The Role of Digital Finance in Economic Development: A Cross Country Analysis

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Abstract
Nations having strong infrastructure on digital platform are likely to have more acceleration in digital finance sector and reap the benefits of this sector. The term digital finance means to provide financial services through personal computers, mobile phones or any reliable digital payment system. Digital finance has the capacity to give convenient, inexpensive and firm banking services. Financial inclusion is a win-win situation that is fulfill by digital finance. Sufficient evidences confirms that internet penetration and mobile phones built up sturdy infrastructure for digital finance and thus support in boosting economic development. Therefore, the objective of this research is to examine the impact of digital finance on World's economic development. By pursuing the fulfillment of objective, this study collected the data of 77 countries from during the period from 2011 to 2021 and adopted two step system Generalized method of moments (GMM) to inspect the effects of mobile cellular subscriptions and internet usage on economic development parameters. Our findings indicate that mobile cellular services and internet uses have better impact on economic growth and per capita income. These findings also proposes some major policy implementations especially for developing countries that they must adopt such policies which make better ground to promote digital financial system and thus move ahead to cashless economies in order to get immense benefits from it.
Keywords: Digital Finance, Economic Development, Mobile, Internet Penetration, Cashless Economy.

1. Introduction

Digital finance depicts the influence of modern technologies upon financial services provider. It incorporates many of applications, business models and products that have reshaped the conventional way of delivering financial and banking services (Sangwan, 2020). Until some years prior, Information and Communication Technology (ICT) was used just as a way to enhance network universally. But the latest boom in use of internet and smart phones grow businesses on one side and on the other side, modify the living standard, communicate style and work behavior also. Banking services and other monetary transactions are now also carried out through mobile devices, which refer to as digital finance services (Chatterjee, 2020).

After the globalization, digital finance reshaped banking sector through personal computers, mobile phones and internet which connect to an authentic digital payment channel. It has a potential to give secure, convenient and affordable banking facilities. Ability to make financial decisions quickly and make secure deposits and receive payments is the benefits of digital finance. Hence digital finance is a win-win condition that promotes financial inclusion also (Durai & Stella, 2019). Since 2010, World Bank have urged the developing countries to increases the level of financial inclusion, which declines the poverty level and helps the marginalized persons to break the vicious circle of poverty (Ozili, 2022).

Digital financial services (DFS) is essential to public, as it provides security to their cash and it`s convenient to keep cash at their home or other premises rather to move with it. Cellular phones give opportunities to rural areas and financially excluded people to open accounts where banking facilities are not available (Wyman, 2017). They give control power of decision making to users, to deposit funds and transmit payments to their desire designation (Harelimana, 2017). In developing nations, 30 percent of account holders are using internet or mobile phone make at least one direct deposit.

According to the (Demirgüc-Kunt et al., 2022), the adult sharing in making or getting digital payments in developing economies increases from 35 percent to 57 during the period of 2014 to 2021, respectively. The Sub Saharan African region shows remarkable boost in using digital finance services, as compare to other regions. The pandemic of COVID-19 have a greater impact on adopting financial services through digitalizing, especially in case of paying utility bills. Along this, 865 million opened their first account in financial institution to get money from public sector and helps in boosting digital payment mechanism.

The rising of digitization also facilitate employment and reducing tax evasion, which directly uplift the economic development across the world proposed by Demirguc-Kunt et al. (2022).The desire of financial services available through digital media is to reduction in poverty and to provide many ways towards financial inclusion, which is the ultimate aim of developing countries. DFS can trigger the economy by providing firms and individuals, with easy access to a variety of financial instruments including digital debt facilities, which helps in increasing the share of

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aggregate expenditure and financial transactions Ozili (2018).

As China's GDP, which has increased by almost 9.4% per year, considering as second largest economy in the world, where unemployment rate is below 5.3%, and per capita income of their citizens valued $4348 and 11.09 million people of rural areas comes out from poverty towards middle to upper income nation. All of this economic development cannot be possible from the availability of finance and empirical study proved the inextricable role of digital finance in this development (Jiang et al., 2021).

However, the mechanism of digital finance includes the involvement of several players that encompasses mobile network companies, financial institutions, regulators authority, financial technology providers, agents, network of retailers. It can reduce or avoid transaction costs and allow convenient, affordable, secure and steady banking services, especially to those who are out of financial inclusion (Haider, 2018). Fintech (technological assistance provider to financial sector), is the key element for digital financial services, now become a vital tool for financial inclusion in both developed and developing economies. Country based research (Jack & Suri, 2014) and regional based studies (Lukonga, 2018) support evidence on how role of fintech is spurring towards accessing financial services.

