THE ROLE OF ACCESS TO FINANCE IN DRIVING INNOVATION AND PRODUCTIVITY OF SMES IN NIGERIA? EVIDENCE FROM THE WORLD BANK ENTERPRISE SURVEY

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ABSTRACT

The primary link between financial institutions and economic performance is the provision of resources by these institutions to businesses in order to drive enterprise expansion, sustainability and development. In this study, the role of access to finance in driving innovations and productivity in Nigerian SMEs is investigated using the World Bank Enterprise Survey (ES) dataset. Innovation is defined based on the ES analysis using five compositions. The study considers finance in terms of source in meeting investment needs and in terms of access. Moreover, finance access is categorized as external and internal to a firm with each having different implications. The results from the empirical analysis shows that in general, access to finance drives firm innovation and productivity. In particular, ease of accessing bank loans and credit is shown to be the strongest positive force in driving all types of innovation among SMEs in Nigeria. In the same vein, the type of finance source for investment matters in terms of how it affects innovation: both internal and external sources improve investment in product, process and organizational innovation, but only external financing has effect on R&D spending and use of foreign licensed technology. For productivity, the results show that while structure of financing investment improves productivity, access to finance may actually lead to productivity decline among SMEs in Nigeria.

Keywords: Access to finance, financing investment, innovation, productivity and Small and Medium Enterprises (SMEs).

INTRODUCTION

Understanding the factors that contribute to firm growth, and competitive advantage has been a major and contentious issue for both researchers and

strategic analysts both at the firm and aggregate levels. There is however consensus that steady growth of individual firms forms a strong basis for overall industrial development in a country, and that access to financial resources is a major factor that drives firm growth over time. In general, the primary link between financial institutions and economic performance is the provision of resources by these institutions to businesses in order to drive enterprise expansion, sustainability and development (Demirgüç-Kunt, Beck & Honohan, 2008).

Moreover, there are various channels through which financial resource availability affects firms' outcomes based on decisions on investment and growth. For enterprises in developing countries, the main challenge to new and small enterprises is generating enough surplus to maintain survival. These are invariably issues of productivity growth and innovation. Since productivity is the ratio of total result achieved over total resources used, its growth in an enterprise is fundamental to survival and development. This is because enhanced productivity can contribute to the competitiveness of small firms in both domestic and foreign markets.

Firm innovation, on the other hand, has become a central factor in modern enterprise development strategies and is an essential factor for business survival. The cost of innovation as well as the uncertainty about acceptance, success and sustainability are issues that generate risk to businesses when faced with innovation decisions. Such risks become larger and daunting when financial resources are not easily assessible by these businesses. Apparently, access to finance provides more leverage for businesses to whether the risks associated with innovation. In this direction, the ability to access external funds is critical for firms in making decision to innovate. There are however, particular features that characterize firms that can easily access external funds, especially in developing countries (European Commission, 2016; Ayyagari, Demirguc-Kunt & Maksimovic, 2011). If these features are taken to account, then innovation decisions could be limited to certain enterprises, and there is need to investigate such features actually contribute to innovation by firms. that Firms that have literature support

In this study, we consider how access to finance affects small and medium enterprises' innovation capacity as well as their overall productivity using a survey panel for Nigeria. The main question to be answered is whether access to finance actually targets these two critical factors in enterprise development in Nigeria? In particular, do the enterprises who have access to finance perform better in terms of productivity growth and innovation when compared to the

ones without access? This study seeks to address these questions by first briefly reviewing pertinent literature in the next section, present an overview of innovation, productivity, and financial access of SMEs in Nigeria in section three, and conduct an empirical analysis of the purported relationships among the variables in sections four and five. Concluding remarks and policy recommendations are done in section six.

THE LITERATURE

The ability of well-functioning financial to drive economic growth through efficient selection of investment opportunities is generally accepted. The channel of this effect is however not too clear in literature. Since innovation is an investment decision for the firm (World Bank, 2008; Hall, 2009) it is expected that financial market financing does promote adequate adoption of technology and the decision to innovate by firms (King and Levine, 1993; Brown, Fazzari & Petersen, 2009; Hsu, Tian & Xu, 2014; Kerr & Nanda, 2014). In spite of this agreement innovation financing has been found to present a unique investment option for the financial system because of the inherent features of innovation in the firm. These are rooted in theoretical analysis of innovation as an investment pattern. Hall (2009) defined innovation investment as consisting of "Research and Development spending (R&D), design and marketing expenses for bringing a new product to market, investment in the necessary new capital equipment, and investment in training" (p. 9).

Studies like those of Hall (2009), Kerr and Nanda (2014) highlighted the foundational discussions on the uniqueness of innovation investment. First, ", the innovation process is inherently uncertain" (Kerr & Nanda, 2009, p. 3). It is usually difficult to know the probabilities associated with the outcomes of innovation – business risk. However, there the additional indeterminacy of even the forms of the potential outcomes are not clear – uncertainty. This uncertainty makes it difficult for fund providers to apply the standard risk adjustment methods in making funding decisions (Bravo-Biosca, 2014). Second, market failure has amplified consequences for innovation expenses. The level of uncertainty surrounding such investments ensures that neither the innovator nor the financier knows the true potential of the project. These relate to the problems of adverse selection and moral harzards that perennially plague lender-borrower relationships, creating agency costs for financing of innovation that can be significantly greater than those present in standard settings between financiers and entrepreneurs (Kerr & Nanda, 2014). The third peculiarity of investment in innovation is the fact that the capital created by R&D is largely

intangible and firm-specific, limiting its resale market value. This is because innovation investment focuses on the human capital of the firm's employees. This often makes fund providers unwilling to invest is such prospects.

The literature on financing and innovation is organized along the lines of either internal or external sources of finance. Internal funds refer to retained profits and dividends, while external funds include equity issuance, debt securities, bank loans, and other financial liabilities (European Commission, 2016). Although there is no unified theory of corporate finance that provides for the conditions under which companies raise different types of finance, the 'pecking order' theory of Myers and Majluf (1984) predicts a general pattern of firm financing options. It showed that the firm considers internal financing first since it is the cheaper than externa financing. The proposition here is that since higher innovation entails a premium in the investment scale, firms would generally be more comfortable in using internal funding for financing such investment. Indeed, Hall (2009) noted that external financing involving creation of new debt and issue of equity "are more expensive for R&D and innovation than for ordinary investment" (p. 13)

The inability of SMEs in developing countries to generate enough surplus to provide strong support for innovation investment forms the background for the studies that focus on external financing and innovation in these economies. The external financing available to SMEs include "credit lines, bank loans and leasing" (European Commission, 2016). In many cases, the nature of the SMEs either facilitate or hinder ability to access external funding. In has been observed that larger firms among SMEs have better access to external finance than smaller ones (Hall, 2009). There are however pertinent issues with external financing that could weaken its effectiveness in developing markets. For instance, the World (2008) noted that the characteristics of a firm alone does not ensure its access to external finance, rather, the wider policy and institutional environment as well as existence and effectiveness of a variety of intermediaries help facilitate financial access. The unavailability of these factors could widen the gap between providers and users of funds and exacerbate information and agency problems (Tirole 2006).

