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The Role of Financial Technology in Enhancing Financial Inclusion: A Case Study of the Tunisian Banking Sector (2010–2024)

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Summary: This study aims to highlight the role of financial technology in enhancing financial inclusion by examining the impact of FinTech-related variables represented by the interbank payment card penetration rate and the internet Banking services penetration rate (% of population) as independent variables on financial inclusion as the dependent variable, measured by the bank account ownership rate (% of adults). The study adopts a case study of the Tunisian banking sector over the period 2010–2024, and employs the multiple linear regression model as its primary econometric methodology.

The results reveal a statistically significant positive effect of the FinTech variable represented by the internet banking services penetration rate on financial inclusion in Tunisia. Conversely, the findings indicate no significant effect of the second FinTech variable namely, the interbank payment card penetration rate on financial inclusion during the peroid 2010-2024.

Keywords: Financial Technology (FinTech); Financial Inclusion; Interbank Payment Card Penetration Rate; Internet Banking Services Penetration Rate; Bank Account Ownership Rate.

Jel Classification Codes: G20; G21; O16; O33.

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I- Introduction :

The world has witnessed profound transformations affecting the economic and financial environment, prompting many countries to seek modern financial instruments capable of meeting emerging needs. Among these instruments is **financial technology (FinTech)**, which has played a pivotal role in bringing about fundamental changes in the financial sector. The widespread diffusion of FinTech has contributed to the enhancement of various economic sectors, most notably the banking sector and financial services in their different forms. This diffusion has enabled the emergence of both startups and large firms specializing in financial technology, which have played a prominent role in simplifying financial transactions, improving efficiency, and reducing costs, thereby making financial services more inclusive and accessible to a broad range of individuals and institutions.

Recent innovations in financial technology represent a genuine revolution in the field of financial services, both in advanced economies seeking to improve efficiency and performance, and in developing economies, where FinTech has emerged as an effective tool for promoting financial inclusion and expanding access to banking services to previously underserved segments of the population.

Moreover, the occurrence of numerous financial crises and significant structural changes that have profoundly affected the financial sector has further underscored the importance of achieving financial inclusion. This requires the commitment of all relevant stakeholders to implement policies aimed at providing advanced, low-cost banking services. Such services have contributed positively to strengthening financial inclusion for individuals as well as for the business sector.

- **The problem of the study :**

Based on the foregoing discussion, the research problem of this study can be formulated through the following question :

How can financial technology contribute to enhancing financial inclusion in the Tunisian banking sector during the period 2010–2024 ?

Accordingly, this study hypothesizes that financial technology has a measurable impact on achieving and enhancing financial inclusion in the Tunisian banking sector over the study period.

- **Significance of the Study :**

The significance of this study stems from the growing importance of financial technology and the role it can play in achieving and strengthening financial inclusion. FinTech represents a modern technological approach that contributes to the development of banking services and the improvement of their efficiency by expanding the scope of service delivery. This, in turn, enhances financial inclusion and improves its associated indicators.

- **Objectives of the Study :**

This study aims to achieve the following objectives :

- To identify financial technology (FinTech) and its various financial services ;
- To examine banking financial services that contribute to enhancing financial inclusion ;
- To highlight the role of financial technology in achieving financial inclusion.

- **Methodology of the Study :**

This study adopts a descriptive approach for the theoretical framework of the topic, as well as for describing the variables of the applied empirical analysis. In addition, a case study methodology is employed using the EViews 12 software package to conduct the econometric analysis.

- **Scope of the Study :**

The scope of this study is confined to the Tunisian banking sector over the period 2010–2024.

- **Previous Studies :**

Numerous studies have examined the role of financial technology in enhancing financial inclusion. The existing literature indicates that financial technology exerts a significant impact on financial

inclusion ; however, the magnitude and nature of this impact vary depending on the characteristics of the institutional environment. The following are among the most relevant studies in this field:

