

Financial Technology As A Driver of Financial Inclusion and Inclusive Development in the MENA Region: Risks and Opportunities

Aomar Ibourk and Zakaria Elouaourti



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Financial technology as a driver of financial inclusion and inclusive development in the MENA region: Risks and opportunities

Aomar IBOURK[†] and Zakaria ELOUAOURTI[‡]

[†] *Head of the Economic Department at Cadi Ayyad University and Senior Fellow - Policy Center for the New South, Morocco, email: aomaribourk@gmail.com*

[‡] *Post-doctorate at Cadi Ayyad University, Marrakech, Morocco, email: zakariaelouaourti@gmail.com*

Abstract

The digital divide in the financial sector has occurred through the development of financial technologies. These latest “FinTech” refers to technological innovations that have emerged in the financial system in recent years, which are the new channels for providing financial services. These innovations have disrupted traditional financing models by making financial transactions more secure and by reducing spatiotemporal constraints. The purpose of this paper is to investigate 1) the digital financial inclusion levels across the MENA countries? 2) which segments of the population are digitally financially excluded? 3) How the digital divide could preclude some segments from being financially included as a result of a lack of financial literacy (risks)? 4) and how FinTech could promote financial inclusion of segments excluded by the conventional financial system (women, elderly) and therefore the inclusive development of the MENA region (opportunities). To tackle these issues, we employed a mixed methodological approach (quantitative and qualitative) and by mobilizing *micro-level data on 9,053 individuals* extracted from the World Bank's latest Global Findex 2021 database. First, our comparative analysis mobilizing the principal component analysis method to develop a **Digital Financial Inclusion Index (DFII)** highlighted that despite the various initiatives that have been undertaken in recent years, digital financial inclusion in the MENA region remains at a low level compared to other countries worldwide. Second, the results of the estimations on a Logit model pointed out that the educational level, labor force participation, information and communication technologies, and internet access are the main drivers of digital financial inclusion in the MENA region. Our work is original in that it provides grounded empirical evidence on the digital financial inclusion levels across MENA countries and investigates how to ensure that the digital divide in the financial sector "Financial Technologies" does not further exclude segments of the population (women, elderly...) financially excluded by the conventional financial system by increasing their digital financial literacy, promoting their participation in the labor market, and expanding access to mobile phones and the Internet. Considering the comprehensiveness of our sample, policy implications will be of great interest to financial sector regulators in MENA region to improve digital financial inclusion in the region, as these implications have been drawn from the micro-level experiences of individuals constituting our database.

Keywords: Financial technology, financial inclusion, inclusive development, Digital Financial Inclusion Indexes, MENA.

JEL Classification: G2; C35.

I. Introduction

Fintech is shaping the future of the banking industry. Recently, there has been a renewed interest in Fintech as a key instrument for financial inclusion. In essence, Fintech, a contraction of “*Financial Technology*” refers to players in the banking industry that use technological innovations to conduct financial activity. On the one hand, these innovations provide excluded populations with mobile banking applications to solve problems related to the remoteness of bank branches, the high cost of financial services, and the lack of trust in the traditional financial system. On the other hand, they offer already financially included populations efficient and more suitable financial services (Ezzahid and Elouaourti, 2021a).

In addition, Fintech’s platforms offer innovative tools for firms to control their operational costs and expanding the financial product palette proposed to firms. At 12% of transactions conducted by fintech’s in the MENA region, this industry is growing by leaps and bounds but is still at an early stage that requires MENA financial sector supervisors to establish the necessary technological infrastructure for the development of this sector as well as the appropriate regulatory frameworks to foster its growth (Chinnasamy et al., 2021).

Financial technologies' potential role as a driver of financial inclusion and development in the MENA region has received particular attention among researchers. Franklin A., (2021) discussed theoretically the benefits of fintech to economies and financial systems in terms of growth in the MENA region. They considered two groups of countries, the first of which was high-income countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) and the second of which was middle-income countries (Algeria, Egypt, Iraq, Jordan, Lebanon, Morocco, and Tunisia). Fintech can increase financial inclusion for both households and businesses and can help reduce inequality in both groups of countries. Belouafi (2021) mobilized a descriptive approach to explore the current state and prospects of fintech in the MENA region. This study identified the Dubai Financial Center as the most developed fintech ecosystem in the MENA region, and will play a leading role in the coming years as a model for other sectors in the region.

The digital divide has brought benefits to many areas of life in moderate societies, although it has not reached all segments of these societies, especially the elderly, women and people with a low educational attainment (Wu et al., (2015); Jun (2021)). Financial technology's role in promoting financial inclusion for both individuals and businesses have become a popular topic in recent years. However, the majority of contributions whose scope is the MENA region have been either theoretical (Khwaja, 2020; Holle, 2020; Franklin, 2021; Chinnasamy et al., 2021; Stefanie, 2021) or using descriptive approaches (Arezki and Senbet, 2020; Belouafi, 2021), in addition, there has not

been sufficient research investigating “how the digital divide in the financial sector could accentuate financial exclusion of already excluded segments of the population due to lack of digital financial education (Fintech risks), but how it could also contribute to filling the gender, generational and educational gaps in financial inclusion (Fintech opportunities)”. The main question of this paper is as follows: “How to ensure that the digital divide in the financial sector "Financial Technologies" does not further exclude population segments (women, elderly ...) financially excluded by the conventional financial system in the MENA region”?

To answer this question, research epistemology provides us with the positivist paradigm by adopting a hypothetical-deductive reasoning mode and a mixed methodological approach (quantitative and qualitative) to investigate the different sub-issues of our main research question and drawing practical implications on the mediating role of financial technologies in financial inclusion and development in the MENA region. To this purpose, other secondary questions arise: 1) How are MENA countries progressing in terms of digital financial inclusion? 2) How individual characteristics are associated with financial technologies use in the MENA region? 3) How the digital divide could preclude some segments from being financially included as a result of a lack of financial literacy? 4) How FinTech could promote financial inclusion of segments excluded by the conventional financial system (women, elderly) and consequently the inclusive development of the MENA region.

