Digital currency and financial inclusion in Nigeria: lessons for development

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Abstract

Purpose – This study aims to empirically investigate the effect of digital currency development (digital finance) on financial inclusion in Nigeria for the period. Nigeria undertook her digital currency development to rip the benefits of financial inclusion, safer remittances and exchange rate regularization among others.

Design/methodology/approach – The researchers developed high-frequency quarterly data for the analysis from 2006:1 to 2020:4 in a weighted stepwise forward regression. A model similar to the one used by Demir *et al.* (2020) and Altunbas and Thornton (2019) with some modifications was developed.

Findings – Findings suggest that (1) a unit rise in the usage of automated teller machines by citizens spontaneously raised financial inclusion in a quarter in Nigeria by 0.012 units and were statistically significant; (2) a percentage rise in the use of point of sales transaction by citizens in the country also raised financial inclusion in Nigeria by approximately 1%; (3) a percentage increase by mobile payment users in Nigeria will spontaneously increase financial inclusion by at least 0.4%; (4) a percentage rise in web payment services reduces financial inclusion by 22% in Nigeria; (5) Cumulative positive effect of digital finances on financial inclusion in Nigeria was approximately 7%.

Practical implications – The researches show, using in-sample forecast, that while financial inclusion will grow in Nigeria, it will not be without systemic fluctuations. Based on the outcome, it is proposed that if the present digital currency penetration for the country is sustained at the present growth rate, the country may be more financially inclusive by 2% additionally by 2025 and 4% more by 2030.

Originality/value – Originally, it is found that digital currency development are positive derivatives for financial inclusion in Nigeria. Cumulatively, the effect of digital finances on financial inclusion in Nigeria is approximately 7% positive.

Keywords Financial inclusion, Digital currency, Economic inclusion, Development, Nigeria

Paper type Research paper

1. Introduction

In this 21st century, financial inclusion is a well-recognized global issue. It is estimated that at present, about 1.7 billion people are underbanked, and about 2.3 billion adults are financially excluded, while small- and medium-sized businesses face challenges connecting with the financial system. Financial users may not be able to access financial services, and, if they can, those services may not be high quality, suitable or affordable (Rhyne, 2020; World Economic Forum, 2021). These cases may be particularly worrisome for developing economies whose structural makeup and social and economic disposition has created equally social and economic inequality and accelerated the level of poverty in these regions to a level beyond accurate description. For instance, Nigeria is one of the regions in Sub-Saharan Africa with a highly unbanked population. It is estimated that over 60% of her over 206.1 million population are excluded from the banking system (Global Finance, 2021). This is not

surprising given that currency outside the banking system continues to rise year on year and citizens tends to be comfortable living their lives without any noticeable relationship with the banking system. Currency outside the banking system grew by more than 50% between 2015 and 2020 from 1.46 trillion naira to 2.3 trillion naira, respectively. This moved the year on year growth rate from 12% in 2016 to 25% in 2020 Central Bank of Nigeria (CBN), 2021. Attributed to two episodes of currency depreciation of 2016 and 2020, whose effect is shown in rising inflation, this has caused many Nigerians to be further drifted away from financial inclusion services.

The quest for digital currency or digital finances is a drive towards redesigning the financial system which is citizens friendly and inclusive. As Yuhelson *et al.* (2020) shows, the utilization of digital currency through an authorized e-cash guarantors has the capacity of widening the entrance and capacity for individuals in financially included activities across boundaries. This was the case in India where, between 2014 and 2018, the growth rate of formal financial users rose from 52.8% to 79.8% as a result of digital financial payments (Mobile Solutions Technical Assistance and Research (mSTAR), 2019). We can then appreciate why developed and developing countries are on their toes for digital currency development in recent times.

There are many reasons why digital currency consideration for financial inclusion is necessary. For one thing, the global community glamour for poverty reduction is on the increase. The United Nations for instance had proposed that by 2030, the world is expected to be on track to end poverty. However, far from being realized, the COVID 19 pandemic has pushed more than 82.9 million people into extreme poverty (as of 2019) and by 2022, over 100.9 million will be poor in Nigeria, and over 3 billion people lacked the basic necessity (notably effective hand washing facilities) to mitigate the impact of COVID 19 around the globe, thereby implying that more and more people will sink below the poverty line by the end of 2025 (World Economic Forum, 2021; Irvin *et al.*, 2021; World Bank, 2021). Digital currency for financial inclusion is expected to accelerate the economic recovery of the poor, both rural and urban post-COVID 19.

Second, financial inclusion has been globally accepted as a tool for sustainable development. Of the 17 sustainable development goals globally accepted as the blueprint for a better and sustainable tomorrow, financial inclusion is identified as a catalyst for attaining 7 of these goals (World Bank, 2018). Interestingly, Goal 9 that discusses sustainable issues in industry, innovation and infrastructure identified investment in critical infrastructures as key enables for tomorrow's development. Here lies the development power of financial innovation in digital currencies for accelerated financial inclusion for not just the equitable distribution of wealth for shared prosperity but also for social inclusion, justice and security-all seen as present global challenges. Already, to put things in the right perspective, a group of developed economies, the G20 had reaffirmed their interest in implementing high-level principles for global financial inclusion, aimed at advancing global access to finance.

Third, financial exclusion undermines the quality of life of the citizens and hold the nations' economies back. Clearly, economies with low financial inclusion produce declining growth. Small- and medium-scale businesses that are financially excluded find it challenging to make timely business plans and productions to meet the market demand. Therefore, economies contemplating faster growth should first think of getting citizens to access financial rights. As Demirguc-Kunt and Klapper (2012) put it, without inclusive financial systems, poor people are left to rely on their own limited savings for investment and small enterprises will rely on their limited earnings to pursue promising growth opportunities. This will contribute to consistent income inequality occasion around the world and slower economic growth.

However, available data show that the financial inclusion stance for Nigeria is low. As shown in Table 1, Nigeria is one of the regions in Sub-Saharan Africa with a high unbanked population with 60% unbanked population. This is disturbing economically when compared

Country	Total pop. (Mill)	Unbanked pop. (%)	Cash trans. (%)	Card Trans. (%)	Internet penetra. (%)	No. of ATMs per 100,000 adults
Morocco	36.9	71	41	21	62	28.6
Egypt	102.3	67	55	27	45	20.1
Nigeria	206.1	60	24	27	70	16.9
Mexico	128.9	63	21	44	66	61.5
Vietnam	97.3	69	26	35	66	25.9
Philippines	109.6	66	37	22	60	29.0
Indonesia	273.5	51	13	34	55	53.3
Kenya	53.8	44	40	25	83	7.7
Brazil	212.6	30	18	62	67	101.7
India	1,380	20	17	32	34	21.0
China	1439.3	20	6	22	54	95.6
USA	331	7	4	59	89	NA

Source(s): Extracted from Global Finance (2021)

Table 1.
World most unbanked countries

with other developing countries with similar populations; for instance, Brazil with only 30% unbanked population, India with only 20% unbanked population and Indonesia with 51% unbanked population. This may be a direct result of dismal access to digital currency channels like automated teller machines (ATMs) in Nigeria compared to other developing countries. As shown in Table 1, ATMs penetration per thousand declined in Nigeria (16.9%) compared with a similar counterpart in Africa (notably Morocco (28.6%) and Egypt (20.1%); and in other regions across the world (for instance Brazil with 101.7%, Indonesia with 53.3% and India with 21.0%) in 2021.