The initial position of researchers on the role of finance on innovation was that internal finance is the best option to promote R&D in the firm. As noted in Kerr and Nanda (2014), a seminal contribution on finance and innovation was provided by Brown, Fazzari and Petersen (2009). Their study provided evidence that young, high-tech, publicly-traded firms finance their R&D investment almost entirely through internal cash flow and external equity markets. They were also

among the first to empirically highlight the unique challenges posed to financing of innovation by information asymmetry and other factors highlighted earlier. The works of Brown et al (2009) was extended by Acharya and Xu (2013) to include external public equity markets as an important source of innovation finance. They find that publicly-traded firms in industries that are more dependent on external finance generate more patents that are of higher quality and novelty than privately-held firms, but that this difference does not exist for firms in industries that are less dependent on external finance.

The role of banks in financing innovation has received increased investigation in recent times. Hochberg, Serrano and Ziedonis (2014) find patents are used as collateral for venture debt, and Chava, Chong and Nanda (2012) find firms with significant patent activity and higher-quality patents receive cheaper bank loans than peers. Moreover, Robb and Robinson (2014) show that external bank finance is an important source of startup capital, even for high-potential startups that might be engaged in innovation and who don't have any collateral–tangible or intangible–to pledge.

With focus on developing countries, Ayyagari, Demirguc-Kunt and Maksimovic (2011) considered the role of finance in firm innovation in emerging economies by characterizing finance into internal, external and foreign-based. They found that the larger the externally financed proportion of a firm's investment expenditures and share of their borrowing is in a foreign currency, the higher the innovation capacity of the firm. They regarded external financing in emerging markets as largely emerging from banks since underdeveloped financial markets make equity and other market-based financing sources veritably limited. A particular study on innovation in Africa is that of Lorenz (2014) who used the World Bank Enterprise surveys to investigate the relation between financials constraints and innovation performance. A sample of firms in 9 African nations: Ethiopia, Zimbabwe, Rwanda, the Central African Republic, Uganda, Zambia, Tanzania, Ghana and the Democratic Republic of Congo was selected for the study. Using direct measures of innovation and financial constraints from the surveys, the study shows that financing constraints tended to reduce the probability of successful innovation by firms in the selected countries. His results were robust both for firms in terms of size and age or maturity. The results from the study suggest that if external finance access could be promoted, especially with government subsidies and financial support programs for SMEs, innovation in these countries could spread remarkably.

Sharma (2007) used firm level data from a cross-section of 57 countries to study how financial development affects innovation in small firms. He found that

relative to large firms in the same industry, spending on research and development by small firms is more likely and sizable in countries at higher levels of financial development.

The theoretical basis for finance and firm productivity growth is similar to that of firm innovation. This is because, innovation has been found to be a strong factor in driving firm productivity in the long run (King & Levine, 1997; Brown, Fazzari & Petersen, 2009; Tian & Xu, 2014). Cirera (2016) has however found that in developing countries where data on innovation is generalized and investment environment is imperfect, innovation may not be a strong factor in firm productivity. In terms of empirical studies on finance access and firm productivity, it has generally agreed that finance promotes productivity (Goedhuys, Janz & Mohnen, 2006; Aterido, Hallward-Driemeier and Pages, 2011; Fowowe, 2017).

Dörr, Raissi and Weber (2017) examined the implications for firm productivity of adverse shocks to bank lending in Italy, using a novel identification scheme and loan-level data on syndicated lending. They found that a negative shock to bank credit supply reduces firms' loan growth, investment, capital-to-labor ratio, and productivity. The channel of the negative shock was shown to be related to labor market rigidities, "which delay or distort the adjustment of firms' desired labor and capital allocations, and thereby reduce firms' productivity" (p. 19). On a sectoral basis, Mukasa, Simpasa and Salami (2017) investigated the impact of credit constraints on Ethiopia's agriculture productivity. Using a panel of 5,308 smallholder farmers and an endogenous regime switching regression model, they find that credit constraints reduced productivity in the sector drastically. Consequently, they showed that alleviating credit constraints would generate substantial productivity gains in Ethiopia of around 60%.

PRODUCTIVITY, INNOVATION AND ACCESS TO FINANCE BY SMES IN NIGERIA

Small and Medium enterprises in Nigeria have been a subject of numerous analysis in terms of survival, development and inputs. It is noted that if these firms could boost productivity levels, growth and survival will be assured, while competitiveness will also be boosted (Uche, 1991; Nto & Mbanasor, 2011; De Grip & Sauermann, 2011; Ofoegbu & Joseph, 2013). The climate for business operations in Nigeria has however not provided strong support for the implementation of firm growth and development strategies within the firms. For instance, Table 1 shows the ratio of private sector credit to GDP in Nigeria and other African countries. In comparison, Nigeria has one of the lowest rates among the countries, suggesting that private sector credit is more difficult to access in

Nigeria than the other countries. As mentioned earlier in the study, inadequate finance has been a major obstacle to overall performance of SMEs in Nigeria. The second panel of Table 1 shows the growth rate of productivity in Nigeria and the other countries. The growth rates were generally low for Nigeria, especially when compared with countries like Camerron and Cote d'Ivoire where productivity growth remained positive even during the period commodity price shock since 2014. The shock has been largely reflected in the negative productivity growth in Nigeria for 2015 and 2016 when reaching a rate of -3.78 percent decline. This forcefully demonstrates the overarching strength of the natural resource sector in in terms of capital accumulation and overall productivity.

Table 1: Private sector credit to GDP and productivity growth in selected African countries

|	Credit to private sector (% of GDP)			Growth in Output per worker employed		
Country	2012	2013	2014	2014	2015	2016
Angola	22.2	23.3	22.89	0.97	-0.72	-3.38
Botswana	31.3	31.79	31.02	1.54	-1.68	1.66
Cameroon	14.1	14.78	15.56	2.90	2.96	1.98
Cote d'Ivoire	16.4	17.99	19.15	5.46	5.42	5.08
Gabon	11.3	15.01	14.54	-2.64	0.87	-0.74
Ghana	15.6	17.07	19.91	1.38	1.59	1.08
Kenya	29.5	31.71	34.14	2.00	1.66	2.30
Namibia	48.5	47.88	49.66	3.03	-1.88	-0.73
Nigeria	11.8	12.59	14.54	0.75	-0.92	-3.78
South Africa	146.5	149.2	151.1	0.01	-0.36	-0.64

Source: WDI 2016

In terms of the overall innovation environment in Nigeria, Figure 1 suggests that even among other African countries, innovation activities have been low. The innovation index for 2017 in the chart reflects 21.9 percent for Nigeria and 35.8 percent for South Africa. Given that innovation and technology are the fundamental routes for rapid and sustainable growth in an economy, the environment in Nigeria appears to be o the wrong track. Some aspects of the innovation environment in Nigeria that lags behind include low investment in R&D, inadequate training and development of personnel, as well as technological and infrastructural inadequacies in the economy.

