-1.5046)	(-3.6352)	(-2.9999)	(-5.6328)	(-3.3911)	(-1.9580)	(-0.6391)	(-0.6187)
Job status: *Self-employed*			1.2022***	0.6249***	0.8783***	0.3073***	0.2972	-0.2513	-0.1875*	0.2117**
(ref.: *Unemployed*)			(12.6659)	(6.3247)	(5.6048)	(3.0125)	(1.0673)	(-0.9973)	(-1.8623)	(2.3490)
Job status: *Employee*			0.5605***	0.3380***	0.9432***	0.4451***	0.4501***	0.1760	-0.0601	0.2841***
(ref.: *Unemployed*)			(6.3278)	(3.7602)	(7.0182)	(6.2290)	(3.4574)	(1.4050)	(-0.8145)	(4.1597)
Informal loan: (ref.:	-0.1388*	0.0063	0.1114	0.1244	0.0094	0.0340	0.0483	-0.0641	-0.0197	0.1713***
No informal loan)	(-1.9577)	(0.0904)	(1.2408)	(1.4473)	(0.0889)	(0.4821)	(0.3941)	(-0.5322)	(-0.2978)	(2.7995)
Country: *Algeria*	0.2592***	1.8033***	-0.0647	-0.0595	0.3031**	-0.3833**	-0.2890**	-0.0042	0.2024*	0.4919***
(ref.: *Tunisia)*	(2.7798)	(16.2784)	(-0.6152)	(-0.5682)	(2.1465)	(-2.3083)	(-1.9978)	(-0.0290)	(1.7913)	(4.6481)
***Country**: Egypt*	-1.0194***	-0.3929**	-0.3498***	-0.3866***	-0.7957***	-0.6395***	-0.6627***	-0.2668	-0.0588	0.1793**
(ref.: *Tunisia)*	(-6.4848)	(-2.5488)	(-3.0195)	(-3.5944)	(-6.3144)	(-5.0053)	(-3.0662)	(-1.4888)	(-0.6020)	(2.0365)
***Country**: Mauritania*	0.2379**	0.9086***	-0.0911	0.1840*	7.6128***	-0.0940	0.0272	0.2234	0.1412	0.5631***
(ref.: *Tunisia)*	(2.5613)	(8.0463)	(-0.8852)	(1.8935)	(58.7161)	(-0.9287)	(0.1178)	(0.9730)	(1.3866)	(5.9808)
***Country**: Morocco*	0.4523***	0.9782***			7.6491***	-0.5302***	-0.6192**	-0.0722	0.0762	0.1275
(ref.: *Tunisia)*	(4.9292)	(8.7428)			(54.4658)	(-5.9558)	(-1.9977)	(-0.2624)	(0.7406)	(1.3415)
Constant	-1.3860***	-0.6206***	-0.7845***	-0.4332***	-0.4790***	-0.1916*	0.1081	0.6141***	-0.7450***	-0.2596**
	(-8.4815)	(-4.3394)	(-5.3461)	(-3.0828)	(-3.1875)	(-1.7908)	(0.5894)	(3.3886)	(-5.7920)	(-2.2028)
Observations	2,687	2,687	2,111	2,111	3,677	3,677	505	505	1,828	1,828
Wald test of *Rho*	0.000		0.000		0.000		0.000		0.000	
Rho (ρ) value	-0.2661		0.5382		0.35		0.3467		0.4758	

Note: No information about *Job status* in 2011. *Morocco* is omitted in 2014. *Self-employed* category includes only farmers in 2021. Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors

According to the full sample regressions in Table 6, Age variable (*Youth*) remains negative and significant with the two models before the pandemic. This age gap confirms our previous results in Table 4. Our *H1* hypothesis remains rejected.

In Table 6 and Table 7, the dependent variable (*Traditional Use*) of model 1a is explained by that of the other model (*Fintech Use*) and vice versa to study the relationship between these two types of financial services. They demonstrate the unidirectional causal effects between them.

