

FINANCIAL INNOVATION AND OUTPUT GROWTH OF SMALL AND MEDIUM-SCALE INDUSTRIES IN NIGERIA

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ABSTRACT

This study assesses the role of financial innovation in output growth of small and medium-scale industries (SMEs) in Nigeria using quarterly data from 2009 to 2016. It employs the regressive distributed bounds testing approach (ARDL) and the Granger causality test to ascertain the long-run impact and the causal relationship between financial innovation variables and SMEs' output growth. Evidence from the analyses confirms the theoretical proposition that financial innovation contributes positively to the output growth of SMEs in Nigeria as the financial innovation variables of POS, MBK, ATM and INTB have positive and statistically significant impact on the output growth of SMEs. The Granger causality test indicates that a unidirectional causal relationship runs from financial innovation variables to SMEs output in Nigeria. Based on this empirical evidence, the paper recommends that the positive impact of the financial innovation variables on SMEs output demands that deposit money banks not only improve but also expand the current level of financial service delivery in Nigeria by establishing more financial channels in both rural and urban areas.

JEL classification: G21, G22, O31

1. Introduction

RAPID growth and development cannot occur in any country that does not give serious attention to the growth of small and medium-scale industries (SMEs). Any attempt by a country to reform its SMEs can be construed as another effort

to industrialize its economy. Also, such an attempt is tantamount to supporting a simultaneous development effort in which industrial enterprises are expected to grow out of small and medium-scale enterprise undertakings. An assessment of the economic history of industrialized nations of the world such as England, China, Taiwan, South Korea (to mention a few) revealed that they all kick-started with small and medium-scale industries. For instance, the industrial revolution in Great Britain did not start with large-scale industries; it started with inventions in the small and medium industries. Also, China is seen as the workshop of the world just on the basis of low-tech manufacturing activities (Agu, Ojimadu and Ogu, 2012).

The goal of industrializing through the growth of small and medium-scale industries is feasible through government conscious policy to remedy one of the fundamental problems of SMEs, which includes limited financial service delivery channels as well as limited access to financial resources. Industrial growth vis-à-vis economic development cannot be fully achieved without policies that seek to enhance access to financial resources. Having access to financial services delivery channels has the implication of drastically cutting down on the cost associated with financial transactions by SMEs. Regrettably, SMEs in Nigeria have underperformed and they constitute more than 90 per cent of the manufacturing sub-sector in Nigeria. Their contribution to the nation's gross domestic product (GDP) is less than 10 per cent (National Planning Commission (NPC), 2009). This low contribution is not unconnected with the pitiable funding options available.

It is widely accepted in the received literature that the cost of accessing financial resources in the formal financial system in Nigeria is staggering and it is responsible for providing financial services to only 35 per cent of the economically active population while the remaining 65 per cent are excluded from access to financial services and are only barely served by the informal financial sector (NPC, 2009). Broadly speaking, financing has remained one of the persisting problems confronting SMEs in Nigeria. For the SMEs, the accessibility to funds and the cost of raising them have hindered their growth and development over time. A survey in Nigeria by an international finance corporation in 2010 suggests that 80 per cent of SMEs are excluded from the official or formal financial markets (NPC, 2009).

Financial sector reorganization and development is one of the means to solving the problem of finance that SMEs face in Nigeria. This is because financial sector development brings with it changes, in the form of financial innovations and e-banking. With financial innovations, new financial instruments, products and services and new forms of organizational structure in a more sophisticated and complete monetary market would emerge. Financial innovations have been noted to be a powerful force in driving financial deepening in the growth of modern economies, especially given the fact that financial innovation is capable of increasing the efficiency of financial intermediation by increasing the array of financial products and services by way of emergence of sophisticated payments and receipt outlets (Chou, 2007). This would in turn promote the productivity of finance, reduce operation costs and ultimately, encourage industrial and economic activities.

In Nigeria, the financial system has undergone series of reforms aimed at repositioning the system for optimal performance. These reforms have resulted in the evolution of new financial sector products and services, made possible by advancements in information and communication technology (ICT). With the emergence of mobile telecommunication and internet services in the country in the millennium era, especially in 2009, the financial system has witnessed many financial innovations which include an array of products and services ranging from debit/credit/prepaid cards for electronic payments and receipts through point of sale (POS) terminals and automated teller machines (ATMs), internet banking, mobile payment, personal computer banking, Real-Time Gross Settlement System (RTGS), etc. Interestingly, statistics have shown that Nigeria has a low formal payment penetration rate of 21.6 per cent as against 46 per cent observed in both South Africa and Kenya. Also, it is evidenced that the number of ATMs in Nigeria as at 2011 stood at 9,640, indicating an average of 11 ATMs per 100,000 adults. This is a clear contrast when compared with South Africa, Brazil and Malaysia, which had an average of 59, 120 and 59 ATMs per 100,000 adults respectively (Mbutor and Uba, 2013). Given this scenario, this study seeks to provide answers to the following questions: Does the availability of financial service delivery channels (which result from financial innovations) impact on output growth of small and medium-scale industries? And if it does, to what extent? This has become necessary because the growth of SMEs through the effective financial services option from the financial institutions has been a subject of debate among policy makers and scholars due to the important role of

SMEs in fast tracking industrialization. Despite the inherent capacity for financial innovations to facilitate access to finances for SMEs, the extent to which this has impacted on output growth of SMEs in Nigeria is yet to be documented conclusively.

