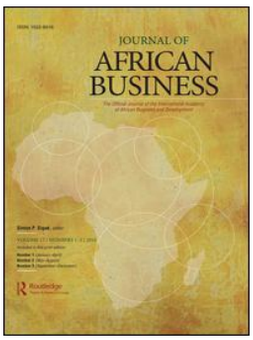

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Financial Access and Firm Productivity in Sub-Saharan Africa

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ABSTRACT

The paper investigates the effect of access to finance on the productivity of manufacturing firms in Sub-Saharan Africa. With the aid of the Semi-parametric approach by Levinsohn and Petrin, findings reveal that access to a cost-effective line of credit/loan or an overdraft facility has a positive effect on firm productivity. The study, therefore, concludes that it is of outmost benefit for firms to acquire credit facilities for more productive projects and that the credit constraints firms in Africa face should be significantly relaxed.

KEYWORDS

Financial access; productivity; TFP

JEL CLASSIFICATIONS

D24; G21; G31

1. Introduction

The average economic growth rate in Africa has been 5% over the past 15 years with little or no trickle-down effects on its populace (World Bank, 2015). Before then, most African countries experienced slow growth rates \over decades, and almost all Sub-Saharan African countries almost never met their projected economic growth rate. One possible reason for the low economic growth rate and underdevelopment is the low productivity growth (Wolf, 2007). It is estimated that Total Factor Productivity (TFP) has been growing far below potential on the African continent at an average rate of 2.1% in the 2000s (2001–2010), up from the 1.4% growth rate in the 1990s (see Nin-Pratt, Johnson, & Bingxin, 2012). A scalar of two of the current amount is expected for any meaningful change to take place on the continent. Therefore measures, approaches, and studies to boost productivity are always useful, which is why this paper is of paramount interest.

There is abundant documented empirical evidence (see Assefa & Mollick, 2017; Beck & Laeven, 2006; King & Levine, 1993; Schumpeter, 1911; World Bank, 2008) that finance and its various indices have a positive effect on economic growth. The channel through which this happens, however, is a gray area that is still being researched, as indicated by numerous authors (Gatti & Love, 2008; Levine & Warusawitharana, 2014; Osei-Assibey, 2013; World Bank, 2008). One such channel is the linkage between financial access and firms' productivity, measured mostly as TFP, which in turn affects economic growth and development.

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It is imperative to study TFP growth, especially within African economies, because empirical evidence suggests that cross-country differences in growth of gross domestic products per capita are due mainly to differences in TFP among these countries and not to factor accumulation (Chen & Guariglia, 2011; Easterly & Levine, 2001; Hall & Jones, 1999; Zheng, Bigsten, & Hu, 2009). Also, Africa has been identified as the region with the slowest growth in the world (Akinlo, 2005; Wolf, 2007). However, the few studies on TFP used either industry-level data focusing on industry-level determinants of productivity or country-level macroeconomic determinants (Akinlo, 2005; Biatour, Dumont, & Kegels, 2011), although evidence (Gal, 2013) indicates that using firm-level data has the potential to identify more credibly the effects of certain policies. Other studies (Chen & Guariglia, 2011; Osei-Assibey, 2013; Ahiakpor & Dasmani, 2012; Krishnan, Nandy & Puri, 2014; Gatti & Love, 2008) focused on specific countries such as Chinese manufacturing firms, Ghanaian firms, US firms, and Bulgarian firms. None of these studies seems to explore the specific link between financial access and firm-level determinants of TFP in Sub-Saharan Africa (SSA). Moreover, a couple of these studies (Nto & Mbanasor, 2011; Gatti & Love, 2008; Osei-Assibey, 2013) used cross-sectional data set constructed in their respective countries, which limits the accurate estimation of TFP over time, as well as the finance-productivity growth causality. This present study overcomes this barrier by using a more reliable World Bank's Enterprise survey panel data set to find out the effect of access to finance and other potential determinants of productivity of firms in Africa.

There may seem to be more important factors to firms' existence, but one key component that cannot be neglected is the firms' productivity. Paul Krugman said, "Productivity isn't everything, but in the long run it is almost everything" (Chen & Guariglia, 2011). Productivity is defined as efficiency in production and can be measured in two ways: partial or total. The most widely used measure, however, is the TFP. This, according to neoclassical theorist Solow (1957), is a residual of output after all factors, especially input components of labor and capital, have been accounted for. In other words, TFP is the output share of a firm that is inexplicable by the amount of labor, capital, and other input factors used in the production process. The partial measure, which is total output per unit of input such as labor (labor productivity), has inherent limitations such as its inability to show clearly why productivity varies across firms (Nto & Mbanasor, 2011) and hence is hardly used in empirical studies. Every effort to enhance firms' productivity growth is instrumental, and one way of doing so is by identifying and enhancing its determinants.

