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The Impact of Digital Financial Technology on Enhancing Financial Inclusion and Achieving Economic Stability in Arab Countries (An Econometric Study Using Panel ARDL Data for the Period 2011–2021)

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Abstract:

This research paper aims to estimate the impact of the use of digital financial technology on financial inclusion and the achievement of economic stability in Arab countries during the period (2011–2021). The study sample included eighteen Arab countries, and the Panel ARDL cross-sectional time-series analysis was applied. The study found that the use of the Internet in financial transactions has a

positive effect on financial inclusion in Arab countries, with the Gulf Cooperation Council (GCC) countries generally leading the Arab region. Likewise, the use of automated teller machines (ATMs) has a positive and statistically significant effect on financial inclusion, as the number of users of these machines has increased in most Arab countries. Kuwait recorded 81 ATMs per 100,000 inhabitants, followed by Saudi Arabia with 62 ATMs, Qatar with 52 ATMs, and the United Arab Emirates with 51 ATMs per 100,000 inhabitants. At the bottom of the list are Mauritania, Iraq, Sudan, and the Comoros.

Keywords: financial inclusion; digital financial technology; Arab countries; Fully Modified Ordinary Least Squares (FMOLS).

1. Introduction:

The information and communications sector is considered one of the most important sectors in light of integration into the digital economy, which requires advanced infrastructure and large investments in order to keep pace with rapid developments in the field of technology and communications. Most countries seek to integrate into the digital economy through the use of digital financial technology with the aim of enhancing financial inclusion. However, the relationship between digital financial technology and financial inclusion is not always certain and differs from one country's economy to another in terms of the magnitude and direction of impact. With the aim of identifying this relationship and measuring its effect on Arab economies, this research paper was undertaken.

A. Problem Statement:

In order to achieve the objective of the study, the main research question can be formulated as follows:

To what extent does digital financial technology contribute to enhancing financial inclusion in Arab economies, and what are the means of strengthening it within the digital economy during the period (2011–2021)?

To answer this problem, the following sub-questions were posed:

- What is the nature of the relationship between digital financial technology and financial inclusion in theoretical and empirical studies?
- What is the reality of the information and communication technology sector in Algeria, and what are the obstacles to integration into the digital economy?
- What are the requirements of digital financial technology to serve financial inclusion?
- What is the magnitude of the impact of digital financial technology on financial inclusion in Arab countries?

B. Research Hypotheses:

To answer the above questions, the following possible hypotheses were proposed:

- There is a positive relationship between digital financial technology and the achievement of financial inclusion;

- Digital financial technology services are below the required level in light of the orientation toward the digital economy;
- The contribution of digital financial technology to financial inclusion is weak in most Arab countries.

C. Importance of the Research:

The importance of this study stems from the significant role played by the digital financial technology sector in national economies in light of the global trend toward strengthening the digital economy to achieve economic progress, as well as attempting to keep pace with economic transformations and overcome obstacles to integration into the digital economy.

D. Research Objectives:

This study mainly aims to identify the role and size of the digital financial technology sector and the extent of its contribution to achieving financial inclusion in Arab countries, and to m

odel the relationship between digital financial technology and financial inclusion in Arab countries. This is intended to facilitate policymakers' understanding of the impact of their various measures on financial inclusion and enable them to choose appropriate tools to achieve desired objectives, as well as to propose solutions and recommendations that may help in shaping future public expenditure policies, maintaining financial balances, and supporting financial inclusion.

E. Research Methodology:

This study is based on data covering the period from 2011 to 2021, derived from various official sources, most notably the World Bank database. The descriptive approach and the econometric approach and its tools were also adopted in order to analyze and study the development of statistical data related to the phenomenon under study.

To cover the aspects of this study, it was divided into two parts: the first part represents the theoretical framework of the study, while the second part is devoted to the applied study.

First Section: The Concept of Financial Technology:

First: Definition of Financial Technology:

The Financial Stability Board defined it as financial innovations using technology, through which business models and applications, as well as processes and products, can be developed, and which have a tangible material impact on markets and financial institutions through their additions to financial services.

The Dublin Digital Research Institute also defined it as modern technological inventions and innovations in the financial sector, including a set of digital programs used in banks' financial operations. It refers to the provision of products and services subject to technological development, with the aim of improving the quality of traditional financial and banking services, through the contributions of startups, in cooperation and competition with financial service providers such as banks. This field has witnessed progress and widespread adoption since 2010, covering several areas including financial literacy and education, money transfers, investment management, and extending

to digital cryptocurrencies, thereby materializing in the provision and development of financial and banking services in particular, and economic aspects in general. (Asia, Khadra, and Hassini, 2023, p. 1002).