As opposed to most studies that have been conducted in the MENA region, our work is original as it will mobilize *a new database (Global Findex 2021 database) at the micro level* that cover **9,053 individuals** to provide empirical evidence on: 1) the digital financial inclusion levels across the MENA countries? 2) which segments of the population are digitally financially excluded? 3) How the digital divide could preclude some segments from being financially included as a result of a lack of financial literacy (risks)? 4) and how FinTech could promote financial inclusion of segments excluded by the conventional financial system (women, elderly) and therefore the inclusive development of the MENA region (opportunities).

The main implications of our study are twofold. *On the practical side*, given the representativeness of our sample, policy implications of our study will be valuable and provide useful insights for international institutions and policymakers in the MENA region working to improve digital financial inclusion within the region. *On the research side*, our study will fill the gap in the literature which has been mainly theoretical or mobilizing descriptive approaches by, first, conducting comparative analyses between the digital financial inclusion levels in the MENA

region and, second, examining the impact of the digital divide that is taking place in the financial sector on population segments already excluded by the traditional financial system.

This paper is structured as follows. Literature review (**section 2**), stylized facts on the use of financial technologies in the MENA region (**section 3**), developing a digital financial inclusion index (**section 4**), data, variables and empirical methodology (**section 5**), presentation and discussion of the empirical results (**section 6**), and some concluding remarks (**section 7**)

II. Literature review

The digital world has profoundly affected human behaviors through information and communication technologies. The main objective of the use of these innovations in the financial services industry is to solve a triple-dimensional problem of remoteness, time and cost, through the provision of financial services to segments of the population excluded by the traditional financial system, anywhere, in real-time and with the minimum of cost. Digital financial services fit into the new paradigm of the financial services industry, allowing the unbanked and underbanked population to gain access to essential financial services in real-time and at affordable prices (Chu, 2018).

Technology and internet infrastructure development combined with financial literacy promote financial inclusion through the digital channel. Beyene Fanta and Makina (2019) investigated the impact of information and communication technology (ICT) development on the financial inclusion level in 168 countries, including 48 African countries. Findings revealed that access to the internet promotes financial inclusion. Kouladoum et al (2022) investigated the impact of digital technology on financial inclusion in a sample of 43 sub-Saharan African countries. Results showed that digital technology has significant positive effects on financial inclusion. Financial inclusion rates in Sub-Saharan Africa increase with the development of digital technologies. Niu et al (2022) investigated the effect of large-scale infrastructure construction on digital financial inclusion in rural China. Empirical results showed that broadband infrastructure contributes significantly to digital financial inclusion in rural areas. However, this effect is driven by several moderators, notably, human capital, social capital, and financial system penetration levels.

Digital financial inclusion is crucial for economic growth and environmental quality. Ozturk and Ullah (2022) examined the relationship between digital financial inclusion, economic growth and environmental quality. Findings based on a panel of 42 countries showed that digital financial inclusion stimulates economic growth but generates more CO₂ emissions, which negatively impacts environmental sustainability. Other studies have found a positive effect of digital financial

inclusion on green development, Zheng and Li (2022) analyzed the relationship between digital financial inclusion and carbon dioxide emissions, by mobilizing a database of 30 Chinese provinces over the period 2013-2020, empirical results pointed out that digital financial inclusion in terms of depth of use and digitalization level contributes to the reduction of carbon dioxide emissions.

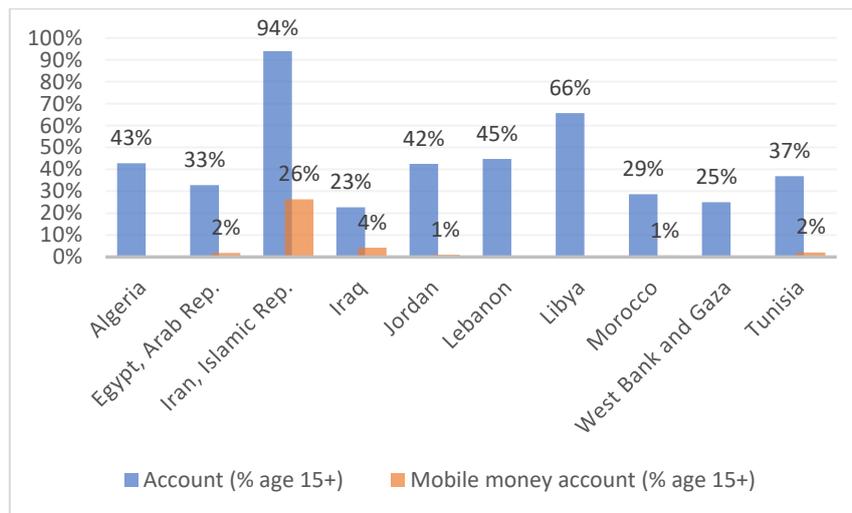
Based on data from 105 countries, Shen et al., (2021) examined the relationship of digital financial inclusion and economic growth, the empirical results highlighted that digital financial inclusion has a significant positive effect on economic growth. Using provincial panel data from 2011 to 2019 in China, Liu et al, (2021) studied the impact of digital financial inclusion on economic growth. Empirical findings showed a positive effect of digital financial inclusion on economic growth, with a threshold effect related to the internet penetration level. However, this effect is moderated by the promotion of domestic consumption and entrepreneurship.

Access to finance is one of the key determinants of success in any entrepreneurial venture, and this access remains gender heterogeneous, making it more difficult for women to engage in entrepreneurship. Yang et al (2022) examined how digital financial inclusion could fill the gender gap in access to finance and consequently promote women's entrepreneurship. Empirical findings revealed that digital financial inclusion contributes to reducing women's financing and information constraints, improves their work flexibility and promotes women's empowerment.

III. Financial technology as a driver of financial inclusion in MENA region: stylized facts

Digital financial services adoption profiles in the MENA region vary by country. However, the common observation across all countries in the region is that cash-based culture remains dominant. With the exception of Iran, where the percentage of mobile bank account ownership has reached 26% of the adult population in 2017, the majority of MENA countries have recorded low rates of mobile bank account usage (figure 1).