2. Conceptual Issues

2.1 Financial innovation

Tufano (2003) explained financial innovation to mean the act of producing and then utilizing new financial instruments as well as new financial technologies, institutions and markets with the intention of overcoming market rigidities or imperfections. Broadly speaking, Nyamongo and Ndirangu (2013) viewed financial innovation as encompassing changes in the structure and depth of financial markets, in the role of financial institutions, the methods by which financial services are provided and the introduction of products and procedures in the wake of deregulation. These products and procedures include but are not limited to automated teller machine (ATM), point of sale terminal (POS), internet banking (Net Banking), mobile banking (M-Banking), branchless banking, etc. Suitably implemented financial innovation can lead to perfection in resource allocation, reduction in growth instability and the enhancement of credit developments by making it easier for banks to hedge credit risk and manage maturity and credit mismatches (Noyer, 2007). Jacque (2007) and Solans (2003) defined financial innovation as the evolution of new financial instruments and services as well as the emergence of new techniques of financial management and a new form of financial organizational structure. The evolution of these new financial instruments and services is aimed at reducing transaction costs, which in turn may lead to improvement in resource allocation and reduction of volatility of economic growth. Financial innovation has not only opened up new opportunities for the sector participants but it has also increased new market players arising from new products in the financial markets. These developments have increased the range of financing and investment opportunities available to both small and large-scale industries.

Adoption of ICT has proved to be of great benefit to the banking sector in Nigeria. It offers numerous advantages, for example, it enables customers to distantly withdraw and deposit money in financial institutions at any time, transfer money as well as correct data management and documentation.

However, banks face many challenges, among which are difficulty in getting well-trained ICT professionals and difficulty in convincing computer illiterate customers to adopt ICT in banking services. Other challenges involve the weakening effect of financial innovation on monetary policy and hence the entire economy through the credit channel.

2.2 Small and medium-scale industries

Enquobahrie (1997) and Harabi (2005) asserted that a passing look at the literature on small and medium enterprises (SMEs) shows that the meaning of SMEs extensively varies from nation to nation, depending on factors such as the nation's number of employees, level of technology used, the value of fixed assets, capital employed, production capacity, management characteristics and economic development. Mukole (2010) opined also that there is no universally accepted definition of SMEs because the classification of enterprises into large-scale or small-scale is a biased and qualitative judgment. On the basis of this, it is relatively difficult to compare SMEs among countries when a common index is not used. Therefore, different benchmarks have been used by scholars to operationalize SMEs. In Nigeria, the Central Bank of Nigeria (CBN) defines SMEs according to asset base, turnover and number of staff employed (Ekpenyong and Nyong, 1992).

The definition of SMEs is dynamic due to changes in price level, advances in technology and other peculiar considerations. In Britain, for example, an SME is seen as an organization with an annual turnover of 200 million pounds or less, with fewer than 200 paid employees. In the United States of America, however, manufacturing organizations with fewer than 500 regular employees or wholesaling and retailing sectors with less than 100 regular employees and an average yearly operating income of less than US\$6 million are classified as SMEs. For the services and construction sectors, they may have a mean annual income of less than US\$6 million and less than US\$28.5 million respectively to be grouped as SMEs (UNCTAD, 2001). In Japan, SMEs are defined based on the type of industry, paid-up capital and number of paid employees. A summary of these figures is presented in table 1. Thus, SMEs in manufacturing are viewed as those with one hundred million yen paid-up capital and three hundred employees, those in wholesale trade with thirty million yen paid-up capital and

one hundred employees, and those in the retail and service trades with ten million yen paid-up capital and fifty employees (Ozigbo and Ezeaku, 2009).

Table 1. Definition and Classification of SMEs

Country	Turnover	Total Investment	No. of Employees
UK	200 million pounds		200
Japan	30 million yen		100
Japan	100 million yen		300
Nigeria (1990)	0.5 million naira	0.5 million naira	200
Nigeria (2001)	1.5 million naira	5.0 million naira	300

Source: Adapted from Gbandi and Amissah, 2014.

In Nigeria, SMEs have been defined and classified in different ways. For instance, in 1990, CBN defined SMEs for purposes of bank credits as those with a yearly turnover not exceeding 500,000 naira. The National Economic Reconstruction Fund (NERFUND) put the ceiling for small-scale industries at 10 million naira. In 2001, the National Council of Industries categorized a small-scale business as one with total capital employed of over ₦1.5 million but not more than ₦50 million (including working capital but excluding cost of land) and a labour size of 11 to 100 workers, while medium-scale industries are those with a total capital of over ₦50 million but not more than ₦200 million (including working capital but excluding cost of land) and a labour size of 101 to 300 workers (Adebusuyi, 2010).

3. Empirical and Theoretical Issues

Alvarez (2009) clearly stated that a financial system whose performance is poor (owing to the absence of or undeveloped financial innovations) can adequately weaken the microeconomic foundations of a country. This may result in lower growth in income/output and employment. Well developed and specifically tailored products that ensure a win-win situation for both financial institutions and SMEs are therefore important in achieving profitability and attainment of organizational goals for both financial enterprises and SMEs. Financial innovations are important instruments through which banking institutions can turn around and lead to an incredible positive change in SMEs performance.