Table 1 shows that a lot is still lacking in deepening financial inclusion in Nigeria and investigation into the role of digital finances in fulfilling this role is more than ripped. Incidentally, discussion on digital finances is rather recent and empirical investigation into how this impact on financial inclusion is also scanty, more so, for developing economies such as Nigeria. We expand the literature at this pace. We use quarterly data from the Nigerian sub-region to show that digital currency development can deepen financial inclusion in developing economies.

Additionally, transaction cost in servicing economic production with cash is on the rise in Nigeria. For instance, the CBN in 2009 pegged the cost of handling cash in the financial system to be 114bn naira and projected the cost to rise geometrically to 1992bn naira in 2012 (Agbaje and Ayanbadejo, 2013). There is no likelihood that this cash-cost-related geometric progression will change in recent history. It could even be argued that this cost divest funds that hitherto be channeled into profitable production and slowed the economic process. This argument lay by the reconsideration of digital currency development as cost-effective derivatives in the financial system for accelerated financial and growth inclusion in Nigeria.

We structure this study as follows: Section 1, introduction; Section 2, literature review; Section 3, methodology; Section 4, analysis and result presentation; Section 5, discussion and conclusion.

2. Theoretical issues
The literature usually identifies two theories that explain the financial inclusion hypothesis. These are the access opportunity frontier theory and the access barrier theory. Developed by Beck and De la Torre (2006), the access opportunity frontier theory relied on the theory of supply and demand in explaining the financial inclusion or exclusion hypothesis. According to this theory, access to financial services depends on the financial cost of service delivery,

products diversification and bank infrastructure density. The theory thus suggests that higher cost of financial services such as the cost of opening and owning a bank account, requirements for minimum amount of deposit and high administrative costs reduce financial inclusion or encourage financial exclusion among financial users.

The availability and use of financial services also depend on the diversity of the products offered by financial institutions. In this sense, e-products availability and digital currency provide differentiated financial products to aid financial inclusion or reduce financial exclusion. Thus, simplifying the process of financial services products (World Bank, 2009) and reducing time cost to financial services usage (Beck and Demirguc-Kunt, 2008) or reducing the bottle necks to formal financial products (Claessens, 2006; Beck and De la Torre, 2004) will improve financial inclusion synthesis. Guerineau and Jacolin (2014) also show that the use of financial services equally depends on the density of banking infrastructure. Beck et al. (2009) showed that the geographical location of financial service providers and other alternative service points either increases or otherwise of customers seeking access to financial services. Batila-Ngouala-Kombo (2021) also identified other economic factors that support financial inclusion synthesis. These include employment status, income, income flows and debt of financial users. As Batila-Ngouala-Kombo (2021) showed, these factors can easily speed up client access to financial services and reduce providers delay in the selection process of financial assistance.

The access barrier theory to financial inclusion, on the other hand, view prices, information and cultural values (language, ethnicity and religion) as barriers to financial inclusion (Honohan, 2004; Beck and De la Torre, 2006). Financial repression which encourages restrictive regulations to financial products availability imposes price restrictive barriers to financial inclusion. In the same vein, information asymmetry in financial distribution mechanism poses financial inclusion barriers that are mostly faced by the financially excluded and disadvantaged population. As Beck and De la Torre, 2004 showed, asymmetric information also poses financial inclusion challenges to financial service providers as unclear information on clients' credit history can pose loan loss risk to banks. Exhibiting asymmetric information in the financial distribution chain is financial illiteracy, thus making education a key determinant of financial inclusion. In addition, cultural values (specific to certain ethnic groups and religions) have a great influence on financial exclusion (Batila-Ngouala-Kombo, 2021). Indeed, certain ethnic groups living in isolation because of discrimination may prevent their nationals to have any contact with the derivatives of globalization, including financial services. Also, certain religious groups, notably Islam, for instance, are generally opposed to cultural changes including financial dealings that give rise to financial usury and credit services or paid savings products (Batila-Ngouala-Kombo, 2021).

Batila-Ngouala-Kombo (2021) further highlighted additional barriers to financial inclusion to include factors such as family size, gender and population age. He showed that family size may pose an inclusion barrier in that service providers may be reluctant to grant access to finance to a household size of large family (apparently for reasons of non-performance); and that gender consideration may indicate that women are more likely to be excluded financially than men, due partly to the differences in educational attainment in which men are usually given priority to educational attainment and cultural inferiority in which women's participation in development is believed to end in the kitchen; and population age in which the young may be considered legally unqualified to use financial services and the aged whose retirement is synonymous with a decrease in financial resources, often face both financial and physical barriers to using financial services.

Digital currency development has been theoretically proposed on the premise of supply leading finance to economic growth and development. Generally, the finance-led growth proposition advocates that financial development creates an enabling environment for growth to thrive. The theory argued that lack of access to finance is the bottleneck

responsible for declining growth and income inequality experienced across regions of the world. Access to an affordable, safe and easy source of finance is, therefore, a necessary condition for accelerating inclusive growth and dipping income inequality across regions. Digital currency development provides such access by ensuring that both economically and socially excluded people are integrated into the economy through closer finance and less external shocks. Often attributed to the original works of Bagehot (1873) and supported by Schumpeter (1911), Goldsmith (1969), McKinnon (1973) and Levine and Zervos (1996), the finance-led growth hypothesis shows that growth is only possible through financial aid.

Others have argued for the discussion of digital currency development from the proposition of Silber's Constraint Theory of Innovation (Kandie, 2013). Silber (1975) argued that financial innovation by a financial firm is the sole outcome of profit maximization against profit-maximizing constraints facing the firm. The theory notes that financial firms are faced with business handicaps which may be internal (for instance management inefficiencies) to the firm or external that limit the firm's profit maximization. Profit maximizing firms innovate through digital currency development to mitigate the restrictions occasioned by these handicaps. According to Kandie (2013), research has shown that firms that are less profitable in their respective sector are disproportionately innovative. This decrease in profitability has provided them with the necessary motivation to innovate in response to markup their profit margin. Thus as Silber (1975, 1983) shows, investment in innovation is a rational response to an unfavorable competition position.