There are certain restraints, which impact on DFS, savings and other financial services, such as trust building of people to save digitally (Wyman, 2017). However, cyber-attacks seem to be a big hurdle in fostering DFS especially in underdeveloped and developing nations. High transactional charges, lack of knowledge to use digital financial mechanism, security issues, bad network coverage are restricting people to quit traditional financial system and enter in new digital era (Durai and Stella, 2019).

We have formulated the research Questions.
a)   What are the relationship between digital finance and economic activities?
b)   Why per capita income will increase after the usage of digital finance?

2.   Literature Review

The universal expeditious progress of digital finance in the last two decades has captivated rising recognition among researchers and economists which tries to analyze the combine effect of digital technology and traditional financial system and how they impact on developed and developing economies regarding their economic growth and development. Previous researches (Pyka and Andersen 2013; Aghaei and Rezagholizadeh, 2017; Waseem et al, 2022; Shah et al 2023) bring out the presence of a significant positive link between usage of Internet and Communication Technology (ICT) and economic growth. They propose that ICT has a valid factor into the mechanism of economic supply and helps in the betterment of production process by making enhancement in labor force quality and technology.

Previous literature has also indicated that economic development influenced by other macroeconomic elements despite of demographic factors also. That's why, for the control variables, we taken employment (EMP), trade openness (TO), inflation (INF), domestic credit to private sector (DCPS), government final consumption expenditure (GFCE) and log of foreign direct investment (lgFDI) which follows many previous studies (Menyelim et al., 2021; Adedokun & Ağa, 2021; Ahmad et al., 2021; Alshubiri et al., 2019; Mushtaq & Bruneau, 2019).

Whereas, Aghaei and Rezagholizadeh (2017) applying static and dynamic panel data for Organization of Islamic Cooperation (OIC) for the year of 1990-2014 and found that every increase of 1% investment in ICT led to 0.52% economic growth. They also point out that digital finance creates value addition in firm level and as well as sectorial level, which leads to enhancement of economic development and productivity.

Numerous researchers Albiman and Sulong (2016); Agyekum et al. (2016); Bahrini and Qaffas (2019);Chatterjee (2020); Rekha et al (2021); Pradhan et al. (2021); Kurniawati (2022) in their papers examine the impact of Internet and Communication Technology (ICT) on economic development and growth due to digital finance. Mostly they used proxies such as mobile phones, internet usage and fixed telephone lines for ICT.

Mushtaq and Bruneau (2019) observed that digital finance parameters when taken as a measurement for financial inclusion boost economic growth and decline poverty along with inequality also. Therefore, suggestions to stimulate mobile and internet technology infrastructure could bracing financial inclusion by enhancing digital finance. Moreover, good association between financial sector and ICT will probable to boost digital financial system and to cover up the gap in financial infrastructure. In addition, Albiman and Sulong (2016) analyze the data of 27 years from1990-2014, of SSA region to examine the long run effect on economic growth due to ICT. They found that statistically significant and positive linear correlation between ICT and economic growth.

Digital technology impact a vital part in development affair in many countries in the era of globalization. Policymakers look forward towards digital technology, as possible solution to increase economic growth and employment. Bakari and Tiba (2020) also confirm the positive impact of digitalization in the process of economic growth. In many parts of Africa, digital financial services trigger economic development both at micro and macro levels, fostering a premise to achieve sustained growth through significant financial inclusion. In Kenya, DFS have been a model example of

controlling adversity in budgetary administration uplift through 19% in 2006 to 67% in 2013, which achieved by adopted a proper mechanism of DFS (Shofawati, 2019).

Moroever, Li et al., (2022) proved that digital finance increased household consumption by enhance the relaxation of borrowing, minimizing liquidity hazards and widening the investment agencies. Due to the above factors, it is inevitable that DFS, as an essential character of the conventional financial market, has deep root covering all sectors of the economy. Its innovation in way of mobile payments, Internet insurance and financing, digital funding and opportunities of online credit gear up the promoting of financial services to public, reducing the financial burden on enterprises , thus ease the way of achieving economic development.