- **Rifai & Yousef Albaker (2025):** This study aimed to assess the role of financial technology in promoting financial inclusion in the Middle East and North Africa (MENA) region within the context of digital transformation. It analyzed how emerging technologies are reshaping traditional banking systems and the delivery of financial services, while also evaluating the core models within the FinTech ecosystem. The study adopted a mixed methodology combining an extensive literature review with a comparative case study on FinTech adoption and financial inclusion trends in both advanced and emerging markets. The findings indicate that FinTech solutions have effectively improved access to financial services for marginalized groups, such as women, youth, and small and medium-sized enterprises (SMEs). Nevertheless, the study emphasizes the need for further efforts to address the persistent barriers faced by marginalized communities.
- **Sarto & Peterson K. Ozili (2025):** This study examined how financial technology is transforming the trajectory of financial inclusion in emerging markets. It identified key research trends, thematic areas, and knowledge gaps, thereby providing both theoretical insights and practical policy recommendations. By integrating financial technology into traditional financial inclusion frameworks, the study highlights FinTech's potential to foster inclusive economic growth. Furthermore, it proposes a future research agenda aimed at addressing emerging challenges and opportunities to ensure the full realization of FinTech's impact on financial inclusion.
  Methodologically, the study employed a bibliometric analysis of the existing literature on financial technology and financial inclusion in emerging markets, using data extracted from the Scopus database. The analysis focused on identifying dominant research trends, core thematic areas, and gaps within the field. The findings reveal that financial technology significantly contributes to enhancing financial inclusion in emerging markets, with increasing scholarly attention devoted to mobile banking services, peer-to-peer lending, and blockchain technologies. The study also indicates that China, the United States, and the United Kingdom are among the leading contributors to this research domain. Key themes include the role of FinTech in reducing financial barriers and promoting economic development. Nevertheless, substantial gaps remain in understanding the long-term effects of financial technology on financial stability, as well as in adequately addressing the specific needs of marginalized populations. The study underscores the need for further specialized research to fully harness FinTech's potential in supporting inclusive growth in developing regions.
- **Rabia & Hamida R. (2024):** This study aimed to analyze the impact of financial technology adoption on financial inclusion in commercial banks in Algeria during the period 2010–2018, using a multiple linear regression model. The results indicate a positive effect of the FinTech variable represented by interbank electronic payment cards on financial inclusion. In contrast, no significant effect was found for the FinTech variable represented by automated teller machines (ATMs) on financial inclusion in Algeria over the study period.
- **Al- Ali & Shehab Zaid Kamel Al-Obaidi (2024) :** This study aimed to clarify the actual role of financial technology as a modern approach to banking operations in enhancing financial inclusion. It examined FinTech's capacity to expand the outreach and accessibility of financial and banking services to a wide range of institutions and individuals within Iraqi society by offering high-quality, low-cost financial services, along with ease of access. The study sample focused on the Iraqi banking sector over the period 2017–2022, which represents the effective phase marking the genuine shift toward electronic banking and financial services. The study adopted a descriptive and analytical methodology to examine the various dimensions of the topic and employed the SPSS software for data analysis. The findings indicate that financial technology plays a significant and fundamental role in promoting financial inclusion, particularly with regard to the extent of utilization of banking services, which should constitute the core foundation for financial service design.

- **Boutebina (2022) :** This study sought to examine the impact of financial technology on financial inclusion by conducting an exploratory survey of customers from 20 Algerian commercial banks. The results revealed a strong causal relationship between financial technology and financial inclusion within Algerian commercial banks, explaining approximately 80% of the variation in financial inclusion.

I.1. Financial Technology (FinTech) :

Financial technology plays a significant role in the financial and banking services sector, largely due to the rapid advancement of modern communication technologies.

I-1-1. Concept of Financial Technology :

Financial technology is defined as a set of technology-based innovations in the financial domain and related services that may lead to the emergence of new business models, applications, processes, or products that have a material impact on financial services (Ya-Ning Li, 2019, p. 21).

FinTech is also defined as a term used to denote institutions that develop and support modern technological processes within their services in order to improve the efficiency and quality of financial service delivery (Saksonova & Kuzmina, 2017, pp. 2329–2357).

I-1-2- Characteristics of Financial Technology :

The main characteristics of financial technology can be summarized as follow (Saida, 2019, p. 730) :

- Financial technology represents a combination of knowledge, skills, methods, and techniques related to financial and banking activities ;
- Technology, in its various conceptual forms, is not an end in itself, but rather a tool utilized by financial and banking institutions to achieve their strategic objectives ;
- Banking and financial services constitute the primary domain for the application of technology;
- The application of technology is not limited to the delivery of financial and banking services but extends to administrative and managerial practices.

I-1-3- FinTech Sectors :

FinTech sectors are generally classified into two main categories (Zainab & Aqassem, 2019) :

✓ **First-Wave Sectors :**

First-wave sectors, as described in Wamda scientific reports, refer to those operating within emerging ecosystem environments, where most users possess basic technological tools such as smartphones and applications that enable them to conduct simple financial transactions, including payments and access to credit at a primary level. On the other hand, these sectors benefit from legal and regulatory frameworks that facilitate their operations and ensure a relatively secure and stable operational environment.

The core activities of this sector are embodied in services provided by banks via the internet, as well as those offered by startups either in partnership with banks or independently. These activities include the following :

Payment Sector :

Paying for goods or services using mobile devices has become highly attractive to modern consumers due to its speed, simplicity, and security, enabling the purchase of almost any product via a mobile device. The widespread adoption of mobile devices such as smartphones and tablets has driven strong growth in mobile commerce. In the fourth quarter of 2016, mobile e-commerce spending in the United States reached USD 22.7 billion.

Mobile shopping capabilities are available through mobile-optimized websites or dedicated mobile applications. Major online market leaders, such as eBay and Amazon, provide mobile-specific shopping applications and platforms. In many physical retail stores, mobile devices can

also be used as a payment method through Near Field Communication (NFC) technologies to scan digital wallets.

Services within this sector typically include bill payments, domestic payment transfers, and mobile-based electronic wallet applications. Notable examples in the studied region include :

- MADFOO3AT (Jordan) : A company specializing in electronic bill payment services ;
- BEAM (United Arab Emirates**):** A company specializing in electronic wallets offered as an application linked to customers' credit cards.