2.1 Conceptual definition

Digital currency is a term used to describe currency that digitally represents value. Digital currency can either be electronic money and/or virtual currency. Electronic money is a fiat currency – the coin and paper money of a country established as legal tender that is represented digitally. Conceived in this manner, electronic money also possesses the legally transferable value domicile in a country's fiat money electronically. Virtual currency, on the other hand, is a "digital representation of value" that can be digitally traded and possesses the traditional functions of money such as the store of value, the nit of account and the medium of exchange. One key attribute of virtual currency is that it lacks the legal tender status inherent in fiat currencies. Conventionally, the virtual currency can either be convertible when it can be an exchange for real currency or non-convertible, where such transfers are not possible. In its administrative form, the virtual currency can either follow a centralized pattern when administered by a single administrating authority or it can be decentralized when no administrator can be linked to it or a hybrid model when it possesses the properties of centralized and decentralized administration combined. Recent innovations in virtual currencies also include algorithm-based administration, open-source administration, peer-to-peer administration, etc.

Cryptocurrencies, a subset of virtual currencies, use an innovative method to process virtual transactions, called "blockchain" or, more generally, distributed ledger technology. When one cryptocurrency user decides to send money to another, this transfer request is sent through a decentralized database shared among a network of computers who must all approve the transaction before it can be recorded. Once approved, the transaction "block" is added to an existing "chain," creating a "digital ledger" that holds information securely and transparently for everyone on the network to see. Currently, there are over 700 different alternative cryptocurrencies traceable in the world (Economic and Social Commission for Asia and the Pacific, 2021).

The literature showed that financial inclusion has connotations on the socioeconomic development of its region (Nguyen, 2021; Akileng et al., 2018). As a result of this, its definition may be region-specific. For the World Bank, Financial Inclusion is seen as individuals and

businesses that have access to affordable financial products and services to meet their financial needs implemented in a conscious, responsible and sustainable manner.

Nguyen (2021) defined financial inclusion as the process of ensuring that people have easy access to and use of financial services from the formal financial system in a timely, adequate and affordable manner, especially for the financially disadvantaged group. All financial inclusion seek to increase access to everyone in a country or region with the aim of enhancing financial access equality for all to mitigate economic inequality across regions. Based on the regional-specific aspect of financial inclusion, many scholars have attempted to construct country- or region-specific index of financial inclusion in the literature (see for instance, Ozili, 2021; Nguyen, 2021; Sarma, 2015; Demirguc-Kunt and Klapper, 2012). Nigeria undertook her digital currency development to rip the benefits of financial inclusion, safer remittances and exchange rate regularization among others.

2.2 Measurement issues

The literature on financial inclusion and exclusion is inconclusive in index or indexes that measure the extent of financial inclusion and exclusion across countries (Ozili, 2021). Understanding the measurement of financial inclusion is necessary for financial planning purposes. A comprehensive measure of financial inclusion and exclusion allows for the country and regional comparison needed for gauging access to finance and growth. It also makes for the identification of factors responsible for slower financial inclusion and strategies for resolving them to strengthen the finance–growth chain. Policymakers and financial experts can, therefore, use this information to gauge their regions standing in financial access development space around the world that will provide a blueprint for strategic movement or sustenance.

More concerns for the measurement of financial inclusion are countries and regional-specific characteristics that make for uneven financial inclusion index across regions. For instance in Sub-Saharan Africa and other developing economies, cultural considerations, security challenges and information disclosure policies continue to pose measurement challenges to financial inclusion in these economies. For instance, the security challenges of the Northwest region of Nigeria had necessitated the shut-down of communication networks in Zamfara state in 2021 posing operational challenges for banks in the region that have equally shut-down their operation, technically excluding a larger part of or the entire region financially.

Another issue for consideration in financial inclusion measurement is what we may here refer to as "inclusion in financial inclusion." As Sarma (2015) showed, most studies on financial inclusion measurement centered on financial penetration-adults owning a bank account without necessary concern on the operationality of such accounts. This measure may present a fallacy in financial inclusion measurement if individuals were actually excluded from financial services due to the cost of the transaction, distance to the nearest financial service points or other psychological hindrances of those individuals owning the accounts and undermine the quality of financial inclusion. For measurement of financial inclusion that caters for the inclusive financial system, financial inclusion should go beyond financial penetration to include other aspects of financial inclusion as the availability and usage of the banking systems measured with such indicators as the number of bank accounts (per 1,000 adult persons), the number of bank branches and ATMs (per million people), the volume of bank credit and deposit as ratios of GDP among others.

In other to develop a comprehensive financial inclusion or exclusion index for countries around the world, The Global Financial Inclusion (Global Findex) database was inaugurated in 2011. The Global Findex data provides data for 148 countries constructed with survey data from interviews with more than 150,000 national representatives and randomly selected adults age 15 and above during the 2011 calendar year (Demirguc-Kunt and Klapper, 2012). This is in addition to the Alliance of Financial Inclusion (AFI), a conglomerate of financial

sector regulators that had been in operation since 2008 providing also a set of measurement indices that bothers around financial system inclusiveness. However, with the specific intent on developing economies, Ozili (2021) developed an easy to measure indices of financial inclusion that takes into consideration data availability for developing economies. He derived formulas for determining the rate of financial inclusion (RFI) index, the rural financial inclusion rate (RFIR) index, the urban financial inclusion rate (UFIR) index, the financially included population rate, the financially excluded population rate, the financial access ratio, among others. His measures are easily derived from information from the banking system of most developing economies and will be applied in this study.

2.3 The quest for digital currency development

Due to the need to bridge the financial gaps between the rich and the poor, the rural and urban dwellers and associated financial settlement issues, many countries have adopted digital currency development as a way to fast track inclusive financial systems. Currently, over 80% of countries in the world are considering CBDCs development as an option to digital finance. Interestingly, both the developed and the developing economies are at the forefront of this development. Other concerns for the development of digital currencies, as pointed out by Benni (2021) and Clifford-Chance (2021) has been the global health risk associated with COVID-19. Central in this development is the "central banks digital currency" (CBDCs). According to the Bank for International Settlement (BIS) (2020), central bank digital currency is a digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank. CBDCs are government-backed cryptocurrencies issued by the central banks and accepted for financial settlements. They provide a digital means for legally tended financial transactions and mitigate the volatility risk associated with other untended cryptos.

Owing to these associated benefits of CBDCs, many economies have researched its possible development. In particular, Ecuador became the first country in the world to launch e-currency that is tied directly to the local currency in 2015. In 2016, Tunisia launched its CBDC the "e-Dinar" in 2016, becoming the First Nation to put its currency on the blockchain. The Bahamas, unveiled its CBDC, the Sand Dollar, in 2020. United Kingdom established its own CBDC in 2021, The People's Bank of China (PBOC) has been a global leader in developing its own national cryptocurrency (CBDC) since 2014 and in October 2020, the first digital Yuan was launched. Sweden began its CBDC project in 2017 and by 2020, the first Swedish e-krona was unveiled. Nigeria began the development of her own CBDC in 2017 relying on the hyperledger fabric blockchain and by October 1st 2021, CBN was already set to roll the e-naira currency. Finally, on October 25th 2021, Nigeria launched its first e-currency. By this launch, Nigeria became the second after the Bahamas to fully have an e-currency. To propagate private financial inclusion through digital currency usage, private firms in Nigeria are on the track. The telecom company MTN Nigeria, for example, waived fees for all mobile money transfers made through its MoMo agent network; the mobile payment company Paga waived fees for merchants to receive e-payments from their customers through its platform; and Jumia, a leading e-commerce provider, discounted the purchase price of all items by 10% for customers who paid using a Mastercard through its JumiaPay portal (Adesina, 2020). Already, Nigeria's digital currency development is gaining international recognition as the international monetary fund (IMF) has tasked the country's financial regulators with risk management associated with digital currency.