Till now, no consensus occurs on the authentic definition of digital financial inclusion (DFI). The parameters of DFI by global researchers are general, which mostly takes immense data technology and the internet to deliver financial services for impeded class and financing help for governments, corporation and individuals that is further compelling with financial inclusion in traditional way (Ozili, 2018; Gomber, 2017). Moreover, Yousefi (2011) selected 62 countries by taking pooled OLS estimator from 2000 to 2006 and shows that digitalizing factor contributes significantly towards economic growth for high and upper-middle-income nations but no significantly impact on lower-middle-income nations.

Similarly, Qu,. et. al. (2017) finds positive effects of digitalization, infrastructure and trade openness on economic growth by using Pooled Mean Group (PMG) technique for 37 countries. Meanwhile, Li (2019) takes a dynamic panel data model of Belt and Road countries from 1996 to 2014, urge that these countries adopt various mechanism to enhance information industry growth because the positive effects of digital finance system buttress with the boost in internet service providers and users.

Notably, recent studies like Habibi and Zabardast (2020), Chiemeke and Imafidor (2020) and Usman et al. (2021) bring out the inevitable role of digital system of finance in economic development for all developing and developed countries. Habibi and Zabardast (2020) after applying the ordinary least square (OLS) technique, fixed effect model and take one step difference GMM estimators for 24 OECD and 10 Middle Eastern countries for the year 2000 to 2017. They found that the positive growth influence on both types of countries of digitalization and in specific, infrastructure and trade openness boost economic growth. They also recommend that governments in such nations pay more attention to spread digital technology framework to strengthen economic growth.

Moreover, Usman et al. (2021) highlights the impact of information and communication technology (ICT) on energy consumption and economic growth and uses the co-integration approach and error correction model for four South Asian countries i.e. Pakistan, Bangladesh, India and Sri Lanka from 1990 to 2018. The outcome of the test is affirmed that, only India has, positively and significantly long run impact of ICT is on economic growth.

Similarly, Murthy et al. (2021) analyzing recent 15 years of developed, developing and the World economy of digital economy taking GDP per capita as development variables and few digitization variables like fixed-telephone subscriptions, mobile-cellular subscriptions and fixed broadband subscriptions along with other variables also. Their findings shows a significant network economies among the mobile technologies and broadband in developed nations, declining in use of fixed broadband worldwide, growth variables of economies and mobile subscriptions. Also they added that developed economies dominated digital economy at large, particularly in E-commerce, which holds a massive share in world economy.

3. Data Analysis and Methodology

3.1. Sample

This study analyzes 77 (seventy seven) countries during the period from 2011 to 2021. The selection of countries based on the availability of data and tried to focus most of the countries from different regions and different levels of income. These data collected from World Development Indicators of World's Bank and International Telecommunication Union (ITU) a specialized agency which works for United Nation.

3.2. Model Specification

After the study of both conceptual and empirical literature, to find the role of digital finance on economic development in the various countries of different regions, the specification model is in view with Nizam et al. (2020), and Ahmad et al. (2021). The dynamic model is specified as follows:

$$lgGDP_{it} = \alpha_1 + \beta1lgGDP_{i,(t-1)} + \beta2lgMCS_{it} + \beta3EMP_{it} + \beta4TO_{it} + \beta5GFCE_{it} + \beta6INF_{I,(t-1)} + \beta7DCPS_{it} + \beta8lgFDI_{it} + \in_{it} \quad (1)$$

Where dependent variable in equation-1 is lag of gross domestic product for country i at time t, and independent variable is log of mobile-cellular services The equation (1) also consist of control variables that includes employment to population ratio (EMP), trade openness (TO), Government final consumption expenditure (GFCE), inflation rate (INF), domestic credit to private sector (DCPS) and log of foreign direct investment (lgFDI).

Our second dynamic model takes log of per capita income (lgPCI) as a dependent variable that also aligns with the prior studies of (Kurniawati, 2022; Albiman & Bakar, 2021) and thus we tries out to find the impact of log of per capita income (lgMCS) on per capita income (lgPCI). Other controllable variables are same as specification of model 1.

$$lgPCI_{it} = a_1 + \beta 1 lgPCI_{i,(t-1)} + \beta 2 lgMCSit + \beta 3 EMPit + \beta 4 TOit + \beta 5 GFCEit + \beta 6 INFI,(t-1) + \beta 7 DCPSit + \beta 8 lgFDIit + \epsilon it \quad (2)$$

3.3. Definition of Variables

3.3.1. Economic Development

In this paper, we are using log of GDP growth as a proxy of Economic Development, considered as prominent vital indicator of economic position of every country and also widely used to compute the economic performance. Earlier, this proxy was used by Ezejiofor et al., (2021); Amin et al., (2020).

