Financial Innovations and Economic Growth in Nigeria: Ardl Approach

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Abstract- ***This study examined the effect of financial innovations on economic growth in Nigeria. Quarterly time series data of secondary source covering the period from 2009Q1 to 2023Q4 were extracted from the NBS Annual Abstract of Statistics and the World Bank Group. The research was conducted using relevant econometric tools which included descriptive statistic test, unit root test, cointegration test and ARDL model. The ADF unit root test carried out revealed that the variables were stationary at first deference and the ARDL bound test showed that there is a long run relationship between the financial innovation variables and economic growth in Nigeria. The findings from the ARDL estimates showed that financial innovation variables can significantly affect economic growth in Nigeria, given that, all the financial innovation variables used in the study such as POS, WBT, ATM, CRR and interest rate were statistically significant in both the short-run and the long-run, indicating the importance of financial innovation in economic growth in Nigeria. The study recommended the need for infrastructure development, the Central Bank of Nigeria (CBN) and the Nigerian Communications Commission (NCC) should collaborate in improving the country's digital infrastructure, ensuring widespread availability and reliability of internet services. This would facilitate the expansion of POS, WBT, and ATM services.***

Index Terms : Point of sale (POS); Automated Teller Machine (ATM); Web banking Transaction (WBT); Economic growth; Financial innovation.

I. INTRODUCTION

The relationship between financial innovations and economic growth has been a subject of intense debate among economists and policymakers around the world. Financial innovations, which refer to the creation and popularization of new financial instruments, technologies, and institutions, have been identified as a key driver of economic growth and development (King & Levine, 1993; Beck et al., 2000). In recent years, there has been a significant increase in the adoption of financial innovations globally, driven by advances in technology, changes in regulatory frameworks, and shifts in consumer behaviour (World Bank, 2020). These innovations have expanded access to financial services, improved the efficiency of financial transactions, and increased the flow of financial resources to productive sectors of the economy (Demirguc-Kunt et al., 2018).

Financial innovations play a critical role in the economic development process globally by providing an effective payment system that promotes trade and businesses through a range of innovative activities. Financial system enhances financial inclusion that encourages optimal savings and consumption decisions and promotes the productive use of funds by business and individuals (World Bank, 2023). The economic strength of any nation and its ability to gain from its accumulated human and material resources require a well-developed financial market to power the industrial sector and the economy as a whole (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess 2018).

In Nigeria, remarkable operational changes have taken place in the financial institutions. The use of tallies and registers has been replaced by cutting-edge technologies such as computers, (ATM), (PoS) among others (Central Bank of Nigeria [CBN], 2023). In the past, business transactions were based on manual cheque clearing, which rendered local and international money transfers time consuming due to

the manual approach to banking transactions then. Also, the internal banking operations such as remuneration leave application, and other staff requests in the bank were less efficient. As the environment in which the banking industry operates became more and more dynamic, coupled with the challenges of the manual approach to banking, the adoption of modern technologies especially ICT, by the banking sector became necessary (Gakure, & Ngumi, 2014).

The Nigeria financial system which comprises of the formal and informal sectors contributes 3.00% to the country's GDP (Nigeria GDP Report, 2018). Nigeria and many developing economies operate a cashed based financial system, where the use of cash is the prevalent method of making payments. However, in 2012, the Central Bank of Nigeria adopted a modern financial system which is termed "cashless policy" characterized by the adoption and emergence of innovative methods of making payments an easier process of transfer of funds from net savers to investors of funds. This innovation in the financial system has made banking operations easier for both the banks and their customers, it has reduced the risks associated with traditional methods of banking and has promoted continuous growth and development of the financial services industry in Nigeria.

Financial innovation and economic growth are closely intertwined in Nigeria, where advancements in the financial sector have had a significant impact on the broader economy. The linkage between financial innovations and economic growth constitutes the introduction and promotion of financial products and services, the development of new processes, as well as the interaction with customers and the development of new structures for financial institutions. Although financial innovation plays a positive role in the growth of the Nigerian economy, some of the problems that have been associated with the adoption of financial innovation are; lack of adequate financial literacy education, low rate of financial deepening and financial inclusion, gender gap in account ownership, poor telecommunication service in rural areas, low level of infrastructural development and inadequate security measures.