Second: Characteristics of Financial Technology:

The features of financial technology are manifested through five elements known as the 5D concept (Dahabiya, 2023, pp. 818–819):

- Data: Innovation in big data management has increased the value of data, which has come to be considered the most distinctive feature of financial technologies, and its use as an alternative to traditional information technology infrastructure that previously contributed to the development of the financial industry.

- Decentralization: The traditional financial system is characterized by a high degree of centralization reflected in government regulations, central banks, stock exchanges, and clearing houses. In contrast, financial technology is based on the concept of Decentralized Finance (DeFi), which emerged in 2013. It represents an innovation in the form of a financial network based on crypto-assets without a central intermediary, open-source in nature, allowing for the provision of more innovative and transparent financial services due to the efficiency it achieves and the greater opportunities it offers for faster and lower-cost access to services, such as money transfers and loan withdrawals based on blockchain technology.

- Diversification: Financial digitization has contributed to diversifying products, services, and financial actors through the entry of new players from non-financial industries, including major technology companies and financial technology firms into financial business activities, particularly in payment services. This has led to the emergence of a wide range of alternative financial products and services that stimulate far-reaching changes in money and finance, strongly affecting households, companies, investors, central banks, and governments.

- Democratization: Financial digitization, increased diversification, and intense competition have empowered customers and users of financial services, making customer satisfaction and points of contact more important for financial service providers. Operational efficiency driven by competitive incentives has strengthened the stability of business models for financial institutions and contributed to the overall efficiency achieved by the financial system and the real economy. Increased transparency has reduced information asymmetry, enabled more accurate risk assessment and pricing, accelerated the innovation of new financial instruments exposed to specific risks, and supported market integration while improving participants' ability to manage risks more effectively.

Third: Areas of Financial Technology:

The areas of financial technology usage are numerous, including the following (Mohamed Amin & Mohamed, 2022, pp. 751–752):

- Digital Payments: This is the most advanced sector in financial technology. Digital or electronic payment refers to the transfer of value from one payment account to another using a digital device such as a mobile phone, point of sale (POS), computer, or digital communication channels such as

mobile wireless data or SWIFT (Society for Worldwide Interbank Financial Telecommunication). This definition includes payments made through bank transfers, mobile money, and payment cards, including credit, debit, and prepaid cards.

- Digital Lending: Digital lending is the process of providing loans that are applied for, disbursed, and managed through digital channels, whereby lenders use digital data to inform credit decisions and build smart customer engagement.

- Digital Insurance: This refers to the digital transformation of insurance services, that is, converting all insurance services provided by insurance companies to all customers into digital services, automating operations to enhance efficiency and speed. More specifically, it involves using software and emerging user interfaces to address shortcomings in the insurance value chain, aiming to develop interaction between insurance companies and their customers.

- Digital Finance: Digital finance refers to enabling every citizen to access financial services through modern technology. It is an important tool within financial inclusion programs, as it offers enormous opportunities to increase financial inclusion and expand basic services in light of the widespread use of mobile phones. The European Commission defines digital finance as the term used to describe the impact of new technologies on the financial services industry, including products, applications, and processes that have changed the traditional way of providing banking and financial services.

- Regulatory Technology (RegTech): This involves managing regulatory processes within the financial industry through the use of technology. The main functions of regulatory technology include regulatory monitoring, reporting, and compliance, that is, using new technologies to address regulatory and compliance burdens more effectively and efficiently.

- Wealth Technology (WealthTech): This term combines wealth and technology and represents a sub-field of financial technology. Just as financial technology combines finance and technology to change how individuals and companies organize, spend, and receive money, wealth technology lies at the intersection of wealth and technology to provide digital solutions that enhance personal and professional wealth management and investment.

Fourth: Stages of Financial Technology Development:

The stages of financial technology development can be divided into three waves (Saida, 2022, p. 233):

1. The First Wave:

- In this wave, the sectors of payments, lending, and capital raising emerged. These sectors are characterized by rapid expansion and a low share of transactions in advanced markets, as they attract individual savings by offering simplified solutions such as providing crowdfunding platforms for companies in the form of direct loans, equity investment, or donations, as well as payment solutions such as PayPal and international money transfers.

2. The Second Wave:

- The second wave witnessed the emergence of international money transfer, wealth management, and insurance sectors. These sectors are characterized by a slow pace of expansion, difficulty in acquiring customers, the presence of numerous regulations and risks, and a high share of transactions in advanced markets. It should be noted that the sectors of the first and second waves are classified at all stages of the incubator environment, while the sectors of the third wave gain greater recognition in advanced incubator environments because they rely on customer and regulatory acceptance of the technologies introduced by the first wave.

3. The Third Wave:

-The third wave consists of the blockchain sector, which is still in its early stages and is likely to play a pivotal role extending beyond finance.