Fig. 1: Innovation Index
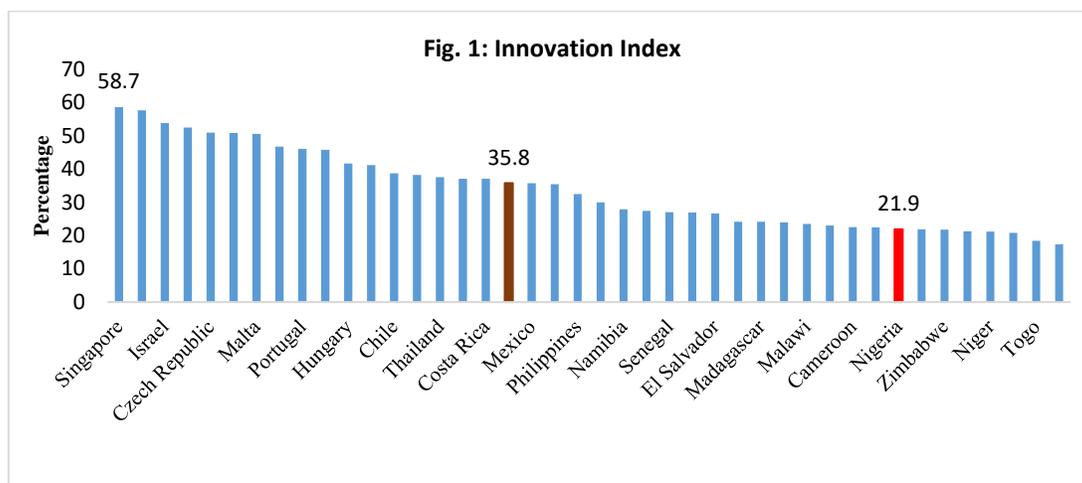
Source: WDI 2016

In terms of innovation among SMEs in Nigeria, 2 shows that Nigerian firms performed worse when each of the measurement is used. Only 7.1 percent of the surveyed firms in Nigeria had internationally recognized certification while just 6 percent have adopted technologies licensed from foreign companies. Moreover, 22 percent of the firms in Nigeria owned a website and 24.1 percent use emails in their communication. The use of computer technology appears to be low in Nigeria when compared with the other countries in the group. In the same vein, 24 percent of the surveyed firms in Nigeria had annual financial statements reviewed by external auditors. Thus, overall the result highlights show that technology and innovation in among Nigerian SMEs is low generally and also does not measure up when compared to firms in other country groups.

Fig. 2: Innovation and Technology by Small Firms
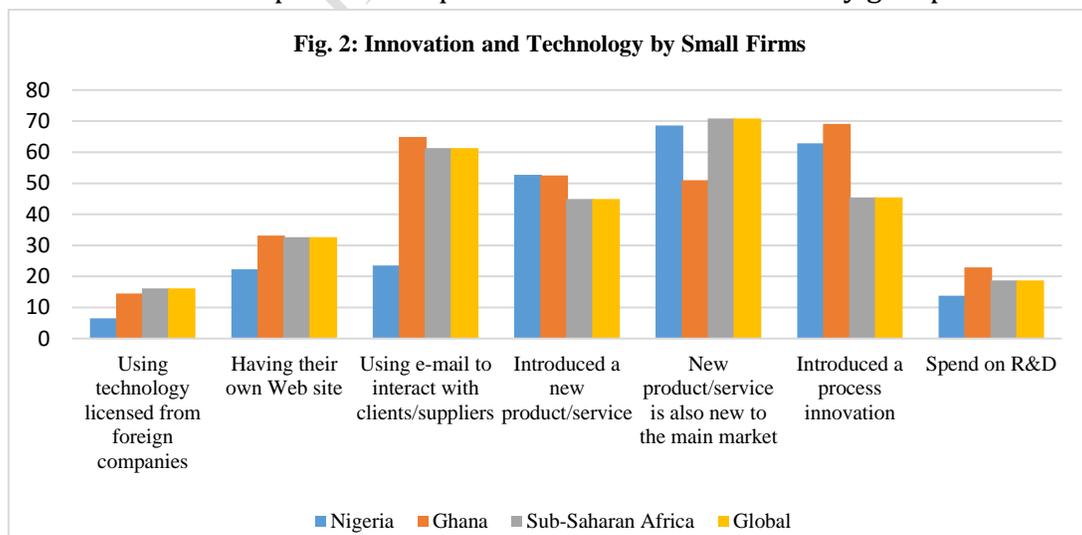
Source: World Bank Enterprise Survey, 2014

The general characteristics and performance structure of SMEs in Nigeria are summarized in comparison with Sub-Saharan Africa and the Rest of the world and presented in Table 2 below. This summary (based on the World Bank Enterprise survey, ES) is intended to show the performance of Nigerian small firms relative to the rest of Africa (or Sub-Saharan Africa – SSA) and the world in general. We select summarized groups based on overall firm characteristics. Average age of the surveyed firms for Nigeria is 15.9 years while it is 14.3 years in other Sub-Saharan Africa countries and 16.5 years for all the countries used in the survey.

Table 2: Summary Statistics of Firm Characteristics

| Indicator	Nigeria	Sub-Saharan Africa	All Countries
Age of the establishment (years)	15.9	14.3	16.5
Proportion of private domestic ownership in a firm (%)	70.7	78.4	88.5
Proportion of private foreign ownership in a firm (%)	3.1	13.2	8.6
Proportion of government/state ownership in a firm (%)	1.9	0.6	0.4
Proportion of a firm held by the largest owner(s) (%)	95.2	84.6	82
Percent of firms with legal status of publicly listed company	3.3	4.5	3.2
Percent of firms with legal status of privately held Limited Liability Company	3.1	12.5	41.7
Percent of firms with legal status of Sole Proprietorship	76.7	51.9	36.6
Percent of firms with legal status of Partnership	8.6	10.7	8.8
Percent of firms with legal status of Limited Partnership	5.5	15.9	7.8

Source: World Bank Enterprise Survey, 2014

Apparently, Nigerian small manufacturing firms appear to be newer than their counterparts in other African countries. Most of the firms in the survey are largely owned by domestic participation and very few of the firms (1.9 percent in Nigeria) are owned by govenments. This indicates that government participation in owning and running small manufacturing firms is quite low in Nigeria. In the survey also, 76.7 percent of the firms surveyed in Nigeria are sole proprietorship businesses. This is also reflected in the 95.2 percent proportion of the surveyed firms coming being owned by the largest owner. The situation is not quite similar for other countries in the overall survey; 51.9 percent and 36.6 percent of the

firms in Africa and the other countries of the world are sole proprietorship businesses respectively. This result show that most of the firms are privately owned and operated in Nigeria.

Figure 3 shows the general performance of the firms in the survey. Capacity utilization for the firms was 73 percent for Nigeria and just below 70 percent for other countries in SSA. The implication of this is that the surveyed firms have impressive capacity utilization. This is particularly interesting for the Nigerian case where poor infrastructural facilities have hampered firm level development in the country (Ikpeze, Soludo, & Elekwa, 2004; Anyanwu, 2004). The performance of the firms in terms of real sale growth for the sample period (2014) was really poor for with -6.6 percent growth rate for Nigeria, although the rate for other SSA firms and that of the rest of the world is positive.