Figure 1 : Digital financial inclusion : MENA region



Source: authors' elaboration based on the World Bank Global Findex database 2017

The profiles of MENA countries in terms of digital financial inclusion can be stratified into two categories (Riley et al., 2020). The first is countries that have made minimal progress in this area, despite the efforts of financial sector regulators:

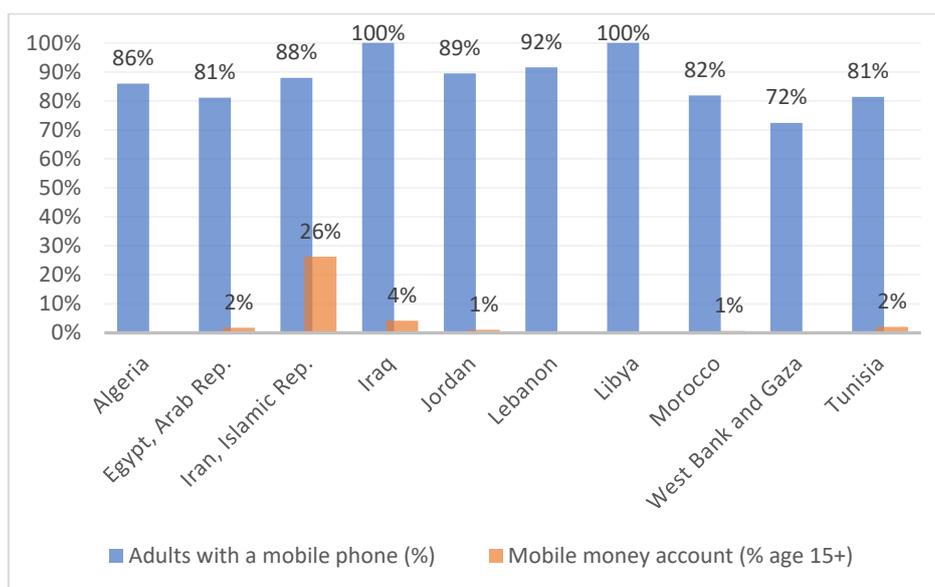
- 1) **Algeria:** the pace of adoption of digital financial services in Algeria remains slow due to the lack of consumer trust in these services, which risks delaying the development of digital financial services.
- 2) **Iraq:** displaying one of the lowest Bancarization rates in the MENA region (23% (Global Findex, 2017), Iraq remains among the countries with the highest financial exclusion rates in this region, thus hindering the development of digital financial services.
- 3) **Jordan:** to increase accessibility to digital financial services, Jordan has engaged in international partnerships and by making IT infrastructure development coupled with programs to cultivate digital literacy among citizens remain the main levers to promote digital financial inclusion. Despite all these efforts, the percentage of adults with an account has reached only 42% in 2017 (Global FIndex, 2017).
- 4) **Lebanon:** the regulatory framework for financial institutions restricts financial actors other than banks from providing digital financial services. As a result, progress in promoting financial inclusion has been minimal, with bank enrollment increasing from 37 percent in 2011 to 45 percent in 2017 (Global Findex, 2017).
- 5) The political instability in **Syria** and **Libya** and **Yemen's** civil war since 2011 has thwarted efforts to promote financial inclusion.

The second category is that of leading MENA countries in terms of digital financial inclusion:

- 1) **United Arab Emirates:** having the most developed fintech ecosystem "Dubai Financial Center" in the MENA region, policy makers in the United Arab Emirates have set their sights on making Dubai a "fintech hub" that will be a reference model for other countries in the MENA region.
- 2) **Morocco:** the financial sector regulators have shown an uneven commitment to promoting digital financial inclusion through the implementation of several reforms, the most recent of which is the " National Strategy for Financial Inclusion " launched in 2018 and through the implementation of the banking laws in 2015 to liberalize the sector and the licensing of new financial technologies entrants to develop the digital financial services supply. Despite this commitment, inter- and intra-regional inequalities in terms of financial inclusion persist in Morocco and are even increasing when considering digital financial inclusion.
- 3) **Egypt:** boasting one of the most dynamic financial technology ecosystems in the MENA region, Egypt has adopted a mixed carrot and stick strategy, highlighting the benefits of using fintech for consumers and facilitating the procedures for opening mobile accounts on the one hand, and mandating the use of e-payments in various daily activities of citizens on the other.
- 4) **Tunisia:** considered one of the first financial technology adopters in the MENA region, Tunisia has introduced these services through its postal networks. However, more efforts are needed as the proportion of unbanked people has reached 63% (Global Findex, 2017).

Recall that the number of unbanked adults owning a cell phone has reached more than 100 million adults in the MENA region distributed as follows (in millions): Algeria (13.10), Bahrain (0.20), Egypt, Arab Rep (33.79), Iran, Islamic Rep (2.54), Iraq (17.11), Israel (0.44), Jordan (2.96), Kuwait (0.65), Lebanon (2. 23), Libya (1. 55), Morocco (14.09), Saudi Arabia (6.80), Tunisia (3.48), United Arab Emirates (0.94), and West Bank and Gaza (1.58), totaling 101.45 million for the MENA region (Global Findex database; Gallup World Poll, 2017).

Figure 2: Mobile phone subscription and digital financial inclusion: MENA region



Source: authors' elaboration based on Gallup World Poll 2017 database.

The use of financial technologies requires mobile phone subscription and internet penetration, which is present in a majority of MENA countries. Mobile phone subscription levels are over 80% in most MENA countries (figure 2). Financial inclusion via the digital channel remains a powerful option, however, digital financial inclusion will continue to elude segments excluded by the traditional financial system in the absence of financial education.

IV. Digital financial inclusion in MENA region

In this section we aim to develop a Digital Financial Inclusion Index for the MENA region, which will allow us to conduct a comparative analysis across the different countries in the region as well as stand out from the literature tackling this issue in this region and which mobilizes separate variables to quantify the level of digital financial inclusion.