Recent challenges in the development of CBDCs for financial inclusion are the issues associated with the end user protection. Some CBDCs are designed to cater for institutional participation notably financial institutions, the so-called "wholesale" CBDCs while others are designs with the aim of the general public usage in mind known as "retail" or "general-purpose" CBDCs. The inclusion concerns are that while the latter may be more financially

inclusive, the latter may not due to its structural nature. Second, there is the issue associated with "true" CBDCs and synthetic CBDCs (BIS, 2020). A synthetic CBDC is a digital currency issued by a private party (e.g. a commercial bank) that is matched by deposits held at a central bank. Didenko and Buckley (2021) argued that in a synthetic structure, private parties essentially act as intermediaries between the central bank and the relevant end-users for profit maximization and hence lack the flexibility needed for social compatibility. Again, synthetic CBDCs may hinder faster global integration in financial settlements due to the time needed to be verified by the apex bank.

2.4 Review of related literature

Risal (2018) examined the impact of digital currency operations on the development of Nepal's economy. The study adopted an exploratory research technique in seeking primary facts from over 100 respondents about digital inclusion in the Nepal economy. His result reveals that Nepal's economy is backward in digital financial inclusion. People in Nepal were either unaware of the existence of digital financial products in Nepal or their existence were legally hampered by the government regulating agencies making digital penetration a mirage in the Nepal economy. He concluded that such effort is dampening developing economies in financial inclusion drive including Nepal.

Ahmad *et al.* (2020) review African experiences on mobile money transactions and financial inclusion in relation to Sub-Saharan African development. Their study used taxonomic, descriptive and analytical methods to evaluate the extent of information available in Sub-Saharan Africa about digital financial inclusion and how mobile technology impacted on economic development and financial inclusion of the region. Their reviews reveal that mobile money development helped households and businesses in shared wealth growth. The Kenyan experience was really impressive where the M-pesa technology reduced business losses and share risk with financial investors and enhance financial inclusion in the Sub-Saharan region.

In the wake of the global financial recession recently experienced in 2007–2010 periods, and the intuition of digital currency usage for financial inclusion, there has been concern raised for the stability of the global financial system. In one such stability consideration, Banna and Alam (2021) considered the effect of digital currency development on seven Asian countries' banking stability and its attendant effect on growth and development from 2011 to 2018 relying on 574 banks panel data set. The countries included in the study were Malaysia, Pakistan, Indonesia, China, Thailand, India and the Philippines. Applying the panel-corrected standard errors (PCSE) and panel two-stage least-squares – instrumental variables (2SLS-IV) methods, their outcome demonstrate that digital currency development can enhance banking stability and an integrated digital financial system among the emerging Asian banks and chat a sustainable pathway for the general economic development of the region in years to come.

Equally, Risman *et al.* (2021) considered the associated risk involved in financial stability in the pursuit of digital finance for financial inclusion for 10 year period (2010–2019) in a panel framework for the Indonesian economy. In their study, over 120 sample data were collected from the Indonesian banking system for the risk assessment. Relying on the power of what they called Moderating Regression Analysis under the Multiple Linear Regression technique, they found supportive evidence that market risk can actually moderate the influence of digital finance on financial stability. The implication is that if systematic banking risk increases, then digital finance for financial inclusion will reduce and vice versa and this will have implications for the overall stability of the financial system over time. Taken by itself, digital finance increases the stability of the financial system at last by 18% but when the risk factor is included, the result was an inverse relationship.

Soriano (2017) investigated the role of digital finance in financial inclusion from the perspective of new financial technology ventures serving the world's underbanked and

unbanked in two key regions of the world – Africa and Asia. His study included a total of about 7,370 data points collected on 63 different fintech firms that have been involved in business startups before 2017, notably from 2004 to 2017. Applying multi-variate regression and binomial logit techniques on the primary data collected for the purpose, he showed that fintech startups with long years of experience in financial services, the degree of customer centrality to the business location and startup and the strategic collaboration of fintech firms with other financial institutions and e-commerce enterprises exerted a strong, significant and positive correlation with financial inclusion and by extension financial performance. He thus argued that digital technologies such as mobile phones, cloud computing, data analytics and blockchain are necessary ingredients of financial inclusion to make the economically underserved and unserved population financially active.

Bostic *et al.* (2020) argued that while the interest in financial inclusion might center on the unbanked and the underbanked population, a greater number of cash inclined population may be financially excluded. In their study of digital payments and financial inclusion in the USA-based cash-inclined population, they showed that increasing cash circulation in the USA are an indication that a shift in focus in financial inclusion analysis is necessary. Consumers who are cash-dependent face the increasing cost of digitalizing finances and may be forced to relocate to areas where digital finances are nonexistent or minimal.

They thus suggest three approaches to accommodate cash-inclined population including ensuring a parallel environment that preserves the use of cash, focusing on innovation as a means to address the barriers preventing consumers from accessing digital payment options and transitioning to a completely cashless society that all consumers needs are met without cash.

Lu *et al.* (2021) showed that digital finances can affect the development of small and Medium-scale enterprises. They examined how the use of digital currency will affect small- and medium-scale businesses in their quest for financial inclusion in China from 2010 to 2017. In their study, they obtain data for SMEs constraint on financial inclusion and rural bank branches effect and SMEs financial inclusion index. Employing generalized methods of moments (GMM) technique on the collected variables, they provide empirical evidence of) local bank branches and digital financial inclusion having a substitution effect on alleviating SMEs' financial constraints. Thus, SMEs sustainability trade-off has to be decided by small firms in China between using local bank branches and financial inclusion. Their study reveals how digital finance technologies could influence traditional SME-bank relationships for sustainability.

Azeez and Akhtar (2021) identified a preliminary impediment to digital currency usage for financial inclusion in rural communities. In their study of the determinants of digital financial literacy, they showed that inability to use digital finance is a result of limited skills, awareness and the knowledge and attitude of users. They demonstrated this for the rural inhabitant of the Indian community using the socio-economic data of the respondents. Applying multiple regression analysis on the generated variables, they found that financial literacy is a major factor in digital currency for financial inclusion. In their conclusion, they argued that digital financial education should be the first and necessary step to consider in the digital currency–financial inclusion relationship for rural communities of India. This should be generally considered for not only the rural dwellers, but also for the urban dwellers as well.