The general slum in economic activities that began in 2014 could have contributed to the poor sales performance among Nigerian firms. The performance of the firms in terms of employment growth was surprisingly positive for each of the groups for the same period. This implies that employment continued to grow even when sales were on the decline. Annual labour productivity generally dropped for the 2014 period among the surveyed firms. There seems to be a general trend in productivity growth among the small firms around the world, including Nigeria. This result generally confirms the argument that small manufacturing firms are often characterized by low productivity and its growth rate (Baldwin, Jarmin & Tang, 2002; Almeida & Carneiro, 2009). Percentage of firms that bought fixed assets for the survey period was lower in Nigeria than in other regions of the world. Nigerian small manufacturing firms appear to have less capacity for acquiring fixed capital in production, or they may be less capital intensive.
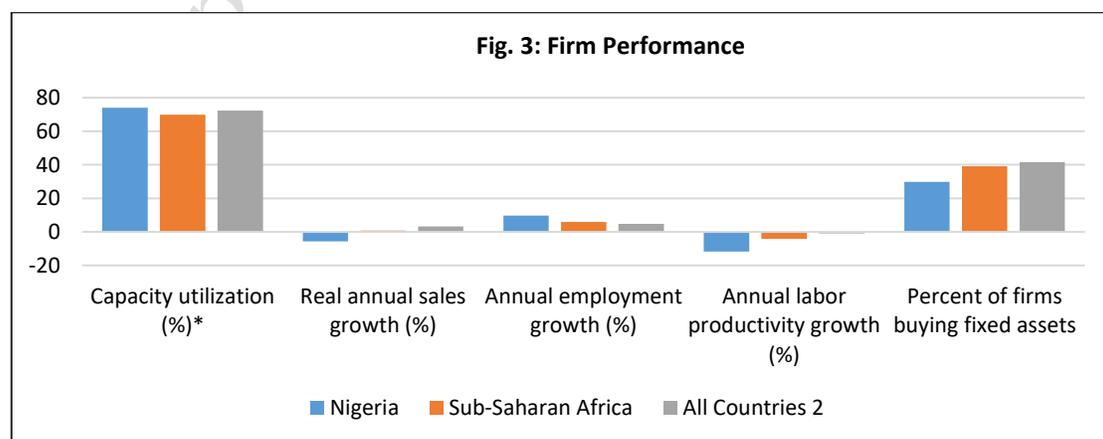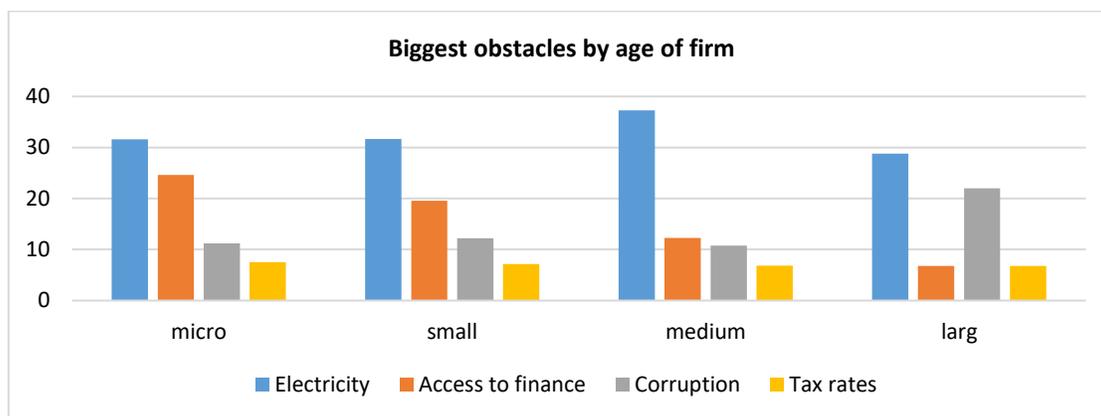

Source: World Bank Enterprise Survey, 2014

The four biggest business environment obstacles as perceived by firms in Nigeria are reported in Figure 4. The constraints are broken down age or stage of firms as well as by size of the firms. these constraints reflect the major issues that strangulate SMEs in Nigeria and render growth and prospects invariably difficult. In the upper part of the chart, it can be seen that all the firms reported electricity as their biggest obstacle. However, only infant firms (firms less than 5 years) reported corruption as their second biggest obstacle. This suggests that setting up a new SME is faced with heavy institutional challenges that render firms constrained. The other firms take access to finance as the second biggest obstacle to their operations. This places inadequacy of finance access as a strong factor that inhibit business development, especially among other firms in Nigeria. For the obstacles in terms of size of firms, micro firms appear to be most hit by inadequate access to finance. A larger proportion of micro firms considered access to finance as the second biggest obstacle to operations and this is quite close to the first biggest obstacle. For the other firms, access to finance was a distant obstacle compared to electricity access. Indeed, larger firms mentioned corruption as their second biggest obstacle. Thus, finance constraints are size-specific among SMEs in Nigeria.

Figure 3: Biggest obstacles to SME operation in Nigeria

Biggest obstacles by age of firm

Biggest obstacles by age of firm

Legend: ■ Electricity ■ Access to finance ■ Corruption ■ Tax rates
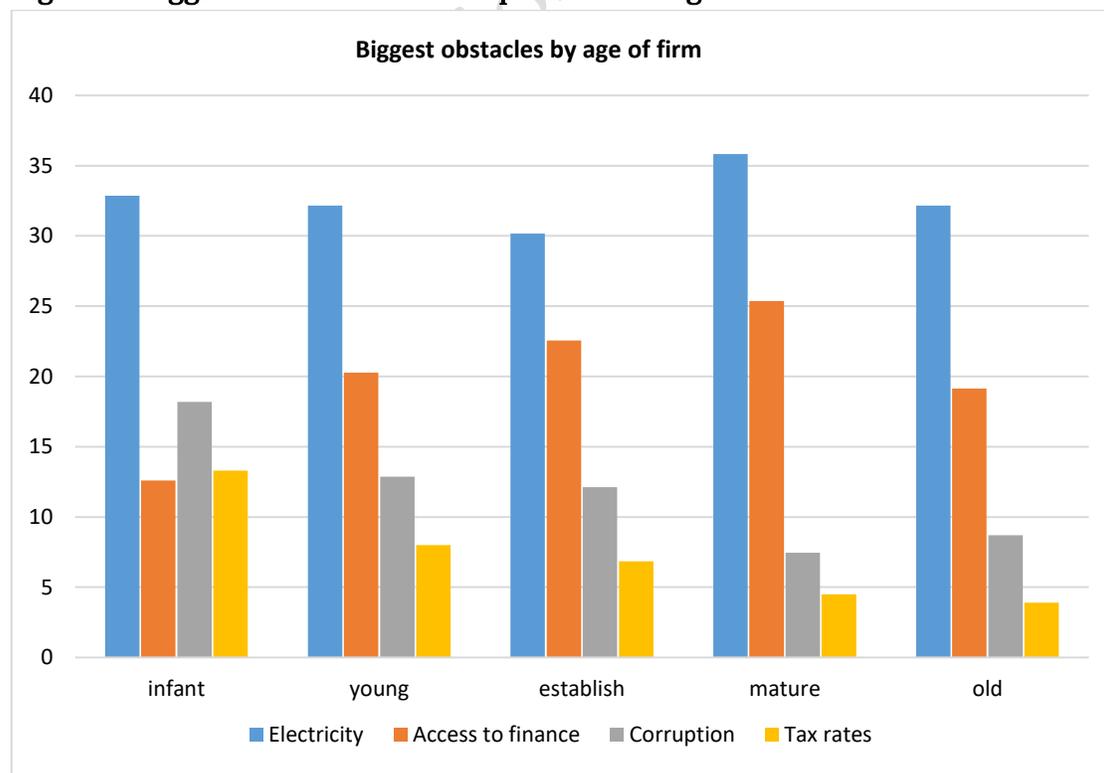
Source: World Bank Enterprise Survey, 2014

We now focus on the finance access to by the SMEs in Nigeria. The general characteristics of firms in Nigeria with respect to access to finance is reported in Figure 5, including firms' banking and loan activates. The lowest proportion of firms with bank accounts as well as firms that have a line of credit and loans with a financial institution are in Nigeria when compared with the other regions. This shows a general preclusion of SMEs from financial access in Nigeria. Also, Nigerian firms possess the highest proportion of loans requiring collateral, while more Nigerian firms had their recent loan applications rejected.