It is projected that SMEs contribute over 60 per cent in employment, 40-60 per cent of gross domestic product (GDP) and 30-60 per cent of exports in the USA and EU countries. The Asian Tigers (Malaysia, India, Indonesia, South Korea, China and Japan) also have flourishing SMEs sectors contributing between 70-90 per cent in employment and a projected 40 per cent of their respective GDPs. In Africa's economic power-house (South Africa, Egypt, Nigeria and Kenya) SMEs are estimated to contribute over 70 per cent in employment and 30-40 per cent to GDP but less than four per cent to export earnings (United Nations, 2005). Financial innovation has made possible the payment of bills and purchase of goods and services, thus, transforming the operations of SMEs from traditional ways to modern ways hence diversifying their access to essential utilities (United Nations, 2005).

A good number of studies have shown that financing and financial services are bigger challenges for SMEs than for large firms, particularly in less-developed countries. Emphatically, access to finance adversely affects the growth of SMEs more than large companies (Nyangosi and Arora, 2009). A study by Ben-Horin and Silber (2003) in Spain using simple non parametric statistics found that online banking (which is a form of financial innovation) was associated with lower costs and higher profitability for a sample of Spanish banks. This has enabled bank customers including the SMEs to access the fundamental banking services. For example, cash deposit, cash withdrawal and bank balance inquiry can be conveniently accessed. The convenience of access to banking services and the extended hours has been the most striking features of these innovations. The rural population (including SMEs in the rural areas) has welcomed this idea since they have had to sometimes go through inconvenient experiences to access banking services due to poor road infrastructure and high costs (Ben-Horin and Silber, 2003).

According to Tufano (2003), mobile banking has the potential to reduce operating costs up to 12 per cent and can help shift some financial flows from informal to formal channels and most in correspondent with other banking channels. Such innovations have facilitated swift exchange of money and access to cash for quick decision making which has also necessitated access to banking services in rural areas leading to the take off and stabilization of SMEs.

In a related study by Nzove (2013) on the impact of e-banking on SMEs in Kenya, it was discovered that banks had financial innovations such as small-scale business loans, small-scale business accounts, mobile banking, e-banking and direct marketing. Business loans, business account and mobile banking were specific innovations tailored towards SMEs. A sample size of 478 SMEs from 98,608 SMEs was selected. Most SMEs indicated that financial innovations such as SMEs business accounts, SMEs credit facilities and direct marketing strategies improved their customer relations and efficiency in their banking operations. A regression analysis revealed that service innovations by financial institutions had the highest influence on growth of SMEs. The study recommended among others, intervention on the side of the government in educating and training SMEs on managerial skills and enhancing accessibility to credit facilities.

In recent times, the adoption of internet financial services (e-finance) has been seen as an area of growing importance for small and medium-sized enterprises (SMEs). This is due to the importance of the SME sector and the suitability of e-finance for solving the problems of SMEs. A study by Riyadh, Bunker, Rabhi (2010), using a descriptive method that discusses barriers to e-finance adoption by SMEs in Bangladesh, showed that most SMEs have structural issues and limited opportunities to participate in traditional markets by adopting internet-driven financial services. This is because of the fact that very few SMEs make use of ICT-based services. A study in Ghana by Attom (2013) on the impact of ICT on business growth strategies and profitability of SMEs using a survey method indicated that 73.29 per cent of the SMEs studied do not make use of ICT and this, to a great extent, has had a negative effect on their growth potential and success as these SMEs cannot take advantage of the financial service delivery options that are available. A shocking proportion of about 27 per cent of SMEs used ICT in their businesses but further maintained it is too expensive to operate. The study recommended capacity building for SMEs on ICT use.

In a related study, Igbara, Emerenini and Daasi (2015) analysed the effect of a cashless policy on the operations and growth of small-scale businesses in Ogoniland, Nigeria. The results indicate that SMEs in Ogoniland are predominately sole proprietorships with meager income and a significant number having very poor banking habit. Also, bank transactions/services such as ATM

usage and online banking (financial innovation instruments) are of little or no significance since the transactions of SMEs in this study area are mostly on “cash and carry” basis. The study discovered that operators of SMEs have zero tolerance for ICT usage in both the operations and financial transactions of their businesses and this constitutes a major challenge to the adoption of the cashless policy in the study area.

A study that examined the implications of electronic banking (a form of financial innovation) on selected businesses in Nasarawa State, Nigeria used the chi-square statistical technique in its analysis (Oluma, Abdullahi, and Madu, 2016). The results indicated that there is a significant relationship between electronic banking platform and the performance of businesses in the state. It was discovered that most of the respondents agreed that e-banking adopted by the banking institutions in Nigeria have improved tremendously the performance of SMEs in terms of efficiency in conducting business activities. It was therefore recommended that deposit money banks should expand on the aspect of automated teller machines to improve the quality of services rendered to allow their SMEs customers offset their bills and enhance business transactions.

Aigboduwa and Oisaimoje (2013) examined the historical trend in the development of SMEs in Nigeria’s oil industry using the descriptive survey technique. The study identified access to financial services for development of the capital base of SMEs as one of the major constraints. The study suggested that the Nigerian Content Development Act of 2010 should be implemented as it would serve as a turning point in the realization of all the policy trusts formulated for growing SMEs in Nigeria. In the same vein, Berg and Fuchs (2013) investigated access to financial services by SMEs in five sub-Saharan African countries using trend and descriptive methods to explain the drivers behind the involvement of banks with SMEs. Nigeria, Kenya, Rwanda, South Africa and Tanzania were covered in the study from 2010 to 2012. The study found varying degrees of access to financial services in the different countries. The reasons suggested for these varying results include the structure and size of the economy, the degree of financial innovation, mainly as introduced by foreign entrants to financial sectors, and the state of the financial infrastructure and enabling environment.