Access to finance refers to easy availability and cost-effectiveness of financial products and services to firms. The 2008 World Bank Finance for all report posits that there are three main channels through which finance, and especially external finance, affects firms' productivity and growth; easy access to finance enables most firms in their early years and helps them to be more innovative. Secondly, finance enables firms to take advantage of economies of scale and opens more investment doors. Finally, easy access to finance is needed to acquire a more efficient productive asset portfolio. The rest of this paper is divided into four sections, including a theoretical and empirical review, data and methods, results, a conclusion, and policy implications.

1.1. *Theoretical review*

There are different models of productivity growth: the classical models (Malthus-Ricardo model and Harrod-Domar model), the neoclassical model, and the new growth model. Briefly narrated below are the latter two which are fundamental to this study, especially the neoclassical model.

1.1.1. *Neoclassical model*

The neoclassical model pioneered by Robert Solow explains that exogenous technical progress drives productivity growth because of diminishing returns to capital. Thus, productivity growth can be attributed to more capital accumulation, but only in the short run, due to diminishing returns. In the long run, however, any improvement in productivity is explained by exogenous factors rather than endogenous causes (capital and labor). The neoclassical model uses the production function as shown below, which is extensively discussed in the methodology section.$Y_{it} = A_{it}F(K_{it}, L_{it})$. The Solow model explains that "A," which represents productivity, is exogenously determined.

1.1.2. *New growth model (endogenous growth model)*

The new growth model explains productivity growth with endogenous technical progress by ignoring diminishing returns to capital or by citing internal reasons for technical progress (Stiroh, 2001). The model explains that the neoclassicals failed to consider the effects of research and development and the stock of knowledge that may be available to firms, and hence diminishing returns has no effect on productivity (Romer, 2006). Thus, while the neoclassicals think that "A" is determined outside the model, the new growth theorists think it is determined within the model. They see "A," which is technical progress measured by TFP as a deliberate investment in human capital and research and development (Biatour et al., 2011). The neoclassical model is central to this study due to the concern that productivity is defined as the output share of a firm that is inexplicable by the amount of labor, capital, and other input factors used in the production process, rather than as an unobservable and hence exogenously determined characteristic of firms, as alluded to by neoclassicals.

1.2. *Literature*

The financial development and economic growth nexus has been established since the early days of Schumpeter in the 1900s. A deepened financial system boosts economic growth through its effect on business expansion and investment, better household welfare, allocative efficiency and risk diversification (Jun, Wan, & Jin, 2007; King & Levine, 1993; Levine & Warusawitharana, 2014; Quartey, 2003). Situated in the financial development-economic growth nexus, however, is the financial access and productivity linkage which is this study's principal focus. The discussion on the relationship between access to finance, especially external credit and productivity of firms, begins with the profound work of Gatti and Love (2008), whose findings revealed that access to credit impacts positively on the productivity of 548 sampled Bulgarian firms. They used access to a credit line and an overdraft facility as alternative means to access credit, among hosts of other correlates that include firm size, age, foreign ownership, and export

orientation. The Levinsohn and Petrin (2003) approach was used as to measure productivity, and the Ordinary Least Square was used both to check the robustness of the productivity measure and as the main technique for the second stage regression. In relation to the above, Goedhuys, Janz, and Mohnen (2006) opined that access to external finance (credit) results in a higher TFP for Tanzanian manufacturing firms. They also determined that among variables that include research and development and innovation, technological variables such as foreign ownership, International Organization for Standardization (ISO) certification, and high education of management have a significant positive effect on productivity. Levine and Warusawitharana (2014), on their part, found debt finance to be associated with higher TFP in four European countries: Spain, France, Italy, and United Kingdom. Another strand of literature headed by Arnold, Mattoo, and Narciso (2008) studied service inputs and productivity of firms and discovered that factors such as good access to telecommunication inputs and foreign-owned firms had a significant positive effect on the productivity of manufacturing firms in some selected Sub-Saharan African economies, while difficulty in accessing credit and power outage had adverse effects on productivity. Chauvet and Jacolin (2015) identified foreign ownership, size, export, and overdraft facility as statistically significant and positive firm-level determinants of productivity.

A study by Krishnan et al. (2014) also shows that increased access to bank financing plays a positive role in the productivity of smaller and financially constrained firms. Their study, unlike the others, was based on a natural experiment of private and public manufacturing firms in the United States of America, after an interstate banking deregulation that increased access to bank financing. Similarly, Robb and Robinson (2014) found that increased access to bank finance plays a very critical role in productivity, especially for small and start-up firms, which need bank finance to operate. It is evident from their study that a large proportion of startups rely heavily on bank debt financing. Findings in China also conform to these results. Du and Girma (2012) observed in a large survey of Chinese firms that access to domestic bank loans was positively related to the productivity of much bigger firms and those with foreign investment, while self-raised finance was instrumental to the growth of smaller firms, medium firms, and domestically privately owned firms.