Shree *et al.* (2021) surveyed the experiences of Indian consumers in digital payment solutions relying heavily on online survey-based dataset for their analysis. In the dataset, 640 respondents who are mostly institutional workers either in the government or private from 20 states in India participated in the survey. The intuition was that fraudulent digital transactions could undermine citizen's perception of digital currency for financial inclusion. Employing multinomial logistic estimation technique on the variables, they showed that individual's preferences for digital payment solutions is largely a function of his or her perception of the digital payment solutions and not undermining their trust in the overall

payments system. Clearly, if a person has been defrauded before in digital financial usage his trust in the payment solution will likely dipped, and the cash payment mode will likely be opt for considering the economy of the region in general.

Perhaps in order to technically tackle the perception issues in digital currency transactions, Roussou *et al.* (2019), in their study developed a research model that combines the Innovation Decision Process Model (IDPM) with the Technology Acceptance Model (TAM), integrating the perception of security in order to examine the factors influencing the actual use of digital currencies in Greece. Relying on data collected from 254 online respondents in 2018 and analyzed with structural equation models (SEM), they found strong statistical evidence of security perception and the fact that managers need to incorporate security policies into transactions in digital currencies for strong commercialization. They also showed that financial and cybercrime education should be an integral part of digital currency development for trust build up in digital currency usage.

Oumarou and Celestin (2021) investigated the determinant of financial inclusion in eight West African Economic and Monetary Union (WAEMU) member countries from 2004 to 2017. Their study included a set of digital finances parameters like mobile phone penetration and interbank credit transfers among other variables. They used panel ordinary least squares and generalized least squares techniques on the selected variables. Their results showed digital finances predicated by mobile money transfers significantly and positively aided financial inclusion in the WAEMU countries. The study further alluded that this positive effect is seen in the growth of financial inclusion in the region by over 50% in just 10 years from 2005 to 2015. Such determinant presents a window of opportunities to tap into digital financing for the growth of the region beyond the 21st century.

In a related development, Agyekum *et al.* (2016) investigated the effect of digital currency usage and financial inclusion in lower-income countries with Ghana as a case study in Africa for the period 2011–2014. The sample data for their study included both bank-based customers and non-bank-based customers. Combining both ordinary least squares regression and logistic regression analysis on both the macro and the micro datasets, respectively, between the difference in difference positions, they showed that significant positive effects exist for digital currency usage and financial inclusion for non-bank-based digital finance users and a negative correlative effect exist for bank-based digital currency users in financial inclusion. They argued that the Ghanaian government should synchronize technological deepening to stimulate an inclusive financial system in the country.

Ugwuanyi *et al.* (2020) examined the impact of digital financing on the movement of money supply in Nigeria from 2009 to 2018. Their study included variables such as web payment systems, automated teller machine payment systems and point of sales payments as digital finance captures to affect money supply growth. Utilizing autoregressive distributed lag technique on the variables, they present positive evidence of digital finances on money supply growth in Nigeria from 2009 to 2018 from web payment and point of sales systems and a declining impact of automated teller machines on money supply growth. Based on the outcome of their study, it was not difficult for them to recommend policy synergy for the central bank and fintech firms to continue to deliver hitch-free finances for growth.

Oyelami *et al.* (2020) investigated the impact of digital finance on consumer spending behavior in Lagos state Nigeria using a combination of data collected from primary and secondary sources. The sample data for the study were 405 commercial banks customers from the Lagos region. Utilizing autoregressive distributed lag framework on the variables, they found that digital finance penetration in Nigeria increases consumer spending behavior due to convenience and cost-effectiveness associated with digital currency. They thus recommended that government should deepen digital currency to boost aggregate demand and investment ultimately in the economy.

Many studies on the Nigerian region do not pay particular attention to digital currency development on financial inclusion. Rather, the few we saw had developed an interest in digital finances and growth (Efanga *et al.*, 2020) or in financial inclusion and growth (Okonkwo and Nwanma, 2021). Our study contributes to this gap in the literature. We, however, extend the literature by deriving a developing country-specific financial inclusion index as outlined by Ozili (2021) for Nigeria.

3. Research methodology
3.1 The model
To examine the impact of digital finance on financial inclusion in Nigeria, we develop a model similar to the one used by Demir *et al.* (2020) and Altunbaş and Thornton (2019) as;

$$\text{Fin Incluion}_t = \partial_0 + \sum_{k=1}^{k} \partial_1 \text{ Digit Fin}_{k,t} + \sum_{p=1}^{p} \partial_2 x_{p,t} + \mu_t \tag{1}$$

In equation (1), Fin Incluion$_t$ refers to financial inclusion, Digit Fin$_{k,t}$ refers to the various digital channels employed in financial transactions, $x_{p,t}$ denotes a vector of control variables in the system commonly accepted to influence financial inclusion, μ_t is the error term. Clearly, ∂_0, ∂_1 and ∂_2 are the regression estimates. However ∂_1, and ∂_2 composite parameters in the case of equation (1). In Nigeria, much as in many other developing economies, notable digital finance channels are the point of sales (POS) transactions, the ATMs and the Web payments (Web pay) (see for instance Risman *et al.*, 2021; Ugwuanyi *et al.*, 2020; Efanga *et al.*, 2020; Oyelami *et al.*, 2020; Agyekum *et al.*, 2016). These form our composite digital finance of equation (1). We also include mobile pay (Mob pay) in our digital finances portfolio. The literature on financial inclusion shows that mobile pay is tending towards becoming the most important means of easy access to financial services for the pro-poor as mobile phones penetration increases (Benni, 2021; mSTAR, 2019). The literature also provides composite control variables on financial inclusion studies and most of these variables tend to be development specific. For instance, with a specific interest in developing economies, income has been identified as a factor (see for instance Shree *et al.*, 2021; Okonkwo and Nwanna, 2021; Demir *et al.*, 2020) and education (see for instance Shree *et al.*, 2021). Thus, our composite control variables of equation (1) are made up of income and education. Respecifying our model explicitly gives us the following equation (2).

$$\text{Fin Inclusion }_t = \partial_0 + \partial_1 \text{ATMs}_t + \partial_3 \text{POS}_t + \partial_3 \text{Web pay}_t + \partial_4 \text{Mob pay}_t + \partial_5 \text{Income}_t$$
$$+ \partial_6 \text{Edu}_t + \mu_t \tag{2}$$

Equation (2) shows that digital finances work in conjunction with other composite variables to influence financial inclusion in any economy.