4.1 Digital financial inclusion Index sub-indicators

Our approach is based on principal component analysis (PCA), a method used to reduce the information contained in a set of highly correlated variables. We extracted from the Global Findex country-level database data on variables that quantify digital financial inclusion in the MENA region. These variables quantify both the access dimension and the usage dimension are presented in the following table:

Table 1: Digital financial inclusion index sub-indicators

Variables	N	Mean	Sd	Min	Max
Used a mobile phone or the internet to check account balance (% age 15+)	9	0.197	0.219	0.0220	0.630
Used a mobile phone or the internet to buy something online (% age 15+)	9	0.167	0.0876	0.0700	0.310
Used a mobile phone or the internet to pay bills (% age 15+)	9	0.0739	0.107	0.00500	0.350
Made a utility payment: using a mobile phone (% age 15+)	9	0.0395	0.0801	0.000900	0.250
Received wages: through a mobile phone (% age 15+)	9	0.00487	0.00366	0	0.01000

Source : authors' calculations

4.2 MENA' Digital financial inclusion Index

After we have identified the sub-indicators of our index, we will reduce our 5 variables to a single synthetic index. In our case, the principal component analysis (PCA) method is mobilized to reduce these sub-indicators. Following the method used by Ezzahid and Elouaourti (2018), we conduct a comparative analysis of Digital Financial Inclusion levels in 08 MENA countries. The weight of each sub-indicator in the synthetic index is:

$$w_j = \text{Weight}_j = \frac{(LF_j)^2}{VT}$$

“LF is the loading factor and VT is the total variance measured by the sum of the eigenvalues in the explained variance table. The composite index for country *i* in year *t* is” (Ezzahid and Elouaourti, 2018, p.82; Ezzahid and Elouaourti, 2021; Ezzahid and Elouaourti, 2021a, b):

$$\text{Digital financial inclusion Index (DFII)}_t = \sum_{j=1}^J w_j \times \text{Indicator}_{jt}$$

Index *j* refers to one of the 05 sub-indicators aggregated to obtain the synthetic index.

Table 2: Digital financial inclusion Index (DFII), 2021.

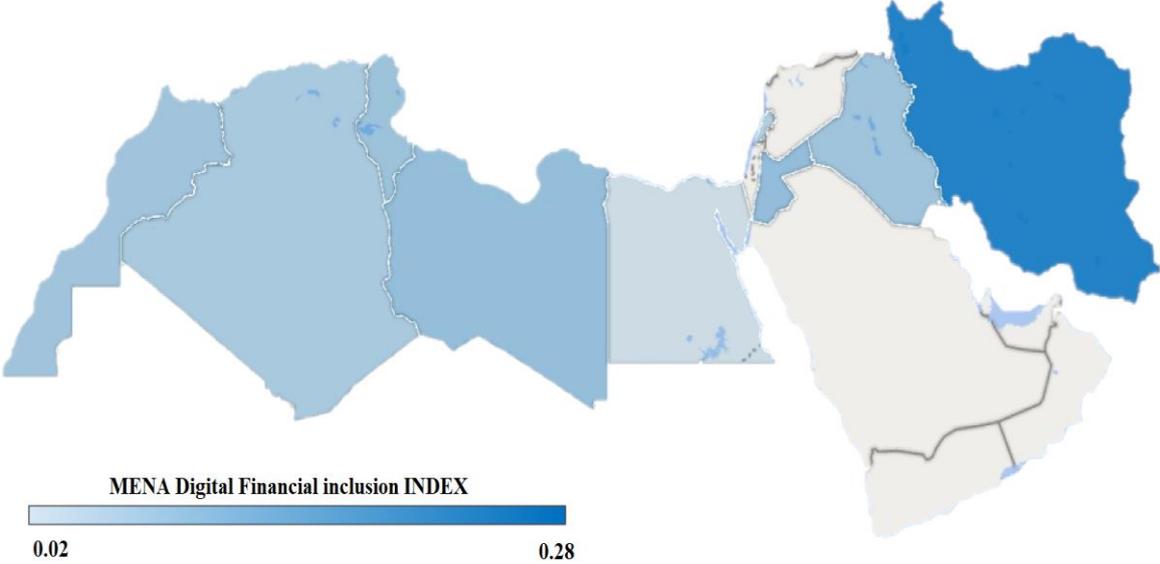
Country	MENA Digital financial inclusion index	Rank
Iran	0.279884	1
Jordan	0.087679	2
Tunisia	0.071019	4
Iraq	0.067749	5

<i>Palestine</i>	0.065406	6
<i>Morocco</i>	0.065054	7
<i>Algeria</i>	0.050504	8
<i>Lebanon</i>	0.031863	9
<i>Egypt</i>	0.016472	10

Source: Author's computation.

Our comparative analysis between the 08 MENA countries for which data is available on the indicators of mobile banking usage in the different areas of daily life revealed that Iran comes in first position with a digital financial inclusion index equal to 0.27 followed by Tunisia with 0.08. The following map on Digital Financial Inclusion in the MENA region highlights two main facts. First, the majority of MENA countries have a low digital financial inclusion level. Second, the gap between Iran and other countries is very pronounced (figure 3).

Figure 3: MENA’ Digital financial inclusion map, 2021



Source: authors’ elaboration. (Countries not displayed are those for which data on mobile banking use are not available).

In sum, our comparative analysis of the levels of digital financial inclusion in the MENA region has revealed that despite the various initiatives that have been undertaken in recent years, the level of digital financial inclusion remains at a low level compared to other countries around the world. Let's now deepen our analysis to understand the reasons for MENA's lagging achievement in Digital Financial Inclusion.

V. Data, variables and empirical methodology

5.1 Data

The purpose of this paper is to investigate the risks as well as the opportunities associated with financial technology developments in the MENA region. First, we have conducted a comparative analysis of the levels of digital financial inclusion in the MENA region. Second, we will explore the determinants of financial technology use in order to identify the excluded population segments in the MENA region. In addition, our study seeks to examine the impact of digital financial literacy on the likelihood of excluded segments to switch to financial inclusion through financial technology use.

To answer these questions, we will mobilize a micro database covering **9,053 individuals** extracted from the latest *Global Findex 2021 database* (table 3). This database was conducted in 120 economies and includes micro-level data on 125,000 adults. This latest edition contains data on access to and use of digital financial services according to several individual characteristics as well as the use of financial technologies in the COVID-19 crisis (World Bank, Global Findex, 2021).