Although the total transactions value of ATM transactions increased by 53.78% year-on-year, from ₦21.23 trillion in 2021 to ₦32.64 trillion in 2022, there was an 8.55% decline in volume, from 4.45 billion in 2021 to 4.07 billion in 2022. There has been a noticeable evolution in ATM usage over the years. As of 2010, Nigeria had about 7,100 ATMs, rapidly growing to over 11,000 in 2011 due to the CBN mandating banks' removal of offsite deployment. In the following decade, the number of ATMs doubled peaking at 22,600 in 2021, which has remained as of December 2023. However, there's still a demand for ATMs, with an estimated 60,000 ATMs required to meet up with its growing population. This has led to an increasing adoption of alternative banking channels.

This shift underscores a trend towards digital payments, such as POS terminals, mobile wallets, and online transfers, signalling increased smartphone and internet usage. POS transfers experienced a 17.00% increase in total volume, rising from 982.83 million in 2021 to 1.14 billion in 2022. Mobile app transfers, with a total volume of 831.54 billion in 2021, increased to 1.86 trillion in 2022, reflecting a 123.85% change in transaction volume. The total transaction value for mobile app transfers increased from ₦53.20 trillion in 2021 to ₦111.12 trillion in 2022 a noteworthy 108.84% year-on-year growth (The Global Findex Database, 2023). To further support financial innovation, the CBN introduced the Digital Financial Services Policy in 2022, focusing on integrating technology into financial service delivery, including mobile payments and digital lending.

Despite these advancements, Nigeria's Gross National Income per capita (GNIPC) has shown a troubling trend since significant financial innovations gained traction in 2009. The GNIPC growth rate was 4.7 percent in 2009 but dropped to 2.65 percent in 2011, briefly rose to 5.23 percent in 2014, then declined to 0.85 percent in 2015, and eventually fell to a negative -4.66 percent in 2020 (World Bank, 2023). This decline in economic growth, despite the financial sector's progress, raises serious concerns about the effectiveness of financial innovations in fostering economic growth. There is a pressing need to reassess the relationship between financial

innovation and economic growth, taking into account financial reforms undertaken by the government to enhance financial innovations in Nigeria. The main aim of the study is to investigate the impact of financial innovations on economic growth from 2009Q1-2023Q4 in Nigeria.

Therefore, this study seeks to close the following knowledge gaps in the body of existing literature. In order to ascertain the relationship between financial innovation and the Nigerian economy, this paper first uses a value-based approach (since it records the volume of financial transactions through financial innovation channels as well as the value of local currency) by breaking down financial innovation into three significant financial innovation channels such as POS, web internet transaction, and ATM transactions. Also, rather than use of annualizing the time series, which is the practice of the majority of studies in this field, the study uses high frequency data (quarterly) to achieve its goal. This study however is crucial for providing valuable insights to policymakers, enabling them to evaluate the impact of financial innovations on Nigeria's economic growth. By analyzing how different financial innovations contribute to the economy, it will assist economic planners in designing targeted strategies to stabilize and support sustainable growth.

The paper is structured as follows: Section 1 is the introduction; Section 2 gives a summary of relevant literature reviews on financial innovations and their effects on emerging economies; Sections 3 and 4 present the methodology and results, respectively; and Section 5 presents the study's conclusion and recommendations.

II. LITERATURES REVIEW

Theoretical investigations into the connection between economic growth and financial development date back to the writings of Hicks (1969), Financial Development Theory by King, and Levine in 1993 and Schumpeter (1911). This paper was anchored on the Schumpeter theory, developed by Schumpeter (1911). Schumpeter theory describes the finance growth relationship as a supply-leading one, whereby the financial sector drives economic expansion by effectively spotting and financing high-yielding ventures. This was predicated on the idea that a healthy financial system will promote technical innovation by choosing and funding ventures that are anticipated to succeed. The theory posits that entrepreneurs engage in novel combinations of existing factors of production through various means, including introducing new goods, adopting fresh production methods, entering untapped markets, exploiting new raw material sources, or restructuring industries. Hicks (1969) encapsulate the role of entrepreneurship and innovations in the model by symbolically representing them as follows:

$$E = E(Rx) \quad 2.1$$

$$X = x(R/w) \quad 2.2$$

This theory underscores the significance of a pragmatic educational philosophy that emphasizes skill acquisition, self-reliance, and entrepreneurship to enhance the reservoir of innovations. Furthermore, as posited by Adegbie and Olubunmi (2018) in the African Development Review, the study delves into the nexus between financial innovations and entrepreneurial endeavors in Nigeria.