Fifth: The Degree of Financial Technology Security:

Financial technology companies enjoy general trust among consumers, according to a Forbes report, as 68% of individuals trust the use of financial management tools distributed by these companies. Nevertheless, some believe that new financial technology applications that have not yet been subject to the same security regulations require caution when dealing with them. This does not mean that society lacks trust in financial technology companies; rather, exercising caution may be highly beneficial for most consumers, as the benefits of working with a financial technology company outweigh the perceived risks.

In general, the use of financial technology continues to grow. According to statistics, approximately 64% of the world's population used financial technology applications in 2019. Currently, banks and major financial companies are either acquiring fintech startups or introducing their financial technologies into the market. (The Nature of Financial Technology: Challenges and Available Opportunities, 2023, pp. 191–198)

Sixth: Risks of Financial Technology:

The main risks associated with the use of financial technology in financial services include the following (Mohamed & Abdelaziz, 2022, pp. 189–191):

- **User Information Security Risks:** Financial services provided by fintech platforms rely heavily on digital technology. The confidentiality, reliability, and security of digital technology directly affect the quality of financial services and user security. Financial fraud and leakage of customer information may cause irreparable damage to users' information and assets and also affect the stability of the entire financial market.

- **Third-Party Risk:** This is the risk arising from a bank delegating a third party, represented by fintech companies, to provide services and transactions using the bank's data on its behalf to customers.

- **Increased Fintech Credit Risk:** This risk results from providing credit, lending, and borrowing through fintech platforms such as peer-to-peer (P2P) lending or crowdfunding platforms, which may weaken lending standards and lead to systemic risks.

- Risk to Financial Stability: This arises from the lack of compatibility of cross-border technology systems, such as not allowing data-protection companies to operate in a third-party country due to their non-compliance with that country's regulations.

- Risks Related to Users' Lack of Adequate Knowledge: Insufficient knowledge of fintech transactions affects the ability to identify and prevent risks. This also includes risks associated with weak financial supervision over fintech products and uses, as well as insufficient skills of financial service employees, since lack of knowledge hinders effective use to enhance development and expand modern financial transactions.

- Risks of Monopoly and Suppression of Competition: Once a restricted ecosystem is established, potential competitors have limited opportunities to build competing platforms. Dominant platforms can strengthen their position by raising entry barriers and exploiting market power and network externalities to increase user switching costs or exclude potential competitors.

- Risks of Operating Systems and Technology Platforms Used in Digital Payment Channels: Such as self-service terminals (SST), online banking, and mobile applications. This is due to the heavy reliance on fintech within the infrastructure of financial markets and banks, and the interdependent relationships with multiple parties locally and internationally, which increases the complexity of the sector's exposure to cyberattacks or electronic risks.

- Peer-to-Peer Lending Platform Risk: This lies in the lack of information about borrowers and investors' limited capacity to bear credit risk, leading to inaccuracies in P2P borrower scoring systems regarding default, as well as the inability of these systems to measure systemic risks arising from contagion mechanisms due to global network interconnections.

- Cyber Risk: This refers to the possibility of losses resulting from internet-related risks affecting financial institutions, such as data loss, financial loss, operational disruption, or damage to organizational reputation due to technology system failures. Common examples include hacking attacks, data breaches, virus transmission, cyber extortion, network disruption, and human errors by employees.

Among the most important cyber risks are:

• **Distributed Denial of Service (DDoS) Risk:** This refers to an attack that floods a system's resources or bandwidth with unwanted traffic (sending unnecessary data from the attacker to affect system performance), thereby preventing authorized use of the system.

• **Advanced Persistent Threat (APT) Risk:** A cyberattack in which the attacker remains undetected and aims to monitor and surveil network activity and data without seeking to damage the device or system.

• **Phishing Risk:** Using email messages while impersonating an official entity, but in a fraudulent manner, to obtain user data by directing them to fake websites.

• **Spam Risk:** Sending unsolicited emails such as advertisements for products and website services, as well as delivering malware and other cyber threats.

• **Malware Risk:** Such as viruses, worms, Trojan horses, and spyware designed to damage computers, software, and applications.

• **Bot Risk:** Used to distribute malware, spam messages, and fraud, allowing intruders to control the system.

• **Spoofing/Fraud Risk:** Refers to imitation, copying, and forgery as various forms of fraud.

• **Insider Threats:** Such as employees or customers who have access to internal information.

The objectives behind cyber risks naturally have their justifications; attacks may be motivated by obtaining money through transfers or ransom payments, accessing system information and acquiring confidential organizational data, or for political breaches such as espionage and surveillance. Accordingly, cyber risk has multiple financial, economic, security, and strategic dimensions.

Second Section: Financial Inclusion Its Concept, Objectives, and Dimensions:

The topic of financial inclusion has received wide attention from writers and economic researchers due to its connection with several parties, including financial institutions, economic units, and households.