Lending and Capital Raising Sector :

Peer-to-peer (P2P) lending is considered a new form of the sharing economy, as P2P lending platforms facilitate direct connections between investors and borrowers without banks acting as intermediaries. Between 2014 and 2015, global P2P lending was expected to grow to approximately seven times its 2014 value, increasing from USD 9 billion to USD 64 billion by 2050. Activities within this sector include, among others :

- **Rotating Savings and Credit Platforms (ROSCA-based Digital Lending) :** These platforms provide direct digital credit lending without intermediaries and are fully driven by their user networks. In Egypt, for example, Money Fellows**,** founded in 2014, has implemented the concept of rotating savings and credit across more than 90 countries, enabling individuals to access loans without resorting to traditional banks. Moreover, these platforms allow users to build a credit history based on their performance within the savings rotation cycles.
- **Crowdfunding :** Crowdfunding platforms are electronic platforms that collect funds from the public for the purpose of financing a specific project. The project owner presents the idea, outlines its features and objectives, and specifies the total project cost. Once the required funding amount is reached within a predetermined time frame, the collected funds are utilized to finance the project. This model has provided a vital outlet for innovators and entrepreneurs. A notable example is IWWA (Jordan**)**, founded in 2013.
- **Loan Comparison Platforms :** These platforms have played a crucial role as alternative financing solutions supporting the growth of small and medium-sized enterprises (SMEs), which often face limited access to financing from traditional financial institutions despite their substantial contribution to economic growth. In the United Arab Emirates alone, there are approximately 300,000 SMEs, contributing more than 60% of GDP and generating over 42% of total employment opportunities. Loan comparison platforms present a variety of financing offers along with their respective features, enabling beneficiaries to select the most suitable option in terms of opportunity and cost. A prominent example is the UAE-based company Compareit4me.com, established in 2011.

✓ **Second-Wave FinTech Sectors :**

The scope of activities within second-wave FinTech sectors expands to include fonctions that increasingly rely on high-precision digital technologies and advanced financial innovations, supported by more modern ecosystems, highly digitized markets, and broader investment activity compared to first-wave sectors, which can be described as relatively rudimentary. Second-wave FinTech sectors include the following (Wahiba & Ben Kaddour, 2018, p. 16) :

International Money Transfers :

These activities take the form of cross-border payments. In 2015, remittance flows to developing countries reached approximately USD 431 billion. In terms of annual outbound remittances, Saudi Arabia ranked second, while United Arab Emirates ranked fourth globally.

Wealth Management :

Wealth management encompasses financial planning, investment portfolio management, and a range of integrated financial services tailored to high-net-worth individuals, small business owners, and families seeking professional financial advice. These services are typically provided

by certified specialists and include the coordination of banking services, estate planning, legal resources, professional tax management, and investment advisory services.

- **Insurance :**

A large number of workers do not possess bank accounts ; consequently, in the absence of a bank account, individuals are unable to establish a credit history and are effectively excluded from participation in institutions that provide insurance services.

- **Blockchain Technology (Cryptocurrencies) :**

Blockchain is a distributed database organized in vertical chains that may be public, private, or hybrid, characterized by transparency and pseudonymity. It is inherently immutable and tamper-resistant, relying on a digital system for data entry and verified digital signatures. Blockchain technology is also considered relatively easy to use and access, as it enables the development of applications without substantial investment in infrastructure, owing to modern technological innovations. Moreover, it is cost-efficient and highly efficient, as it does not require intermediaries to settle transactions. Its data records cannot be manipulated, since blockchain governance operates through controlled rules, practices, and processes under defined ownership and authority structures.

This high-precision technology has brought about a qualitative leap in financial transactions, and competition to adopt it has become a strategic objective pursued by most banks and financial institutions.

I. 2. Financial Inclusion :

Financial inclusion plays a significant role in economic development, as it contributes to enabling individuals and firms to achieve their objectives by gaining access to a wide range of financial services.

I-2-1. Concept of Financial Inclusion :

Multiple definitions of financial inclusion have been proposed, reflecting the diversity of institutions that have addressed this concept. Among the most prominent definitions are the following :

Financial inclusion is defined as an economic condition that enables any individual to access basic financial services at costs that are affordable to the general public, particularly to the most vulnerable segments of society (Lara & Antonio Jose, 2021, p. 12).

According to the definition issued by the Group of Twenty (G20) and the Alliance for Financial Inclusion (AFI), financial inclusion refers to the set of actions undertaken by regulatory authorities to enhance access to and usage of financial products and services by all segments of society, including low-income groups, in a manner that is aligned with their needs and delivered fairly, transparently, and at reasonable costs (Cull & Ehrbeck, 2014, p. 1).

Furthermore, the Organisation for Economic Cooperation and Development (OECD) and the International Network on Financial Education (INFE) define financial inclusion as the process through which access to a broad range of regulated, formal financial services and products is enhanced at appropriate times and affordable prices, while expanding their effective use among different segments of society through the adoption of innovative approaches. These approaches include financial awareness and education, with the objective of promoting financial well-being as well as social and economic inclusion (Chenbi & Al-Saeed Ben Lakhdar, 2018, p. 106).