3.2 Data
Earlier, we showed that Ozili (2021) developed an easy to measure indices of financial inclusion that takes into consideration data availability for developing economies. He derived formulas for determining the rate of financial inclusion (RFI) index, the rural financial inclusion rate (RFIR) index, the urban financial inclusion rate (UFIR) index, the financially included population rate, the financially excluded population rate, the financial access ratio, among others. His measures are easily derived from information from the banking system of most developing economies. Our financial inclusion index was constructed based on the formula

$$\text{Fin Inclusion Index}_t = \frac{\Delta \text{ in fin size}}{\Delta \text{ in pop size}} * 100 \qquad (3)$$

where fin size is the size of the financial sector, pop size is population growth, and Δ is the change operator. Conceptually, the size of the financial sector can be measured using a number of indices including the financial system deposits to GDP ratio, bank deposits to GDP ratio, and M2 to GDP ratio. We relied on M2 to GDP ratio in the construction of our financial sector size. Our argument is that since Nigeria is majorly a cash-based economy, then M2 better mirrors financial system size than deposits as the majority may not operate an account.

The country-wide literature on digital payment systems for Nigeria has shown that the three most common e-transactions channels are POS transactions, the ATMs transactions and the Web pay (Ugwuanyi *et al.*, 2020; Efanga *et al.*, 2020; Oyelami *et al.*, 2020). Data on other payment channels like the remita and paypal payments systems are jet to be available officially on the size suitable for empirical investigation. We totally relied on financial transactions provided for by POS, ATMs and Web pay channels and extended the literature by including Mobile pay channel in our analysis. In the extraction of the data, we relied on data on the volume of transactions than on the value of transactions. We argued that the volume of transactions better X-rayed the inclusive tendency of citizens of how regular they depend on digital finances for financial inclusion. Data on the gross domestic product (GDP) was proxied for income and data on secondary school enrollment was proxied for education. The literature is also in agreement with these proxies. We used quarterly data that span from 2006:1 to 2020:4 to retain the information embedded in the variables. All dataset in the system were variance weighted to account for information variability occasion by data point dispersion. All data sets were sourced from the world development indicators (WDI) for Nigeria and the Central Bank of Nigeria (CBN). We investigated the stationarity properties using the augmented Dickey Fuller (ADF) test and the Dickey Fuller generalized least squares (DF-GLS) test.

4. Analysis and results
In this section, we discuss the results of the effect of digital finances on financial inclusion in Nigeria. Specifically, we begin with the presentation of the performance of financial inclusion in Figure 1. Financial inclusion in the country witnessed impressive growth from 471 units in 2006 to 804 units in 2008. It, however, dipped to 88 units in 2010 before accelerating to 713 units in 2011. From 2011 onward, financial inclusion in Nigeria has been growing at a declining rate to 675 units in 2014. It further grew from 734 units in 2015 at an undulating rate to 905 units approximately in 2020.
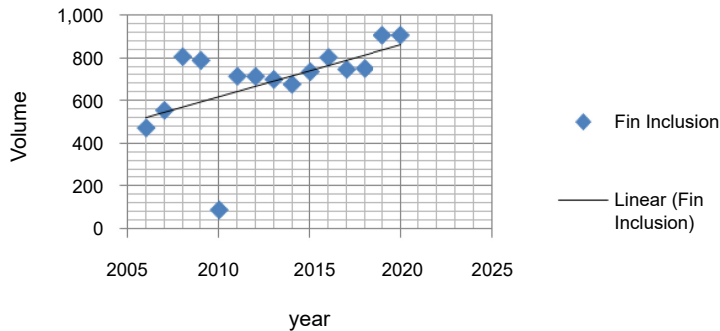
Fin Inclusion

Source(s): Authors calculations
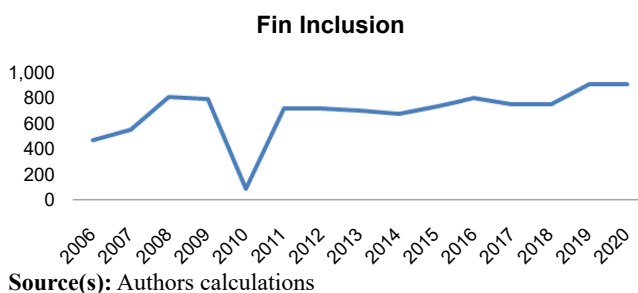
Figure 1.
Growth of financial
inclusion in Nigeria
2006–2020

Generally, the performance of financial inclusion in Nigeria has been on the rise indicating that financially included population grew over the review period (Figure 2). The scatter plot in Figure 2 shows that only one outlier (the 88 units in 2010), attributed mainly to the dampening effect of the global financial recession, was far from the scatter cluster. The linear graph indicates a fair steady growth in the volume of financial inclusion in Nigeria.

The growing strength of financial inclusion in Nigeria may be attributable to a tantamount rise in the use of digital finances in the period concerned. The volume of digital financial users grow year on year in Nigeria from 2006 to 2019 (Figure 3). Financial transactions of Nigerians in ATMs, point of sale servicesPOS, Web pay and Mob pay all grew substantially in the review period. However, the growth shows that ATMs had a larger share of the financially inclusive population (Figure 3). This made earlier scholars adjudge that ATMs services promote digital financial dominance in Nigeria by 93% (CBN, 2011; Agbaje and Ayanbadejo, 2013).

Clearly, between 2009 and 2013, ATMs services occupy a larger market share of digital financial services in Nigeria (more than 90%) (Figure 4). However, it is intuitive to note that as digital finances awareness penetrates the population, the market share of ATMs services weaned. Our extract shows that as of 2019, the share of ATMs in digital finances weaned to 48%, ceding more than 20% each to POS and Mob pay, respectively, and less than 10% to Web pay services. Ohiani (2021) showed that this market change continued from 2017 where ATMs had 78.2% share, POS 14.3% share, Mob pay 4.7% share and Web pay with 2.8% share. Development in digital finance services in Nigeria as shown by the market completion of the digital channels ATMs, POS, Web pay and Mob pay underscores the role of product
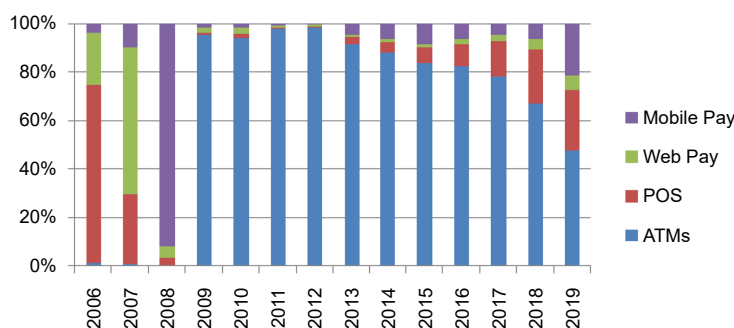

Figure 2.
Volume of financial inclusion in Nigeria 2006–2020

Source(s): Authors calculations
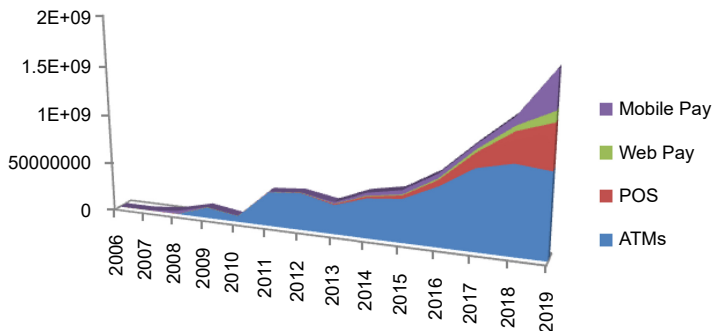
Figure 3.
Growth of digital finance in Nigeria

Source(s): Authors, based on data from CBN

Figure 4.
Share of Digital
Finance channels in
Nigeria 2006–2019

Source(s): Authors, based on data extracted from CBN

innovation in making citizens financially inclusive in years following this review period. As Ohiani (2021) showed, these innovations have enhanced self-services and facilitated the e-funds transfer, tele-banking, smarts cards, e-data interchange, e-home and office banking.