Finance Access Characteristics of SMEs in Nigeria

Legend: ■ All Countries ■ Sub-Saharan Africa ■ Nigeria
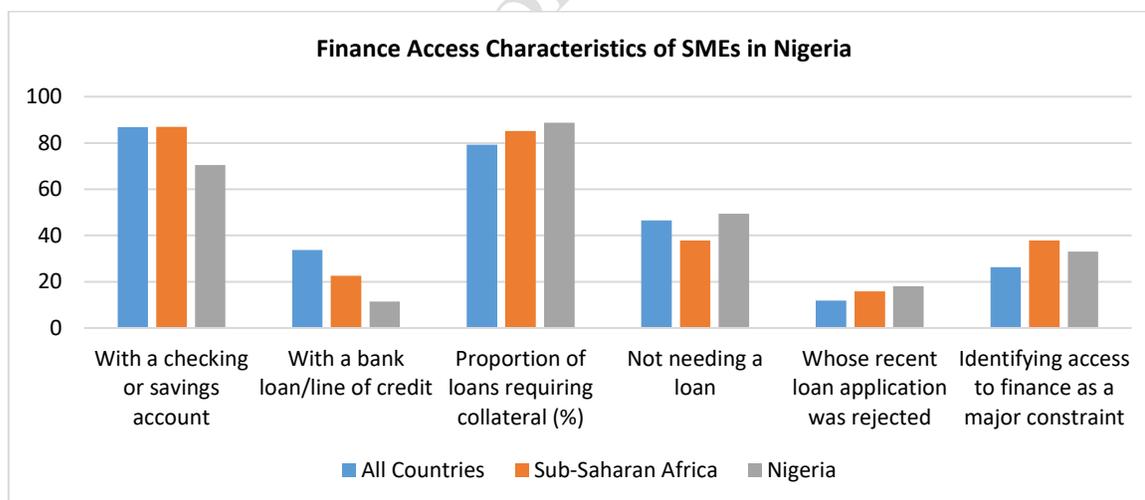
Source: World Bank Enterprise Survey, 2014

For the access to finance factor, Table 3 shows the proportion of investment financed by financial institutions for those who have a line of credit with financial institutions and those that do not have. It can be seen that more of the firms that had line of credit financed less than 5 percent of their investment with bank funds. Indeed, only 9.6 percent of the firms that had line of credit with financial

institutions actually financed their investment with the institutions' funds. This shows that investment activites of SMEs in Nigeria receive low funding by financial instructions even when the firms have a financial relationship with the banks. Further analysis (not reported in this study) reveals that there is only a weak positive relationship between having a line of credit with financial institutions and financing investment with loans from financial institutions; the relationship was actually negative and very strong in 2007 and 2009 surveys.

Table 3: Having a line of credit with financial institutions and proportion of investment financed by the institutions

Proportion of investment financed by financial institutions (%)	Firm has line of credit/loan with financial institutions	
	yes	no
5	2.04	2.02
10	8.16	9.09
15	0.00	3.03
20	42.86	25.25
30	20.41	23.23
32	0.00	1.01
40	16.33	16.16
45	0.00	1.01
50	2.04	14.14
60	0.00	2.02
70	2.04	3.03
80	2.04	0.00
90	2.04	0.00
100	2.04	0.00
Total	100.00	100.00

Source: Source: World Bank Enterprise Survey, 2014

MODEL SPECIFICATION AND METHODOLOGY
The Models
The models specified for the effects of access to finance on SME innovation and productivity are drawn from the models developed in Segarra and Teruel (2009), Ayyagari *et al.* (2011), and Lorenz (2014). For the innovation model, a logit form is specified to capture the probability of a firm innovating based on the five innovation definitions used in this study. In the model, the probability of

innovation is assumed to depend on financial access effects (as the baseline effects) and other firm characteristics that either promote innovation or enhance firm access to finance. The model is specified as:

$Pr(innov = 1) =$ f($internalfin, extfinFI, extfinoth, finaccess, finconstr, age, size, female$) (1)

where

internalfin	=	internal financing
extfin	=	external financing from financial institutions
extfinoth	=	external financing from other sources
finaccess	=	measure of ease of access to bank financing
finconstr	=	level of financial constraint
age	=	age of the firm
size	=	size of the firm
female	=	proportion of firm owned by female

In the model, it is argued that the finance source and financial access factors will have positive impacts on firm innovation, while the financial constraint factor will exert negative impact on firm innovation. Also, older and bigger firms are expected to be more stable with better capacity to innovate, while firms largely owned by women are expected to have lesser access to finance and therefore less able to innovate.

The theoretical framework for the productivity model is based on a modified neoclassical production function developed by Segarra and Teruel (2009) that relates the representative firm "i" with the labour, capital and intermediate materials as well as a measure of technology that incorporates the product changes not explained by the previous factors. The function for output is of the form:

$$dy_i = da_i + \beta_1 dn_i + \beta_2 dk_i + \beta_3 dm_i + u_i \qquad (2)$$

where $dy_i, dn_i, dk_i, dm_i,$ and da_i represent log of sales, employment, capital stock, intermediate assets and technical change. Since the focus of the study is on the effects of access to finance on productivity, we introduce the finance effects though the technical change variable. This variable also measures total factor productivity (Iyoha, 2004) and thus natural fits in as an accommodating variable of the effects of finance on productivity. This means that

$$da_i = \alpha + \delta_i X_i + v_i \qquad (3)$$

Where X is the firm's set of financial sources. When (3) is substituted into (2) the resulting equation is the output model that incorporates firm characteristics effects and the effects of financial sources on technical change. Note that the other variables in the model represent economies of scale effects. The model is now

$$dy_i = \alpha + \beta_1 dn_i + \beta_2 dk_i + \beta_3 dm_i + \delta_i X_i + v_i + u_i \qquad (4)$$

The model in (3) is an expanded form of the neoclassical output model with economies of scale and financial access effect where δ_i represents the output elasticity of the different financial sources.

The full econometric model to be estimated for the productivity equation is designed to capture the direct impact of financial sources on a firm's productivity. Productivity is measured as the per capita form of y_i in (4). The model is specified as:

$$dy_i = \alpha + \delta_i internalfin_i + \delta_i extfinFI_i + \delta_i extfinoth_i + \delta_i finaccess_i$$
$$+ \delta_i finconstr_i + \gamma_2 innov_i + \beta_3 Z_i + \mu_i \qquad (5)$$

Where

y = productivity;

innov = measure of innovation; and

Z = vector of economies of scale or firm-specific variables including training, firm age, firm size and capacity utilization.

