“The role of Fintech and financial inclusion in the economic development of countries: A comparative analysis”

AUTHORS	Izz Eddien N. Ananzeh Lubna Khalaf Diya’a Khalawi

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Izz eddien Ananzeh (Jordan), **Lubna Khalaf** (Jordan), **Diya'a Khalawi** (Jordan)

THE ROLE OF FINTECH AND FINANCIAL INCLUSION IN THE ECONOMIC DEVELOPMENT OF COUNTRIES: A COMPARATIVE ANALYSIS

Abstract

The integration of digital financial technology has revolutionized the global financial system, driving financial inclusion as an important pillar of sustainable economic development. This study examines the multidimensional effects of Digital Financial Technology and Financial Inclusion on Economic Development in middle- and high-income countries. The study employs various indicators of financial inclusion and technology, namely access to the internet, Automated Teller Machines (ATMs), bank branches, and the number of depositors examined using panel regression analysis covering 20 middle-income countries and 22 high-income countries from 2010 to 2021.

The regression analysis results show that ATMs, internet access, bank branches, and the number of depositors all have a positive correlation with the Index of Human Development, which was used to measure economic development. This supports the idea that wider use of technology and increased financial inclusion can lead to higher levels of human development. Conversely, the study highlights a negative correlation between inflation rates (as a control variable) and Human Development Index (HDI) emphasizing the significance of maintaining price stability for sustained economic progress.

The study concludes that digital financial technology and financial inclusion positively impact the economic development of countries and the disparity between middle- and high-income countries. So, the middle-income countries should prioritize the development of financial technology and policies to promote financial inclusion.

Keywords financial technology, financial inclusion, economic development, panel regression analysis, middle-income countries, high-income countries

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Izz eddien Ananzeh, Ph.D., Associated Professor, Faculty of Business, Department of Finance and Banking, Philadelphia University, Jordan. (Corresponding author)

Lubna Khalaf, Ph.D., Assistant Professor, Faculty of Business, Department of Financial and Accounting Sciences, Middle East University, Jordan.

Diya'a Khalawi, MSc, Institute of Banking Studies, IBS, Jordan.

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INTRODUCTION

The Organization for Economic Cooperation and Development (OECD) has recently highlighted the far-reaching impact of digital transformation on economic growth and social development. In particular, digital financial inclusion can foster innovation in the finance industry and meet the capital needs of the market, thus driving economic growth forward (Chen et al., 2017; Sheng, 2021). Fintech has become one of the most important opportunities that should be optimally utilized to achieve financial inclusion that meets people's aspirations. Moreover, providing innovative financial services and products will undoubtedly contribute to narrowing the financial literacy gaps and enabling various segments of society, including low-income groups, to integrate into financial advancement and education programs (Feyen et al., 2022).

Fintech, with its various fields and stages, has the pinnacle of progress in providing financial services worldwide. It combines cutting-edge

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technology with corporate finance, software, and tools that are flexible, fast, and affordable (Manyika et al., 2016; Hinson et al., 2019). In addition, technology and finance have a long history of mutually reinforcing relationships, helping to materialize financial inclusion through effective access and effective use of financial services by different groups of individuals and businesses.

Financial products and services developed through Fintech today have seen high growth rates in recent years, which in turn has contributed to stimulating financial inclusion (Arner et al., 2018; Makina, 2019). Despite the negative repercussions of the Corona epidemic on various economic sectors, on the other hand, it had a positive impact on the financial industry sector and played an important role in supporting financial inclusion. In addition, it is feasible for Fintech to "globalize" basic services by encouraging financial inclusion in developing as well as advanced economies (Hamdi, 2020).

The importance of this study came from its focus on one of the most important topics of modern times. It aims to examine the impact of Digital Financial Technology and Financial Inclusion on Economic Development in various middle and high-income countries, where digital financial technology and financial inclusion play a significant role in fostering financial development and stability. This study aims to assess the extent to which digital financial technologies enhance Financial Inclusion and contribute to economic development in middle- and high-income countries.