The financial development theory argues for the efficient allocation of capital towards productive investments through mechanisms like online transactions, mobile payments, and interbank transfers, which improve financial intermediation by reducing transaction costs, boosting liquidity, and expanding financial services accessibility. Innovations in banking and payment systems play a crucial role in facilitating credit access for businesses and individuals, particularly in underserved regions with limited traditional banking infrastructure. Despite this, studies have demonstrated that financial innovation has been essential to the expansion of all economies, developed or emerging. Furthermore, a significant amount of empirical research has been done on how financial innovation affects economic expansion. Nevertheless, the findings from a large number of these studies on different aspects of financial innovation have not been definitive.

Akintola, Oji-Okoro, and Itodo (2023) examined the impact of financial sector development on economic growth in Nigeria, focusing on the individual contributions of the money, capital, and foreign

exchange markets. The study utilized quarterly data from 2000Q1 to 2019Q4 and found that financial deepening, banking system liquidity, and the all-share index had a positive and significant impact on real output growth in the long run. However, the study also revealed that the behavior of the exchange rate spread was associated with declining real output growth. Based on these findings, the authors recommend that policymakers prioritize the growth of the money and capital markets to enhance economic growth in Nigeria. To achieve this, the monetary authority is advised to adjust policy rates and other monetary policy instruments, such as the cash reserve ratio, to increase banking system liquidity. This, in turn, would expand banks' lending capacity to the private sector, ultimately boosting economic growth in Nigeria.

Gbanador (2023) assessed the impact of digital payments on the growth of Indian economy. The study used the Ordinary Least Square (OLS), Autoregressive Distributive Lag (ARDL) cointegration approach and ARDL bound test techniques for the analysis. Digital payments were measured using Real Time Gross Settlement (RTGS), Clearing Corporation of India Ltd (CCIL) operated system, paper clearing, retail electronic clearing, card payments, and Prepaid Payment Instruments (PPIs). While real GDP is used as a measure for economic growth during the periods of 2011 to 2019. The OLS results show that only retail electronic payments as a measure of digital payments influences the real GDP significantly. All other variables used as measures of digital payments do not have significant impact on the real GDP in India. Moreover, the results obtained from the ARDL bound test revealed that digital payments do not have significant impact on the economic growth of India in the long run.

Daniel, Emmanuel and Godfred (2022) studied financial innovations and economic growth. Secondary data from 26 selected SSA countries over the period 2004 to 2017 were used. The data were analysed using the GMM estimation technique. It was found amongst other things that investments in innovations in the banking sector promote financial inclusion. In addition, financial inclusion fully mediates the relationship between innovation and economic growth. It is thus recommended that governments in the sub-region invest in the appropriate technological infrastructure that the banking sector can leverage on in the provision of banking services as the key to promoting financial inclusion and economic growth.

Ikhide (2022) reviewed the impact of financial liberalisation on monetary policy in Nigeria, examining in particular the progress made in the transition from direct to indirect forms of monetary management. While recognizing the inherent shortcomings of the previous direct control system, it highlights the difficulties that have been experienced in practice in moving to indirect controls. It argues that Nigeria's inability to meet certain minimum conditions could to a great extent compromise the successful implementation of indirect controls. It concludes that a range of measures are needed, including far reaching measures on restructuring insolvent banks, introduction of powers to deal with offending market participants, development of the secondary market, plus a shift to a realistic exchange rate. Even when all these have been achieved, there remains the need to substantially reduce government fiscal deficits and remove ceilings on interest rates, without which the money market cannot function adequately. The paper raises serious questions about the advisability of implementing open market operations on a large scale at this stage of the economic reform.