Three levels of stratification were used in the Nigerian ES survey, namely, industry in which the firm falls, region of firm location, and size (based on employees). In particular, industry of firm and its size are strong factors that can determine the outcome of a firm in terms of access to finance, innovation and productivity. In this study, these two factors are used to as panel (fixed) effects either to control estimation output or ensure robustness of the estimates. Based on the World Bank ES survey data and the study by Cirera (2016), the variable definition and measurements are presented in the appendix.

Data description

The data used in this study will be based on resources from the survey analysis from the World Bank Enterprise Survey data collected in Nigeria between April 2014 and February 2015 under an initiative of the World Bank. The Enterprise Surveys collect information from a representative sample of the non-agricultural formal private economy. In addition to collecting information on the business environment the surveys collect information on the characteristics of the firms interviewed. Consequently, the data collected provides a description of the representative private firm in the country and also an estimate of how some of the attributes of the average firm are distributed across the population of firms. For Nigeria, this project was expanded with increased geographic coverage during fieldwork. It began as a 9-state exercise and 10 more states were added

for a total of 19 states. As Ayyagari *et al.* (2011) noted, the survey sample from the universe of registered businesses in each country and follow a stratified random sampling methodology. The core survey uses standardized survey instruments to benchmark the investment climate of individual economies across the world and to analyze firm performance. A great advantage of these surveys is their broad coverage of the extent of innovation that the firms undertake.

The World Bank ES survey team acknowledges the fact that innovation in developing countries should be considered in broad terms rather than as just new inventions as is available in advanced economies. from the survey manual, the following innovation metrics can be obtained (Cirera, 2015):

1. **Product innovations -** essentially new, redesigned, or substantially improved goods or services;
2. **Process innovation** - the implementation of new or significantly improved production or delivery methods;
3. **Organizational innovation** - the implementation of a new organizational method in business practices, workplace organization, or external relations;
4. New licensing agreement obtained from foreign firms;
5. Spending on R&D in the firm which is the proportion of investment devoted to research and development; and
6. Employee innovation – involving the encouragement and sponsorship of employees to produce or introduce new product or services.

In addition to the rich detail on the innovative activities undertaken by firms, the survey has information on firm size, age, and capacity utilization, all of which are used as firm-level controls in our study. The definition of firm size is based on SMEDAN (2014) categorization of firms into four different sizes along employment lines. Firms that employ less than 10 workers are micro firms, those with 10 – 49 workers are small firms, those employing 50 - 199 workers are medium firms, while the firms that employ 200 and above are large firms. In the study, 45.55% of the firms are micro, 41.97% are small, 9.75 are medium, and 2.73 are large. This shows that more of the firms in the study (87.52%) are micro and medium firms.

EMPIRICAL ANALYSIS
Descriptive Statistics
The data used for the empirical analysis are summarized in Table 5 where the averages and standard deviations are reported. For the innovation variables,

2127 observations were obtained, apart from foreign licensing of innovation with 897 observations. In all, it is seen that more than half of the firms were involved in both product and process/method innovation while R&D spending surprisingly involved just 16.2 percent of the observations. This indicates that spending in R&D has not been a major proportion of SME spending in Nigeria. The least innovation activity among the sampled firms is the use of technology licensed from abroad. Indeed, cash-strapped firms find it difficult to use foreign exchange in obtaining foreign technology.

For the finance variables, the Table shows that 41.34 percent of investment financing is funded from internal sources, while only 4.12 percent is funded by financial institutions. The major source of external financing for investment is provided through credit facilities (at 20.49 percent). Apparently, investment financing has not relied on financial institutions by SMEs. We also consider the sources of directing funding for innovation. The outcomes are based on an adjoining survey conducted by the World Bank to the ES. It shows that more of the innovation financing (79.8 percent) is provided internally by the SMEs. Only 10.5 percent is financed by banking institutions, while government financing accounts for just 4.7 percent.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
Innovation activities			
innov_pr	2127	0.508	0.50
innov_mtd	2127	0.522	0.50
innov_org	2127	0.406	0.491
innov_spending	2127	0.162	0.368
innov_lic	897	0.114	0.318
Finance			
internal_fin	1257	41.34	44.03
extfin_FI	1257	4.142	12.789
extfin_oth	719	20.49	30.41
fin_access	2126	0.080	0.272
severity of finance constraint	2127	1.559	1.238
Funding of innovation (source)			
own	257	0.798	0.403
bank	257	0.105	0.307

government	257	0.047	0.211
NGO	257	0.019	0.138
money lenders and friends	257	0.156	0.363
Firm characteristics			
age (years)	2127	15.65	9.12
size	2071	2.549	1.023
female (%)	370	84.31	32.03
training	2573	0.293	0.455
Capacity utilization (%)	1141	48.54	44.47

The firm characteristics included in the models include firm age and size, female ownership of firms, training, and capacity utilization. The average age of the firms is 15 years. For the size, it was categorized into five segments with 5 representing the large firms and 1 representing the micro firms based on SMEDAN five-fold definition of firm size. It is seen that more of the firms are around the medium size. For the firms that reported the proportion of female ownership, the women owned 84.31 percent of the firms on average. Following Ayyagari *et al.* (2011) we argue that the investment opportunities available to a firm is often an important determinant of the productivity of such firms. Investment opportunity is proxied by firm capacity utilization rates as in Ghosal and Loungani (1996) and Ayyagari et al (2011) since it can measure the amount of slack in an economy and are good leading indicators of business investment spending. Average capacity utilization of the firms is 48.54 percent, which is low.

Econometric Results

The results of the estimated models are presented and analysed in this section. The first result in Table 4 is the baseline output for the innovation model. In the results, the impacts of financial access on the five innovation outcomes in the firms are presented without controlling for any firm characteristics which may be firm-specific. However, robustness is checked by introducing industry fixed effects in the equations and reporting the outcome on the left panel of the results. The results show that there are essentially no changes in the outputs even with sector fixed effects.