1. LITERATURE REVIEW

This part deals with previous studies to show the method of the previous treatment of the subject and the dimensions that represent the relationship between Digital Financial Technology (DFT) and Financial Inclusion (FI) on Economic Development.

In recent times, significant attention has been directed towards enhancing FI within the global financial system. According to previous studies, financial technology has a positive impact on financial institutions in general, especially in developing countries. Mobile banking has greatly helped rural residents' access financial services on a large scale. In addition, financial literacy takes advantage of financial technology by providing educational resources and tools to help individuals better manage their various financial affairs (Ozili, 2018).

Digital financial technology plays an important role in supporting financial inclusion to achieve the 17 United Nations Sustainable Development Goals (SDGs). Danladi et al. (2023) emphasized that financial technology can directly and indirectly support the achievement of the 17 Sustainable Development Goals and this is done by providing payment services, long-term financing and insurance services. Furthermore, the limited existing theories seem inadequate in elucidating various aspects of FI and constrained in their explanatory power (Beasley et al., 2020; Kumar, 2022). This leaves room for research and development in this field, particularly in creating experimental models capable of effectively testing and analyzing the structures of FI, as addressed by Ozili (2020).

Aterido et al. (2013) examine the impact of Fintech on reducing the gender gap in FI in sub-Saharan Africa. It demonstrated that in sub-Saharan Africa, there is a clear gender gap associated with other aspects relating to the utilization of financial services, such as lower income, education level, and employment status. Compared to men, women use formal financial services less frequently.

Allen et al. (2014) examine the financial development of a group of African countries and the Financial Inclusion (FI) gaps compared to another group of developing countries. The study's findings indicated that, more than anywhere else, population density in Africa significantly related to financial development and FI. As a result, Fintech has the potential to significantly raise the FI.

By analyzing Fintech startups as a case study in Ghana, Senyo and Karanasios (2020) show that financial technology companies in general act as innovators, as they take advantage of the infrastructure of existing companies, and to address financial inclusion, they deploy collaborative strategies that include elements of cooperation and compe-

tition. Based on results, the financial technology model was developed, this model explains how financial technology companies generally work to address FI. Using adoption survey data, Jünger and Mietzner (2020) examined financial services that households are likely to use. The results indicated that families have a level of trust in modern technology, comprehensive transparency, and financial literacy, all of which affect their desire to switch to financial technology.

Jaber and Hussain (2020) discuss the opportunities and challenges facing financial technology in Iraq, specifically regarding ease of use, effectiveness, trust, and degree of safety. What steps are being taken with customers to increase the use of DFT and what is its contribution to improving FI? The study concluded that expanding the provision of financial services, especially electronic ones, enhances FI by reducing costs and facilitating access to credit. This helps risk assessment and stimulates all commercial activities, thereby boosting production and economic growth.

Ahmad et al. (2020) analyze the effect of mobile money, a type of Fintech, on savings behavior in Kenya, and find that it can significantly increase FI.

Park and Mercado (2021) used a comprehensive set of indicators (financial technology infrastructure, financial access, financial development, and usage) for 153 developing, emerging, and advanced economies to provide a new indicator of FI. The results of this study indicated that effective FI and the four dimensions reduce poverty. Fintech infrastructure and financial access reduce income inequality. Moreover, increasing effective financial inclusion is not so much for low-income economies compared to middle-income economies.

Using Global Findex data and emerging Fintech indices, Tok and Heng (2022) examined the role of Fintech in promoting FI. The study concluded that Fintech has a more positive relationship with DFI than those adopted conventional measures of FI. The outcomes in the second part indicated that the increase in the use of DFT is significantly linked to narrowing the class gap and the rural division. The results also indicated that financial technology alone might not be able to bridge the gender gap in accessing financial services.

Asif et al. (2023) investigated the effect of DFT on FI in India. The results report that financial technology has greatly aided financial inclusion in this country, particularly for the middle class.

Overall, the literature consistently emphasizes the transformative potential of digital financial technology in strengthening financial inclusion and encouraging economic development, while also highlighting a range of challenges such as gender disparity and the need for targeted strategies to improve the impact of fintech.