4.1 Descriptive properties of the variables
Table 2 presents the descriptive properties of the variables. As shown in Table 2, most of our variables were multivariate normal with acceptable Jarque-Bera values except financial inclusion, whose error is attributed to data outliers. However, most of our variables were negatively skewed except for POS and Web pay that skewed to the right. Generally, all our variables exhibited acceptably peaks indicating that they all emanated from a normal distribution. Thus, we proceed to further statistical investigation.

4.2 Unit root test
The unit root test result of our quarterly data from 2006:1 to 2020:4 is presented in Table 3. We investigated the stationarity properties using the augmented Dickey Fuller (ADF) test and the Dickey Fuller generalized least squares (DF-GLS) test to clear empirical doubt of spurious stationarity arising from weak and power size failures of one test method against the other. Our results indicate clear stationarity of the variables at levels not beyond order one. Clearly, any result obtained from the estimation of these variables can be adjudged reliable for policy formulation and recommendations.

Theoretically, the stationarity of variables in a model not exceeding order one is believed to inform the use of the autoregressive distributed lag technique in estimation (see, for instance, Ekong and Mbobo, 2021). However, because the sole intent of this exercise is to investigate the relevance of digital finance through her channels in driving financial inclusion in Nigeria, we choose to use forward-looking weighted stepwise regression. This technique allows us to see the relative importance of every added variable in impacting financial inclusion. We weighted the variances of our regression variables to account for variations in data clusters occasioned by shocks detrimental to the equilibrium states of the variables. We present our result in Table 4.

Table 4 shows that many channels of digital finances in Nigeria positively aided financial inclusion. For instance, a unit rise in ATMs usage by citizens spontaneously raised financial inclusion in a quarter in Nigeria by 0.012 units and was statistically significant. Presently, the share of ATMs per thousand in Nigeria stood at 16.9% (Global Finance, 2021), and low in comparison to similar developing nations. The economics here is that increasing the share, for instance, to 51% as obtained in other developing countries like Indonesia will sour up citizen's

	FIN_INCL	ATMS	POS	WEB_PAY	Income	EDU
Mean	872.4857	2.37E+08	10,840,511	3,556,293	63280.01	43.14913
Median	980.5528	2.97E+08	2,018,293	2,291,003	6456.29	45.09340
Maximum	1277.457	5.90E+08	63,715,203	14,088,247	102575.4	56.20540
Minimum	460.8661	−14481996	383,598.9	409,903.1	25236.06	31.86770
Std. Dev	256.9067	1.87E+08	6,227,206	3,199,339	25319.30	6.684962
Skewness	−0.154904	−0.006670	1.737893	1.677614	−0.038699	−0.105436
Kurtosis	1.753009	1.561147	5.140721	5.140891	1.558476	2.347120
Jarque-Bera	2.751613	3.450795	27.77297	26.40162	3.473305	0.784531
Probability	0.252636	0.781102	0.620001	0.611002	0.761091	0.675525
Sum	34,899.43	9.50E+09	4.34E+08	1.42E+08	2531,200	1725.965
Sum Sq. Dev	2,574,041	1.37E+18	1.03E+16	3.99E+14	2.50E+10	1742.860
Observations	40	40	40	40	40	40

Source(s): Authors extracted from empirical result

Table 2.
Descriptive properties
of the variables

	ADF	DF-GLS
atms$_t$	−0.1570176	−1.049643
Δatms$_t$	−3.786939***	−2.035332**
POS$_t$	−0.296707	−4.502675***
ΔPOS$_t$	−4.4133311***	
income$_t$	−0.668608	−0.901225
Δincome$_t$	−9.575940***	−8.242228***
Edu$_t$	−6.140575***	−0.667100
ΔEdu$_t$		−11.18810***
Web Pay$_t$	*2.886850*	*0.393213*
ΔWeb Pay$_t$	*−3.141405****	*−2.114250***
Mob Pay$_t$	−0.862783	−1.444071
ΔMob Pay$_t$	−5.478756***	−5.125460***
Fin Inclusion$_t$	0.617462	−5.989056***
ΔFin Inclusion$_t$	−11.32722***	

Note(s): *, ** and ***Indicates significance at 10%, 5% and 1%
Δ Indicates the difference operator
Source(s): Authors

Table 3.
Unit root test results

Dependent variable: Fin inclusion

Variable	Coefficient	t-Statistic	Prob
C	13.02738	2.331544	0.0281**
atms$_t$	0.012660	5.272665	0.0000***
POS$_t$	0.007527	0.449452	0.6570
Web Pay$_t$	−0.221445	−2.109606	0.0451**
Mob Pay$_t$	0.044950	3.607237	0.0013***
income$_t$	−0.006568	−2.298422	0.0302**
Edu$_t$	0.154257	2.010367	0.0553**

Weighted statistics

R-squared	0.61
Adjusted R-squared	0.51
F-statistic	6.412239
Prob (F-statistic)	0.000346
Durbin–Watson stat	1.8572
Weighted mean dep	14.83788
Schwarz criterion	8.784578

Note(s): ** and *** Indicates significance at 5% and 1%
Method: Weighted Stepwise regression
Source(s): Researchers

Table 4.
Estimation results

inclusiveness financially by 0.036 units or 4% approximately in the future. Also, a percentage rise in the use of POS by citizens in the country also raised financial inclusion in Nigeria by approximately 1%. However, this will not be statistically significant. Notably, the market share of POS penetration in Nigerian digital finances is low roughly 22% in this report and one will expect such one for one delivery. Mobile phone payment also showed a statistically significant effect on financial inclusion in Nigeria. As shown in Table 4, a percentage increase by mobile payment users in Nigeria will spontaneously increase financial inclusion by at least 0.4%. This means that as the market share of mobile phone payment increases as Figure 4

shows in Nigeria, financial inclusion in Nigeria will increase. Clearly, the transaction volume of 377,265,208 for mobile phone payment in Nigeria was low for a country with over 206 million people in 2019 with only 1.8 volume dept. However, the positive prospects are indications of more diffused inclusion in the future.Whereas other channels of digital finances in Nigeria had a positive impact on financial inclusion, web payment services did not. Our outcome shows that a percentage rise in web payment services reduces financial inclusion by 22% in Nigeria. This could be a result of network failures in completing transactions and the time lost in making a physical appearance in the banking halls. In some cases, citizens have even lost their funds or their wares for incomplete web transactions.