2. Data and methods

2.1. *Data*

The data are sourced from the World Bank's Enterprise survey, which collects standardized panel data sets with uniform sampling methods and, as such, constrains minimal errors comparable among countries. The enterprise survey is a firm-level survey designed to collect panel data sets of a representative sample of an economy's private sector, usually the manufacturing and service sectors. These surveys cover business environment topics including access to finance and performance indicators which capture production function variables. The sample for this study covers 15 Sub-Saharan African countries between 2003 and 2014 due to data availability, but with a good representation of the major countries on the continent. These countries include Angola, Botswana, Burkina Faso, Cameroon, DRC, Ghana, Kenya, Malawi, Mali,

Nigeria, Senegal, South Africa, Tanzania, Uganda, and Zambia. This study focuses only on the manufacturing sector with examples of products such as food, textiles, metals, chemicals, furniture, machinery, and equipment. The sample of manufacturing firms used for this study totaled 2,830.

2.2. *Estimating TFP*

Production function could take several forms such as the Transcendental Logarithmic (Translog) production function, the Constant Elasticity of Substitution, and the Cobb–Douglas production function. This study, like most empirical studies (Arnold et al., 2008; Chen & Guariglia, 2011; Eifert, Gelb, & Ramachandran, 2005; Gatti & Love, 2008; Osei-Assibey, 2013), uses the Cobb–Douglas production function in estimating TFP. The Cobb–Douglas production function expresses output (sales) as a function of labor, capital, and intermediate inputs. It also contains "A_{it}," which is the main variable of concern when estimating productivity. It captures the residual after accounting for all input variables, and it is used to measure productivity, i.e., it represents changes in output (sales/revenue) that cannot be accounted for by the various inputs. The process of estimating TFP is shown below:

$$Y_{it} = A_{it}{K_{it}}^{B_1}{L_{it}}^{B_2}{M_{it}}^{B_3} \tag{1}$$

where Y_{it} represents Output/Sales, K_{it} represents Capital stock, L_{it} represents Labor, M_{it} represents intermediate inputs, and A_{it} represents TFP (Hicks neutral shifter) of firm i at time t. B_1, B_2, and B_3 are capital, labor, and intermediate input shares respectively. If the input shares (B_1, B_2, and B_3) sum up to 1, less than 1 and more than 1, the production function exhibits constant returns to scale, decreasing returns to scale, and increasing returns to scale respectively.

The next step in estimating TFP is by taking the natural log of the production function (the logs are used in order to estimate average level firm input elasticities, which show the degree of responsiveness of output to changes in the various inputs used in the production function). This results in a linear production function as shown in equation (2):

$$\ln Y_{it} = \ln A_{it} + B_1 \ln K_{it} + B_2 \ln L_{it} + B_3 \ln M_{it} \tag{2a}$$

Since equation (2a) is estimated as a regression, it can be expressed as:

$$\ln Y_{it} = B_0 + B_1 \ln K_{it} + B_2 \ln L_{it} + B_3 \ln M_{it} + \varepsilon_{it} \tag{2b}$$

TFP is measured as the residual (Solow residual) and expressed as:

$$\ln A_{it} = \ln Y_{it} - B_1 \ln K_{it} - B_2 \ln L_{it} - B_3 \ln M_{it} \tag{3}$$

$$\ln A = B_0 + \varepsilon_{it} \tag{4}$$

B_0 is the mean productivity across firms over time, and ε_{it} is the deviation from the mean productivity for firm i at time t. TFP is finally estimated as the exponential of the sum of the residual and constant:

$$TFP_{it} = \exp(B_0 + \varepsilon_{it}) \tag{5}$$

Thus, $(TFP)_{it}$ serves as this study's dependent variable.

2.3. Productivity estimation techniques and methodological issues

TFP can be estimated using several approaches, notably Ordinary Least Square (OLS), Fixed Effects, Random Effects, Generalized Method of Moments (GMM), and the Olley and Pakes (1996) and Levinsohn and Petrin (2003) methods. However, only the three methods used in this paper, OLS, Fixed Effects, and the Levinsohn and Petrin (2003) method, are briefly discussed and their inherent limitations outlined.

2.3.1. OLS

It is believed that the use of the traditional method of OLS in estimating TFP on a panel of firms has input choices more likely to be correlated with productivity, resulting in what is termed simultaneity or endogeneity bias (Van Beveren, 2010), and hence biased and inconsistent estimates.

2.3.2. Fixed Effects

Fixed Effects is one of the traditional econometric methods used to deal with simultaneity bias or endogenous input. Fixed Effects, however, require a restrictive assumption that firm-observed productivity is time-invariant, which is imprecise, given that panel data which is used in most cases as well as in this study spans over long periods (Staal & Brogaard, 2011). This model is expressed in equation (6). Lower-case letters are used to represent the natural logarithm of the production function, with "y" representing output, "k" representing capital, "l" representing labor, "m" representing intermediate inputs, "w" representing deviation from mean productivity, which is observed by the firm but unobserved by the econometrician, and "u" representing deviation from mean productivity, which is unobserved by both the firm and the econometrician.

$$y_{it} = B_0 + B_1 k_{it} + B_2 l_{it} + B_3 m_{it} + w_i + u_{it} \tag{6}$$

It can be observed from equation (6) that the firm-observed mean productivity does not have the time dimension, "t" subscripts supposing that it is invariant with time. Estimating equation (6) using Fixed Effects partly removes the simultaneity and endogeneity concerns. However, extant literature (Ackerberg, Benkard, Berry, & Pakes, 2007; Van Beveren, 2010) has indicated that fixed effects does not perform well in practice and also produces capital shares or elasticities that are unreasonably low.