Table 3: Number of individuals per country, MENA, 2021

Economy	Freq.	Percent	Cum.
Algeria	1,002	11.07	11.07
Egypt, Arab Rep.	1,003	11.08	22.15
Iran, Islamic Rep.	1,005	11.1	33.25
Iraq	1,012	11.18	44.43
Jordan	1,009	11.15	55.57
Lebanon	1,022	11.29	66.86
Morocco	1,000	11.05	77.91
Tunisia	1,000	11.05	88.95
West Bank and Gaza	1,000	11.05	100
Total	9,053	100	

Source: Authors' calculation.

5.2 Variables

The purpose of this paper is to investigate factors determining the use of digital financial inclusion in MENA region. We will mobilize a series of variables that provide information on the use of financial technology in the various daily activities (mobile banking, bills payments, remittances,

utility bills payment, wage and salary payments and government transfers). To do this, we will mobilize binary variables that inform whether or not the individual has used one of the financial technologies (mobile banking or e-banking) for the achievement of the transaction, if the individual has used one of the so-called Fintech innovations, the variable is equal to 1 otherwise, the variable is equal to 0. Additionally, to capture the impact of technology and internet infrastructure on the likelihood that an MENA's adults will be financially included via the digital channel, individuals in our database were asked whether they have a " **mobile phone** " and whether they have access to the " **internet** ", both variables are binary and equal to 1 if the individual has a cell phone and/or access to the internet and equal to 0 otherwise (table 4).

Table 4: Study variables

VARIABLES	N	mean
Female	9,053	0.488
Age ¹	9,050	37.65
<u>Education</u>		
Primary	9,040	0.308
secondary	9,040	0.504
Tertiary	9,040	0.188
<u>Income</u>		
Quartile 1	9,053	0.164
Quartile 2	9,053	0.177
Quartile 3	9,053	0.198
Quartile 4	9,053	0.213
Quartile 5	9,053	0.246
<u>Workforce and location</u>		
In workforce	9,053	0.559
Location (Urban =1)	4,015	0.854
<u>Technologies access</u>		
Owns a mobile phone	9,047	0.929
Internet access	9,053	0.768
<u>Digital financial inclusion</u>		
Has an account	9,053	0.472
Has an account at a financial institution	9,053	0.458
Has a mobile money account	7,029	0.0718
Used mobile phone or internet to check account	3,869	0.254
<u>Barriers to financial inclusion</u>		
Too far	5,139	0.116
Too expensive	4,917	0.293
Lack of documentation	5,135	0.128
Lack of trust	5,052	0.234
Religious reasons	5,108	0.136
Lack of money	5,141	0.778
Family member have one	5,125	0.189
No need of financial services	5,091	0.407
<u>Financial technologies use</u>		
Borrowing with mobile banking app	499	0.0741
Saving with mobile banking app	501	0.367
Use mobile phone to pay for a purchase in-store	9,039	0.0823
Bought something online using the Internet	9,038	0.160
Send money to a relative or friend online using the Internet	9,039	0.0860

¹ The sample age range is between 15 and 98 years old.

If received domestic remittances: through a financial institution or mobile money app	1,442	0.194
If received wage payments: through a mobile phone	1,791	0.0413
If received government transfers: through a mobile phone	1,539	0.0754
If received agricultural payments: through a mobile phone	274	0.0365

Source: Authors' calculation.

Preliminary analysis of our database (table 4) shows that MENA region's adults using the digital channel more in financial transactions related to saving and remittances, with over 36% of individuals in our database using mobile banking applications to save money. Our database is made up of 48% women, the average age of the individuals in our database is 37 years old and there are 85% living in urban areas. As for the educational level, only 18% of the individuals have a tertiary education compared to 30% for primary and 50% for secondary education. As for access to technological and internet infrastructure, 92% have a cell phone and only 76% have access to the internet.

5.3 Empirical model

To investigate the determinants of digital financial inclusion and what role technology and internet infrastructure plays in MENA region, we mobilize the Probit model methodology used in a broad empirical literature (Ezzahid and Elouaourti, 2021). The specification of our model on the microeconomic data is as follows:

$$Y_i = \alpha_0 + \alpha_1 * Female_i + \alpha_2 * Age_i + \alpha_3 * Age_i^2 + \alpha_4 * Income_i + \alpha_5 * Education_i + \alpha_6 * Workforce_i + \alpha_7 * Location_i + \alpha_8 * Mobile\ phone_i + \alpha_9 * Internet_i + \varepsilon_i$$

Y are the endogenous variables that capture digital financial inclusion and i denotes the individual. The “**Gender**” variable provides information on the gender of the individual, equal to 1 for women and equal to 0 for men. The “**Age**” variable represents the age of the individual, the “**Age²**” variable is used to check for a possible non-linear relationship between age and the endogenous variables. The “**Income**” variable quantifies the income level of the individual, by distinguishing four quantiles (poor, second, third and fourth quantiles) which are binary variables with the value 1 if the income level of the individual belongs to the so-called quantile and equal to 0 otherwise; the fifth quantile "rich" is the omitted binary variable. The “**Education**” variable informs on the educational attainment of the individual with three levels: primary or less, secondary and tertiary or more, the education variable is equal to 1 if the individual is in the said educational level and equal to 0 otherwise. The variable “**Workforce**” indicates if the person is participating in the labor market, equal to 1 if the person is participating and equal to 0 if not. “**Location**” variable provides

information on the individual's location, equal to 1 for urban and equal to 0 for rural. “**Mobile phone**” and “**Internet**” are binary variables that inform about the individual's access to the technological infrastructure, equal to 1 if the individual has access and equal to 0 otherwise.

VI. Digital financial inclusion: empirical results and discussion

We investigate the determinants of digital financial inclusion in MENA region. We will estimate Logit models whose dependent variables are the ones that capture the use of Fintech (mobile banking) in the different areas of daily lives, such as consulting their accounts via a mobile banking application, receiving and sending remittances, paying purchases on the internet, wage and then we will examine the barriers that constrain the use of financial services in MENA region.