First: Concept of Financial Inclusion:

The term financial inclusion (the opposite of exclusion) first appeared in 1993 in a study by Lyshon and Thrift on financial services in Southeast England, which examined the impact of closing a bank branch on residents' actual access to banking services. During the 1990s, numerous studies emerged addressing the difficulties faced by certain social groups in accessing banking and non-banking financial services. In 1999, the term financial inclusion was used more broadly for the first time to describe the determinants of individuals' access to available financial services. It is important here to distinguish between voluntary withdrawal from seeking to use financial products and services due to lack of need or for cultural and/or ideological reasons, and the lack of access to and use of such services due to their unavailability or inability to afford them. The focus of those concerned with financial inclusion is on targeting individuals who have been forcibly excluded from financial inclusion and identifying ways to overcome the causes and factors of exclusion, rather than those who have chosen to exclude themselves from using financial products and services. (Samir, 2016, p. 15)

Financial inclusion refers to providing and using all financial services for all segments of society institutions and individuals through official channels, including savings accounts, payment and transfer services, insurance, financing, and credit, as well as innovating more suitable financial services at competitive prices. The concept also includes protecting the rights of financial service consumers and encouraging them to manage their funds and savings prudently, in order to avoid resorting to informal channels and means that are not subject to regulatory and supervisory authorities and often apply high prices. Financial inclusion is measured by assessing the availability of financial services (supply side) and their use and utilization (demand side). Thus, financial inclusion aims to expand opportunities for access to financial services by developing both the supply and demand sides. (Arab Monetary Fund and Secretariat of the Council of Central Bank Governors, Introductory Bulletin on the Concept of Financial Inclusion, 2017)

The G20 and the Alliance for Financial Inclusion (AFI) defined financial inclusion as enhancing access to and use of financial services and products by all segments of society, including marginalized and poor groups, in a manner that suits their needs and is provided fairly, transparently, and at reasonable costs. (Arab Monetary Fund, Requirements for Building a Financial Inclusion Strategy, 2016)

Second: Importance of Financial Inclusion:

Financial inclusion is a long-term strategy; however, to achieve its objectives, the main areas that financial inclusion should address must be considered. (Ben Dhab, The Impact of Financial Inclusion on the Performance of Algerian Commercial Banks during the Period 2004–2012, 2019, p. 12):

– A growing body of research reveals numerous developmental benefits that can be achieved through financial inclusion, particularly via the use of digital financial services, including mobile financial services, payment cards, and other fintech applications. Although evidence varies to some extent, even studies that did not reach positive results often indicate the possibility of achieving better outcomes by giving greater attention to local needs.

– Achieving wide-ranging benefits from financial inclusion, as studies have shown that mobile financial services allow users to save and transfer money, thereby improving income-generating opportunities and reducing poverty. A study in Kenya found that access to these services generated significant benefits by enabling households to increase their savings by more than one-fifth and allowing approximately 150,000 women to leave agricultural work and establish businesses or retail activities, thus reducing poverty rates among these households by about 22%.

– Digital financial services can also help people manage financial risks by facilitating the collection of funds from friends and distant relatives during difficult times. In Kenya, for example, researchers found that when an unexpected income shock occurred, users of mobile financial services did not reduce household spending, whereas non-users and those with limited access reduced their purchases of food and other goods by 7%–10%. In addition, digital financial services reduce the cost of receiving payments; in Niger, switching monthly government social benefit payments from cash to mobile phones saved beneficiaries an average of 20 hours in travel and waiting time.

– Financial services help individuals accumulate savings and increase spending on essentials. After providing vendors in Kenya especially women with savings accounts, their savings increased and investments in their businesses rose by about 60%. In Nepal, spending by female-headed households increased by 15% on essential foods (meat and fish) and by 20% on education after obtaining savings accounts, while spending on agricultural equipment increased by 13%, and crop values increased by about 15%.

– For governments, shifting from cash to digital payments can reduce corruption and improve efficiency. In India, for example, leakage of pension funds decreased by about 47% when payments were made through smart cards using biometric fingerprints. In Niger, distributing social transfers via mobile phones reduced the variable cost of managing these benefits by 20%.

Third: Objectives of Financial Inclusion:

(Ben Dhab, The Impact of Financial Inclusion on the Performance of Algerian Commercial Banks during the Period 2004–2012, 2019, p. 12)

Given the global interest in expanding financial inclusion and creating alliances among international financial bodies and institutions to coordinate and work within shared and unified mechanisms, the benefits derived from financial inclusion continue to grow. The Consultative Group to Assist the Poor (CGAP) considers that building an inclusive financial system is the only way to reach the poor and low-income groups, in order to achieve the following objectives of financial inclusion:

- Enhancing access of all segments of society to financial services and products, raising citizens' awareness of the importance of financial services and how to obtain and benefit from them to improve their social and economic conditions;
- Facilitating access to sources of finance with the aim of improving living conditions, especially for the poor;
- Promoting self-employment projects and economic growth;
- Enabling micro, small, and medium enterprises to invest and expand;
- Reducing poverty levels and achieving prosperity and economic well-being.