3.3.2. Per Capita Income (PCI)

Earlier, Ozturk & Ullah, (2022); Yang et al., (2022); Thathsarani et al., (2021) was used as a proxy of per capita income for economic growth. Another cause for taking per capita income is to blend the model with population effect.

3.3.3. Mobile Cellular Subscription (MCS)

According to Mushtaq & Bruneau (2019), the financial sector lead by Internet and Communication (ICT) enabled technologies declines the transactional costs of financial services and thus considered as an essential part of financial inclusion. This is used as a proxy for digital finance in my paper and considered towards the modern means of using digital finance (Murshed et al., 2023).

3.3.4. Employment (EMP)

Employment is also one of the main factors which affect financial inclusion whether digital or traditional and its impact on economic development is significant and positive. The reason behind this as employment boost, income also increases of individuals and thus need of reliable, fast and safe financial inclusion exist. Earlier this proxy was used by Hjazeen et al., (2021).

3.3.5. Government Final Consumption Expenditure (GFCE)

In our research, we take government final consumption expenditure as percentage of gross domestic product as control variables. If public spending goes in a systematic way, positive coefficient expected on account to foster gross domestic product and negative coefficient outcomes regarding elimination poverty and inequality (Mbate, 2013).

3.3.6. Trade Openness (TO)

Many researchers take trade openness as a control variable which affects the economic development. It is widely used as the proxy variable for trade as a percentage of gross domestic product (GDP). Mostly in developing nations, it is assumed to be negative sign as their imports succeed exports. Earlier, this proxy was used by Fatima et al., (2020).

3.3.7. Inflation (INF)

Inflation is the key signal to judge macroeconomic activities and also helps in determining the solidity of economy of any nation, as high degree of inflation shows a great level of trouble linked with the economy (Akram et al., 2011). In literature, it is associated with negative performance towards economic development. We take measurement of inflation as consumer prices (annual %).

3.3.8. Foreign Direct Investment (FDI)

Foreign direct investment is very prudent forecaster of economic development (Falki, 2000). Moreover, Husnain et al., (2011) has developed a negative relation of foreign direct investment (FDI) with gross domestic product (GDP) after analyzing of cross countries panel data.

3.3.9. Domestic Credit to Private Sector (DCPS)

Role of private sector is inevitable in economic development of any nation and potential of participating private sector in development and investment activities is measured by domestic credit to private sector and its shows positively impact on economic growth (Olowofeso et al., 2015). It is measure in percentage of gross domestic product.

3.4. Econometrics Estimation

The objective of this research is to examine the impact of digital finance on economic development for different countries. Traditional approaches of panel data estimation are required check the validity of stationarity of the data by using the unit root test for finding its unbiased estimators. Initially, we generate estimators by using fixed effects (FE) and random effects (RE) but in dynamic analysis these effects are not biased, so we use Arellano-Bover/Blundell-Bond system GMM estimator, to overcome the endogeneity biases along with other econometric complications linked with FE and RE models ((Okafor et al., 2015). In small data size, weak instruments given biased estimators and to rectify these potential biases we uses the Arellano–Bond estimator after adopting the additional condition of taking instrument's first differences which are not linked with the FE (Kitamura & Phillips, 1997).

In this study, we use the two step system generalized method of moments (GMM), for estimation of both equations, sp that we can overcome the problem of endogeneity and autocorrelation and assure the result should be accurate and consistent (Iftikhar et al., 2022). Countries having different demographic and macroeconomics factors, makes biasness's in the model, but GMM methodology handle omitted variable biases, heteroskedasticity and autocorrelation issues effectively. Furthermore, in view with several studies, which takes GMM estimators, the Arellano and Bond autocorrelation [AR(2)] is not rejected and Sargan test of over-identification restrictions (OIR) is rejected. Nonetheless, Arellano-Bond GMM estimators uses two techniques i.e. one step and two step GMM estimators, in which two step estimation technique is asymptotically more efficient, due to the adopting optimal weighting matrix, which is lack in one step GMM estimation (Ugwuanyi et al., 2022). Arellano & Bond (1991) Blundell & Bond (1998) we apply two-step GMM estimation technique of Arellano-Bond in this paper. The firmness of system GMM estimator is rely on two conditions. First, the group of instrumental variables should not be linked with the error terms and overidentifying Sargan test assure. Second, non-appearance of second-order autocorrelation (AR2) in residuals should be substantiated, while a rejection of first-order autocorrelation (AR1) could be identified and this second condition is verified by Arellano-Bond tests for AR1 and AR2 (Chatterjee, 2020).