Based on previous literature, the academic works inspecting the role played by digital financial technology in promoting financial inclusion are generally recent research that does not cover all countries of the world and cannot generalize them. Therefore, this study came to present its applied contribution to testing the role played by Digital Financial Technology (DFT) and Financial Inclusion (FI) in Economic Development.

The purpose of this study is to inspect the impact of digital financial technology and financial inclusion on economic development, particularly in middle- and high-income countries. The study examines how the study variables – ATMs, internet access, bank branches, and the number of depositors – can contribute to the Human Development Index (HDI). This aims to identify strategies that can enhance the fintech sector and promote financial inclusion, thereby supporting economic growth and, ultimately, well-being.

2. RESEARCH METHODOLOGY

This study aims to inspect the impact of financial inclusion and financial technology on the economic growth in two world economic categories, Middle Income and High-Income economies, as categorized by the World Bank, the exclusion of other countries is mainly attributed to data unavailability issues. Therefore, the analysis was divided into two models: the middle-income countries model and the high-income countries model. The list of countries selected is reported in Appendix A and categorized into two groups: Middle-Income and High-Income countries. The group of countries was selected based on data availability for these countries during the study period.

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This study adopted a set of independent variables representing digital financial technology (DFT) and financial inclusion (FI) to inspect their impact on the dependent variable, which is economic development. DFT is represented by two variables. Firstly, automated teller machines (ATMs) it is access to financial transactions in a public place through an ATM, and secondly, Individuals using the Internet (% of population) it is the percentage of individuals in the population who use the Internet (INT). FI represented by another two sub-variables: The commercial bank branch count per 100,000 adults (BRA), and the number of deposit accounts at commercial banks (DEP). While economic development is measured through using the Human Development Index (HDI). The researchers included two control variables that were expected to have a direct impact on HDI. The two control variables are Inflation (INF) and Population growth (POP). Table 1 describes the variables studied and how they were measured.

To obtain the data, the study relied on the Global Financial Development Database (GFDD) and Human Development Report from the World Bank.

To investigate the impact of financial inclusion and financial technology on economic growth (Van & Linh, 2019), the study uses panel model analysis for 20 countries with middle-income and 22 countries with high-income for the period spanning from 2010 to 2021.

Several tests were run before the estimation to give guidance in the model selection and accuracy of the estimated parameters. Firstly, the correlation was inspected. The second step is to apply the Hausman test to specify a model based on the variance in the coefficients between fixed effect and random effect models.

According to Van and Linh (2019), the estimated model of multiple linear regression is as follows:

$$HDI = \beta_0 + \beta_1 ATM_{it} + \beta_2 INT_{it} + \beta_3 BRA_{it} + \beta_4 DEP_{it} + \beta_5 INF_{it} + \beta_6 POP_{it} + \mu_{it}, \quad (1)$$

where *HDI* refers to Human Development Index, *ATM* and *INT* are Fintech indicators, while *BRA* and *DEP* are Financial Inclusion indicators.

This study uses two control variables that are widely used in the current literature: technology inequality and finance inequality, such as Asongu and Odhiambo (2019), Neaime and Gaysset (2018), Jaumotte et al. (2013) and Dabla-Norris et al. (2015). These variables are inflation (Mittal et al.,

Table 1. Measurements of variables

Variable name	Code	Measurement	References
Human Development Index	HDI	The HDI is calculated as the geometric mean of normalized indices across the three dimensions: being knowledgeable, achieving longevity with good health, and having an adequate standard of living	Sakariyahu et al. (2022)
Digital Financial Technology Variables			
Automated teller machines (ATMs)	ATM	ATM is an electronic communication tool that lets customers of financial institutions carry out transactions in areas that are open to the public	Kumar et al. (2022), Kredina (2021), Badruddin (2017)
Individuals using the Internet (% of population)	INT	People who have accessed the Internet in the past three months (from any location) are considered internet users	Emara (2023)
Financial Inclusion Variables			
Commercial bank branches	BRA	Retail outlets of resident commercial banks and other resident banking institutions operating in a commercial capacity	Kumar et al. (2022), Maity and Sahu (2018)
Commercial banks Depositors (per 1000 adults)	DEP	Holders of deposit accounts in commercial banks and other resident banks that operate as commercial banks. These deposit accounts can include various types, such as checking accounts, savings accounts, and time deposits	Kumar et al. (2022)
Inflation	INF	The consumer price index	Cheumar and Yunita (2022), Demir et al. (2022), Neaime and Gaysset (2018), Lenka and Sharma (2017)
Population growth	POP	The annual percentage change in population	Demir et al. (2022), Neaime and Gaysset (2018)