Table 4: Finance and innovation baseline result

	pr	mtd	org	rd	lic	pr	mtd	org	rd	lic
internal_fin	0.003*	0.008**	-0.001	-0.012**	-0.01**	0.004*	0.007**	-0.002	-0.01**	-0.007*
extfin_Fl	0.002	0.005	0.013**	0.001	0.002	0.005	0.009	0.013**	0.003	0.002

extfin_oth	-0.003	-0.002	0.001	-0.011**	-0.01*	-0.004	-0.003	0.00	-0.01**	-0.004
fin_access	0.45*	1.06**	0.91**	0.89**	0.89**	0.7**	0.91**	0.90**	0.92**	1.13**
fin_constr	0.128*	0.152	0.066	-0.062	-0.40**	0.038	-0.029	0.046	0.031	-0.25**
_cons	-0.011	-0.13	-0.11	-0.21	-0.35*	-0.01	-0.12	-0.28	-0.31	-0.38
sector fixed effects	yes	yes	yes	yes	yes	no	no	no	no	no
Wald test Prob > chi²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*Note * and ** indicate significance at 5 and 1 percent levels respectively*
Source: World Bank Enterprise Survey, 2014

Access to internal financing has positive impacts on the probability of the SMEs to carry out product and method innovation, but the impact on organizational R&D spending and foreign licensing is negative. This shows that internal finance effects vary depending on the innovation pattern. Use of finance from financial institutions has positive effects on probability to innovate, irrespective of the type. The positive impact is only significant for organizational innovation. This suggests that financial institutions focus on ability of SMEs to provide improved organizational setting which can ensure stability over time. Other external sources of investment financing have outright negative impact on probability to innovate among the SMEs, the negative impact is significant especially for R&D spending. Apparently, the decision to obtain more financing from creditors significantly inhibits the firms ability to innovate and limits the funding for R&D. one reason for this outcome could be found in the fact that SMEs that rely more on credit financing are weak in terms of overall cashflows and most of them do not have enough resources to innovate or for R&D. Financial constraint has a significant negative impact on the use of foreign-licensed technology. This result confirms that cash-strapped firms find it difficult to use foreign exchange in obtaining foreign technology.

The next set of results presentations involves introduction of finance source and access variables into the model with firm characteristics. In Table 5, the results for product innovation is shown. The results are robust with introduction of fixed effects control. Both internal and financial institution finance sources have significant positive impacts on product innovation for the firms. The supplier credit source of finance has negative impact on product innovation. These results show that firms that have larger proportions of internal financing options as well as financing from financial institutions are more likely to innovate than firms with more external finance sources that border on credit.

The finance access variable is positive and shows that the more access a firm has to bank credit and loans, the higher its probability of innovating. The coefficient of the finance access is quite high, suggesting that firms with access to bank finance are 61.3 percent more likely to conduct product innovation than firms without such financial access. The surprising outcome in the result is the positive and significant coefficient of the financial constraint variable which suggests that more financial constrained firms actually carry out product innovation than those firms that are not constrained. Similar results were found by Fowowe (2017) in terms of cash constraint effects on firm overall performance, although Lorenz (2014) found that with more controls in the modeling, the relationship is actually inverse.

Table 5: Product innovation

	1	2	3	4	5	6	7	8	9	10
internal_fin	0.008**					0.007*				
extfin_Fl		0.046**					0.043**			
extfin_oth			-0.011*					-0.01		
fin_access				0.677*					0.613**	
fin_contr					0.175*					0.143*
age	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
size	0.007	0.049	-0.136	0.028	0.088	0.01	0.047	-0.086	0.063	0.074
female	-0.009*	-0.007	-0.009	-0.008*	-0.009*	-0.007	-0.005	-0.006	-0.012*	-0.007*
constant	0.982	0.881	1.98	0.713*	0.611	0.992	0.917	2.14*	0.638*	0.734
sector fixed effects	yes	yes	yes	yes	yes	no	no	no	no	no
Wald test Prob > chi²	0	0	0	0	0	0	0	0	0	0
N	452	197	182	434	438	452	307	452	434	452

Source: World Bank Enterprise Survey, 2014

For the control variables in the result in Table 5, female ownership of a firm has strong negative impacts on probability to conduct product innovation. Indeed, each of the innovation models has strong negative relationship between share of female ownership of a firm and probability to innovate. This suggests that firms owned by females tend to innovate less.

The results for process or method innovation is presented in Table 6. The results for finance sources and access are similar to those of product innovation, suggesting that financing has identical implications for both product and process innovation by SMEs in Nigeria. The coefficient for finance constraint is however negative, but fails the significance test. This indicates that finance constraint only slightly affects the probability of SMEs to conduct process or method innovation. Female ownership of firms again has strong negative impact on innovation, while the other factors of age and firm size have insignificant impacts on process innovation.

The results for organizational innovation in Table 7 are similar to the previous outcomes where internal and instructional sources of financing have significant positive impacts on firm innovation, finance access greatly improves probability to innovate while other external finance sources and finance constraint have insignificant negative impacts on probability to carry out organizational innovation. These results reveal that the three innovation categories perhaps move in the same direction in the organization. Firms that innovate in product development are more likely going to innovate in process of carrying out activates as well as introduce new organizational strategies.

Table 6: Method/process innovation

	1	2	3	4	5	6	7	8	9	10
internal_fin	0.011*					0.01**				
extfin_Fl		0.066*					0.064**			
extfin_oth			-0.008					-0.073		
fin_access				0.795*					0.715**	
fin_contr					-0.53					-0.007
age	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.14
size	0.011	0.063	-0.014	0.071	0.117	-0.29	-0.81	-1.3	-1.88	-1.4
female	-0.006	-0.005	-0.005	-0.008*	-0.007*	-0.27	-0.74	-1.53**	-0.88**	-1.49
constant	0.822	1.763*	2.31	0.934	1.222	0.652	0.554	0.423	0.55	0.377

	1	2	3	4	5	6	7	8	9	10
sector fixed effects	yes	yes	yes	yes	yes	no	no	no	no	no
Wald test Prob > chi²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	452	197	182	434	438	452	307	452	434	452

Source: World Bank Enterprise Survey, 2014

Table 7: Organisational innovation

	1	2	3	4	5	6	7	8	9	10
internal_fin	0.009**					0.008**				
extfin_FI		0.017						0.018		
extfin_oth			-0.005						-0.005	
fin_access				0.594**						0.527*
fin_contr					0.097					0.102
age	0	0	0	0	0	0	0	0	0	0
size	0.03	0.054	0.042	0.058	0.087	0.046	0.076	0.093	0.077	0.104
female	-0.014	-0.014**	-0.02**	-0.013**	-0.02**	-0.01**	-0.01*	-0.02**	-0.01*	-0.01*
constant	-13.981	10.32	12.03	-3.44	9.63	0.809	0.887	1.61*	0.638	0.531
sector fixed effects	yes	yes	yes	yes	yes	no	no	no	no	no
Wald test Prob > chi²	0	0	0	0	0	0	0	0	0	0
N	307	307	452	434	438	307	307	452	434	438

Source: World Bank Enterprise Survey, 2014

For the innovation that involves R&D spending, the results (in Table 8) are different compared to the previous three outcomes. For instance, when sector fixed effects are not included, none of the finance coefficients is significant although they all retain their signs. This result suggests that R&D innovation are sector-specific with some sectors innovating more than others. Further analysis reveals that sectors like manufacturing and construction have high degrees of R&D while retail and services sectors have very low R&D. Moreover, internal finance source does not have significant impact on firm R&D innovation, but external finance from financial institutions and access to finance do. This shows that R&D is a special aspect of innovation among SMEs in Nigeria that require more of banking institutional support than internal financing. From the results, the coefficient of the financial access variable (which shows ease of assessing

bank loans) is high and suggests that SMEs that have access to bank loans and credit are 122 percent more likely to carry out R&D than the firms that do not have such access.

In terms of the firm characteristic factors, the results in Table 8 indicate that apart from the effects of female ownership of firms, the size of firms also matter significantly in carrying out R&D. The positive coefficient in each of the result outputs indicate that the larger the firm, the more it will likely spend on R&D. Smaller firms are less likely to spend on R&D as an innovation strategy.