4. Results and Discussion

Table 1 depicts the summary statistics of all variables used in this paper. Majority of variables are expressed in percentages such as internet, employment, education, domestic credit to public finance, government final consumption expenditure and trade openness. Other variables include gross domestic product, per capita income and foreign direct investment in log form which is in millions of USD. Mobile cellular subscriptions are also in log form but actual measures in per 100 inhabitants.

The descriptive statistics from the following table reveals that the domestic credit to private finance holds the highest number of mean 60.555 and the lowest mean value is of inflation which is 3.970. Only three variables shows standard deviation in double digits, having high value is of domestic credit to private finance i.e. 41.845 and lower value shows by mobile cellular subscriptions i.e. 0.286. Higher observations of our data set carries jointly by gross domestic product and per capita income and that is 847 observations respectively while lowest observation in our data set is of education and its value is 515.

Table 1. Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Gross Domestic Product	847	25.113	1.881	20.473	29.467
Per Capita Income	847	8.883	1.315	5.9586	11.818
Mobile Cellular Subscriptions	835	4.691	0.286	3.3931	5.358
Internet (%)	746	53.957	27.95	1.2	99.701
Employment (%)	836	56.531	9.356	30.597	84.944
Education (%)	515	50.125	28.31	4.736	148.530
Inflation (%)	822	3.970	7.382	-3.749	154.756
Government Fixed Consumption Expenditure (%)	812	16.004	5.764	3.587	40.553
Domestic Credit to Private Finance (%)	727	60.555	41.845	4.022	255.310
Foreign Direct Investment	707	21.561	1.885	12.154	25.867

Table 2 illustrate positive correlation between per capita income, mobile cellular subscription, internet, education, domestic credit to private sector and foreign direct investment against gross domestic product which is our dependent variable also of model 1, rest of variables have negative correlation for dependent variable. This tells us the clear picture that there is a linear correlation of our sample data set.

Table 2. Correlation Matrix

	Gross Domestic Product	Per Capita Income	Employment	Mobile Cellular Subscrip-tion	Internet	Education	Inflation	Government Final Consumption Expenditure	Domestic Credit to Private Sector	Foreign Direct	Trade Openness
Gross domestic Product	1.000 0										
Per Capita Income	0.403 3	1.000 0									

Employment	-0.1500	-0.2919	1.0000							
Mobile Cellular Subscription	0.1499	0.6159	-0.2379	1.0000						
Internet	0.3314	0.8876	-0.1607	0.6100	1.0000					
Education	0.4111	0.6908	-0.2544	0.4445	0.7197	1.0000				
Inflation	-0.0685	-0.3619	0.1005	-0.2777	-0.3447	-0.1924	1.0000			
Government Final Consumption Expenditure	-0.204	0.3002	-0.2336	0.1584	0.2938	0.1919	-0.2155	1.0000		
Domestic Credit to Private Sector	0.2703	0.595	-0.1169	0.344	0.5137	0.503	-0.3202	0.1101	1.0000		
Foreign direct Investment	0.7728	0.4415	-0.1512	0.1123	0.3742	0.3562	-0.0773	-0.128	0.3671	1.0000	
Trade Openness	-0.3673	0.3358	-0.1323	0.1967	0.3358	0.0513	-0.0918	0.2877	0.1466	-0.0815	1.0000

In table 3 and 4, first we apply Hausman test which supports the FE estimator on RE. Our model fulfills the condition of valid overidentifying restrictions through post-estimation test of Sargan/Hansen. The Arellano-Bond test AR(1) and AR(2) confirms that our model have no autocorrelation issue. So there is sufficient confirmation that the estimation model is accurately specified. In Model 1 we primarily focus to look into whether mobile cellular subscription variable affect a significant part on gross domestic product or not? In table 4, The Arellano–Bover/Blundell–Bond system GMM results clearly specify that proxy of digital finance i.e. is log of mobile cellular subscription (lgMCS) is positive and significance at 10% for gross domestic product (GDP) growth. This outcome is compatible with the result of Mohammed et al. (2017), and Khan et al. (2016). The log value of gross domestic product (lgGDP) has a positive and significant value which reveals that as connection with magnitude, GDP increases by 0.112% for any 1% surge in mobile cellular subscription. Even though the coefficient is 0.112 which is proportionally smaller but we expect in future that improvement and availability of mobile-cellular services along with robust digital financial infrastructure upsurge the impact of this factor on GDP growth.