5.1 Digital financial inclusion determinants

We estimated a Logit model with the dependent variables "Used cell phone or internet to check account balance" and "Has a mobile money account" to capture the determinants of digital financial inclusion in MENA region (table 5). Empirical results highlighted that being a male with a higher educational attainment and participating in the labor market favors being financially included via the digital channel. Regarding the impacts of access to technological infrastructure, our results point to the fact that having a mobile phone and having access to the internet positively and significantly affects digital financial inclusion. These results are in line with the literature that found that access to technological and internet infrastructure promotes financial inclusion (Beyene Fanta and Makina, 2019; Kouladoum et al., 2022; Niu et al., 2022).

Table 5: Digital Financial Inclusion vs. Traditional Financial Inclusion Determinants, MENA Region

Variables	<i>Has an account at a financial institution</i>	<i>Has a mobile money account</i>	<i>Used mobile phone or internet to access FI account</i>
Female	-0.0734***	-0.0214***	-0.0193
Age	0.0172*** (0.00217)	0.000997 (0.00141)	-0.00869** (0.00388)
Age ²	-9.65e-05*** (2.45e-05)	-2.38e-05 (1.81e-05)	6.73e-05 (4.53e-05)
<u>Education</u>	(0.0149)	(0.00740)	(0.0205)
Secondary	0.0754*** (0.0166)	0.0180* (0.00983)	0.0582 (0.0366)
Tertiary	0.243*** (0.0210)	0.0394*** (0.0111)	0.133*** (0.0373)
<u>Income</u>			
Q2	0.0714*** (0.0254)	-0.0140 (0.0140)	-0.0703 (0.0490)
Q3	0.0647*** (0.0248)	-0.0143 (0.0128)	-0.0497 (0.0429)
Q4	0.104*** (0.0240)	-0.000495 (0.0119)	-0.0613 (0.0418)

Q5	0.183*** (0.0226)	0.0216* (0.0112)	-0.0241 (0.0391)
In workforce	0.0678*** (0.0158)	0.00875 (0.00776)	-0.0361 (0.0226)
Urban	-0.0174 (0.0189)	0.0107 (0.0103)	0.0143 (0.0299)
Owns a mobile phone	0.0899*** (0.0245)	0.0407* (0.0210)	0.0573 (0.0788)
Internet access	0.0563*** (0.0170)	0.0252** (0.0105)	0.161*** (0.0444)
Observations	4,005	4,005	1,182

Source: Authors' calculations. P-value: ***p < 0.01, ** p< 0.05, * p< 0.1. Estimated marginal effects without stars are statistically insignificant.

Our results corroborate several studies that have examined the determinants of digital financial inclusion (Zins and Weill, 2016; Ezzahid and Elouaourti, 2021a). Based on micro-level data on 37,102 African adults, Zins and Weill (2016) found that educational attainment is a key determinant of mobile banking use in Africa. Ezzahid and Elouaourti (2021a) based on a sample survey of 5110 Moroccan adults reported that educational attainment and labor force participation significantly and positively impact mobile banking usage in Morocco.

5.2 Financial inclusion barriers

Global Findex 2021 database listed 08 barriers to financial inclusion, including voluntary exclusion barriers (religious reasons) and involuntary exclusion barriers (Too far away, expensive, lack of money and lack of documentation). It is worth noting that financial inclusion, meaning access to and use of formal financial services, can be achieved either through the traditional bank branch channel or through the development of the digital world via financial technologies. In many cases, these financial technologies are inaccessible either for reasons specific to the individual or for reasons inherent to the environment.

To determine the probable barriers to financial inclusion in MENA region, we integrate the 08 barriers to digital financial inclusion as dependent variables (table 6), controlling the models by individual characteristics and access to technological infrastructure variables. Empirical results indicate that MENA' region women are not financially included as they consider that the possession of an account by a family member prevents them from being financially included, as well as individuals with secondary education. Individuals in lower income quintiles face involuntary barriers to financial inclusion, including lack of trust and a family member owning an account.

Table 6: Barriers financial inclusion in MENA region

Variables	Too far	Too expensive	Lack of documentation	Lack of trust	Religious reasons	Lack of money	Family member have one	No need financial services
Female	-0.0102 (0.0151)	-0.0525** (0.0207)	-0.0124 (0.0141)	-0.0694*** (0.0184)	0.0151 (0.0154)	-0.00144 (0.0179)	0.0714*** (0.0165)	-0.000589 (0.0221)
Age	-0.00108 (0.00201)	0.00205 (0.00285)	-0.0116*** (0.00185)	-0.00200 (0.00257)	-0.00204 (0.00204)	0.00486** (0.00233)	-0.00426* (0.00221)	-0.00250 (0.00302)
Age ²	6.24e-06 (2.32e-05)	-3.20e-05 (3.33e-05)	0.000108*** (2.12e-05)	9.62e-06 (3.04e-05)	2.42e-05 (2.34e-05)	-6.68e-05** (2.67e-05)	4.56e-05* (2.62e-05)	1.78e-05 (3.52e-05)
<i>Education</i>								
Secondary	-0.0668*** (0.0148)	-0.131*** (0.0201)	-0.0217 (0.0144)	-0.0363* (0.0186)	-0.0437*** (0.0154)	-0.0364* (0.0186)	0.0472*** (0.0173)	-0.00759 (0.0222)
Tertiary	-0.0719*** (0.0257)	-0.148*** (0.0343)	-0.0296 (0.0256)	-0.0260 (0.0299)	-0.0291 (0.0248)	-0.0430 (0.0290)	0.0170 (0.0264)	-0.00423 (0.0361)
<i>Income</i>								
Q2	0.0152 (0.0212)	-0.00404 (0.0282)	-0.0124 (0.0190)	0.0682*** (0.0261)	-0.00362 (0.0217)	-0.00420 (0.0262)	0.0811*** (0.0288)	0.0442 (0.0309)
Q3	0.0165 (0.0210)	-0.0124 (0.0280)	-0.0328* (0.0193)	0.0413 (0.0262)	-0.0206 (0.0219)	0.00246 (0.0259)	0.113*** (0.0275)	0.113*** (0.0299)
Q4	0.0345* (0.0208)	0.00839 (0.0280)	-0.0158 (0.0190)	0.0494* (0.0263)	0.0121 (0.0211)	-0.0244 (0.0256)	0.174*** (0.0265)	0.118*** (0.0302)
Q5	0.0170 (0.0216)	-0.0778*** (0.0295)	-0.0395* (0.0204)	0.0357 (0.0271)	0.0239 (0.0212)	-0.111*** (0.0244)	0.206*** (0.0263)	0.102*** (0.0309)
In workforce	0.000122 (0.0154)	0.000822 (0.0213)	-0.0256* (0.0147)	0.0130 (0.0189)	-0.00326 (0.0158)	0.0436** (0.0185)	-0.0687*** (0.0170)	0.0334 (0.0226)
Urban	-0.0947*** (0.0155)	-0.0301 (0.0252)	-0.00731 (0.0171)	0.00496 (0.0230)	-0.0430** (0.0174)	0.00849 (0.0219)	-0.0465** (0.0194)	0.00221 (0.0268)
Owns a mobile phone	0.0144 (0.0203)	0.0393 (0.0274)	-0.00553 (0.0181)	0.00514 (0.0252)	0.0114 (0.0208)	0.0648*** (0.0229)	-0.0306 (0.0224)	0.0202 (0.0287)
Internet access	0.0301* (0.0161)	0.0632*** (0.0219)	0.0169 (0.0157)	0.0497** (0.0200)	0.0423** (0.0167)	-0.0929*** (0.0199)	0.126*** (0.0191)	0.0346 (0.0231)
Observations	2,795	2,663	2,800	2,748	2,779	2,792	2,797	2,772