2.3.3. Levinsohn and Petrin (2003) method

At the base of the Levinsohn and Petrin (2003) approach is the Olley and Pakes (1996) method. Olley and Pakes (1996) semi-parametric approach tried to solve the simultaneity issue inherent in the OLS and Fixed Effects approach by using the firms' investment as a proxy for unobserved productivity shock. It requires a monotonicity condition that investment must be strictly increasing in productivity (Van Beveren, 2010), implying that only observations with positive investments are considered. This results in significant loss of data, creating somewhat inefficient and biased coefficients. Also, a number of firms can report zero investment, which is ignored by Olley and Pakes (1996). Levinsohn and

Petrin (2003) addressed this concern by using intermediate inputs as a proxy for unobserved productivity shock. Most firms, especially manufacturing firms, report positive usage of intermediate inputs: raw materials, intermediate goods, fuel, etc.; hence the use of the Levinsohn and Petrin method as a proxy for unobserved productivity shock retains far more observations than the Olley and Pakes method. For the technicalities of all these productivity estimations, see these papers (Levinsohn & Petrin, 2003; Olley & Pakes, 1996; Van Beveren, 2010). This paper, therefore, mainly uses the semi-parametric method by Levinsohn and Petrin (2003) in estimating productivity (TFP), because it controls for simultaneity between firms' inputs and productivity shocks with intermediate input as a proxy, capital as a state variable and labor as a free variable. The OLS and Random Effect are used as alternatives for robustness checks. The choice of the random effects over the fixed effects is due to its appropriateness in this present study as confirmed by the performance of the Hausman specification test.

2.4. Empirical model

The second major procedure after estimating productivity (TFP) will be to regress TFP_{it} on several of its policy variables. The main policy variable of concern in this study is financial access proxied by access to an overdraft facility or a line of credit/loan. Other potential determinants of firms' productivity identified in the literature are ownership status, export orientation, power outage, gender of manager, managerial experience, and certification. Also, firm-level control variables as suggested by recent studies (Du & Girma, 2012; Gatti & Love, 2008; Osei-Assibey, 2013) to be included in the model are age, size, and location. To the extent that all these control variables are significant, a positive relationship with productivity is expected. The specification of the empirical model is as shown below:

$$TFP_{it} = B_1 FinAcc_{it} + B_2 FirmChar_{it} + B_3 FirmCont_{it} + u_i + u_t + \varepsilon_{it} \quad (7)$$

Where TFP_{it} is total factor productivity of firm in time t, and $FinAcc_{it}$ is a proxy for financial access of firm i in time t, which is the key explanatory variable. Alternative measures of financial access used in this study are overdraft facility and line of credit/loan. $FinAcc_{it}$ is a vector of firm i's characteristics at time t, which include ownership status, export orientation, power outage, gender of top manager, managerial experience, and certification. $FinAcc_{it}$ is a vector of firm-level control variables which include the age of the firm, firm size, and location. B_1, B_2 and B_3 are the parameters to be estimated on financial access, firm characteristics, and firm controls respectively. U_i, U_t, and $\mathcal{E}_{it}$ represent the firm-specific effect, time-specific effect, and idiosyncratic error respectively.

2.5. Choice of empirical model estimation technique

Panel data regression models can be estimated using several approaches including GMM, Instrumental Variables, Fixed Effects, and Random Effects. The choice between the Fixed Effects and the Random Effects, however, is usually decided by the use of the Hausman test.

The null hypothesis underlying the Hausman test suggests that the random effects is more appropriate. Rejection of the null hypothesis, therefore, will imply that the error component model (random effects) is not appropriate, and hence the fixed effects will be preferred. The Hausman test performed for this study in the choice between fixed effects and error component model in estimating the determinants of TFP is shown in Appendix 1. The error component model was chosen because Prob > chi2 = 0.1445, implying the failure to reject the null hypothesis at the 5 percent significant level. It should be noted that the fixed effects model produced highly insignificant and inconsistent results, resonating the essence of the usage of the random effects.

3. Results

3.1. *Summary statistics of productivity estimators*

Table 2 shows summary statistics of the variables used in estimating productivity and the natural logarithm of the estimated productivity itself. These variables are the natural logarithm of sales, capital, labor, and intermediate inputs represented as ln_sales, ln_capital, ln_labor, and ln_intermediate, respectively. The average sales, capital, labor, intermediate inputs, and TFP are 14, 6, 12, 13, and 8, respectively. Though the summary statistics is worth presenting, not much exposition is needed here, since a detailed explanation of the more desired productivity estimates is presented in the next section.