A study in Nairobi, Kenya by Mwaura (2009) on the effect of mobile banking (M-banking, a form of financial innovation) on enterprises using the

descriptive method revealed among other findings that only 18 per cent of small businesses in Nairobi have access to formal financial services through banks while 8 per cent are served through micro finance institutions and 35 per cent are served through informal institutions. Sadly, 38 per cent of small businesses in Nairobi have no access whatsoever to any form of financial services and rely on personal savings. In summary, only 55 per cent of small businesses in Nairobi can access financial services through m-banking while 45 per cent of SMEs in Kenya currently cannot access m-banking services. Mwaura (2009) concluded that the high penetration of mobile communication devices in Nairobi can serve to help the high percentage of unbanked small business access financial services through m-banking.

Interestingly, developments in technology have played an important role in improving financial service delivery channels in the banking industry. In its simplest form, automated teller machines (ATMs), point of sale terminals (POS), internet banking, mobile banking and deposit machines, to mention but a few now allow bank customers (including SMEs) to carry out financial transactions beyond banking hours and these have enhanced customers' satisfaction in Nigeria and globally. It is agreed by scholars (Polatoglu and Ekin, 2001, Adeyemi, Ola and Oyewole, 2014) that financial innovations are developed to help banks deliver services and products better, faster and cheaper to their customers. Though Emeni and Okafor (2008) had used statistical techniques to show in Nigeria that change in banking focus (cutting down on number of bank branches in rural areas, otherwise referred to as restructuring) tends to result in poor financial services to SMEs, even with mergers and acquisition. This may be due to poor financial innovative products in the rural areas where SMEs abound.

Theoretically, Schumpeter's growth model, the Financial Innovation Hypotheses and Diffusion of Innovation theory appear to be relevant to this study. Schumpeter's growth model was developed in 1934 and is regarded as an alternative of the endogenous growth theory. This theory is based on three major pillars, namely: a) that growth is generated by innovations, b) that innovations result from entrepreneurial investments that are themselves motivated by the prospects of monopoly rents, and c) that new innovations replace old technologies. Implicitly, this theory is of the view that each innovation is aimed at creating some new process that gives its creator a competitive advantage over

its business rivals. This is done by rendering obsolete some previous innovations and it is in turn destined to be rendered obsolete by future innovations. The role of financial innovation is captured by means of financial intermediation within the Schumpeter growth theory. This is because the theoretical connection between financial development and output growth is that the services provided by financial institutions are seen as drivers of innovation and output growth (Ukeje and Akpan, 2007). Specifically, Schumpeter (2012) considered the relationship between financial developments (financial innovation) and output growth from the supply leading perspective. Supply leading is the process by which the financial sector leads output growth by identifying and funding high yielding projects. This is based on the assumption that a well-functioning financial system would promote innovation by selecting and funding enterprises that are considered to be successful (Ukeje and Akpan, 2007).

Financial innovation hypotheses were developed as a result of various studies by authors such as Merton (1992), Allen and Gale (1994) and Grinblatt and Longstaff (2000). The major propositions in financial hypotheses were derived from different theoretical postulations and empirical studies undertaken to assess the impact of financial innovation on output growth. There are two schools of thought namely, the financial innovation growth view and the financial innovation fragility view. The financial innovation growth view asserts that there is a positive relationship between financial innovation and output growth. According to this view, a financial innovation facilitates reduction of a firm's operation costs, facilitates risk sharing in the financial system, and above all, improves the quality and variety of financial services. All these, in the long run, improve allocative efficiency and increase in economic output. In line with this reasoning, it is believed that financial innovations have the inherent capacity to improve the efficiency of financial intermediation by virtue of its available variety of products and financial services. Also, with the emergence of innovations in the wake of financial innovations in the financial system, productivity of capital is promoted, thus stimulating higher levels of output growth in the economy.

The financial innovation fragility view, on the other hand, tends to be skeptical on the issues of finance innovation. This view attributed the recent global financial crisis to financial innovation. According to this view, the unprecedented increase in credit creation resulted in the initial boom and

thereafter the burst in housing prices (Brunnermeier, 2009). Also, others like Henderson and Pearson (2011) further argued that financial innovation includes engineering securities perceived to be safe but exposed to neglected risks and assisting financial institutions to design structured products to exploit customers' lack of understanding or misunderstanding of financial markets. Given this scenario, financial innovation-driven regulatory arbitrage does not ensure efficient resource allocation to promote output growth but rather reinforces financial fragility and hence output volatility (Houston et al., 2010).

The diffusion innovation theory was developed by Rogers in 1962 to explain how, why and the rate at which new ideas and technology spread across cultures. The theory identified four key elements influencing the spread of a new idea to include innovation itself, communication channels, time and the social system. According to the theory, this process depends more on the level of human capital development. Thus, the higher the level of human capital development, the faster the process of innovation transfer and adoption. Since its formulation, the diffusion of innovation theory has been applied in so many fields, including the financial system. For instance, the revolution in information and communication technology has given rise to financial innovation with the consequent proliferation of financial products or instruments and services such as ATM, internet banking, mobile banking, point of sale, branchless banking, etc.

Given this background review, the inherent capacity for financial innovations to facilitate access to finances for SMEs is very certain but the extent to which this has impacted on output growth of SMEs in Nigeria is yet to be documented conclusively. Therefore, this study seeks not only ascertain the extent to which financial innovation in Nigeria impacts on output growth of SMEs but also to identify and compare which of the various financial innovation delivery options significantly impact on output growth of SMEs in Nigeria.