Source: Authors' calculations. P-value: ***p < 0.01, ** p < 0.05, * p < 0.1. Estimated marginal effects without stars are statistically insignificant.

5.3 Financial technologies use

Several innovative systems for payment, money transfer, borrowing and saving have emerged with the advent of cell phones, smartphones and the Internet. All of these innovations have reduced people's dependence on cash and the way it is transferred. Our empirical results show that gender is a significant variable in the use of financial technology for money transfer and borrowing via mobile banking apps. Being female reduces the likelihood of using mobile banking apps to send money, while an opposite result is observed in the case of borrowing, with women being more likely than men to borrow money using financial technology in MENA.

Table 7: Financial technologies use determinants, MENA

Variables	Send money to a relative or friend using mobile banking	Received domestic remittances through a mobile phone	Borrow money with mobile banking apps	Save money through a mobile banking app
Female	-0.0298*** (0.00808)	-0.00896 (0.0304)	0.103** (0.0525)	0.0968 (0.0728)
Age	0.00134 (0.00146)	0.00308 (0.00514)	-0.0108 (0.0139)	0.00663 (0.0182)
Age ²	-2.50e-05 (1.85e-05)	-3.65e-05 (6.09e-05)	0.000111 (0.000192)	-0.000157 (0.000245)
Education				
Secondary	-0.000592 (0.00922)	0.0914** (0.0407)	0.0506 (0.0774)	0.0906 (0.117)
Tertiary	0.0140 (0.0106)	0.165*** (0.0464)	-0.0110 (0.0897)	0.187 (0.123)
Income				
Q2	0.00127 (0.0144)	0.0686 (0.0567)	0.0540 (0.0912)	-0.0582 (0.178)
Q3	-0.0199 (0.0147)	0.0112 (0.0577)	-0.0373 (0.0843)	0.192 (0.132)
Q4	0.00147 (0.0134)	0.0541 (0.0553)	-0.0602 (0.0868)	0.0921 (0.136)
Q5	0.0361*** (0.0124)	0.0760 (0.0533)	-0.0398 (0.0753)	0.202 (0.123)
In workforce	0.0263*** (0.00869)	-0.0375 (0.0324)	0.0208 (0.0580)	0.0415 (0.0810)
Urban	0.00506 (0.0103)	0.00989 (0.0385)	0.0247 (0.0918)	-0.309*** (0.117)
Owns a mobile phone	0.00106 (0.0174)	0.0239 (0.0592)	-0.0896 (0.135)	0.0766 (0.244)
Internet access	0.0727*** (0.0145)	0.0671* (0.0395)	0.131 (0.126)	0.166 (0.140)
Observations	3,999	688	201	201

Source: Authors' calculations. P-value: ***p < 0.01, ** p< 0.05, * p< 0.1. Estimated marginal effects without stars are statistically insignificant.

The education variable is statistically and significantly correlated with the variables on receiving remittances, which means that in the MENA region, the higher the educational attainment of an individual, the more likely he or she is to use digital channels for remittances (table 5). An important finding of our study is that, in the MENA region, individuals in the highest income quantiles use

mobile banking applications more for money transfer purposes. In addition, access to the internet is a key determinant of the use of financial technologies in the MENA region.

5.4 E-commerce determinants

Fintech has had a major impact on the manner in which we pay for our products and bills, particularly with the innovations of mobile banking and crypto-currencies. The latter have revolutionized the means of payment used in the daily lives of economic agents (households and firms). As an example, crypto-currency is a digital/virtual currency that allows a first party (the holder of the crypto-currency) to pay and transfer value online directly to a second party without going through an intermediary (Chuen and Low, 2018, p.35). Crypto-currencies are alternative currencies that rely on the decentralized Blockchain system and are powered by the "mining" technique.

Our results revealed that women in the MENA region are more likely to use the digital channel for online shopping. In addition, educational level is a key determinant of the use of mobile banking channels for online purchases, which is positively significant for individuals in the highest income quantiles as well as for those who participate in the labor market.

Table 8: Fintech and payments determinants, MENA

Variables	Purchase in-store with mobile banking app	Bought something online using the Internet
Female	0.0211** (0.00938)	0.0441*** (0.0120)
Age	-0.000111 (0.00193)	0.000433 (0.00247)
Age ²	-2.14e-05 (2.54e-05)	-6.05e-05* (3.30e-05)
<u>Education</u>		
Secondary	0.0276** (0.0126)	0.0231 (0.0149)
Tertiary	0.0461*** (0.0144)	0.0726*** (0.0174)
<u>Income</u>		
Q2	0.00344 (0.0185)	0.0606*** (0.0230)
Q3	0.0187 (0.0170)	0.0532** (0.0222)
Q4	0.0216 (0.0169)	0.0656*** (0.0219)
Q5	0.0442*** (0.0162)	0.113*** (0.0211)
In workforce	0.0527*** (0.0104)	0.0393*** (0.0127)
Urban	0.00753 (0.0130)	0.00653 (0.0163)
Owns a mobile phone	0.0176 (0.0225)	0.0238 (0.0256)
Internet access	0.124*** (0.0194)	0.202*** (0.0219)
Observations	3,995	3,997

Source: Authors' calculations. P-value: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Estimated marginal effects without stars are statistically insignificant.