Fourth: Dimensions of Financial Inclusion:

Over the past decade, the concept of financial inclusion has evolved into three main dimensions (Mohamed Badr Ajouz, p. 10), namely:

1. Access to Financial Services:

This refers to the ability to use financial services from formal institutions. Measuring access requires identifying and analyzing potential barriers to opening and using a bank account, such as cost and proximity to banking service points (branches, ATMs, etc.). Data related to access to financial services can be obtained from information provided by financial institutions. Indicators for measuring access to financial services include:

- Number of access points per 10,000 adults at the national level, disaggregated by type of administrative unit;
- Number of ATMs per square kilometer;
- Electronic money accounts;
- Degree of interconnection between service delivery points;
- Percentage of the total population living in administrative units with at least one access point.

2. Use of Financial Services:

This refers to the extent to which customers use financial services provided by banking sector institutions. Measuring usage requires collecting data on the regularity and frequency of use over a specific period of time. Indicators include:

- Percentage of adults with at least one regular deposit account;
- Percentage of adults with at least one regular credit account;
- Number of insurance policyholders per 1,000 adults;
- Number of non-cash retail transactions per capita;

- Number of mobile payment transactions;
- Percentage of adults who use a bank account regularly and frequently;
- Percentage of individuals who maintained a bank account during the past year;
- Percentage of adults receiving domestic or international remittances;
- Percentage of small and medium-sized enterprises with formal financial accounts;
- Percentage of small and medium-sized enterprises with outstanding loans.

3. Quality of Financial Services:

Developing indicators to measure the quality dimension is a challenge in itself. Over the past 15 years, financial inclusion has become part of the agenda of developing countries, where improving access to financial services was necessary. Quality is not always clear, as many factors affect the quality and nature of financial services, including cost, consumer awareness, effectiveness of compensation mechanisms, consumer protection services and financial guarantees, transparency and competition, as well as intangible factors such as consumer trust. Indicators for measuring the quality dimension include:

– **Affordability:** Measured by the cost of maintaining a bank account, especially for low-income groups, through indicators such as average monthly cost, average annual fees, average cost of credit transfers, and the percentage of customers reporting that transaction fees are expensive;

– **Transparency:** Access to information plays a crucial role in financial inclusion, as financial service providers must ensure that all customers receive relevant information to enable sound decisions regarding the use of financial services. It can be measured through indicators such as: the percentage of customers reporting that they receive clear and sufficient information about financial services at the initiation of a financial contract, the existence of a standardized description model for financial services at the initiation of a financial contract, and the existence of a standardized description of the financial services provided;

– **Convenience and Ease:** Measures customers' perceptions of ease of access and convenience in using financial services, through indicators such as: the percentage of individuals who feel uncomfortable with the average waiting time in queues at financial institution branches, and the average time customers spend queuing in branches of financial institutions and banks;

– **Consumer Protection:** Refers to laws and regulations designed to guarantee and protect consumer rights and prevent companies from gaining unfair advantages through fraud and unfair practices;

– **Financial Literacy:** Measures basic financial knowledge and users' ability to plan and budget their income;

– **Indebtedness:** Considered an important characteristic of customers within the financial system, making it necessary to know how borrowers delay repayment within a specific time period;

– **Credit Barriers:** Financial inclusion does not only involve the use of financial services, but also grants customers the ability to choose financial services and products within a range of options, measured through indicators such as: the percentage of administrative units in urban areas with at least three formal financial institution branches, the percentage of small and medium-sized enterprises

required to provide collateral for their most recent bank loan, and the extent of barriers or lack of information in credit markets.

Fifth: Requirements of Financial Inclusion and Indicators for Measuring It:

Financial inclusion is subject to several requirements to achieve it, as well as multiple measurement indicators that allow for assessing the level of financial inclusion.

1. Requirements of Financial Inclusion:

Achieving financial inclusion in any country requires the following (Ibrahim Salem & Yahya, 2021, pp. 128–129):

- Establishing sound regulatory, institutional, and supervisory frameworks by the government, working to develop them, supporting information provision, and adopting direct measures such as subsidies and mandatory requirements to ensure the achievement of financial inclusion;
- Building national strategies that identify the gap between demand and supply and provide financial infrastructure;
- Improving and developing communications and information exchange through the expansion of digital services;
- Connecting rural areas to the internet network and enhancing financial literacy;
- Conducting a study of existing financial services and their suitability for consumers, which represents the first step for the state to set objectives to raise the level of financial inclusion, requiring the participation of many entities within the country;
- Protecting consumers in order to enhance public trust in the banking and financial sector.