4. Performance of SMEs in Nigeria

A World Bank report (2001) showed that 39 per cent of small-scale firms and 37 per cent of medium-scale firms in Nigeria are financially constrained. These are from the 17,000,000 SMEs that are playing a significant role in Nigeria (Eniola and Entebann, 2015). Nigerian SMEs do not only provide employment and income for its citizens but are also seen as the breeding ground for domestic business capabilities, technological innovativeness, technical skills, and

managerial competencies for private sector growth (SMEDAN, 2005; Aina, 2007).

Over the past few decades, there has been a remarkable increase in the number of Nigerian government projects aimed at stimulating the unemployed and other disadvantaged persons to set up SMEs. Government has established several micro credit institutions, which include: Nigerian Bank for Commerce and Industry (NBCI), National Economic Reconstruction Fund (NERFUND), People’s Bank of Nigeria (PBN), community banks (CB), and Nigerian Export and Import Bank (NEXIM), to provide financial services to SMEs. This is in view of the fact that SMEs in Nigeria are expected to contribute about 34 per cent (gross value of manufacturing to GDP ratio) to the national income and generate 60-70 per cent employment with sustainable annual growth (Egabor, 2004). Specifically, Aina (2007) and Ihua (2009) have it documented that SMEs in Nigeria contribute 10 per cent of the total manufacturing output and 70 per cent of the industrial employment. According to them (Aina, 2007 and Ihua, 2009), an average of 97 per cent of enterprises in Nigeria are SMEs and they employ 50 per cent of the working population as well as contributing an average of 50 per cent to Nigeria’s industrial output. Table 2 reveals a dramatic increase in the output of SMEs in the years of financial innovations when compared to the output in the selected years before financial innovations were introduced in Nigeria’s banking system in 2009.

Table 2. Performance of SMEs before and after Financial Innovation

Year	Products of Financial Innovation				SME Output in ₦’M
	ATM Value in ₦’M	POS Value in ₦’M	Mobile Banking Value in ₦’M	Internet Banking Value in ₦’m	
2002	0.00	0.00	0.00	0.00	193,109.22
2008	0.00	0.00	0.00	0.00	875,795.40
2012	496.17	12.05	7.8	7.89	1,466,337.79
2015	919.97	78.08	86.61	18.51	1,516,988.93

Source: CBN Statistical Bulletin (Various issues) and National Bureau of Statistics (Various Issues).

Financial statistics from a 2006 to 2007 survey as published by the World Bank (2007) indicated that the percentage of firms using formal financial services from the conventional banks to finance investments in SMEs was an

average of 2.6 per cent, 31.77 per cent and 35.65 per cent for Nigeria, South Africa and Brazil respectively. This shows the level of financial exclusion of SMEs in Nigeria as compared to the other developing countries mentioned. Currently, the statistics must have changed but the pattern remains unchanged.

5. Model and Data

The period of analysis covers 2009-2016. This is the longest period for which numerical data is not only available but accessible. The study used quarterly data and the error correction model (ECM) is estimated using the contemporary econometric approach of ordinary least squares (OLS). To adequately examine the time series properties of the data, given that most time series data are unstable, it has become increasingly necessary to test the time series properties of the variables used in the regression for meaningful economic results. Various theoretical models have been used to explain the relationship between financial innovation and output growth of SMEs. This study adopts and modifies a theoretical framework in which the effect of financial innovations on output growth of SMEs is well derived and explained. Thus, the model for this study is anchored on the three theories reviewed (Schumpeter's growth theory, financial innovation theory and diffusion of innovation theory). It is an eclectic model with augmentations to suit the study. In line with these theories, financial innovations usually result in the evolution of new financial products and services which improve the productivity of capital, reduce transaction cost and stimulate higher output growth. In this regard, financial innovation can be measured by way of the emergence of sophisticated financial service delivery channels such as ATM, m-banking, internet banking, point of sale (POS), interbank transfers and automated cheque clearing system. Thus, the SMEs output growth – service delivery channels model can be formulated and expressed as:

$$SMQ = f(ATM, MBK, POS, INTB, LSM, TN) \quad (1)$$

where:

SMQ = Output of small and medium-scale industries (the proxy for measuring this is wholesale and retail trade output as a component of gross domestic product).

- ATM = Value of automated teller machine transactions in millions of naira.
 MBK = Value of mobile banking transactions in millions of naira.
 POS = Value of point of sale transactions in millions of naira.
 INTB = Value of internet banking transactions in millions of naira.
 LSM = Loans to SMEs from deposit money banks in millions of naira.
 TN = Technology (time variable, one year is one data point).

In this study, technology is simply a control variable which gives an idea on the level of human capital development in line with the diffusion of innovation theory. The dynamic linear version of the model is of the general econometric form:

$$\ln SMQ_t = a_0 + a_1 \ln ATM_t + a_2 \ln MBA_t + a_3 \ln POS_t + a_4 \ln INTB_t + a_5 \ln LSM_t + a_6 TN_t + E_t \quad (1)$$

where: $a_1, a_2, a_3, a_4, a_5, a_6 > 0$.

In equation (1), financial innovation variables (ATM, MBK, POS, INTB) are combined with other control variables (LSM and TN) in order to comparatively ascertain their effect on output growth of SMEs in Nigeria. It should be noted that a_0, a_1 to a_6 are the coefficients. All the variables are as previously defined and E_t and \ln are the error term and log respectively. The signs of all the elasticity coefficients are expected to be positive. Whether these financial service delivery channels/variables actually impact on output growth of SMEs in Nigeria would depend on their sign and statistical significance.