2023; Cheumar & Yunita 2022; Demir et al., 2022; Joseph et al., 2021; Saraswati et al., 2020; Le et al., 2019; Lenka & Sharma 2017; Neaime & Gaysset, 2018) and population growth (Demir et al., 2022; Lacalle-Calderon et al., 2019). This analysis is divided into two models: the middle-income model, which was applied using panel regression analysis for 20 middle-income countries over the period 2010–2021, and the high-income model, which was applied using panel regression analysis for 16 high-income countries over the period 2010–2021.

3. RESULTS AND DISCUSSION

3.1. Descriptive statistics

Tables 2 and 3 show the descriptive statistics regarding the study's variables for each model. As seen from the tables, on average, HDI in high-income economies is greater than in middle-income economies, 0.86 and 0.74, respectively. This points up the relationship between income levels and outcomes related to human development. High-income economies typically have more infrastructure, financial resources, and access to high-quality healthcare, education, and other important services. A higher HDI is indicative of better overall human development outcomes because of these factors. This finding emphasizes the difficulties faced by middle-income countries in increasing their capacity to utilize the scarce resources they possess and reducing socioeconomic gaps within the nation. As a result, technological advancements were made to ensure that all societal sectors have access to financial services. The analysis of the study variables reveals that high-income economies tend to have higher levels of FI. Also, digital financial services compared to middle-income economies (on average, ATMs and internet usage are 54.5 and 52.78 in middle-income countries compared to 72.4 and 77 in high-income countries, while on average, bank branches and deposits are 16.3 and 877 in middle-income countries and 22 and 1,299 in high-income countries).

There are many reasons for the discrepancy between financial inclusion and digital financial services. Economic development is often stronger in high-income societies, which makes it easier to construct stable financial systems and infrastructure. They might also invest more in technology and innovation and have stronger regulatory systems, enabling laws, and supportive policies. Middle-income nations, on the other hand, may encounter challenges such as limited access to financial services in rural areas, lower levels of technological adoption, and legislative barriers that impede the spread of digital financial services.

According to the correlation test, which is reported in Tables 4 and 5, it was found that there is no

Table 2. Descriptive statistics (Middle-income model)

Variable	Mean	Maximum	Minimum	Std. Dev.	N
HDI	0.7424	0.8190	0.5850	0.0518	215
ATM	54.5261	126.7073	5.2379	28.9060	215
INT	52.7874	96.7514	6.0000	18.5654	215
BRA	16.3175	56.2254	3.8910	9.2078	215
DEP	877.035	1956.040	13.2616	415.8736	215
INF	3.2273	11.2734	–1.3697	2.3805	215
POP	1.0992	4.4225	–1.757	1.0967	215

Table 3. Descriptive statistics (High-income model)

Variable	Mean	Maximum	Minimum	Std. Dev.	N
HDI	0.8570	0.9430	0.7660	0.0367	177
ATM	72.4375	276.2867	33.9017	33.2166	177
INT	77.0348	100.0000	41.0000	14.2632	177
BRA	22.1413	56.4777	6.6352	13.7533	177
DEP	1298.936	2714.642	563.4039	486.3140	177
INF	2.0910	9.7564	–2.5403	2.5042	177
POP	0.9017	8.6511	–4.1703	2.0446	177

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Table 4. Correlation (Middle-income model)