2. Indicators for Measuring Financial Inclusion:

There is a set of internationally recognized indicators and measurement tools used to assess the level of financial inclusion, the most important of which are the following (Mohamed Badr Ajouz, p. 17):

- Percentage of adult citizens who own a bank account (current/savings/deposit);
- Number of bank accounts (savings, current, or deposit) per 10,000 adult citizens;
- Percentage of adult citizens who have obtained any type of banking facilities;
- Number of banking facility accounts per 10,000 adult citizens;
- Percentage of small and medium-sized enterprises that own a bank account (current/savings/deposit);
- Percentage of small and medium-sized enterprises with outstanding financing;
- Number of adult citizens holding insurance policies per 1,000 adults, divided into life insurance and other types of insurance;
- Number of beneficiaries of financial leasing services, both operating and lease-to-own;
- Number of participants in the financial market by gender over a specific time period and the volume of transactions;
- Number of access points (bank branches and offices, lending institutions, money changers, ATMs, points of sale, insurance company branches and offices, financial brokerage firms, financial leasing companies, and other financial institutions, etc.).

3. Financial Inclusion Policies:

Some financial inclusion policies can be highlighted as follows (Haning & Jansen, 2010, pp. 14–21):

– **Banking Agents:** Policies allowing banks to contract with non-bank retail outlets as agents for financial services have proven highly successful in accelerating financial inclusion, as bank branches alone are not economically viable. Such policies leverage existing retail channels and transform pharmacies, post offices, and supermarkets not only into bank agents but also into agents of financial inclusion. Cooperation between banks and agents has become possible as technology has reduced the costs and information risks of remote transactions for financial transfers, alongside simplified account-opening procedures and other incentives to use this channel such as cash transfers and financial system awareness, as well as a significant increase in the number of users, as observed recently in Brazil, which was an early pioneer in large-scale banking agents through correspondent banking to distribute social grants to the unbanked population.

– **Mobile Payments:** The spread of mobile phones opens another channel for delivering financial services to the poor. This new technology has significantly reduced transaction costs and made financial transfers easier through real-time delivery. It has also expanded access points and reduced the need to carry cash due to electronic money, while attracting previously unbanked customers. Several countries have demonstrated success in using mobile payment mechanisms for financial inclusion; in the Philippines, the first successful mobile payment service in a developing country was recorded in 2004.

– **Diversification of Service Providers:** Policymakers have adopted various regulatory and supervisory strategies to manage licensing risks for a wide range of institutions providing insurance and deposit services. These strategies, known as adaptations of banking regulations for microfinance, include specialized licenses for institutions operating in micro-deposits, banking licenses for the transformation of non-governmental organizations into banks, as well as licenses for non-bank financial institutions.

– **Reform of Public Banks:** In many countries, public banks play an important role in the banking sector and in improving the delivery of financial services to the poor. Between 73 and 102 countries own public banks representing about 15% of banking assets. Public banks are often the only financial institutions operating in rural areas through their extensive branch networks, and they are widely used to encourage savings and credit in sectors of low commercial importance such as agriculture and housing, as well as to implement social programs. In this context, some countries have closed poorly performing public banks as a cost-reduction option, as in Brazil and Peru, while others continue to suffer from political interference and below-average performance. Notably, some policymakers have pursued reforms to improve the profitability and structure of public banks rather than restructuring them entirely; Indonesia and Brazil established separate management lines to deliver profitable microfinance operations through governance reforms and the introduction of new microfinance technologies.

– **Consumer Protection:** Information asymmetry between consumers and banks regarding financial products and services places customers in a disadvantaged position, a problem that is exacerbated when customers have limited experience while financial services are increasingly complex. Thus,

expanding financial inclusion carries the risk of involving more vulnerable and inexperienced customers. Although many financial institutions ensure that customers receive services appropriately, some have misused information advantages to increase profits at the expense of customers who are heavily indebted, uninsured, or lack investment returns, as occurred in Bolivia in 2000, where the combination of financial illiteracy, unethical practices by some institutions, and gaps in the legal framework led to violations. Preventing such practices is therefore essential. In general, failure of consumer protection represents a regulatory response to market failure; regulations and laws must correct information imbalances and encourage sustainable market expansion by providing customers with timely information before and after contracts are concluded, helping them understand their rights and obligations at the appropriate time.

– **Financial Identity Policy:** In most countries, credit information is provided only for certain loans, and poor customers are excluded from the cost-reducing benefits offered by credit registries. More importantly, some customers lack the personal documentation required to open an account. Policymakers have begun addressing barriers to access to financial services by narrowing the gap between documentation requirements for bank accounts and the quality of documents commonly held by low-income customers. As a result, these policies provide customers with financial histories and convert their transaction records into financial assets that can be used to access other banking and credit services.