A quarterly time series data set was obtained from different sources. The data on output growth of SMEs (SMQ), automated teller machine (ATM), M-banking (MOB), point of sale (POS), internet banking (INTB) and loans to SMEs (LSM) were obtained from the Central Bank of Nigeria *Statistical Bulletin* (various issues), *Annual Report and Statement of Accounts* (various issues) and National Bureau of Statistics (2015). Technology (TN) is the time variable; one year is one data point.

6. Presentation of Results

Table 3 presents the correlation matrix. This matrix shows the correlations among the variables in the model.

Table 3. Correlation Matrix

	SMQ	INTB	LSM	MBK	POS	TN	ATM
SMQ	1.000000	0.114225	0.200578	0.621653	0.672446	0.887860	0.821810
INTB	0.114225	1.000000	0.042170	0.403053	0.398598	0.295540	0.336153
LSM	0.200578	0.042170	1.000000	0.220400	0.254493	0.247000	0.233026
MBK	0.621653	0.403053	0.220400	1.000000	0.988842	0.859023	0.911676
POS	0.672446	0.398598	0.254493	0.988842	1.000000	0.905757	0.945630
TN	0.887860	0.295540	0.247000	0.859023	0.905757	1.000000	0.967612
ATM	0.821810	0.336153	0.233026	0.911676	0.945630	0.967612	1.000000

As revealed in Table 3, there is a high positive correlation between the output of SMEs and mobile banking (0.62), point of sale (0.67), technology (0.88), automated teller machine (0.82), and a low positive relationship with internet banking (0.11) and loans to SMEs (0.20). The correlation matrix provides the opportunity to assess the degree of multi-collinearity between the variables of the study before regression is carried out. However, the results indicate that there is no perfect multi-collinearity among the variables. Thus, the analysis would depend more on the theoretical relationship as the correlation results have only descriptive values.

Table 4 shows the results of the unit root test using Augmented Dickey-Fuller (ADF). It reveals that all the variables are integrated of order one (that is I(1) except internet banking (INTB) and loans to SMEs (LSM) that are integrated of order zero, that is I(0).

The result of the unit root test indicates that the variables are integrated of different order, hence the need for the ARDL bounds testing approach. To establish the long-run relationship, the Wald tests, based on the bounds testing approach is conducted. The result of the bounds test is reported in table 5.

Table 4: Augmented Dickey-Fuller (ADF) Test

Variables	ADF Statistics		Remark
	Level	1 st Difference	
SMQ	-1.536773	-4.146785	I(1)
ATM	-0.669534	-3.924664	I(1)
INTB	-4.020505	-	I(0)
LSM	-3.571434	-	I(0)
MBK	-0.896979	-2.980209	I(1)
POS	-0.708894	-2.976161	I(1)
TN	-0.484544	-6.864756	I(1)

ADF at 5% Level = 2.9627 and ADF at 5% 1st Difference = 2.9665

Source: Computed by the authors using E-views (2017).

6.2 Co-integration results of the SMQ model

Table 5. Results of the ARDL Bounds Test for Co-integration

Unrestricted Intercept and Critical Value	
Unrestricted Trend	
F-statistic	10.50246
P-Value	0.000001
Critical Bounds (5%)*	
Upper Bound	3.83
Lower Bound	2.55
Decision	Co-integration Exists

*Unrestricted Intercept and Unrestricted trend (k=7) from Pesaran et al (2001).

Note: Upper and lower bounds critical values are obtained from Table C1.v of Pesaran, Shin and Smith (2001).

From the results obtained in table 5, the F-statistic value calculated (10.50) is greater than the upper-bound critical value of 3.83 at 5 per cent level. Since the F-statistic value is greater than the upper-bound critical value, the null hypothesis of no co-integration is rejected while the alternative hypothesis of co-integration is accepted. Thus, there is a long-run relationship among the variables in the model.

Table 6. Lag Order Selection Criteria

Endogenous variables: SMQ, POS, MBK, LSM, INTB, TN, ATM

Included observations: 32

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4014.746	NA	2.50e+71	187.1045	187.4321	187.2253
1	-3617.076	628.8723	4.79e+64	171.5850	174.5339	172.6724
2	-3435.511	219.5680*	2.77e+62*	166.1168*	171.6871*	168.1709*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

The study used VAR lag length selection criteria to select the lag length as shown in table 6. The outcome of the analyses suggests a maximum lag length of two at five percent level of significance.

Long-Run Static Regression of SMQ Based on ARDL

Table 7. ARDL Long Run Estimates

Dependent Variable: LOG(SMQ)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(POS)	0.061673	0.028860	2.136971	0.0032
LOG(MBK)	0.030434	0.014568	2.089038	0.0033
LOG(LSM)	0.005007	0.258625	0.019361	0.7982
LOG(INTB)	0.015523	0.017104	0.907547	0.3735
LOG(ATM)	0.554773	0.132423	4.189401	0.0000
TN	0.018291	0.015915	1.149256	0.2623
C	28.86252	0.963288	29.96251	0.3454
R-squared	0.890503	F-statistic		29.40902
Adjusted R-squared	0.868917	Prob(F-statistic)		0.000000
Durbin-Watson stat	2.145135			

Source: Authors' computation using E-views. (2017)