Interestingly, other supporting determinants of financial inclusion in developing economies were well-behaved. For instance, the role of citizenship education on digital finances in enhancing financial inclusion was shown to be statistically significant and positive. In fact, citizen's awareness of the effect of digital finances in enhancing financial inclusion will be strong and up to 15 percentage point in every single citizen's awareness. This is an indication that financial courses in the education sector in Nigeria should include in its curriculum digital finances awareness to breed a future of a digitally conscious population for inclusive finances. However, the role of income in financial inclusion will be negative but statistically significant. A rise in income dipped financial inclusion by approximately 1% over the review period. This should not be surprising if we conceived of the role of income inequality inherent in developing economies across the world and particularly in Nigeria. Second, the cling to cash transactions by citizens in developing countries like ours dampened financial inclusion. Earlier, we showed that the cost of cash transactional businesses is on the rise for the country. Traditionally, these transactions in themselves have the tendency of concentrating transactions in a particular enclave that hinders digital finance inclusion.

Our analysis shows that about 61% of the accelerated financial inclusion in Nigeria was determined by digital currency development in the country. The system was free of autocorrelation as highlighted by the Durbin Watson value of approximately 1.9. More than that, the overall system was stable, as indicated by the F-statistic value. Thus, we accept the null hypothesis of the overall system significance.

4.3 Post diagnostic test
We tested for the presence of multicollinearity in our model using the Variance Inflation Factor (VIF). VIF is a measure of how much the variance of the estimated regression coefficient b_b is "inflated" by the existence of correlation among the explanatory variables in the model. A VIF of 1 means that there is no correlation among the pth explanatory variable and the other variables, and hence the variance of b_b was not inflated. VIFs exceeding 10 are indications of serious multicollinearity requiring empirical attention. Our VIF result in Table 5 shows that we do not have serious multicollinearity problems to attract further empirical attention. We are confident that our estimates are reliable.

We also tested for our model specification using the Ramsey RESET test specification. We were interested in seeing that we did not commit non-linear specification errors for linear specification or otherwise. The result, reported in Table 6, shows that our probability of F-statistic greater than 0.5 level of significance indicates that the null hypothesis of model misspecification should be rejected. Our model was correctly specified linearly.

5. Discussion and lessons for development
Our analysis of digital finance for financial inclusion in Nigeria has shown generally that digital finances hold positive financial inclusiveness for Nigeria. Cumulative positive effect of digital finances on financial inclusion in Nigeria in the review period was approximately 7%.

These positive impacts were felt from the ATMs, POS and Mobile pay channels. The implication here is that if the present digital currency penetration for the country is sustained, the country may be more financially inclusive by 2% additional by 2025.

More generally, the analysis shows that as digital finances awareness increases, the share of digital finances products penetration changes due to citizen's alignment. Technically, the lesson for development is that designing more digital currency products in the financial system will drive citizen's financial inclusiveness. In this instance, the CBN's adoption of retail options to e-currency development is highly commendable and recommended. This will help individuals to create their own e-wallets that could ease digital transactions in the country.

Moving forward, we constructed an in-sample forecast of financial inclusion for Nigeria in the years to come and presented the result in Figure 5. Our in-sample forecast corresponds to the findings of our scatter plot in Figure 2, but with more insight. While financial inclusion

Variables	Coefficients variance	Centered VIF
C	31.21955	4.355106
atms$_t$	5.771314	4.093793
POS$_t$	2.810012	1.008628
Web Pay$_t$	1.101023	2.104293
Mob Pay$_t$	1.551200	6.656885
income$_t$	0.000817	6.648813
Edu$_t$	0.005890	8.707898
Source(s): Authors, extracted from empirical result		

Table 5.
Variance Inflation Factor (VIF) result

	Values	df	Probability
t-statistic	5.515768	24	0.5787
F-statistic	30.42369	(1,24)	0.5219
Likelihood ratio	26.19986	1	0.7063
Note(s): Method: Ramsey RESET test			
Source(s): Authors, extracted from empirical result			

Table 6.
Model specification test result
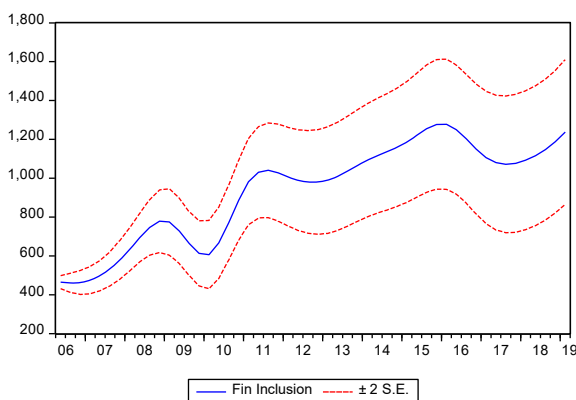
Forecast: Fin Inclusion	
Actual: Fin Inclusion	
Forecast sample: 2006Q1 2020Q4	
Adjusted sample: 2006Q2 2019Q1	
Included observations: 52	
Root Mean Squared Error	333.7245
Mean Absolute Error	304.3447
Mean Abs. Percent Error	62.07173
Theil Inequality Coefficient	0.200045
Bias Proportion	0.597928
Variance Proportion	0.048621
Covariance Proportion	0.353451
Theil U2 Coefficient	4.389183
Symmetric MAPE	39.52131

Source(s): Authors generated from empirical result

Figure 5.
Financial inclusion forecast

will grow in Nigeria, this will not be without systemic fluctuations. The lesson for development here lies in developing a conscious effort digital finances smoothening for progressive growth. We recommend such consciousness to include financial cybercrime detention and prevention, systemic network failure corrections and more digital finance friendly products that take care of the pro-poor group. Generally, our result shows that the selected channels for digital currency are relevant outliers for financial inclusion in Nigeria and other developing economies as the system included all of them in the analysis.

5.1 Conclusion

This paper discusses the role of digital currency development and its effect on financial inclusion in Nigeria over the period 2006–2020. Digital currency or digital finance is gaining growing attention in driving financial inclusion across all regions of the world, and so the need for developing economies including Nigeria to tap its benefit. We use the commonly accepted channels of digital finances for developing economies in development literature and show that cumulatively, the effect of digital finances on financial inclusion in Nigeria is approximately 7% positive. Based on our outcome, we proposed that if the present digital currency penetration for the country is sustained at the present growth rate, the country may be more financially inclusive by 2% additional by 2025 and 4% more by 2030. To achieve the desired progress, we recommend notable policy for development including, but not limited to, financial cybercrime detention and prevention, systemic network failure corrections and more digital finance friendly products that take care of the pro-poor group in financial inclusion.

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