Third Section: An Applied Study of the Impact of Digital Financial Technology on Enhancing Financial Inclusion in Arab Countries

First: Study Sample, Data Sources, and Model Specification:

1. Study Sample and Data Sources:

The study aims to measure the impact of digital financial technology on enhancing financial inclusion during the period (2011–2021) for a sample consisting of 18 Arab countries (Algeria, Egypt, Lebanon, Saudi Arabia, Kuwait, and Mauritania). As for data sources, the World Bank database was relied upon.

2. Study Model:

After reviewing the literature related to the impact of digital financial technology on financial inclusion (Ozili, 2018, p. 330) and (He & Li, 2020, p. 309), the indicator of the number of borrowers from commercial banks (financial inclusion) is adopted as the dependent variable, with the following explanatory variables: the percentage of adults owning a credit card, the number of automated teller machines (ATMs), account ownership in a financial institution with a mobile money service provider, and the number of Internet users. This is expressed in the following functional form:

FI = f (CC, ATM, MOB, NET)

Table 01: Definition of the variables included in the study model.

Variable Definition	Variable Symbol	

The financial inclusion index, expressed as the number of borrowers from commercial banks (per 1,000 adults);	FI	**Financial Inclusion**
The percentage of adults who own a credit card;	CC	**Digital Financial Services**
The number of automated teller machines (ATMs) (per 100,000 adults);	ATM	
The percentage of the adult population who own an account in a financial institution with a mobile money service provider;	MOB	
The number of Internet users (per 1 million people).	NET	

Second: Stationarity Analysis and Estimation of the Study Model:

1. Stationarity Analysis of the Study Variables:

Table 02: Results of the Stationarity Analysis

UNIT ROOT TEST RESULTS TABLE (PP)						
Null Hypothesis: the variable has a unit root						
	At Level					
		FI	CC	ATM	MOB	NET
With Constant	t-Statistic	0.1656	0.4113	0.4360	0.3491	0.7141
	Prob.	***0.2579***	***0.7095***	***0.9997***	***0.6728***	***0.9897***
		n0	n0	n0	n0	n0
With Constant & Trend	t-Statistic	0.6668	0.7415	0.9941	0.8074	0.7447
	Prob.	***0.0626***	***0.6223***	***0.9954***	***0.6604***	***0.2795***
		*	n0	n0	n0	n0
Without Constant & Trend	t-Statistic	0.5191	0.8443	0.9709	0.7476	0.5251
	Prob.	***0.9822***	***0.7670***	***1.0000***	***0.7531***	***0.9805***
		n0	n0	n0	n0	n0
	At First Difference					
		d(FI)	d(CC)	d(ATM)	d(MOB)	d(NET)
With Constant	t-Statistic	0.0317	0.0969	0.3761	0.1046	0.1232
	Prob.	***0.0073***	***0.0770***	***0.9724***	***0.0946***	***0.0295***
		*	*	n0	*	
With Constant & Trend	t-Statistic	0.2114	0.2606	0.0238	0.2233	0.4384
	Prob.	***0.0228***	***0.2480***	***0.9640***	***0.2906***	***0.0655***
			n0	n0	n0	*
Without Constant & Trend	t-Statistic	0.0018	0.0134	0.1809	0.0105	0.0289
	Prob.	***0.0050***	***0.0116***	***0.9344***	***0.0125***	***0.0448***
		*		n0		

From Table 02, which presents the results of the stationarity tests for the study variables, it is observed that the PP test indicates non-stationarity of the study variables (FI, LCC, ATM, MOB, NET) at the level. After applying the first difference (1st Difference) to these variables, they became stationary. Accordingly, all study variables are integrated of order one, that is, I(1). As a result, in the subsequent stage, panel cointegration tests will be conducted.

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2. Study of Cointegration Relationships among the Study Variables:

After confirming that all study variables are integrated of order one, I (1), the next step is to test for the existence of cointegration among these variables. The Pedroni test is considered one of the most important tests used for this purpose. The following table presents the results of this test:

Table (03): Results of the Pedroni Cointegration Test

Pedroni Residual Cointegration Test
Series: FI CC ATM MOB NET
Date: 01/23/24 Time: 15:37
Sample: 2011 2021
Included observations: 198
Cross-sections included: 8 (10 dropped)
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.593532	0.9445	-1.577155	0.9426
Panel rho-Statistic	1.784745	0.9628	1.663824	0.9519
Panel PP-Statistic	-7.345122	0.0000	-7.309077	0.0000
Panel ADF-Statistic	-4.829719	0.0000	-4.215088	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	3.348660	0.9996
Group PP-Statistic	-5.198298	0.0000
Group ADF-Statistic	-5.804207	0.0000

The results shown in Table (03) indicate that the majority of the Pedroni test statistics are statistically significant at the 5% level, with the exception of the Panel rho-statistic and the Group rho-statistic. Accordingly, the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted, which confirms the existence of a cointegration relationship among the study variables.