Based on table 7, the long-run elasticity on output of SMEs (SMQ) with respect to financial innovations (that is, financial service delivery channels) in Nigeria is positive. Specifically, the long-run impact of POS on SMEs output is positive and indicates that a one per cent increase in the value of POS transactions would increase SMEs output by 0.061 per cent, all things being equal. Similarly, the long-run impact of mobile banking (MBK), loans to SMEs

(LSM), internet banking (INTB), automated teller machines (ATM) and technology on SMEs output is positive and reveals that a one percent increase in the value of MBK, LSM, INTB, ATM and technology would lead to 0.03 per cent, 0.10 per cent, 0.01 per cent, 0.55 per cent and 0.02 per cent increases in SMEs output respectively, holding all other factors constant. Despite the positive results and impact of financial innovation variables, only POS, MBK and ATM have statistically significant impact at 5 per cent significant level. The implication of this result is that ATM, followed by POS and MBK are the only significant financial service delivery options (financial innovation variables) that significantly impact on the performance of SMEs in Nigeria. Comparatively, the impact of ATM on SMEs output which is 0.55 is nine times greater than the impact of POS (0.06) and nineteen times greater than the impact of MBK (0.03). This result gives credence to the fact that financial innovation has contributed to output growth of SMEs in Nigeria. Particularly, the introduction and use of ATM, POS and MBK in 2009 has facilitated SMEs operations and this has actually reflected in the output growth of SMEs in Nigeria over time.

The result is in line with the works of Nzove (2013) in Kenya and Oluma, Abdullahi and Madu (2016) in Nassarawa State, Nigeria. Nzove (2013) discovered that financial service innovations had the highest positive influence on the growth of SMEs in Kenya. Also, Oluma, Abdullahi and Madu (2016) found a positive significant relationship between electronic banking platforms and business performance in Nassarawa State, Nigeria. There is the need to provide more financial service delivery channels (financial innovations) in Nigeria as this will be favourable to SMEs performance and the country economy-wise.

The adjusted R^2 shows that about 86 per cent of the total variation in SMEs output is determined by changes in the explanatory variables. Thus, it is a good fit. The F-statistic (29.4) indicates that all the variables are jointly statistically significant at 5 per cent level. The Durbin Watson statistic of 2.1 reveals that it is within the acceptable bounds, thus it is good for policy analysis.

The next step is to analyse the short-run dynamic impact of the independent variables on SMEs output. Short-run dynamics of the equilibrium relationship are obtained through the error correction model and the results are presented in table 8. The error correction term measures the speed at which the endogenous

variable adjusts to change in the explanatory variables before converging to its equilibrium level.

Table 8 reports the results of short-run dynamics of point of sale, mobile banking, internet banking, automatic teller machine, loan to SMEs, technology and output of SMEs in Nigeria. In a short span of time, the values of POS, MBK, ATM and TN had significant positive impact on the output of SMEs in Nigeria while LSM and past year INTB had insignificant positive and significant negative impact on the output of SMEs respectively.

Table 8. Dynamic Short-run Results

Dependent Variable: LOG(SMQ)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(SMQ(-1)))	0.585798	0.078244	7.486832	0.0000
D(LOG(POS))	0.007786	0.006016	1.294190	0.1987
D(LOG(POS(-2)))	0.217170	0.054261	4.002343	0.0001
D(LOG(MBK))	0.000668	0.000308	2.171317	0.0324
D(LOG(MBK(-1)))	0.034192	0.049541	0.690175	0.1435
LOG(LSM)	0.009472	0.017580	0.538802	0.2623
LOG(INTB(-1))	-0.000190	0.000069	-2.744874	0.0072
D(LOG(ATM))	2.435101	0.060322	4.036837	0.0000
D(TN)	0.870700	0.414423	2.100993	0.0340
D(TN(-1))	0.022109	0.032272	0.067654	0.9469
ECM(-1)	-0.125311	0.032411	-3.870412	0.0013
C	78.12599	34.31213	2.306065	0.0088
R-squared	0.790503	F-statistic		23.77914
Adjusted R-squared	0.778917	Prob(F-statistic)		0.000000
Durbin-Watson stat	2.275924			

Source: Authors' computation using E-views

The significant negative impact of internet banking (INTB) on SMEs output in Nigeria is at variance with economic theoretical expectations. This result may be attributed to the fact that internet banking has not been deepened and embraced by SMEs in Nigeria over time. Thus, its use may reduce SMEs' output growth rather than increase it. Also, the positive impact of POS, MBK and ATM corresponds to the long-run result. Thus, a one percent increase in the

value of POS, MBK and ATM would lead to 0.217170, 0.00066 and 2.435101 per cent increases in SMEs’ output respectively, all things being equal in the short run.

The negative and statistically significant estimate of ECM validates the established long-run relationship among the variables in the model. The results also indicate that the estimated ECM is 0.125311 and is statistically significant at 5 per cent level. This implies that about 12 per cent of deviations from long-run equilibrium are corrected for in one quarter period.

6.2 Post estimation test

The test for stability of the short-run model using the CUSUM and CUSUM of squares, as shown in figure 1a & b, reveals that the error correction model is stable since the recursive residual falls within the 5 per cent critical bounds. The stability tests show that the bound testing cointegration approach offers strong results with regard to the quarterly data.