Table 8: Research and Development innovation spending

	1	2	3	4	5	6	7	8
internal_fin	0.002				0.001			
extfin_FI		0.017*				0.018		
fin_access			1.22**				1.163	
fin_contr				-0.098				-0.046
age	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
size	0.339**	0.345**	0.31**	0.37**	0.34**	0.34**	0.29**	0.36**
female	-0.02**	-0.015**	-0.02**	-0.015**	-0.015**	-0.015**	-0.014	-0.014**
constant	12.18*	10.93*	7.66*	11.17*	-0.777	-0.899	-1.101	-1.041**
sector fixed effects	yes	yes	yes	yes	no	no	no	no
Wald test Prob > chi²	0	0	0	0	0	0	0	0
N	307	307	452	434	438	307	307	452

Source: World Bank Enterprise Survey, 2014

The last innovation equation relates to the effects of the finance and firm characteristic factors on the use of technology licensed from abroad by an SME. The results are reported in Table 9. In the result, only access to finance (in the fixed effects controlled) is significant in determine the use of foreign technology among the finance variables. Note that adoption of foreign technology involves larger costs, especially in regard to foreign exchange. SMEs would be reluctant in engaging in this type of innovation because of the higher costs involved, especially when bank financing is not forth-coming. This result is corroborated by the findings of Ayyagari et al (2007, 2011) who found that the more foreign exchange involved in a firm's investment strategy, the more innovative such a firm would be.

For the foreign technology adoption innovation, firm size is the main factor that matters. The results show that a larger has up to 87.1 percent chance of using

foreign licensed technology than a smaller firm. Thus, apart from finance, the nature of the firm is also critical to adoption of foreign technology as an innovation strategy.

Table 9: Foreign licensed technology innovation

	1	2	3	4	5	6	7	8
internal_fin	-0.005				-0.005			
extfin_FI		0.005				-0.001		
fin_access			1.674**				1.683	
k30				0.114				-0.255
age	0	0	0	0	0	0	0	0
size	0.871**	0.767**	0.643**	0.644**	0.714**	-0.009	0.565**	0.023
female	0.008	0.006	0.011	0.002	0.005	-0.02**	0.01	-0.015**
constant	-4.943**	-4.677**	-0.687	-4.18**	-3.94**	-4.27	-4.693	-3.22
sector fixed effects	yes	yes	yes	yes	no	no	no	no
Wald test Prob > chi²	0	0	0	0	0	0	0	0
N	307	307	452	434	438	307	307	452

Source: World Bank Enterprise Survey, 2014

Based on the model specified in (5), the results for effects of finance on firm productivity is presented in Table 10. When firm size is controlled in the model, finance source from financial institutions is not significant, thus suggesting that the size of a firm could preclude it from using funds from financial institutions to stimulate productivity. The other finance coefficients are significant and robust in the different estimations. This indicates that internal sources of financing have strong positive impacts on firm productivity. Also, external finance sources from sources other than the banks (e.g. supplier credits) have significant positive impact on firm productivity. In comparison with the persistent negative coefficient of other external finance sources in the innovation equations, it can be seen that finance sources do not matter for the improvement of productivity in SMEs in Nigeria. The sources only matter for innovation activities in the firms. as in the baseline regression for innovation, finance constraint has a positive impact on productivity while finance access tends to lead to decline in productivity. These outcomes are ironical and suggest that increasing finance access may not necessary stimulate productivity growth. Rather it is increasing the share of bank financing in investment activities that boost productivity. Segarra and Teruel (2009) as well as Goedhuys et al (2006) found similar results for advanced economies and Tanzania respectively.

Table 10: Productivity results

variables	1	2	3
internal_fin	0.023**	0.024**	0.096**
extfin_FI	0.012	0.014	0.103**
extfin_oth	0.019**	0.019**	0.054
fin_access	0.842	1.129	-0.533*
fin_constr	0.409**	0.399**	-0.006
innov_eply	0.517**	--	-0.503
innov_org	0.268	--	0.381
training	3.079**	3.146**	2.677*
age	0.084**	0.094**	0.193**
size	1.587**	1.612**	--
capacity tilization	0.014**	0.014**	-0.003
R^2	0.96	0.96	0.96
N	289	289	49

Source: World Bank Enterprise Survey, 2014

The firm characteristics variables performed well in the productivity model, especially when size of the firm is controlled. Employment innovation also has a positive impact on productivity growth among the firms. such innovation boosts productivity by about 51.7 percent, indicating that innovation is an essential factor in boosting productivity among SMEs. Firm age and size have positive impacts on productivity of the firms. also, capacity utilization tends to boost productivity.

CONCLUSION

The challenges facing growth and development of small, non-agricultural firms in Nigeria are enormous and divergent. The effects of poor operational environments are perennial and has drawn a variety of assessment in terms of the impact on firm performance and performance indicators. In this study, it has been shown that access to finance matters for firms in terms of investment in terms of innovation and productivity. There is therefore need to boost finance access by the firms with special focus on stimulating innovation among these firms in Nigeria. The study finds that innovation is low in Nigeria and finance access is a strong tool for boosting the innovation capacity of these firms. Moreover, since the study finds that internal financing of investment can only go so much in improving innovation strategies, government could step in by

providing subsidies and enabling environment for accessing easy funds. A pattern of sustained innovation over time becomes contagious and spreads within and among sectors, thereby spurring over rapid development of the industrial sector and economic growth in general. If the authorities recognize this, more focus would be on helping smaller firms improve their innovation, instead of just focusing of helping the firms produce more jobs. Increases in ability to generate more jobs may not be sustainable over time and borders more on welferistic inclinations. But when innovations grow and spread among firms, standard practices will be instigated and more jobs and higher incomes will be ensured.

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Appendix: Description of Variables intensity

Innovation outcomes	
Product innovation	Dummy with value 1 if any new or significantly improved product or service introduced by this establishment.
Process or method innovation	Dummy with value 1 if any new or significantly improved process introduced by this establishment.
Organization innovation	Dummy with value 1 if establishment make any changes in its organizational structure by creating, dissolving or merging any units of departments.
Innovation spending	Dummy with value one if organization spent on R&D in the last three years and 0 otherwise
Licensed innovation	Dummy with 1 if establishment uses technology licensed from a foreign-owned company, excluding office software
Employee innovation	Dummy with 1 if the establishment gave employees time to develop new product or idea in last three years and 0 otherwise
Productivity: Sales per worker	Logarithm of sales per worker
Finance	
Internal finance	Proportion of investment funded by owners' contribution or new equity issue

External finance (financial institutions)	Proportion of investment financed by banks and other financial institutions
External finance (others)	Proportion of investment financed by credit suppliers, etc
Financial access	Establishment has a line of credit or loans from a financial institution with 1 for having such and 0 otherwise
Finance constraint	How Much Of An Obstacle is Access to Finance. Index 0: not an obstacle to 4: very severe obstacle.
Firm characteristics	
Size	number of workers in the firm
training	Dummy that takes the value 1 if the enterprise trained its permanent staff in last three years and 0 otherwise
female	proportion of firm owned by female
Age	Age of the firm.
Capacity utilization	output actually produced relative to the maximum amount that could be produced with the firm's existing machinery, equipment, and regular shifts