The outcome of estimation results of controllable variables are also worth discussing. The lag of foreign direct investment (FDI) shows positive value but insignificant (Angyie & Annicet, 2020). The reason may be severe economic crisis during past years due to corona and worldwide economic slowdown. Lag of domestic credit to private sector (DCPS) is positive and highly significance due to the efficient and productive use of credit which further boost gross domestic product. This finding is compatible with studies done by (Pandey et al., 2023; Okwu, et al., 2020). The other control variable employment (EMP) having insignificant positive value, this is because of past 3 to 4 years many people lost their jobs due to economic setback done by corona. Trade openness (TO) has negative and insignificant value due to lack of FDI and bad economic situations and the result also supported by (Adu-Gyamfi et al., 2019; Amna et al., 2020).

Government fixed consumption expenditure (GFCE) is significant at 1% but negative value and the basis of negative are less foreign direct investment (FDI) in many countries and due to corona, govt. of many developed and underdeveloped nations curtail their expenses for overcome economic crisis after corona pandemic (Obinna, 2020). As regard to inflation (INF) which value is significant at 1 % and positive impact on gross domestic product (GDP), primarily because of less production worldwide and demand for necessaries increases which soar the prices level and all this analysis also supported by (Omran & Bilan, 2021; Tien, 2021).

Table 3: Summary of Test Result of Model 1

Variable	FE	RE	GMM
Log(Gross Domestic Product)$_{t-1}$	-	-	1.225***
			(0.087)
Log(Mobile Cellular Services)	0.306***	0.311***	0.112*
	(0.043)	(0.050)	(0.066)
Employment	0.012***	0.010***	0.002
	(0.003)	(0.003)	(0.002)
Trade Openness	-0.004***	-0.005***	-0.000
	(0.000)	(0.000)	(0.000)
Government Final Consumption Expenditure	-0.015***	-0.015***	-0.005***
	(0.003)	(0.004)	(0.003)
Inflation	-0.004***	-0.004**	0.008***
	(0.001)	(0.001)	(0.002)
Domestic Credit to Private vSector	0.001**	0.001***	0.013***
	(0.000)	(0.000)	(0.002)
Log (Foreign Direct Investment)	0.024***	0.038***	0.022
	(0.007)	(0.008)	(0.015)
Constant	23.049***	22.883***	0.126
	(0.305)	(0.371)	(0.888)
Hausman Test	CHSQ = 69.69		
	(0.00)		
Arellano Bond AR (1)			Z = -3.7176
			(0.00)
Arellano Bond AR (2)			Z = -1.8853
			(0.06)
Sargan Test			CHSQ = 48.63
			(0.12)
No. of OBS	592	592	454

Notes: (1) FE, RE, and GMM refers to fixed effect, random effect and two step system generalized method of moment respectively;
(2) *, **, *** represents statistical significance at 10%, 5% and 1% level respectively. (3)WC-Robust standard errors are in parenthesis.

4.1. Empirical Analysis of Model 2

Table 4 depicts the result of equation 2, where we try to search out the that how much per capita income influenced by mobile cellular subscriptions which is our a proxy of digital finance in this model also. The result reveals that lag of per capita income (lgPCI) is also influenced by lag of mobile cellular subscriptions (lgMCS), because it has a positive and significant value at 10% which is match with the findings of (Tiwari et al., 2019; Lee et al., 2021). Due to massive increase in mobile and e-commerce which on the one hand boost businesses particularly of small and medium size and on the other hand reduces many costs, such as transportation cost, middleman cost and time cost. All such uplift per capita income (PCI) directly or indirectly Waseem et al, (2023).