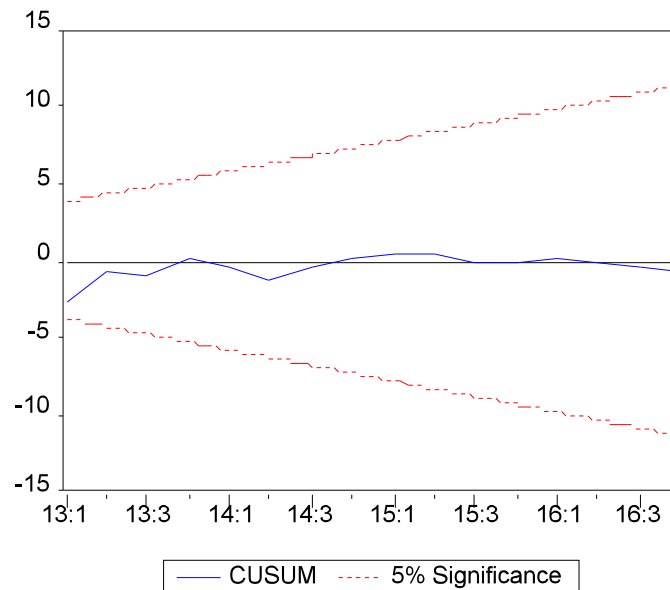


Figure 1a. CUSUM Test.

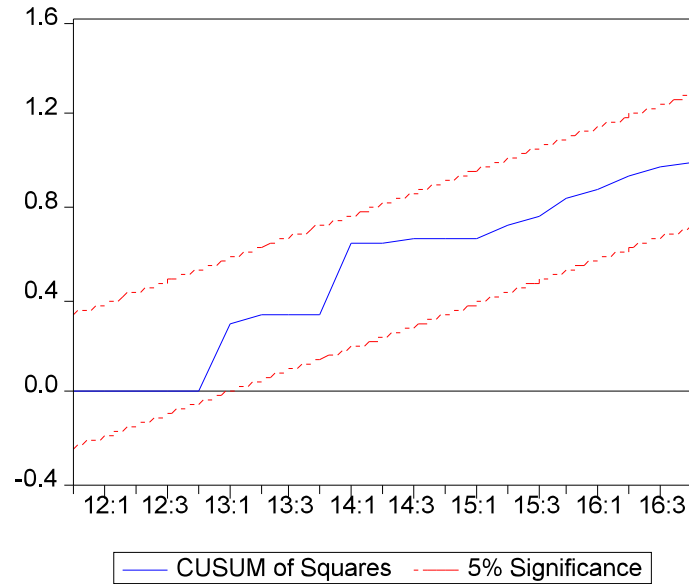


Figure 1b. CUSUM of Squares Test.

The existence of the long-run relationships demands an investigation into the extent of causality between the independent and dependent variables. In line with this, the Granger causality test as shown in table 9 was applied. The table (that is, table 9) shows rejection of the null hypotheses that POS, MBK, LSM and ATM do not Granger cause SMQ. This implies that there is evidence of causality moving from these endogenous variables to SMQ. Interestingly, three (that is, POS, MBK and ATM) out of the four variables of financial innovation cause SMQ. In the same vein, there is no causality between internet banking (INTB) and SMQ. This means that the null hypothesis that internet banking does not Granger cause SMEs output and SMEs output does not Granger cause internet banking is accepted. There is however a bi-directional causality between SMEs output and technology (TN). This implies that technology causes SMEs output just as SMEs output causes technology. From this analysis, there is a clear indication of the relative positive impact of financial innovations on SMEs output in Nigeria.

Table 9. Granger Causality Results

Null Hypothesis	Lags	Obs	F-Statistics	Probability
POS does not Granger Cause SMQ	4	30	4.76715	0.00046
SMQ does not Granger Cause POS			0.59733	0.55794
MBK does not Granger Cause SMQ	4	30	2.83131	0.00716
SMQ does not Granger Cause MBK			0.28215	0.75653
LSM does not Granger Cause SMQ	4	30	12.1029	0.00000
SMQ does not Granger Cause LSM			0.18035	0.83606
INTB does not Granger Cause SMQ	4	30	1.50247	0.24200
SMQ does not Granger Cause INTB			0.01743	0.98274
ATM does not Granger Cause SMQ	4	30	2.99548	0.00585
SMQ does not Granger Cause ATM			1.01702	0.37615
TN does not Granger Cause SMQ	4	30	2.29697	0.03351
SMQ does not Granger cause TN			4.29133	0.00071

7. Conclusion and Policy Implications

This paper examined the relationship between financial innovation and small and medium scale enterprises' (SMEs) performance in Nigeria. The paper went a step further to explore the causal relationship among financial innovation variables and SMEs performance in Nigeria. As expected, the positive and statistically significant results of POS, MBK, ATM and INTB confirm the theoretical proposition that financial innovation contributes positively to the output growth of SMEs in Nigeria. This means that in the long run, improvements in financial innovations have the potential of stimulating the growth of SMEs' output in Nigeria. Similar conclusions were drawn by Nzove (2013) in Kenya and Oluma, Abdullahi and Madu (2016) in Nigeria. This means that financial innovations which increase financial service delivery channels or options are capable of leading to improvement in SMEs performance in Nigeria. Finally, financial innovations should be financial service delivery options that will encourage more deposits than withdrawals.

Based on this empirical evidence, the paper recommends that the positive impact of financial innovation variables (such as POS, MBK, INTB and ATM) on SMEs output demands that deposit money banks should not only improve but also expand the current level of financial service delivery channels in Nigeria by establishing more financial channels in both rural and urban areas. Also financial institutions that are innovating should be protected with the necessary legal and

security framework that will encourage them to innovate for the growth of SMEs.

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