The Wald test for *rho* (using a significance level of 10%) confirms the presence of endogeneity and validates the use of the bivariate probit model only for the *Traditional Use* equation (Model 1a) in all years except 2021, as shown in Table 7.

The *Fintech Use* variable is positive over 2014-2021 period (model 1a). By facilitating financial transactions, Fintech services can help unbanked people, especially youths, to find employment and foster entrepreneurship (Festa et al., 2023). It allows them to access the formal financial system through other services such as credit or savings. As a result, banks have become more willing to extend credit to groups that were previously excluded.

Digital services provided by banks, such as mobile banking and credit/debit cards, also allow youths to connect to their bank accounts (if they have one), to track their expenses, plan their savings, anticipate their overdrafts and predict credit possibilities.

In 2024, the sign of *Fintech Use* becomes negative (model 1a.24). This suggests that after a co-adoption phase, mature Fintech institutions are starting to replace some traditional services.

Result confirms our *H2* hypothesis only for the 2014-2021 period and those of Al Smadi (2023), Selka and Benani (2024), Khalaf and Wadi (2023) and Al Rifai and Albaker (2025), although their researches do not focus on youth.

Noteworthy is that the sign of *Fintech Use* variable runs opposite to the sign of the rho value whatever the period. When youth use both services at the same time (complementarity), it sometimes happens that they choose between the two (substitution) for specific financial needs and *vice versa*.

In model 2a, a positive sign of *Traditional Use* shows that the more youths borrow or save from financial institutions, the more they are encouraged to use fintech services. This positive effect is quite significant (marginal effect) during and after the pandemic (model 2.21 and 2.24) compared to 2014 (model 2.14). If young workers, *Employees* or *Self-employed*, are financially included, they will become more accustomed to banking and digital services. However, this traditional financial experience can arouse the desire of youths to explore other more suitable

but non-banking digital tools, especially if they encounter obstacles from their banks hindering the launch of their startup (high bank costs, lack of guarantees, etc.).

This result confirms our *H3* hypothesis only during and since the pandemic and the findings of Rani et al. (2025) and Carranza (2021). In 2011 and 2017 using traditional services had a negative causal effect on the probability of using fintech services. There is substitution: young people choose Fintech instead of traditional services.

Table 6. Estimation of Traditional and Fintech models on the full sample: Unidirectional causality effect (marginal effects only for Univariate probit)