Abang and Ayodele (2022) examined the impact of financial innovation on economic development in Nigeria using quarterly data for the period 2009 to 2020 and the Autoregressive Distributed Lag (ARDL) bounds testing approach. The study made use of Gross National Income per capita (GNIPC) as the dependent variable, gross fix capita formation (GFCF), Government Expenditure (GEXP), Inflation (INF), Domestic Credit to Private Sector (DCPS), value of payment channels transaction of Automated Teller Machine (ATM), Point of Sale (POS), mobile banking (MOB), and internet banking (WEB) as measures of financial innovation as the independent variables. Furthermore, all the variables are also statistically significant except WEB, with ATM and MOB having a positive relationship with economic development, while POS and WEB have negative relationship with economic development. Based on

the results obtained, the study recommended that financial innovation should be sustained while measures and policies that will cause the improvement in the technological advancement of financial innovation should be encouraged and improved. In conclusion, from the result of the analysis keen on the relationship between financial innovation and economic development, implies that financial innovation has a positive effect on economic development. Thus as the use of financial innovation increases, it will cause an increase in economic development.

Ahmed, Adamu and Dauda (2020) examines the impact of financial innovation on the Nigerian economy using both quarterly and monthly series ranging from 2010 to 2020. The study adopted the autoregressive distributed lag model (ARDL) and the polynomial distributed lag mixed data sampling (PDL MIDAS) model as it is effective when combining low frequency and high-frequency data. The outcome of the ARDL showed that mobile payment platform in Nigeria had a positive significant effect both in the long run and short run while internet web transactions and POS transactions have a negative insignificant effect on the Nigerian economy in the short run and long run. The PDL MIDAS equation result, also confirms mobile payment transactions is positively related to Nigeria's economic growth while POS transactions were negatively related to the Nigerian economy. The results of the study suggest that financial innovation in the Nigerian financial system has a crucial role to play in the nation's economy which validates the finance-growth theory. The study, therefore, recommends that there is need to strengthen policies towards improving the performance of the financial innovative channels in Nigeria and improve the financial security of existing payment platforms.

Ogunsakin and Alabi (2020 examined the effect of financial innovation on different components of real output of some selected sectors of Nigerian economy between 1990 to 2018 using panel vector Error Correction as estimation technique. Result from VAR revealed that sectoral output responded heterogeneously to shocks emanating from financial innovation. Take for instance, the responses of manufacturing and Agricultural sectors to shocks from financial innovation variables were positive and significance while responses of service and construction sectors were positive but insignificant. Results obtained from variance decomposition showed that the most essential financial innovation variables which have much influenced on sectoral output in Nigeria during the study period are Automated teller machine ATM) and point of sale transaction (POS). Based on these findings, the study therefore, concludes that financial innovation has effects but not a significant effect on sectoral real output in Nigeria. The study recommends that more regulatory guide-lines should be formulated for financial institutions to perform their financial intermediation functions effectively.

III. METHODOLOGY

Given the nature of the objectives of this study, a quarterly time-series dataset covering the period 2009-2022 was compiled from the Central Bank of Nigeria's (CBN) Statistical Bulletin. The Autoregressive Distributed Lag (ARDL) regression econometric technique was applied to analyze the data. The ARDL is considered as the most appropriate estimation technique in this study because while it has capacity to handle structural breaks, it also has the ability to capture both short and long-run dynamics. The model used for this paper was developed on the assumption from the theoretical framework that financial innovation influences economic growth. This model is in line with Abang and Ayodele (2022) who specified that Nigeria's GDP growth is determined by financial innovation variables such as value of Automated Teller Machine (ATM), Point of Sale (POS), mobile banking (MOB), and internet banking (WEB) as measures of financial innovation as the independent variables. However, the model for this study was modified to include cash reserve ratio and interest rate as controlled variables and as suggested by the financial development theory to capture the effect of the innovation on the banking sectors reform and economic growth in Nigeria. The functional form of the modified model is expressed as follows:

$$RGDP = F(POS, WBT, ATM, CRR, INT) \quad (3.1)$$

Where, Financial innovation will be proxy for variables such as the point of sale (POS), web-based Transaction (WBT), automated teller machines (ATM), cash reserve ratio (CRR), Interest rate (INT) and while real gross domestic product (RGDP) as proxy for economic growth in Nigeria. Transforming the equation into linear function:

$$RGDP = \beta_0 + \beta_1 POS + \beta_2 WBT + \beta_3 ATM + \beta_4 CRR + \beta_5 INT + U \quad (3.2)$$