3.2. *Summary statistics of production function estimates*

Table 3 shows the summary statistic of the coefficients or input elasticities of variables used in estimating TFP using the Levinsohn and Petrin method (LEVPET), Random Effects (RE) and OLS techniques. The input elasticities of all three models conform to previous traditional empirical findings, with OLS and RE estimates producing almost similar results, but for the statistically significant level of capital and the standard errors for all inputs, which seem slightly different. The input factor elasticity for OLS and RE sums up to 0.982. It should further be noted that, except for capital using the RE, all other inputs are highly significant even at the 1% significance level, depicting the strong suitability of the Cobb–Douglas production function for these firms. It can also be observed that labor and intermediate inputs accounted for 96% variation in annual sales of firms in SSA with a paltry 2% usage of capital. This confirms that most firms in Africa are more labor-intensive, produce low value-added products, and use little capital for manufacturing, one major fact identified in the literature to be responsible for its slow pace development. All three inputs are jointly significant and explain the 92% variation in sales.

The more robust Levinsohn and Petrin (2003) method uses labor as a free variable, intermediate inputs as a proxy variable, and capital as a state variable, and since intermediate input is used as a proxy for unobserved productivity shock, it is lost in the process of estimating TFP. The labor coefficient under the LEVPET method, as can be seen from Table 3, and decreases slightly to 0.42, while capital increases significantly to 0.17 from 0.48 and 0.03, respectively, a plausible indication of correcting simultaneity

Table 1. Measurement and classification of variables.

Variable	Classification	Measurement
Output/Sales	Continuous variable	This is measured as the monetary value of all manufactured goods sold during the year. All sales data have been converted to international dollars and deflated using country-specific GDP deflators with 2010 used as the base year.
Capital	Continuous variable	Capital is measured as net book value of firms' capital stock or assets. This is computed as the purchase value of assets minus depreciation. Assets include buildings, structures, machinery, plants, and equipment. Capital stock is also deflated as sales.
Labor	Continuous variable	Labor is measured as the total cost of labor including total annual wages, salaries, and annual benefits. Labor cost is also deflated as sales
Intermediate inputs	Continuous variable	This comprises the annual cost of all inputs used in the production process. It includes raw materials and intermediate goods as well as fuel.
Overdraft facility	Dummy variable	This refers to a flexible account that firms can draw upon in the event that their account balance becomes negative. The firms will incur fees or are subject to interest payments if they exercise this option.
Line of credit	Dummy variable	This refers to the available amount of credit that the establishment can draw upon or leave untapped. Lines of credit usually carry monthly interest rates and are repaid quickly (as soon as the establishment's cash flow allows for repayment).
Loan	Dummy variable	This is generally a much less flexible form of finance. It comes in fixed amounts (rather than ranges), carries annual interest rates (either fixed or floating), and has a determined term to maturity (finite period for repayment).
Location	Dummy variable	This refers to the geographical location of the firm, that is, whether or not the firm is located in the capital city.
Foreign ownership	Dummy variable	This refers to whether the firm is owned by a resident or a foreigner. Ownership is defined in terms of the nationality of the shareholders. A firm is considered to have foreign ownership if at least 10% of ownership is held by foreigners. If the firm has less than 10% foreign ownership, it is classified as domestically owned
Export orientation	Dummy variable	This refers to whether the firm exports part or all of its products. A firm is said to be an exporter if at least 10% of its annual sales is exported.
Firm size	Dummy variable	Firm size means whether a firm is small, medium, or large. A small firm is one that employs 5–19 employees inclusive. A medium firm is one that employs between 20 and 99 employees inclusive, while a large firm employs 100 or more people.
Firm age	Continuous variable	Age refers to the number of years the firm has been in operation in the country of concern. It is computed as the difference between the year the survey was undertaken and the year the firm was established, plus one.
Managerial experience	Continuous variable	This is the number of years the top manager has worked with the firm. Top manager refers to the highest management personnel of the firm.
Female manager	Dummy variable	This means the top manager heading the firm being female.
Quality certification	Dummy variable	Certification implies whether the firm has received and still has an internationally recognized quality certification. An example is the International Organization for Standardization (ISO)
Power outage	Continuous variable	This refers to the average number of days in a month the firm experienced power outages during the fiscal year.

Source: World Bank's Enterprise Survey.

Table 2. Summary statistics.

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
ln_Sales	2830	14.05492	3.790926	5.183258	27.64247
ln_Capital	2830	6.281263	1.742734	0	7.658227
ln_Labour	2830	12.1178	3.725933	4.087796	26.3656
ln_Intermediate	2825	12.78358	3.982537	3.363099	27.02933
ln_TFP	2830	7.944146	2.38059	2.162691	18.64314

Source: Author's computation from World Bank's Enterprise Survey.