Year	**2011**		**2014**		**2017**		**2021**		**2024**	
Models	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**	**Traditional use**	**Fintech use**
	Bivariate (1a.11)	Univariate (2a.11)	Bivariate (1a.14)	Bivariate (2a.14)	Bivariate (1a.17)	Bivariate (2a.17)	Bivariate (1a.21)	Univariate (2a.21)	Bivariate (1a.24)	Univariate (2a.24)
Age: *Youth (15-34)*	-0.0168	-0.0019	-0.2335***	-0.2220***	-0.1646**	-0.1284***	-0.2720***	0.0217	0.0391	0.0060
(ref.: *Mature ≥ 35)*	(-0.3732)	(-0.1806)	(-4.1876)	(-4.7970)	(-2.5121)	(-3.0138)	(-3.1020)	(0.8095)	(0.8443)	(0.3530)
Fintech use	-1.3905***		1.6035***		1.9068***		-0.7507**		-0.6496*	
(ref.: *no Fintech use*)	(-7.3446)		(5.2412)		(14.2988)		(-2.1769)		(-1.7496)	
Traditional use		0.2424***		-0.9303***		-0.5814***		0.1714***		0.3233***
(ref.: *no Traditional use*)		(22.4197)		(-28.4874)		(-8.7425)		(6.7852)		(18.7429)
Gender: *Female*	0.0282	0.0235**	0.1866***	0.2857***	-0.0267	0.1645***	-0.0144	0.0172	0.0143	-0.0193
(ref.: *Male)*	(0.6263)	(2.4085)	(3.3568)	(6.4223)	(-0.4005)	(3.7424)	(-0.1956)	(0.6515)	(0.3048)	(-1.1872)
Education: *Primary*	0.0260	-0.1361***	-0.2851**	-0.7985***	0.0055	-1.0050***	-0.8464***	-0.3079***	0.0042	-0.0797***
(ref.: *Tertiary*)	(0.2099)	(-7.3676)	(-2.2888)	(-10.5378)	(0.0495)	(-16.0049)	(-6.2166)	(-8.6005)	(0.0478)	(-2.7931)
Education: *Secondary*	-0.0354	-0.1073***	-0.1633	-0.5863***	-0.0190	-0.5762***	-0.3439***	-0.1157***	-0.0500	-0.0764***
(ref.: *Tertiary*)	(-0.3120)	(-5.7728)	(-1.4669)	(-8.0691)	(-0.1942)	(-9.8764)	(-4.0219)	(-3.8769)	(-0.6306)	(-2.9843)
Income: *Poorest*	-0.2400**	-0.1572***	-0.1798*	-0.3733***	-0.3123***	-0.5382***	-0.4417***	-0.0316	-0.0491	-0.0257
Q1 (ref.: *Richest Q5)*	(-2.4370)	(-9.5330)	(-1.8828)	(-4.9302)	(-2.8136)	(-7.3096)	(-3.2838)	(-0.6960)	(-0.6709)	(-0.9797)
Income: *Middle(Q2+Q3+Q4)*	-0.1397**	-0.0833***	-0.0299	-0.2654***	-0.0965	-0.3368***	-0.2574***	-0.0386	-0.0921*	-0.0261
(ref.: *Richest Q5)*	(-2.1172)	(-7.4923)	(-0.4161)	(-4.6089)	(-1.3476)	(-7.4223)	(-3.4551)	(-1.4066)	(-1.6595)	(-1.2848)
Job status: *Self-employed*			0.8143***	0.8598***	0.6475***	0.3286***	0.0094	-0.0213	0.0258	0.1402***
(ref.: *Unemployed*)			(8.4304)	(14.4474)	(7.5761)	(5.3723)	(0.0621)	(-0.3968)	(0.2507)	(5.9187)
Job status: *Employee*			0.3358***	0.3343***	0.5515***	0.4154***	0.3050***	0.0451	0.0350	0.1245***
(ref.: *Unemployed*)			(4.9232)	(6.0633)	(6.4440)	(8.4908)	(4.0812)	(1.6378)	(0.4228)	(6.8706)
Informal loan: (ref.:	-0.1269**	0.0304***	0.1024	0.0723	-0.1355**	-0.0369	-0.0721	-0.0181	0.0662	0.0519***
No informal loan)	(-2.4814)	(2.9786)	(1.6250)	(1.3781)	(-2.0677)	(-0.7822)	(-1.0097)	(-0.6896)	(1.3172)	(3.1248)
Country: *Algeria*	0.8402***	0.3250***	-0.0456	-0.0187	0.4944***	-0.2909***	-0.1397	0.0341	0.3146***	0.1553***
(ref.: *Tunisia)*	(7.1827)	(21.4053)	(-0.6194)	(-0.2823)	(5.3546)	(-2.8493)	(-1.4705)	(1.0448)	(3.4767)	(5.8277)
***Country**: Egypt*	-0.5564***	-0.0980***	-0.2023**	-0.3368***	-0.3269***	-0.6042***	-0.8787***	-0.1565***	0.0569	0.0640***
(ref.: *Tunisia)*	(-6.8249)	(-4.2065)	(-2.5561)	(-5.3899)	(-4.2746)	(-8.3080)	(-8.8649)	(-4.6289)	(0.7734)	(2.7212)
***Country**: Mauritania*	0.5784***	0.1694***	-0.2645***	0.0486	8.6144***	0.6451***	-0.0457	0.0202	0.3213***	0.1832***
(ref.: *Tunisia)*	(7.3485)	(10.0882)	(-3.4896)	(0.7846)	(19.3276)	(5.9349)	(-0.2880)	(0.3769)	(3.2584)	(6.8721)
***Country**: Morocco*	0.7465***	0.2136***			8.8627***	0.3100***	-0.5621***	-0.0077	0.0301	0.0212
(ref.: *Tunisia)*	(8.9833)	(13.3868)			(21.2789)	(3.0510)	(-2.5818)	(-0.1135)	(0.4309)	(0.8500)
Constant	-0.8834***		-1.0962***	0.0125	-1.0681***	0.0886	0.9892***		-0.3816	
	(-5.3833)		(-7.4091)	(0.1325)	(-8.3940)	(1.1083)	(4.1871)		(-1.3471)	