Accordingly, regarding the control variables, the employment level (EMP) is positive but insignificant value to make impact on lag of per capita income (lgPCI), supporting by (Emara & Said, 2021 & Habibi & Zabardast, 2020)). The trade openness (TO) and government fixed consumption expenditure (GFCE) appears negative impact on lag of per capita income (lgPCI) with almost insignificantly results in the model and this is also supported by Adedokun and Ağa (2021). Lack of use of modern technology and unskilled workers in many countries of various regions, might be the causes of negative and insignificant values of these variables.

Lag of inflation (INFi,$_{(t-1)}$) exerts a positive value of 2.40 which is significant at 5%, also influences the per capita

income as inflation causes to many persons to increases their incomes, which is in the view of (Ehigiamusoe, et al., 2019). Domestic credit to private sector (DCPS) and lag of FDI highlighted negative but significant values and reason of this might be worst globally economic crisis from the last 2 to 3 years and in many countries specially in developing nations, which evidence the curtail in foreign direct investment (FDI) may be because of less economic opportunities worldwide. The outcome of Arellano-Bond test AR (1) and AR(2) are 0.01 and 0.06 respectively which confirms that of no sign of autocorrelation and value of Sargan test i.e. 0.09 is also valid.

Table 4: Summary of Test Result of Model 2

Variable	FE	RE	GMM
Log(Per Capita Income)$_{t-1}$			1.166***
			(0.092)
Log(Mobile Cellular Services)	0.247***	0.253***	0.125*
	(0.040)	(0.046)	(0.074)
Employment	0.012***	0.010***	0.002
	(0.002)	(0.003)	(0.001)
Trade Openness	-0.003***	-0.002***	-0.000
	(0.000)	(0.000)	(0.000)
Government Final Consumption Expenditure	-0.016***	-0.010***	-0.003
	(0.003)	(0.003)	(0.005)
Inflation	-0.002**	-0.004**	0.006**
	(0.001)	(0.001)	(0.002)
Domestic Credit to Private vSector	0.000	0.001**	0.012***
	(0.000)	(0.000)	(0.003)
Log (Foreign Direct Investment)	0.019***	0.026***	0.024
	(0.006)	(0.008)	(0.018)
Constant	7.102***	6.865***	0.016
	(0.280)	(0.336)	(0.604)
Hausman Test	CHSQ = 69.69		
	(0.00)		
Arellano Bond AR (1)			Z = -3.0826
			(0.01)
Arellano Bond AR (2)			Z = -1.8605
			(0.06)
Sargan Test			CHSQ = 50.13174
			(0.09)
No. of OBS	592	592	454

Notes: (1) FE, RE, and GMM refers to fixed effect, random effect and two step system generalized method of moment respectively;
(2) *, **, *** represents statistical significance at 10%, 5% and 1% level respectively. (3)WC-Robust standard errors are in parenthesis.

5. Conclusion and Policy Recommendation

This research analysis an impact of digital finance in economic development globally by using the Random Effect, Fixed Effect and Arellano-Bond system GMM estimators also construct two models, showing the impact of digital finance on economic development by using the Arellano–Bond system Generalized Method of Moment estimator. Ample evidences proved that surge in digital finance services boost gross domestic product, per capita income and employment opportunities also. Additionally, trade openness, education, domestic credit to private sector, foreign direct investment and government final consumption expenditure are all essential for supporting the digital finance platform. In developing nations, where non-institutional ways dominance the credit spreading, so if economically non developed people having the opportunities to come in the digital finance circle, can boost economic growth which further improve their living standards and helps in eliminating inequality and poverty. With stable economies going towards cashless economy to lessen corruption, money laundering, terror financing and financial mismanagement, which is necessary for entering in any international business accords and helps in future to running economic matters smoothly.

Policymakers must expand digital financial infrastructure and services capable of spreading growth advantages equitably. A first step should be taken by financial institutions to upgrade the services to obtain credit for private sector through steady expansion of mortgages, credit cards, overdrafts, corporate and retail loans for willing persons. Secondly, this is also need to design policies that enhance easy accessibility to stimulate digital financial inclusion and modernize

Fintech commodities like internet banking, mobile money services, ATMs and various digital mobile applications need to be made in such a way that people living in remote areas and less educated population should be benefited from the blessings of digital finance. Moreover, financial knowledge must be amalgamated into the banking business to gear up the economic agents on the digital products and financial services accessible to them. It is envisaged that the above directions will steady integrate masses of adult population which are unbanked, under the umbrella of digital finance platform.

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