Table 3. Production function estimates.

	OLS	RE	LEVPET
ln_Labour	0.4752009*** (0.0253943)	0.475201*** (0.017217)	0.416324*** (0.024159)
ln_Capital	0.0260897*** (0.014076)	0.02609** (0.011511)	0.169686 (0.435566)
ln_Intermediate	0.479986*** (0.0246822)	0.479986*** (0.016101)	
Constant	1.998915*** (0.1010957)	1.998915*** (0.098217)	
R^2	0.9212	0.9212	
N	2,825	2,825	2,825
Wald test of constant returns to scale $Chi^2 = 0.63$			

The dependent variable is a natural log of sales and robust standard errors are in parenthesis.
***Significant level at 1%; **significant level at 5%.

and endogeneity bias otherwise present in the RE and OLS. The null hypothesis of the Wald test of constant returns to scale (whether the input elasticities sum to one) is rejected even at the 5% significant level, indicating decreasing returns to scale of 0.6. This finding is not far from the findings of Qureshi and Velde (2007) who had decreasing returns to scale of 0.72 for Zambian firms using the Levinsohn and Petrin (2003) estimation approach, Gatti and Love (2008) who had 0.71 for Bulgarian firms, and Eberhardt and Helmers (2010) who had 0.55 for UK firms. The estimation of TFP used as the regressand in the second stage regression was carried out mainly using the LEVPET method because it supposedly addresses all the major productivity estimation concerns as indicated in Section 3.

3.3. *Summary statistics of variables used in regression analysis*

The descriptive statistics of variables used in the second model are presented in Table 4. The average age of the firms is 18 years, meaning that the firms used in the study have been in existence for quite a reasonable number of years for which they should have been productive. The average power outage is nine times in a month. This presupposes that firms operate with power outages averaging nine times in a typical month, which is expected to have an adverse effect on the firms' productivity. Also, the average number of years the top manager has worked in a typical firm is 15 years. This is quite high considering that the labour turnover in most Sub-Saharan African countries is high. It can also be observed that 12% of firms used in this study have an internationally recognized quality certification for their operation. Also, approximately 19% of these firms export at least 10% of their annual sales, while 16% have at least 10% foreign ownership in terms of shareholding status. It is expected that these variables will have a positive impact on the productivity of firms. In addition, 16% and 25% of the sampled firms are large-sized and medium-sized firms respectively, while the remaining 59% are

Table 4. Summary statistics of regressors.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Age	2830	17.54311	14.33397	1	108
Power outage	2827	9.249027	18.28688	0	500
Managerial Experience	2830	15.23604	10.00909	0	61
Certification	2830	0.1208481	0.3260082	0	1
Overdraft	2830	0.2975265	0.4572509	0	1
Line of credit	2830	0.239576	0.4269001	0	1
Exporter	2830	0.1890459	0.3916143	0	1
Foreign-owned	2830	0.159364	0.3660798	0	1
Large size	2830	0.0159011	0.1251149	0	1
Medium size	2830	0.024735	0.1553438	0	1
Location	2830	0.1477032	0.3548682	0	1
Female Manager	2830	0.0229682	0.1498285	0	1

Source: Author's computation from World Bank's Enterprise survey.

small-sized firms. Fifteen percent of firms are also located and operate in the capital city of their respective countries, and 2% have a female as the top manager.

Finally, in terms of the variables used as a proxy for financial access, 24% of the firms have a line of credit or loan from a financial institution, while 30% have an overdraft facility. It is the study's expectation that both access to a line of credit/loan and an overdraft facility will impact productivity positively.

The correlation matrix of all explanatory variables and dependent variable used in the regression is presented in Table 5. The correlation between ln_TFP and the explanatory variables is of no concern, and all the variables came out with their expected signs. Also, there is no alarming concern for multicollinearity or high correlation among the explanatory variables, since none of the variables had a correlation value of 0.5 or more.

3.4. *GLS random-effects estimation*

Access to finance proxied by access to an overdraft facility or a line of credit/loan facility has a significant positive relationship with a firm's TFP. The main variable is access to an overdraft facility, while access to a line of credit/loan is used for robustness. The main difference in the results is that the overdraft is statistically significant at the

Table 5. Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13
ln_TFP (1)	1.00												
Age (2)	0.22	1.00											
Overdraft(3)	0.23	0.25	1.00										
LineCredit (4)	0.12	0.21	0.41	1.00									
Cert (5)	0.18	0.19	0.13	0.19	1.00								
Export (6)	0.19	0.24	0.21	0.19	0.24	1.00							
Foreign (7)	0.21	0.16	0.20	0.11	0.23	0.21	1.00						
Large (8)	0.00	0.01	0.03	0.05	0.12	0.02	0.09	1.00					
Medium (9)	−0.02	−0.03	0.02	0.05	0.04	0.00	0.09	−0.02	1.00				
Location(10)	−0.15	−0.16	−0.09	−0.05	−0.04	−0.09	0.00	0.25	0.20	1.00			
Female (11)	−0.07	0.00	−0.00	0.01	0.00	0.03	−0.02	−0.02	0.04	−0.00	1.00		
Powerout(12)	−0.05	−0.00	−0.01	0.00	−0.01	−0.01	−0.02	−0.03	−0.03	−0.01	0.01	1.00	
ManExp (13)	0.11	0.46	0.18	0.15	0.03	0.13	0.06	0.00	−0.00	−0.07	−0.01	0.06	1.00

Source: Author's computation from data (2016).