Observations	5,036	5,036	4,016	4,016	8,293	8,293	1,358	1,358	3,330	3.330
Wald test of Rho	0.0017	0.5440	0.0370	0.0000	0.000	0.000	0.0284	0.4358	0.0294	0.1362
Rho (ρ) value	0.5146	-0.1712	-0.4079	0.9879	-0.6878	0.7173	0.7326	0.4282	0.8186	0.7948

Note: No information about *Job status* in 2011. *Morrocco* is omitted in 2014. *Self-employed* category includes only farmers in 2021. Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors

Table 7. Estimation of Traditional and Fintech models on the youth sub-sample: Unidirectional causality effect (marginal effects only for Univariate probit)

Year	**2011**		**2014**		**2017**		**2021**		**2024**	
Models	**Traditional use** Bivariate (1a.11)	**Fintech use** Univariate (2a.11)	**Traditional use** Bivariate (1a.14)	**Fintech use** Univariate (2a.14)	**Traditional use** Bivariate (1a.17)	**Fintech use** Bivariate (2a.17)	**Traditional use** Univariate (1a.21)	**Fintech use** Univariate (2a.21)	**Traditional use** Bivariate (1a.24)	**Fintech use** Univariate (2a.24)
Fintech use	-1.4054***		2.2033***		0.8997***		0.1906***		-0.8770***	
(ref.: *no Fintech use*)	(-4.6395)		(8.5099)		(6.0210)		(4.8704)		(-3.2191)	
Traditional use		-0.1093***		0.2048***		-0.7132***		0.2130***		0.3128***
(ref.: *no Traditional use*)		(-5.7722)		(12.6310)		(-10.7150)		(4.8846)		(13.3252)
Gender: *Female*	0.0685	0.0143	0.0482	0.0381***	-0.1425**	0.1904***	0.0529	0.0033	-0.0120	-0.0335
(ref.: *Male)*	(1.1663)	(1.0338)	(0.6576)	(2.6753)	(-2.3415)	(3.2681)	(1.2646)	(0.0744)	(-0.1947)	(-1.5185)
Education: *Primary*	-0.0350	-0.1709***	-0.1523	-0.1126***	0.5533***	-1.1110***	-0.1001	-0.2247***	0.0775	-0.0559
(ref.: *Tertiary*)	(-0.1844)	(-6.1107)	(-0.9997)	(-4.5058)	(5.3889)	(-11.9331)	(-1.3207)	(-3.0794)	(0.6974)	(-1.3778)
Education: *Secondary*	-0.0754	-0.1756***	-0.0381	-0.1158***	-0.1448	-0.7579***	-0.1125**	-0.0876*	-0.0653	-0.0701**
(ref.: *Tertiary*)	(-0.4140)	(-6.5220)	(-0.2711)	(-4.9626)	(-1.4761)	(-10.1525)	(-2.5450)	(-1.7958)	(-0.6639)	(-2.0522)
Income: *Poorest Q1*	-0.3009**	-0.1719***	-0.1505	-0.0456*	-0.1259	-0.4820***	-0.2078***	-0.1227	-0.0841	-0.0141
(ref.: *Richest Q5)*	(-2.2558)	(-7.1627)	(-1.1616)	(-1.8557)	(-1.3430)	(-4.6466)	(-2.6834)	(-1.6209)	(-0.8869)	(-0.3977)
Income: *Middle(Q2+Q3+Q4)*	-0.2158***	-0.0893***	0.0384	-0.0633***	-0.0886	-0.3133***	-0.1286***	-0.0592	-0.0559	-0.0120
(ref.: *Richest Q5)*	(-2.5777)	(-5.5824)	(0.3871)	(-3.3248)	(-1.2623)	(-5.0135)	(-3.1117)	(-1.2867)	(-0.7805)	(-0.4444)
Job status: S*elf-employed*			0.8031***	0.0418**	0.2696**	0.3425***	0.1197	-0.1169	-0.0466	0.0982***
(ref.: *Unemployed*)			(6.4766)	(1.9904)	(2.3003)	(3.6940)	(1.3067)	(-1.2957)	(-0.4207)	(2.9900)
Job status: *Employee*			0.3485***	0.0362**	0.5628***	0.4452***	0.1406***	0.0309	0.0694	0.1141***
(ref.: *Unemployed*)			(3.5924)	(1.9728)	(7.0817)	(6.8438)	(3.3717)	(0.6750)	(0.8306)	(4.6533)
Informal loan: (ref.:	-0.1256*	-0.0025	0.0518	0.0208	-0.2732***	0.0104	0.0205	-0.0281	0.0510	0.0679***
No informal loan)	(-1.8020)	(-0.1624)	(0.5650)	(1.1969)	(-3.9039)	(0.1566)	(0.4985)	(-0.6408)	(0.7762)	(3.0303)
Country: *Algeria*	0.9714***	0.4121***	-0.0154	-0.0089	-1.7307***	-0.8944***	-0.0982**	0.0204	0.3449***	0.1672***
(ref.: *Tunisia)*	(4.5720)	(19.2479)	(-0.1514)	(-0.4257)	(-14.8329)	(-5.2107)	(-2.0590)	(0.3842)	(3.0902)	(4.4236)
***Country**: Egypt*	-1.0316***	-0.0954***	-0.1724	-0.0597***	-2.4643***	-1.2681***	-0.2055***	-0.0494	0.0390	0.0748**