Variable	HDI	ATM	INT	BRA	DEP	INF	POP
HDI	1	–	–	–	–	–	–
ATM	0.3418	1	–	–	–	–	–
INT	0.6313	0.2158	1	–	–	–	–
BRA	0.2912	0.0657	0.0266	1	–	–	–
DEP	0.4503	0.1070	0.2649	0.4262	1	–	–
INF	–0.2411	–0.0338	–0.3303	0.1563	–0.0711	1	–
POP	–0.5517	–0.3585	–0.2616	–0.5502	–0.3001	–0.0438	1

Table 5. Correlation (High-income model)

Variable	HDI	ATM	INT	BRA	DEP	INF	POP
HDI	1	–	–	–	–	–	–
ATM	–0.1640	1	–	–	–	–	–
INT	0.4486	0.0054	1	–	–	–	–
BRA	–0.1968	0.0833	–0.5295	1	–	–	–
DEP	0.3540	0.0421	0.2362	–0.0608	1	–	–
INF	–0.3891	0.1953	–0.2312	–0.1500	–0.1100	1	0.0013
POP	–0.1091	–0.2470	0.0071	–0.1472	–0.1984	0.0013	1

correlation between any two variables, meaning that there is no collinearity problem.

Overall, the correlation coefficients in both models suggest that HDI moderately positively correlated with INT, DEP, and ATM in the Middle-income model, and moderately positively correlated with INT and weakly positively correlated with BRA in the High-income model. On the other hand, HDI has a strong negative correlation with POP in the Middle-income model and a weak negative correlation with BRA in the High-income model. These correlation coefficients offer insights into the relationships among the variables included in the models, depending on the results there is no collinearity problem.

3.2. Hausman test

The Hausman test is usually used to determine whether a particular regression analysis should use a fixed effects model or a random effects model. The finding of the Hausman test (see Table 6) indicates the appropriateness of the fixed effect model for the middle-income model and random effect model for the high-income model. This was determined based on the results of the test's significance level, with the p-value being less than 5% for the first model and greater than 5% for the second model.

Results from the random effect regressions are presented in this section. Equation (1) is estimated as shown in Table 7.

Table 7 shows the results of a regression analysis with the HDI as the dependent variable and various indicators of financial inclusion and technology as the independent variables. The results are presented for two models (Model 1 and Model 2) with slightly different sets of independent variables.

Both models have a statistically significant intercept (constant term) at the 1% level, indicating that there is a significant baseline level of HDI that is not explained by the independent variables included in the model.

The INTERNET variable has statistical significance at the level of one percent in both models, demonstrating that countries with more internet access have higher levels of HDI. The ATM variable in Model 1 is statistically significant at the level of 1%, but not in Model 2. This implies that

Table 6. Hausman specification test

Model	Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Middle-income model	Cross-section random	22.052209	6	0.0012
High-income model	Cross-section random	3.017360	6	0.8067

Table 7. Random effects results for Fintech and Financial Inclusion impact (Dependent variable: HDI)

Variable	Model 1			Model 2		
	Est. Parameters	P. value	T-Stat	Est. Parameters	P. value	T-Stat
Intercept	0.6915	0.0000	77.703	0.8036***	0.0000	55.8769
ATM	0.0002***	0.0012	3.2840	0.0000	0.5033	–0.6707
INTERNET	0.0005***	0.0000	5.3219	0.0006***	0.0000	5.6249
BRANCHES	0.0010***	0.0001	3.9305	–0.0005***	0.0046	–2.8748
DEPOSITORS	0.0000***	0.0090	2.6383	0.0000***	0.0099	2.6097
INFLATION	–0.0012**	0.0292	–2.1980	–0.0020***	0.0012	–3.2833
POP	–0.0195***	0.0000	–8.9787	–0.0002	0.7084	–0.3746
F-statistic		92.11224			23.0773	
Prob (F-statistic)		0.000000			0.0000	
Number of observations		215			177	

Note: Significance levels: *** < 0.01; ** < 0.05; * < 0.10.

other model variables may influence the impact of ATM on HDI. Lyons et al. (2020), Gomber et al. (2018), Koch and Siering (2017), and many others have found similar results.