I-2-2- Objectives of Financial Inclusion :

In light of the growing global interest in expanding financial inclusion and establishing alliances among international financial institutions and authorities to coordinate efforts within unified and shared frameworks, the benefits derived from financial inclusion have continued to expand. The Consultative Group to Assist the Poor (CGAP) emphasizes that building an inclusive financial system represents the only effective pathway to reaching the poor and low-income populations. Accordingly, the key objectives of financial inclusion can be summarized as follows (Al-Sharfa & Ajjour, 2019, p. 35) :

- To enhance access for all segments of society to financial services and products, and to raise public awareness of the importance of financial services and how to access and utilize them in order to improve social and economic conditions;

- To facilitate access to financing sources with the aim of improving living standards, particularly for low-income and poor populations ;
- To promote self-employment initiatives and foster economic growth ;
- To empower micro, small, and medium-sized enterprises (MSMEs) to invest and expand their activities ;
- To reduce poverty levels and achieve economic prosperity and overall well-being.

I-2-3-Dimensions of Financial Inclusion :

Identifying the dimensions of financial inclusion requires reliance on its measurement indicators, which depend on the nature and accuracy of available data, as well as on the structure of the financial system and its level of development. According to the leaders of the Group of Twenty (G20) and the recommendations of the Global Partnership for Financial Inclusion (GPFI), as well as the Alliance for Financial Inclusion (AFI), the Financial Inclusion Data Working Group developed a set of core dimensions through a dedicated initiative. These dimensions can be summarized as follows (Al-Dhubyan, 2024, pp. 52–55) :

Access to Financial Services

This dimension refers to the ability to access and use financial services provided by formal financial institutions. Assessing access levels requires identifying and analyzing potential barriers to opening and using a bank account, such as costs and physical distance to banking service points. Data related to access to financial services can be obtained from financial institutions' records. Key indicators used to measure access include :

- Number of access points per 10,000 inhabitants, taking into account the geographical characteristics of the area ;
- Number of automated teller machines (ATMs) per 1,000 square kilometers;
- Number of electronic money accounts ;
- Interconnectivity among service delivery points ;
- Ratio of population to service access points.

Use of Financial Services :

This dimension reflects the extent to which customers actively use financial services provided by banking institutions. Measuring usage requires collecting data on the regularity and frequency of service utilization over a given period of time. Key indicators include :

- Percentage of adults holding at least one type of active deposit account ;
- Percentage of adults holding at least one type of active credit account ;
- Number of insurance policyholders per 1,000 adults ;
- Number of non-cash retail transactions per capita ;
- Number of mobile payment transactions.

Quality of Financial Services :

Developing indicators to measure the quality dimension constitutes a challenge in itself. Although financial inclusion has been a growing concern for developing countries for nearly 15 years, the quality dimension remains neither straightforward nor easily observable, due to the influence of multiple factors. These include service costs, consumer awareness, effectiveness of grievance and compensation mechanisms, consumer protection services, financial guarantees, and transparency of market competition, in addition to intangible factors such as consumer trust. The main indicators used to assess service quality include :

- **Affordability :** This indicator measures the cost of maintaining a bank account, particularly for low-income individuals ;
- **Transparency :** Access to information plays a crucial role in financial inclusion. Financial service providers must ensure that all customers receive accurate, clear, and relevant information about financial services to enable informed decision-making ;

- **Convenience and Ease of Use :** This indicator reflects customers' perceptions regarding the ease of access to and convenience of using financial services ;
- **Consumer Protection :** This indicator examines the laws and regulations designed to safeguard consumer rights and prevent firms from gaining unfair advantages through fraud or unfair practices ;
- **Financial Literacy :** This indicator measures basic financial knowledge and users' ability to plan and manage their income effectively.

II– Methods and Materials:

This study seeks to highlight the role of financial technology in enhancing financial inclusion by analyzing the impact of financial technology variables, as independent variables, on the dependent variable represented by financial inclusion, based on the application of a set of appropriate statistical and econometric tests.

II-1- Population and Sample of the Study :

The sample of this study consists of the Tunisian banking sector over the period 2010–2024. In order to address the research problem concerning the role of financial technology in enhancing financial inclusion, the study relies on 15 observations. The analysis examines selected FinTech variables namely, the penetration rate of electronic payment cards and the penetration rate of internet banking services as independent variables, in relation to financial inclusion measured by the bank account penetration rate as the dependent variable.

An econometric and statistical analysis is conducted using a set of standard diagnostic and estimation tests to estimate the multiple linear regression equation and to assess the robustness and overall quality of the model.

II-2. Study Variables and Measurement Methods :

- Dependent Variable :

The dependent variable in this study is financial inclusion, which is measured by the bank account penetration rate. This indicator reflects the extent to which banking services reach the adult population in a given country and is calculated as the ratio of the number of adults holding a bank account to the total adult population.

- Independent Variables :

Financial technology represents the independent variable in the present study and is operationalized through the following two indicators :

- **Interbank Debit Card Penetration Rate (DPC) :**
  This indicator measures the proportion of adults who own and use debit payment cardsspecifically **debit cards** relative to the total adult population in a given country.
- **Internet Banking Services Penetration Rate (Online Bank Penetration):**
  This indicator measures the proportion of the population using internet banking services relative to the total population or to the total number of eligible bank customers.