1% significance level and has a higher coefficient, while the line of credit is statistically significant at the 5% significance level. This finding means that firms that have easy access to lower-cost sources of external finance are more productive than those that do not. It stands to reason that firms that can easily have external sources of finance will quickly tap into them when needed and utilize them well for the firms' benefit. This is so because firms that have access to external finance can be more innovative, which also opens more investment opportunities as indicated by World Bank (2008).

The various robustness checks and the introduction of firm controls may not be enough to produce unbiased estimates, since endogeneity concerns may still persist as to the relationship between financial access and firm productivity. That is, does access to an overdfraft facility or line of credit/loan make firms more productive? Do more productive firms stand a better chance of getting access to external financing, as mentioned in earlier studies by Du and Girma (2012), Arnold et al. (2008), and Gatti and Love (2008)? This paper addresses this concern by intrumenting financial access with sales growth using a two-stage least squares (2SLS). This is so because external credit is more likely to be extended to firms that show growth potential than those that do not; hence the correlation between sales growth and financial access makes it a good instrument as backed up by literature (see Gatti & Love, 2008). Access to an overdraft facility and line of credit/loan both remained positively related to productivity and significant, even at the 1% significance level after contolling for endogeneity, but the coefficients are greater than those from the original result in Table 6.

The age of the firm has a positive relationship with productivity, in conformity with a priori expectations, and is also statistically significant. Age-squared, although it has the negative expected sign, is insignificant. This means that as firms get older, they tend to be more productive, probably taking advantage of learning by doing techniques, goodwill through enhanced reputation, and economies of scale. The increment in productivity as a firm gets older is only up to a point in time, hence the need to

Table 6. GLS random-effects estimation.

Independent variable: natural log of TFP		
Dependent variables	Coefficients	Robust standard errors
Age	0.0213701**	0.0088083
Age squared	−0.0000098	0.0001168
Line of credit	0.1914243**	0.0956006
Overdraft	0.7427995***	0.0963309
Export	0.5337177***	0.1153265
Foreign ownership	0.9212003***	0.1246501
Large-sized firms	−0.0102069	0.2750743
Medium-sized firms	−0.134728	0.2058245
Location in capital	−0.7558467***	0.0991208
Certification	0.6661189***	0.1381276
Female manager	−1.170641***	0.2963173
Power outage	−0.0069961***	0.00207
Managerial experience	−0.0067634	0.0138699
Managerial experience squared	0.0002803	0.0003156
Constant	7.418251***	0.1280878
Number of firms	2,827	Wald chi^2 (13) = 471.94
R^2: within	0.0006	Prob > chi^2 = 0.0000
Between	0.1271	
Overall	0.1208	

***Significant level at 1%; **significant level at 5%.

introduce the age-squared, which supposedly takes care of the nonlinearity. Export orientation is another important determinant of firms' productivity. Export has a positive sign as expected and is highly significant at the 1% significance level. The implication is that firms that export part or all of their annual sales are more productive than those that do not. Foreign ownership, just like export orientation, is statistically and highly significant with a positive sign as expected, implying that firms that have a foreign stake are more productive than those that are wholly domestically owned or have less foreign control. The reasoning behind this is that foreign-owned firms bring foreign expertise and skills to bear on the local scene and make firms more productive, not neglecting the fact that foreign-owned firms enjoy certain preferential treatment and facilities that local firms may not enjoy.

Gender of manager is another significant determinant of productivity of firms, but with an inverse relationship. This indicates that firms that have a female as their top manager are far less productive. This is in line with the findings of Naude and Nagler (2014) who alluded to the time-demanding nature of running businesses, which constrains women due to pressures from home duties. This is a plausible reasoning especially among African nations where there is a culture of women having to play major domestic roles irrespective of their position in the corporate world. Another very important variable that seems to surprisingly impact negatively on firms' productivity and is also highly significant even at the 1% significant level is a location in the capital city. Firms that are located in the capital city or town are less productive than those that are located in a city that is not the capital or in any rural area. This result is quite amazing and unexpected, since firms located in the capital city have access to a more developed infrastructure and enhanced conditions of service, even in Sub-Saharan African countries.