In addition to the Pedroni test, there is another test known as the Kao test, which has the same null hypothesis (H0) as the previous test (Kao, 1999, p. 25). The following table presents the results of this test:

Table (04): Results of the Kao Cointegration Test

Kao Residual Cointegration Test
Series: FI CC ATM MOB NET
Date: 01/23/24 Time: 15:40
Sample: 2011 2021
Included observations: 198
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 0

User-specified bandwidth: 1 and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.069353	0.0011
Residual variance	27648298	
HAC variance	19345433	

Note: * ( ) and ** ( ) indicate statistical significance at the 1% and 5% levels, respectively.

It can be observed from the results of the Kao test presented in Table (04) that the probability value (0.0011) corresponding to the ADF-Statistic is less than 0.05. Accordingly, the null hypothesis is rejected and the alternative hypothesis is accepted, which states that there is a cointegration relationship among the study variables.

3. Estimating the Impact of Digital Financial Technology on Financial Inclusion in Arab Countries Using the FMOLS Method

Table (06): Results of Estimating the Impact of Digital Financial Technology on Financial Inclusion in Arab Countries Using the FMOLS Method

Dependent Variable: FI
Method: Panel Fully Modified Least Squares (FMOLS)
Date: 01/23/24 Time: 16:57
Sample (adjusted): 2012 2020
Periods included: 9
Cross-sections included: 8
Total panel (unbalanced) observations: 71
Panel method: Pooled estimation
Cointegrating equation deterministics: C
Coefficient covariance computed using default method
Long-run covariance estimates (Bartlett kernel, Newey-West fixed bandwidth)
Warning: one more more cross-sections have been dropped due to estimation errors

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CC	-725.2867	481.8705	-1.505149	0.1380
ATM	417.2200	152.3907	2.737831	0.0083
MOB	526.3805	419.3467	1.255240	0.2147
NET	3.791745	2.995909	1.265641	0.2110

R-squared	0.956673	Mean dependent var	17574.32
Adjusted R-squared	0.944856	S.D. dependent var	14038.58
S.E. of regression	3296.636	Sum squared resid	5.98E+08
Long-run variance	22268997		

The above table presents the results of estimating the impact of digital financial technology on financial inclusion in the long run for a sample of Arab countries. The estimation results show that most of the explanatory variables acquired the expected economic sign and were statistically significant, except for the variable (MOB), whose sign was contrary to economic theory and was not statistically significant. It is also evident that the value of the Adjusted R-squared equals 0.95, which

indicates the good fit of the model and its ability to explain the changes occurring in the financial inclusion index in Arab countries, as the explanatory variables explain approximately 95% of the fluctuations in the financial inclusion index.

The estimation results presented in the table above also show the following:

- The variable representing the number of automated teller machines (ATM) has a positive and statistically significant sign at the 1% level, as an increase in the number of ATMs by 1% leads to an increase in financial inclusion in Arab countries by 417%. This result highlights the importance of increasing the number of ATMs in supporting long-term financial inclusion in Arab countries;
- The variable representing the percentage of adults owning a credit card (CC) has a negative effect, as an increase in the percentage of adults owning a credit card by 1% leads to a decrease in financial inclusion by 725% in Arab countries;
- The results also indicate that the variable representing the percentage of the adult population owning an account in a financial institution with a mobile money service provider (MOB) has a positive effect on financial inclusion in the Arab countries under study.
- As for the variable representing the number of Internet users (LNET), the estimation results show that its coefficient has a positive sign, as an increase in the number of Internet users by 1% leads to an increase in financial inclusion by 3.79%.

Conclusion:

This study aimed to estimate the impact of digital financial services on financial inclusion for a sample consisting of 18 Arab countries during the period (2011–2021). To achieve the study's objective, panel data and the Fully Modified Ordinary Least Squares (FMOLS) method were used to estimate the study model. The estimation results revealed a positive impact of most digital financial services indicators on financial inclusion in the Arab countries under study. The results indicated that financial inclusion in Arab countries is positively affected in the long run by both the number of automated teller machines and the number of Internet users, except for the percentage of adults owning a credit card, which has a negative effect. Accordingly, digital financial technology contributes to enhancing financial inclusion in Arab countries.

Recommendations:

– Working to develop and improve communication systems and information exchange in Arab countries through expanding the provision of digital financial services, particularly via mobile phone payments;

– Increasing the number of automated teller machines and expanding the network for providing digital financial and banking services;

– The necessity of developing digital financial technology infrastructure and ensuring its effectiveness;

– Benefiting from the experiences and expertise of countries that have achieved good levels of financial inclusion by developing digital financial services technology.

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