The BRANCHES variable in Model 1 is statistically significant at the level of one percent but has a negative coefficient in Model 2. This suggests that the relationship between the number of bank branches and HDI is complex. At the 10 percent significance level, the DEPOSITORS variable is statistically significant in both models, implying that a country's depositors may positively influence HDI.

The INFLATION variable exhibits a statistically significant negative coefficient in both models, suggesting a negative correlation between greater inflation rates and lower HDI levels. In Model 1, the population variable "POP" demonstrates statistical significance at the 1% level; however, this is not the case in Model 2, suggesting that other factors moderate the relationship between population size and HDI.

The F-statistic is significant at the 1% level in both models, demonstrating a significant relationship between the independent variables and HDI. Model 2 has fewer observations than Model 1, which may decrease the estimate's precision.

The findings confirm and demonstrate that the explanatory variables (ATMs, internet access, bank branches, and depositors) have a significant positive impact on the human development index (HDI), despite the small magnitude of the coefficients for these variables, particularly depositors. These results are in line with the results of many previous studies, which proved the existence of a statistically significant relationship between DFT, FI and HDI, such as Laeven et al. (2015), Beck et al. (2016), Lashitew et al. (2019), Danladi et al. (2023), Sakariyahu et al. (2022), and many others.

CONCLUSION

The purpose of this study is to inspect the impact of digital financial technology and financial inclusion on economic development, particularly in middle- and high-income countries. The study examines how the study variables – ATMs, internet access, bank branches, and the number of depositors – can contribute to the Human Development Index (HDI).

The regression analysis results confirm and demonstrate that the explanatory variables (ATMs, internet access, bank branches, and depositors) have a significant positive impact on the human development index (HDI), despite the small magnitude of the coefficients for these variables, particularly depositors. ATMs, Internet access, bank branches, and depositors all have a positive relationship with HDI, but in the opposite direction, inflation rates showed a negative relationship with HDI.

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The study concludes that digital financial technology and financial inclusion have a positive impact on the economic development of countries and disparity between middle- and high-income countries. So, middle-income countries should prioritize the development of financial technology and policies to promote financial inclusion.

Based on the results of this study, it has become clear to all regulatory bodies in all countries that there is an urgent need to pay attention to the growing role that digital financial technology plays in achieving the goals of sustainable development Moreover, it has become necessary to formulate national policies and plans for all countries by establishing strong regulatory rules to promote innovation in the field of financial technology and enhance financial inclusion, especially in developing countries, to achieve development and well-being for all members of society.

Based on the above findings, the study recommends strategies for middle-income countries to prioritize developing the financial technology sector and initiatives that enhance financial inclusion to stimulate economic growth and improve the well-being of their populations, as well as regulatory policies to promote innovation in digital financial technology.

AUTHORS CONTRIBUTIONS

Conceptualization: Lubna Khalaf.
Data curation: Diya'a Khalawi.
Formal analysis: Izz eddien Ananzeh.
Funding acquisition: Lubna Khalaf.
Investigation: Izz eddien Ananzeh.
Methodology: Izz eddien Ananzeh.
Project administration: Diya'a Khalawi.
Resources: Lubna Khalaf.
Software: Izz eddien Ananzeh.
Supervision: Lubna Khalaf.
Validation: Izz eddien Ananzeh.
Visualization: Diya'a Khalawi.
Writing – original draft: Izz eddien Ananzeh.
Writing – reviewing & editing: Diya'a Khalawi.

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APPENDIX A

Table A1. List of selected countries

Categories	Countries
Middle-Income Countries	Albania, Botswana, Belize, Brazil, Colombia, China, Costa Rica, Dominican Republic, Ecuador, Equatorial Guinea, Georgia, Malaysia, Maldives, Mauritius, Moldova, North Macedonia, Namibia, Paraguay, Peru, and Thailand
High-Income Countries	Brunei Darussalam, Belgium, Croatia, Chile, Cyprus, Estonia, Hungary, Italy, Kuwait, Latvia, Malta, Portugal, Poland, Qatar, Romania, San Marino, Saudi Arabia, Seychelles, Spain, Singapore, Uruguay, United Arab Emirates

Note: The separation of countries depends on World Bank country classifications.

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