Being internationally certified is undisputedly a statistically significant determinant of productivity of firms in SSA. Manufacturing firms that have received and still have an internationally recognized quality certification such as ISO certification are more productive than those that are not certified or are yet to be certified. The reason for this phenomenon (see Goedhuys et al., 2006) is that being certified is a good indicator of the quality of the firm's products; it grants firms access to international markets and enables them to charge higher prices, hence inducing productivity. Increasing prices in conjunction with improved productivity is in line with economic theory: the marginal product should be equal to price. So the higher the marginal product, the higher the price should be. The last but not least determinant of firm productivity that is statistically and highly significant even at 1% and had the expected negative sign is power outage. The negative nexus on power outage measured by the average number of days in a month that a firm experienced power outage during the fiscal year implies that firms are adversely affected when they experience frequent outages during operation, due to losses in production, and more so, when there are no alternative sources of power or when the alternative sources are very costly.

In summary, overdraft, line of credit, export orientation, foreign ownership, gender of manager, certification, and power outage are statistically significant determinants of firms' productivity in SSA, while age squared, large, medium, managerial experience, and managerial experience square are not. Consistent with these findings is the robust OLS, which was used for robustness checks and the results presented in Appendix 2.

4. Conclusion and policy recommendations

There is an abundant literature to show that finance plays a very significant role in the economic growth and development of nations across the globe (see Beck & Laeven, 2006; World Bank, 2008). The precise channels and linkages through which the broad measures of finance such as financial development, financial deepening, and financial inclusion affect economic growth are in a high dearth. One such channel is the nexus between financial access and firm productivity, which this paper focuses on. Using panel data from the World Bank's Enterprise survey and with the aid of a semi-parametric approach by Levinsohn and Petrin, this study has revealed that gaining access to an overdraft facility or a line of credit/loan has a positive and statistically significant effect on firm productivity. Also, after controlling for firm size, age, and location, export orientatation, foreign ownership, and internationally recognized quality certification have been identified to have a positive effect on productivity, while being headed by females and having frequent power outages adversely affect productivity. Other variables such as age squared, managerial experience, large-sized firms, and medium-sized firms do not seem to have any meaningful effect on productivity.

The paper suggests as a policy recommendation that firms should be sensitized on benefits of acquiring credit facilities for more productive projects, and that credit constraints should be significantly relaxed for firms. Manufacturing firms should also try as much as possible to acquire internationally recognized quality certification, since this translates into the firms' products being viewed as quality and serves as a basis for increasing prices. Finally, policies to integrate African economies into the world economy and market should not be hampered. This is because export orientation and access to foreign knowledge are of paramount significance.

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Appendix

Appendix 1. Hausman specification test of TFP determinants.

	Coefficients			
Variables	Fixed effects (b)	Random effect (B)	Difference (b − B)	SE (sqrt(diag(V_b-V_B)))
Large	0.3576073	−0.0102069	0.3678142	3.564022
Age squared	−0.0036124	−0.0000098	−0.0036026	0.0029518
Line of credit	−0.3459349	0.1914243	−0.5373592	1.156438
Man Exp	0.2216238	−0.0067634	0.2283872	0.16524230
ManExp squared	−0.0055938	0.0002803	−0.0058742	0.0041938
Age	0.1945049	0.0213701	0.1731349	0.1953602
Certification	−1.026623	0.6661189	−1.692742	1.785495
Overdraft	0.3386	0.7412	−0.4025	1.2107
Exporter	−0.5584575	0.5337177	−1.092175	1.498366
Foreign	2.412864	0.9212003	1.491664	1.665916
Location	1.096373	−0.7558467	1.852219	1.661543
Female manager	−0.3313233	−1.170641	0.8393178	1.465496
Power outage	.031086	−.0069961	0.0380821	.0328936

b = consistent under Ho and Ha; obtained from xtreg.
B = inconsistent under Ha, efficient under Ho; obtained from xtreg.
Test: Ho: difference in coefficients not systematic.
chi2 (12) = (b-B)'[(V_b-V_B) ^ (−1)] (b-B).
= 17.14
Prob>chi2 = 0.1445.

Appendix 2. Robust OLS estimation with Levinsohn and Petrin for TFP.

Independent variable: natural log of TFP		
Dependent variables	Coefficients	Robust standard errors
Age	0.0213701**	0.0087977
Age squared	−0.0000098	0.0001165
Line of credit	0.1914243**	0.0954307
Overdraft	0.7427995***	0.0962682
Export	0.5337177***	0.1152402
Foreign ownership	0.9212003***	0.1236894
Large-sized firms	−0.0102069	0.2741215
Medium-sized firms	−0.134728	0.2016896
Location in capital	−0.7558467***	0.0995211
Certification	0.6661189***	0.1381301
Female manager	−1.170641***	0.296793
Power outage	−0.0069961***	0.002068
Managerial experience	−0.0067634	0.0139279
Managerial experience squared	0.0002803	0.0003162
Constant	7.418251***	0.1279643
Number of firms	2,827	F (13, 2813) = 36.63
R^2	0.1208	Prob > F = 0.0000

***Significant level at 1%; **significant level at 5%.