(ref.: *Tunisia)*	(-6.7857)	(-2.7762)	(-1.4791)	(-2.7007)	(-24.6763)	(-9.1822)	(-2.9177)	(-0.7465)	(0.4077)	(2.2987)
***Country**: Mauritania*	0.4942***	0.2091***	-0.2103**	0.0410**	-1.9837***	-0.3537***	-0.0069	0.0797	0.3280***	0.2016***
(ref.: *Tunisia)*	(4.1155)	(8.4293)	(-2.0177)	(2.0958)	(-22.9058)	(-2.9543)	(-0.0922)	(0.9870)	(2.8824)	(5.9537)
***Country**: Morocco*	0.7276***	0.2314***			5.2957***	0.3774***	-0.2048**	0.0176	0.1052	0.0398
(ref.: *Tunisia)*	(6.2302)	(9.4942)			(63.3947)	(4.5421)	(-2.0011)	(0.1772)	(1.1363)	(1.1549)
Constant	-0.7653***		-1.5097***		0.9466***	0.5710***			-0.1791	0.3128***
	(-3.1424)		(-9.3602)		(8.3686)	(4.2967)			(-0.7328)	(13.3252)
Observations	2,686	2,686	2,111	2,111	4,019	4,019	505	505	1,828	1,828
Wald test of *Rho*	0.043	0.7152	0.0014	0.7126	0.0000	0.0000	0.2456	0.8853	0.0355	0.5570
Rho (ρ) value	0.5951	0.1435	-0.6655	-0.1751	-0.3024	0.6107	0.5011	0.1075	0.9131	-0.6160

Note: No information about *Job status* in 2011. *Morrocco* is omitted in 2014. *Self-employed* category includes only farmers in 2021. Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors

4. Conclusion and Policy implications

Univariate and Bivariate Probit regression models on five pooled samples of households in Algeria, Egypt, Mauritania, Morocco and Tunisia allowed to test three hypotheses on the role of age in financial inclusion aspects and the nature of in the relationship between traditional services use (Savings and borrowings) and the Fintech use (digital services provided by financial institutions and by mobile money service providers) before, during and after the pandemic. Our results show that, although there is an age gap in terms of traditional services use, there is no difference between young and mature people in using Fintech services during and after the pandemic. Hypothesis H_1 is rejected.