II-3- Statistical Methods and Tools Used :

The statistical approach employed in the present study to measure the impact of financial technology (the independent variable) on financial inclusion (the dependent variable) consists of applying the multiple linear regression model over the period 2010–2024, using the EViews 12 software package. This approach is adopted in order to estimate the study model and to conduct all necessary econometric diagnostic tests to ensure the robustness and reliability of the estimated model. The sample size comprises 15 observations.

The multiple linear regression equation is specified as follows :

$$FI = C + a_1(DCP) + a_2(OBP)$$

Where :

- **FI** : Financial inclusion indicator, measured by the percentage of adults owning bank accounts in Tunisian banks ;
- **C** : Constant term ;
- **DCP** : Percentage of adults who own and use interbank payment cards ;
- **OBP** : Percentage of adults who use internet banking services ;
- a_1, a_2: Regression coefficients.

II-4- Descriptive Statistical Analysis of the Study Variables :

Table (01) : Summary of the Main Results of the Descriptive Statistics for the Variables of the Estimated Model

	FI	DCP	OBP
Mean	36.12667	18.39333	0.367753
Median	35.50000	20.30000	0.405465
Maximum	52.60000	23.50000	1.757858
Minimum	21.60000	12.30000	-1.203973
Std. Dev.	10.01766	3.670630	0.958473
Skewness	0.146108	-0.317086	-0.107709
Kurtosis	1.779894	1.676848	1.727120
Jarque-Bera	0.983781	1.345566	1.041643
Probability	0.611469	0.510287	0.594032
Sum	541.9000	275.9000	5.516302
Sum Sq. Dev.	1404.949	188.6293	12.86140
Observations	15	15	15

Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

Table (01) presents the descriptive statistics of the study variables related to the Tunisian banking sector over the period 2010–2024. The main observations can be summarized as follows :

- With regard to the dependent variable, represented by the financial inclusion index **(FI)**, the results show a positive mean value of 36%, indicating a positive growth in the rate of bank account ownership among adults during the study period. The minimum value recorded was 22%, while the maximum value reached **53%**. The standard deviation amounted to 10.01766, reflecting a noticeable variation and overall improvement in this indicator, which may be attributed to state-led efforts aimed at enhancing financial inclusion.

  Regarding the first independent variable, namely the interbank payment card penetration rate **(DCP)**, the variable recorded a positive mean of 18%, representing the proportion of adults who own electronic payment cards. This result reflects the widespread use and ease of transactions conducted through electronic payment cards. The maximum value reached 24%, while the minimum value was 12%, with a standard deviation of 3.670630. These figures indicate a positive growth in the number of payment cards owned by adults in Tunisia throughout the study period.

- As for the second independent variable, the internet banking services penetration rate **(OBP)** recorded an average value of 0.37%, representing the proportion of the population using internet banking services. This relatively low percentage suggests limited diffusion of online banking services among citizens, which may be attributed to insufficient awareness or familiarity with such services. The maximum value reached 2%, while the minimum value was 1%, with a standard deviation of 0.958473, indicating a lack of significant development in this indicator over the study period.

II-5- Stimation and Testing of the Multiple Linear Regression Model :

This section aims to estimate the multiple linear regression equation for the study variables, while also conducting the necessary diagnostic tests to verify the adequacy and reliability of the estimated model.

- **Correlation Matrix :**

Prior to presenting the estimation results of the study model, the correlation matrix reported in Table (02**)** is examined. This matrix reflects the strength and direction of the relationships among the study variables and is commonly used to identify the nature of linear associations between them, as well as to provide preliminary insights into potential multicollinearity issues.

Table (02) : Correlation Matrix

Covariance Analysis : Ordinary
Date : 11/12/25 Time : 17 :57
Sample : 2010 2024
Included observations : 15

Correlation Probability	FI	DCP	OBP
FI	1.000000 -----		
DCP	0.738609 0.0017	1.000000 -----	
OBP	0.994127 0.0000	0.777042 0.0007	1.000000 -----

Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

The results presented in the table above indicate the existence of a relationship between the dependent variable (financial inclusion**)** and the independent variables, namely the interbank electronic payment card penetration rate **(DCP)** and the internet banking services penetration rate **(OBP)**. This is evidenced by the statistical significance values, which are below the 0.05 threshold for both independent variables, indicating a strong and statistically significant relationship among the study variables.

- **Estimation of the Multiple Linear Regression Model for the Study Variables :**

Table **(03)** reports the results of estimating the study model that examines the impact of financial technology variables (independent variables) on financial inclusion (dependent variable).

Table (03) : Results of the Estimation of the Multiple Linear Regression Model for the Study Variables

Dependent Variable : FI
Method : Least Squares
Date : 11/12/25 Time : 17 :49
Sample : 2010 2024
Included observations : 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	36.34153	2.052450	17.70641	0.0000
DCP	-0.233305	0.117519	-1.985258	0.0705
OBP	11.08457	0.450057	24.62929	0.0000

R-squared	0.991184	Mean dependent var	36.12667
Adjusted R-squared	0.989715	S.D. dependent var	10.01766
S.E. of regression	1.015947	Akaike info criterion	3.046376
Sum squared resid	12.38578	Schwarz criterion	3.187986
Log likelihood	-19.84782	Hannan-Quinn criter.	3.044868
F-statistic	674.5944	Durbin-Watson stat	0.946169
Prob(F-statistic)	0.000000		

Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

Based on Table **(03)**, which reports the estimation results of the multiple linear regression model for the dependent variable (**financial inclusion**) and the independent variables (**interbank electronic payment card penetration rate** and **internet banking services penetration rate**), the main findings can be summarized as follows :

- The constant term is statistically significant at the 10% significance level, as indicated by a probability value of less than 0.1.
- A statistically significant negative relationship was found between the electronic payment card diffusion rate (**DCP)** and financial inclusion (**FI**) in Tunisia at the 10% significance level. The estimated probability value (Prob) was 0.0705, which is lower than the 10% significance threshold. This indicates that a one-unit increase in the diffusion rate of electronic payment cards leads to a decline in the proportion of bank account ownership among adults.
- A positive and statistically significant relationship is observed between the internet banking services penetration rate **(OBP)** and financial inclusion **(FI)**, as reflected by the estimated coefficient value of 11.08. This indicates that a one-unit increase in the penetration rate of internet banking services leads to an increase in bank account ownership among adults.
- The overall significance of the estimated model is statistically acceptable at the 10% level, as evidenced by the F-statistic probability value (Prob (F-statistic = 0.000000). This confirms that the FinTech indicators adopted in the study jointly exert a significant effect on the dependent variable (**FI**), which represents financial inclusion in Tunisia and is measured by the proportion of adults owning bank accounts during the study period.
- The coefficient of determination reaches $R^2 = 0.99$, indicating that the two independent variables explain approximately 99% of the variation in the dependent variable (**FI**), while the remaining 1% is attributed to random error based on the data and period under consideration.

II-6- Econometric Diagnostic Tests for the Estimated Multiple Linear Regression Model :

The purpose of conducting these tests is to ensure that the estimated model used in the present study is free from econometric problems**,** by applying the following diagnostic tests **:**

- **Residual Plot Analysis :**

Plotting the residuals against the actual values is an important diagnostic procedure, as it may indicate the presence of potential problems in the estimated multiple linear regression model. Specifically, if the residual points deviate beyond the dotted confidence bounds, this suggests the existence of an autocorrelation problem in the estimated regression equation.

Figure (01): Residual Plot of the Estimated Multiple Linear Regression Model

obs	Actual	Fitted	Residual	Residual Plot
2010	21.6000	19.8931	1.70695	
2011	23.3000	22.9419	0.35810	
2012	25.1000	25.0887	0.01127	
2013	27.0000	26.8997	0.10029	
2014	29.0000	30.9984	-1.99843	
2015	31.1000	31.6274	-0.52742	
2016	33.3000	32.9885	0.31146	
2017	35.5000	35.3533	0.14673	
2018	37.8000	38.7288	-0.92875	
2019	40.2000	40.9364	-0.73635	
2020	42.6000	43.1973	-0.59733	
2021	45.1000	45.4451	-0.34512	
2022	47.6000	47.4894	0.11059	
2023	50.1000	49.2214	0.87857	
2024	52.6000	51.0905	1.50945	

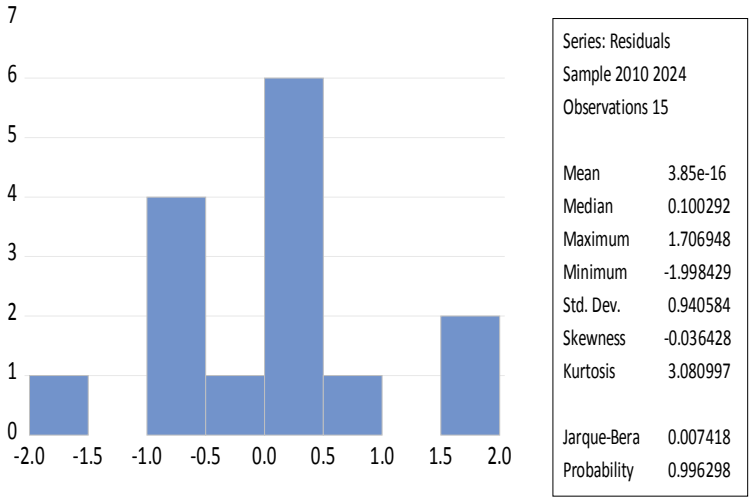
Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

It can be observed from the figure above that the calculated residuals mostly fall within the confidence interval (the two dotted lines), indicating that they do not differ significantly from zero.

- **Normality Test of the Error Terms (Residuals) :**

This test is based on the Jarque–Bera test, which relies on the null hypothesis (H□) stating that the residuals of the estimated multiple linear regression model are normally distributed.

Figure (02) : Results of the Normality Test of the Residuals of the Estimated Multiple Linear Regression Model



Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

It can be observed from Figure (02) that the probability value of the Jarque–Bera **(JB)** statistic, estimated at Prob = 0.996298, exceeds the 10% significance level. This indicates that the residuals of the estimated multiple linear regression model for the dependent variable (FI) are normally distributed. Accordingly, the null hypothesis (H□) is accepted.