Where β_0 is the constant or intercept of the model, β_1.....β_5 are coefficient of the explanatory variables of the model, U is the stochastic error terms To standardize the variables and interpret the resulting coefficients as elasticity's, the equations below are restructured in log form as thus:

$$LnRGDP = \beta_0 + \beta_1 LnPOS + \beta_2 LnWBT + \beta 3 LnATM + \beta_4 LnCRR + \beta_4 LnINT + U \quad (3.3)$$

Apriori expectation of the parameters of the explanatory variables are expected to have the following sign $\beta_1, \beta_2, \beta_3, \beta_4,$ and $\beta_5 > 0$.

The ARDL representation of equation 3.2 is stated as follow

$$lnGDP = \beta_0 + \sum_{i=1}^{p} \theta_i \Delta lnRGDP_{t-i} + \beta_1 lnPOSt + \beta_2 lnIWBTt + \beta_3 lnATMt + \beta_4 lnCRRt + \beta_6 lnINT\tau + \sum_{i=0}^{q-1} \beta^*_1 \Delta lnPOS_{t-i} + \sum_{i=0}^{q-1} \beta^*_2 \Delta lnWBT_{t-i} + \sum_{i=0}^{q-1} \beta^*_3 \Delta lnATM_{t-i} + \sum_{i=0}^{q-1} \beta^*_4 \Delta lnINT_{t-i} + \sum_{i=0}^{q-1} \beta^*_5 \Delta lnCRR_{t-i} + u_t \quad (3.4)$$

IV. PRESENTATION OF RESULT AND DISCUSSION OF FINDINGS

4.1. Unit Roots Test Result

The unit root test or stationarity test is use to ascertain whether or not the variables in the study are stationary or not. The stationarity of the variables is investigated in this study using the Augmented Dickey-Fuller (ADF) unit root test. The alternative hypothesis contends that the variable under study does not contain a unit root, whereas the null hypothesis asserts that it does. The null hypothesis is rejected in favor of the alternative if the absolute value of the ADF statistic is greater than the critical value at the selected significance level, according to the ADF test's decision criteria. On the other hand, the null hypothesis is accepted if the ADF statistic is less than the crucial value. Table 1 displays the outcomes of the ADF test.

Table 1: Unit Root Test

Variables	ADF	5% Critical Level	Order of Integration
Dln(GDP)	-9.693028	-2.912631	I (1)
Dln(POS)	-9.635116	-3.489228	I (1)
LnWBT	-8.200978	-2.912631	I (1)
DlnATM	-9.245963	-3.492149	I(1)
DlnCRR	-7.744933	-2.912631	I (1)
DINT	-7.848055	-2.912631	I (1)

Source: Author's Computation E-Views 10

The test statistics are compared to the 5% critical level to determine the order of integration. The results indicate that all six economic indicators are non-stationary in their levels, as evidenced by the failure to reject the null hypothesis of a unit root. However, upon taking the first difference, all indicators become stationary, as indicated by the rejection of the null hypothesis of a unit root. This suggests that the indicators are non-stationary in their levels, but become stationary upon taking the first difference. This has implications for modeling and forecasting, as it suggests that the indicators may exhibit stochastic trends, hence the need to conducted bounds test proposed by Pesaran et al. (2001) to confirm if a long-run relationship exists among the variables in the model.

Table 2: ARDL Bounds Test for Cointegration

ARDL Bounds Test F-Statistic		Critical Value Bounds @ 5%	
	6.79	Lower Bound I(0)	Upper Bound I(1)
	10%	2.08	3.00
	5%	2.39	3.38
	2.5%	2.7	3.73
	1%	3.06	4.15

Sources: Author's Computation E-Views 9.0

The bounds test results showed that the estimated F-statistic value of 6.79 is higher than the upper bound at 5% levels, indicating the existence of a cointegration and the presence of long-run relationship. In other to achieve objective of this study, the ARDL estimation techniques were adopted to ascertain the long-run effect of financial innovation on economic growth in Nigeria and presented in table 3.