Over 2014-2024, the relationship between traditional services use (Savings and borrowings) and the Fintech use are complementary (without a direct causal effect): Young people use both types of financial services simultaneously. This complementarity is justified by common characteristics of individuals which are not observed by our variables.

Despite North African people mays prefer turning to Fintech services, including mobile money accounts over traditional services during the pandemic, youths have adopted different behaviours: Their Fintech use promotes their financial inclusion. On the other hand, the more youths borrow or save at financial institutions the more they are encouraged to use digital bank services or to explore other digital tools via Fintech platforms that are more adapted. Thus, hypothesis H_2 and hypothesis H_3 are validated, respectively for 2014, 2017 and-2021, and 2021-2024.

This unidirectional causality between these two types of use - Fintech and Traditional - has revealed not only that there is a complementarity for young people, but also that these services compete and substitute for each other for specific transactions or services needed by young people that it will be interesting to identify in future researchers.

The positive causality between these two kinds of usage suggests a complementary relationship (unidirectional) between Fintech and bank services for youths and *vice versa*. It also deserves to be studied in future work in both directions (bidirectional or simultaneous).

Financial technologies that are accessible at low cost, tailored for underserved segments, and able to quickly launch new products play a vital role in promoting youth financial inclusion. In turn, banks can leverage this by integrating Fintech solutions or even collaborating with Fintech companies to enhance their service offerings, thereby increasing youth loyalty and engagement. Fintech companies can benefit from the solid banking experience in regulation compliance and robust security, enabling them to innovate more suitable services.

Age is key in promoting financial inclusion, but it is no panacea and cannot substitute for inclusive labor market policies, much as income is the main condition fostering financial inclusion.

Despite the advantages of digital financial services, North Africa has an untapped opportunity (Global Findex, 2025). Several obstacles (limited digital literacy; poor technological infrastructure, lack of digital government skills, low digitalisation of payments, etc.) hinder the use of Fintech services by youths, requiring the intervention of policymakers and the Central Bank in particular.

In the absence of clear protocols, providers have an incentive to sell the highest-function, highest-fee products, regardless of what a customer needs. Customer service agents may also push higher-priced products, motivated by commissions (Klapper et al, 2025).

A balance between appropriate regulatory reforms and consumer protection in the Fintech sector calls for collaboration between Fintech companies and banks to strengthen the role of technology in financial inclusion and *vice versa*.

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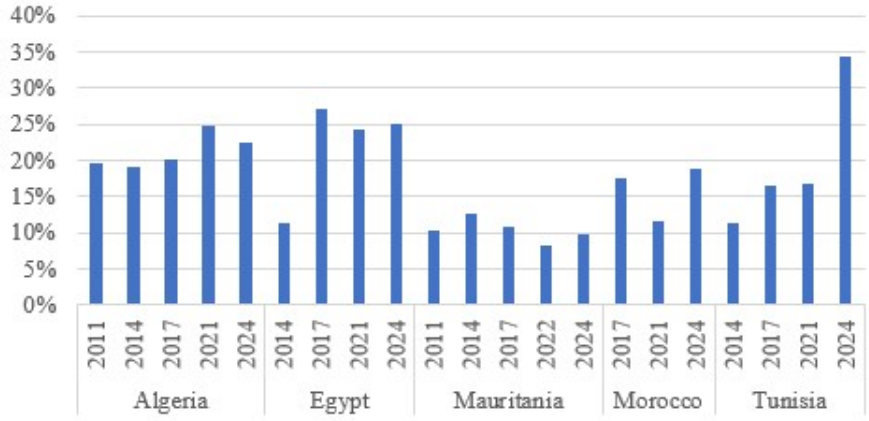
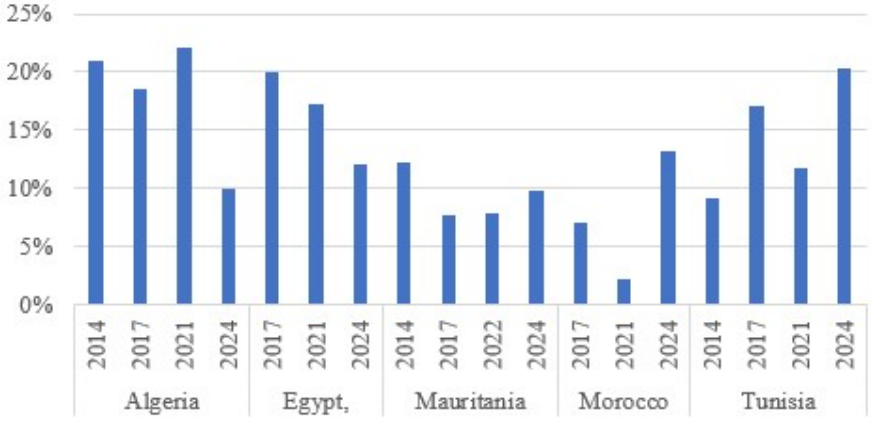
Appendix