- **Serial Autocorrelation Test (LM Test) :**

Table (04): Results of the Serial Autocorrelation (LM) Test for the Residuals of the Estimated Multiple Linear Regression Model

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	1.635269	Prob. F(1,11)	0.2273
Obs*R-squared	1.941315	Prob. Chi-Square(1)	0.1635

Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

Based on the results reported in Table (04), both tests—the F-test and the Chi-square test exhibit probability values that are greater than the 10% significance level, which implies acceptance of the null hypothesis (H□). Accordingly, the estimated model is free from the problem of serial autocorrelation.

- **Homoscedasticity Test :**

Table (05) : Results of the Homoscedasticity Test for the Residuals of the Estimated Multiple Linear Regression Model

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	4.490078	Prob. F(5,9)	0.0249
Obs*R-squared	10.70753	Prob. Chi-Square(5)	0.0575
Scaled explained SS	7.130347	Prob. Chi-Square(5)	0.2111

Source : Prepared by the author based on outputs generated by the EViews 12

Statistical software.

The results presented in Table (05) indicate that the statistical significance values of both the F-test and the Chi-Square test are lower than the 10% significance level. Accordingly, the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted, implying that the residuals do not satisfy the homoscedasticity assumption (i.e., they exhibit heteroskedasticity)

- **Multicollinearity Test :**

This test is considered one of the most important diagnostic procedures used to assess the quality and reliability of the estimated model. The results of this test are reported in Table (06).

Table (06) : Results of the Multicollinearity Test for the Residuals of the Estimated Multiple Linear Regression Model

Variance Inflation Factors
Date: 11/12/25 Time: 18:04
Sample: 2010 2024
Included observations: 15

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	4.212550	61.22011	NA
DCP	0.013811	70.42601	2.523946
OBP	0.202551	2.922050	2.523946

Source : Prepared by the author based on outputs generated by the EViews 12 Statistical software.

Based on the results reported in Table (06), the Variance Inflation Factor (VIF) values for both independent variables are equal to 2.523946, which are below the commonly accepted threshold. Accordingly, the null hypothesis (H□) is accepted, indicating that the estimated model is free from multicollinearity problems.

Furthermore, based on the outcomes obtained from all the previously conducted diagnostic tests, the quality and robustness of the estimated model are confirmed, as it does not suffer from any econometric issues. Therefore, it can be concluded that the model is statistically valid and acceptable.

III- Results and discussion :

The results obtained in this study indicate that FinTech variables exert an effect on financial inclusion in Tunisia during the study period, despite the variation in the nature and significance of this effect across the two variables. The main findings can be discussed as follows :

- A statistically significant negative relationship was found between the electronic payment card diffusion rate (DCP) and financial inclusion (FI) in Tunisia during the study period. This implies that the expansion of electronic payment cards does not necessarily lead to broader financial inclusion. This result may be attributed to several factors. First, the diffusion of electronic payment cards may be concentrated among individuals who are already integrated into the banking system. In this case, financial technology contributes to financial deepening rather than expanding financial inclusion. Second, the spread of payment cards may not be accompanied by a corresponding expansion in point-of-sale (POS) infrastructure or adequate digital coverage, Furthermore, weak trust in the banking system due to withdrawal restrictions or financial instability may encourage individuals to hold cash despite owning payment cards, thereby limiting the integration of new segments into the formal financial system. In addition, the cost of banking services may constitute a barrier for low-income groups, meaning that increased card diffusion does not necessarily translate into higher financial inclusion, Consequently, financial technology may enhance service utilization among already banked individuals without expanding the overall base of financially included populations.
- In contrast, a positive and statistically significant relationship is identified between the internet banking services penetration rate (OBP) and financial inclusion (FI). This indicates that an

increase in the diffusion of internet banking services contributes to higher levels of bank account ownership among adults. Such a relationship enhances financial inclusion and improves its various indicators over the study period. This result can be explained by several factors, including the facilitation of access to financial services for vulnerable groups, which expands the base of beneficiaries within the financial system, as well as the reduction of transaction costs for individuals and firms. Furthermore, internet banking supports financial inclusion by integrating previously excluded populations and enabling the easy opening of digital accounts, thereby fostering broader participation in the formal financial system.

IV- Conclusion:

Financial technology represents one of the most significant modern tools in contemporary financial systems. Accordingly, this study aimed to highlight the role that financial technology can play in enhancing financial inclusion by examining the impact of its key variables—namely, the interbank payment card penetration rate and the internet banking services penetration rate as independent variables—on financial inclusion as the dependent variable, measured by the bank account penetration rate. The study adopted a case study of the Tunisian banking sector over the period 2010–2024.