Table 4.4: Short-Run and Long-Run ARDL Model

Short-Run Estimate				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(POS)	0.471318	0.025777	18.28459	0.0000
D(WBT)	0.056172	0.007285	7.710593	0.0000
D(ATM_IN_B)	0.452106	0.038416	11.76875	0.0000
D(CRR_IN__)	0.042970	0.005938	7.236589	0.0000
D(INT_IN__)	0.213042	0.020152	10.57185	0.0000
C	3.025528	0.214761	14.08785	0.0000
Long Run Coefficients Estimate				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
POS	0.183081	0.005961	30.71455	0.0000
WBT	0.024603	0.003422	7.190472	0.0000
ATM_IN_B	0.074182	0.022892	3.240457	0.0033
CRR_IN__	0.050293	0.003775	13.32402	0.0000
INT_IN__	0.256462	0.030333	8.455021	0.0000
C	1.935126	0.137193	14.10513	0.0000

Source: Author's Computation 2024

In order to investigate the short- and long-term links between GDP and financial innovations on their determinants (POS, WBT, ATM, CRR, and INT) this study uses the Autoregressive Distributed Lag (ARDL) model. The result of the short-run estimates indicates that all the explanatory variables has a positive and statistically significant relationship with GDP. Specifically, a 1% increase in POS, WBT, ATM, CRR and INT leads to a 0.47%, 0.06%, 0.45, 0.04 and 021 increase in GDP in the short-run respectively.

Additionally, the long-run coefficients revealed a similar situation where all the explanatory variables have a positive and significant relationship with GDP in the long-run. Specifically, the long-run result revealed that 1% increase in POS leads to a 0.18% increase in GDP in the long-run. Also the result shows that 1% increase in WBT, ATM, CRR and INT leads to a 0.02%, 0.07, 0.05 and 0.25 increase in GDP in the long-run respectively. The findings suggest that increasing POS, WBT, ATM, CRR, and INT can lead to significant increases in GDP in both the short-run and long-run. Therefore, policymakers may consider implementing policies aimed at promoting these variables in order to stimulate economic growth and development.

This finding is also consistent with the results of previous studies, such as Gbanador, Makwe & Olushola, (2022) suggests that financial innovation stimulates economic growth and found a positive relationship between POS and GDP. Additionally, Nwokah and Gladson (2021) demonstrated that financial innovations enhance transaction efficiency, culminating in increased economic output in the long run. The affirmative long-run impact of these innovations corroborates the assertions made by Abang and Ayodele (2022) and Nwokah and Gladson (2021), who underscored the importance of technological advancements in stabilizing and enhancing economic performance. Furthermore, the finding is line with our a-priori expectations which state that the parameters of the explanatory variables are expected to have the following sign β_1, β_2, β_3, β_4, and $\beta_5>0$.

CONCLUSION AND RECOMMENDATIONS

The essence of the study was to investigate the effect of financial innovation on economic growth in

Nigeria. The short-run and the long-run outcomes of the ARDL estimates indicated that financial innovation instruments such as automated teller machine (ATM), point of sale (POS), web-based transaction (WBT), cash reserve (CRR) and interest rate (INT) impacted significantly on economic growth in Nigeria within the period under study. The findings are also in line with our apriori expectation, that the financial innovation variables determine the level of economic growth in Nigeria. In light of the above, the study concludes that economic growth responds to some financial innovation instruments (POS, WBT, ATM,) in Nigeria. Also the financial innovative channels in the Nigerian financial system have a pivotal role to play in fostering Nigeria's economic growth and bringing about a positive change in the welfare of citizens and policies matter for reaping the full benefits of financial innovation.

Based on the above findings, the study therefore, recommends: Infrastructure development, the Central Bank of Nigeria (CBN) and the Nigerian Communications Commission (NCC) should collaborate improving the country's digital infrastructure, ensuring widespread availability and reliability of internet services. This would facilitate the expansion of POS, WBT, and ATM services. Regulatory framework, the CBN should review and refine the regulatory framework governing financial innovation instruments to ensure they are conducive to growth and innovation. This could involve relaxing stringent regulations, providing incentives for innovation, and establishing clear guidelines for the development and deployment of new financial technologies. Finally, financial inclusion initiatives, policymakers should implement targeted financial inclusion initiatives to increase access to financial services, particularly in underserved and rural areas. This could involve partnerships between financial institutions, telecommunications companies, and government agencies to expand the reach of POS, WBT, and ATM services.

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