Figure A1. Age gap in account holding at a bank or financial institution



Source: Authors from Global Findex (2024)

Figure A2. Age gap in digital payment



Source: Authors from Global Findex (2024)

Table A1. Correlation matrix

	2011		2014		2017		2021		2024	
	Fintech Use	**Traditional Use**	**Fintech Use**	**Traditional Use**	**Fintech Use**	**Traditional Use**	**Fintech Use**	**Traditional Use**	**Fintech Use**	**Traditional Use**
Fintech Use	1.0000		1.0000		1.0000		1.0000		1.0000	
Traditional Use	-0.0883*	1.0000	0.3317*	1.0000	-0.0907*	1.0000	0.3426*	1.0000	0.2944*	1.0000
Age	-0.0148	-0.0179	0.0247	0.0766*	-0.0187	-0.0232	-0.0000	0.0889*	-0.0857*	-0.0156
Gender	-0.0758*	0.0226	-0.1094*	-0.1251*	-0.1204*	0.0905*	0.1179*	0.0973*	0.0312	-0.0165
Education	0.2139*	-0.0348	0.0819*	0.0903*	0.1855*	-0.0416*	0.1184*	0.1154*	0.0136	0.0017
Income	0.1214*	-0.0788*	0.1505*	0.1184*	0.2831*	-0.2157*	0.3783*	0.2245*	0.0768*	-0.0009
Informal loan	-0.0015	-0.0439*	0.0129	0.0385	0.0107	-0.1514*	-0.0305	-0.0115	0.0828*	0.0274

Source: Authors

Table A2. Dictionary of variables

	Name	Type	Definition
Financial inclusion measures	*Account holding*	Discrete, binary	*Yes, has an account at a formal financial institution, a mobile money account or both =1, No=0*
	Traditional services at financial institution	Discrete, binary	*Yes, if saving or borrowings or both =1, No=0*
	Fintech services by financial institution	Discrete, binary	*Yes, withdrawals, check account, pay bills, send or receive money, wages, public or private transfers, Savings and loan*

	and/or Mobile money service providers		*via mobile money account and other Fintech services=1, No=0*
External funding sources	*Informal loan*	Discrete, binary	*Yes, borrowed from family or friends, an informal savings club or private lenders =1, No=0*
Household characteristics	*Age*	Discrete, binary	*Young (15-34) = 1* *Mature (≥ 35) = 2*
	Gender	Discrete, binary	*Female = 1* *Male = 2*
	Education level	Discrete, categorical (1, 2, 3)	*Primary or less= 1* *Secondary = 2* *Tertiary or higher= 3*
	Income	Discrete, categorical (1, 2, 3)	*Poorest 1st quintile (Q1) = 1* *Middle (2nd +3rd+4th quintiles) =2* *Richest 5th quintile (Q5) = 3*
	Job status	Discrete, categorical (1, 2, 3)	*Unemployed = 0* *Employee = 1* *Self-employed = 2*
Control variables	*Country Dummies*	Discrete	*Algeria, Egypt, Mauritania, Morocco and Tunisia*

Source: Authors from the Global Findex database (2011, 2014, 2017, 2021 and 2024).