IV -1- Results:

The main findings of the study can be summarized as follows :

- A statistically significant negative relationship was found between the electronic payment card diffusion rate (DCP) and financial inclusion (FI) in Tunisia during the study period. This implies that the expansion of electronic payment cards does not necessarily lead to broader financial inclusion. This result may be attributed to several factors. First, the diffusion of electronic payment cards may be concentrated among individuals who are already integrated into the banking system. In this case, financial technology contributes to financial deepening rather than expanding financial inclusion. Second, the spread of payment cards may not be accompanied by a corresponding expansion in point-of-sale (POS) infrastructure or adequate digital coverage, Furthermore, weak trust in the banking system due to withdrawal restrictions or financial instability may encourage individuals to hold cash despite owning payment cards, thereby limiting the integration of new segments into the formal financial system. In addition, the cost of banking services may constitute a barrier for low-income groups, meaning that increased card diffusion does not necessarily translate into higher financial inclusion, Consequently, financial technology may enhance service utilization among already banked individuals without expanding the overall base of financially included populations.
- In contrast, a positive and statistically significant relationship is found between the internet banking services penetration rate (OBP) and financial inclusion (FI). This implies that increased diffusion of internet banking services leads to higher levels of bank account ownership among adults. This result can be explained by the ease of accessing financial services, the facilitation of opening digital accounts for various population groups including vulnerable segments and the resulting expansion of the financial system's user base, which strengthens financial inclusion and improves its associated indicators.

Therefore, it can be concluded that the study hypothesis has been tested andconfirmed, as evidence was found of the impact of financial technology on enhancing financial inclusion in Tunisia during the period 2010–2024. This, in turn, contributes to improving the level of financial inclusion. The findings of this study are consistent with the results reported by Rifai and Yousef Albaker (2025), Rabia and Hamida (2024), and Al-Ali and Al-Obaidi (2024).

IV-2- Recommendations:

Based on the findings of this study, the following recommendations are proposed :

- Given that this study focuses on the Tunisian banking sector, future research could replicate the analysis for the Algerian banking sector, using different variables and alternative study periods.
- Policymakers and financial institutions should seek to draw lessons from the experiences of advanced economies in the adoption and utilization of financial technology services, given their proven role in improving financial inclusion.

- Promoting the broader and more cost-effective use of electronic payment cards, as this would contribute to enhancing financial inclusion.

Referrals and references:

1. ABDULLAH, A. (2024). The effect of financial technology on the promotion of financial inclusion in Arab nations. Al-Bashaer Economi Journal.

2. Al, M. M. (2012). A Study of Relationship between Board Characteristics and Earning Management : Iranian Scenario. *Universal Journal of Management and Social Sciences, 02*(03), pp. 17-18.

3. Cull, R., & Ehrbeck, T. a. (2014, April). Financial inclusion and development : Recent Impact Evidence Focus Note, World Bank. (92), 1.

4. Lara, J., & Antonio Jose, V.-J. V. (2021). Reseach advances on financial in clusion A Bibliometric analysis. Sustainability, 13(6), 12.

5. Moradi, M. (2012). A Study of Relationship between Board Characteristics and Earning Management : Iranian Scenario. (et al, Éd.) *Universal Journal of Management and Social Sciences, 02*(03), pp. 17-18.

6. Rabia, B., & Hamida, R. (2024). The reality of financial technology and its role in enhancing financial inclusion : A case study of the banking sector in Algeria during the period (2010-2018). International Journal of Economic Perspectives.

7. Rifai, M. A., & Yousef Albaker. (2025). The Role of Financial Technology in Enhancing, Financial Inclusion : A Regulatory Perspective on Current Industry Trends. Corporate & Business Strategy Review.

8. Saksonova, S. &., & Kuzmina, M. (2017). Fintech as Financial innovation : the possibilities and problem of implementation. Journal of Business and Management, 9(5), 2329-2357.

9. Sarto, N. D., & Peterson K.Ozili. (2025). FinTech and financial inclusion in emerging markets : a bibliometric analysis and future research agenda. Tnternational Journal of Emerging Markets.

10. Ya-Ning Li, a. o. (2019). Which is More Advantageous in Financial Technology and Traditional Finance ? Evidence From JD Finance. Advances in Economics, Business and Management Research, 84, 21.

11. Boutabina, H. (2022). The impact of financial technology on financial inclusion : An exploratory study of the opinions of a sample of customers of Algerian commercial banks. Al-Maaref Journal.

12. Harfoush, S. (2019). Financial technology as a promising industry in the Arab world. Afaaq Scientific Journal, 11(03), 730.

13. Hamdi, Z., & Aqassem, A. (2019). Concepts of financial technology. Al-Ijtihad Journal for Legal and Economic Studies, 8(01), 404–411.

14. Al-Dhubyan, H. N. S. (2024). The role of financial inclusion in improving the financial performance of Yemeni commercial banks (1st ed.). Arab Democratic Center for Strategic, Economic, and Political Studies.

15. Chenbi, S., & Ben Lakhdar, S. (2018). The importance of financial inclusion in achieving development : Enhancing financial inclusion in the Arab Republic of Egypt. Journal of Research in Financial and Accounting Sciences, 2(2), 106.

16. Wahiba, A. R., & Ben Kaddour, A. (2018). FinTech trends in light of successful company experiences. Al-Ijtihad Journal for Legal and Economic Studies, 1(03), 16.

17. Al-Ali, A. H. H., & Al-Obaidi, S. Z. K. (2024). The role of financial technology in enhancing financial inclusion : An analytical study of the Iraqi banking sector for the period 2017–2022. Al-Ghari Journal of Economic and Administrative Sciences.

18. Al-Sharfa, Y. A. T., & Ajjour, H. (2019). The role of financial inclusion in national banks in achieving social responsibility toward customers : A case study of Islamic banks operating in the Gaza Strip. International Journal of Economics and Business, 6(5), 35.

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