Our empirical results regarding the determinants of e-commerce are in line with Ünver and Alkan (2021) who investigated the determinants of e-commerce use in Turkey according to several individual characteristics (education level and demographic characteristics...). Results of the study showed that, as individuals' educational level increased, their online shopping increased as well.

5.5 Wage, salary payments and government transfers

Unlike previous model estimation results, which emphasize the role of education level and labor market participation as determinants of digital financial inclusion in the MENA region. We estimate a Logit model with the dependent variables "If received salary payments: through a cell phone" and "If received government transfers: through a cell phone" to investigate the factors that determine the use of Fintech in collecting their salary, salary payments, and government transfers.

The empirical results showed that the age variable is statistically significantly correlated with receiving government transfers, which means that older people tend to use the digital channel to receive government transfers but from a certain age and this is due to the non-linear relationship between the age² variable and the dependent variable.

Table 9: Wage, salary payments and government transfers determinants, MENA

Variables	Received wage through a mobile phone	Received government transfers through a mobile phone
Female	0.00807 (0.0134)	-0.0222 (0.0227)
Age	0.00585 (0.00403)	0.00834* (0.00461)
Age ²	-7.99e-05 (5.42e-05)	-0.000104** (5.22e-05)
<u>Education</u>		
Secondary	0.0244 (0.0234)	0.0264 (0.0235)
Tertiary	0.0292 (0.0248)	0.0172 (0.0332)
<u>Income</u>		
Q2	-0.0445 (0.0354)	-0.0153 (0.0291)
Q3	-0.0454 (0.0286)	-0.0794* (0.0423)
Q4	-0.0121 (0.0216)	-0.0877** (0.0423)
Q5	-0.00643 (0.0202)	-0.0277 (0.0294)
In workforce	-0.00949 (0.0199)	-0.0183 (0.0236)
Urban	-0.00244 (0.0166)	-0.0384 (0.0254)

Owns a mobile phone	-0.0230 (0.0328)	
Internet access	0.0339 (0.0245)	0.0270 (0.0252)
Observations	873	503

Source: Authors' calculations. P-value: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Estimated marginal effects without stars are statistically insignificant.

Our study provided individual-level substantiated evidence on the role of FinTech as a key driver of digital financial inclusion, as well as pinpointing the other facilitating variables in this nexus, namely the significance of educational achievement, workforce participation, and information and communication technology and internet access as the key drivers of digital financial inclusion in MENA region. In this sense, to ensure that the digital divide in the financial sector "Financial Technologies" does not further exclude segments of the population (women, elderly ...) financially excluded by the conventional financial system in the MENA region, policymakers in this region should strive to strengthen financial literacy among segments of the population excluded from the traditional financial system, enhance labor market participation, and expand access to information and communication technology.

As opposed to most studies that have been conducted in the MENA region, Our study is original in that, on the one hand, it mobilized a large micro-level database on 9,053 individuals extracted from the a new database (Global Findex 2021 database) which allowed us to provide empirical evidence on: 1) the digital financial inclusion levels across the MENA countries? 2) which segments of the population are digitally financially excluded? 3) How the digital divide could preclude some segments from being financially included as a result of a lack of financial literacy (risks)? 4) and how FinTech could promote financial inclusion of segments excluded by the conventional financial system (women, elderly) and therefore the inclusive development of the MENA region (opportunities).

The practical implications of our study are valuable as they will guide public policies aimed at accelerating digital financial inclusion in MENA region by leveraging channels such as promoting quality education and encouraging their participation in the labor market and the widespread access to information and communication technologies and to the Internet. Furthermore, implementing financial education programs for women, elderly and impoverished people to increase their awareness of the benefits of using fintech and the protection of their personal data will foster their cultural digital financial inclusion in the MENA region.

VII. Conclusion and policy implications

In this paper, we aimed to investigate how to ensure that the digital divide in the financial sector "Financial Technologies" does not further exclude segments of the population (women, elderly...) financially excluded by the conventional financial system. For this purpose, we first conducted a comparative analysis of the levels of digital financial inclusion in the MENA region using the principal component analysis method. Then, to answer our main question, we mobilized individual-level data on 9,053 adults from 9 MENA countries. A binary choice model of the Logit type is employed.

Our comparative analysis on the Digital financial inclusion levels between the MENA countries revealed, First, that Iran comes in first position with a digital financial inclusion index equal to 0.27 on the scale of our index followed by Tunisia with 0.08. Second, the majority of MENA countries have a low digital financial inclusion level. Then, the gap between Iran and other countries is very pronounced.

Our empirical findings on the determinants of digital financial inclusion have indicated that financial technologies are not conducive to the financial inclusion of elderly people, women, individuals with limited education, and poor social classes. In MENA region, the most important factors that determine digital financial inclusion are educational attainment, labor market participation, and widespread access to information and communication technologies and the Internet.

In light of the empirical evidence from our study, policymakers in MENA region are expected to promote access to internet and to equip citizens with cell phones, which could contribute to their digital financial inclusion. Our study identified several instruments to facilitate the access these technologies, specifically, through both education and labour market participation. Moreover, regulatory institutions should strive to increase people' trust in financial technologies through financial education programs and, most importantly, through the protection of their personal data.

As for contribution and originality of our study. First, while the literature on this topic in MENA region has been either theoretical (Khwaja, 2020; Holle, 2020; Franklin, 2021; Chinnasamy et al., 2021; Stefanie, 2021) or using descriptive approaches (Arezki and Senbet, 2020; Belouafi, 2021), Our study used a large database at the individual level and covered most MENA countries. Second, our study focused on several areas of adults' daily lives in the MENA region, which enabled us to find effective instruments (education and labor market participation) that will help facilitate the use

of fintechs. Third, the practical implications of our study are of great relevance since it was based on micro-level data.

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