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Finance and Firm Productivity in Africa:
Background Study from World Bank
Enterprise Survey Data

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Enterprise Survey Data

ABSTRACT

Access to finance has been considered to be one of the important factors in influencing firms' real activities and in promoting aggregates. However, literature on the relationship between finance and firm-level productivity is almost non-existent for African countries. This paper fills this gap by using cross-sectional firm-level data to estimate the effect of access to finance on labour productivity, total factor productivity (TFP), and the stochastic frontier trans-log model. This study estimates an instrumental variable model - two-stage estimator to address potential endogeneity bias between access to credit and firms' productivity. The results obtained show that the lack of access to finance, especially overdraft facilities negatively affects the productivity of firms in Africa. Also, smaller firms and sole-proprietorships are mostly affected because they have less access to finance. This study suggests that the development of a balanced financial system should be of topmost priority to policy makers. This ensures that more finance is channelled towards those firms whose productivity depends heavily on the availability of finance irrespective of their characteristics. This would result in firms increasing their investments in productivity-enhancing activities, which would benefit long-term economic growth.

Keywords: Productivity, Total Factor Productivity, Cobb-Douglas, Production function, Finance.

JEL Classification: E62, D24, G32

1. Introduction

The growth and competitiveness of Africa's enterprises are important catalysts for increasing rate of growth and development in Africa's economy (Becks et al., 2013). According to African Development Bank Group Report 2015, the informal sector¹ contributes about 55 percent of Sub-Saharan Africa's GDP. Predominantly, small and medium-sized enterprises (SMEs) are commonly recognised as drivers of economic growth, innovation, diversification, regional development, job creation, and contribute to more than 80 percent of output and employment in most African countries (Becks et al., 2013). However, a vast majority of firms in Africa are constrained by several factors such as limited access to stable energy service, skilled labour, business management, and access to finance for investment from both the formal and informal sector (Becks et al., 2013).

This study focuses on the finance constraint and examines the effect of access to internal and external finance² on firms' productivity. Although, there are diverse ways through which firms can finance their operations and growth, the choice of a particular method is determined by management preferences and available options (Gatti and Love, 2008). However, the availability of external finance is largely a component exogenous to the firm, determined by the wider institutional environment. The lack of internal finance may suggest that the firm is not profitable or profits have been exhausted on other projects and funds are not available for advancing new projects. The unavailability of finance both internally and externally is a major business obstacle firms' face because firms require more finance to achieve higher levels of productivity and growth (Gatti and Love, 2008; Becks et al., 2013; Chen and Guarigila, 2013).

This study explores the channels through which finance affects firms' productivity in Africa using cross-country and cross-firm level data from World Bank Enterprise Surveys.

An extensive range of internal and external factors determines the form, source and cost of finance to firms. The ability and expertise of firm managers, structured business plan, and risk analysis are essential internal resources needed for sourcing external financing (Becks and Honohan, 2008). However, the accessibility of external finance mainly depends on conditions outside the control of the firm. The availability of external finance depends mainly on the effectiveness and existence of a range of intermediaries and subsidiary firms that assist

¹ The informal sector is defined as entities whose objective for producing goods and services is the generation of employment and income to the persons concerned.

² This study focuses on access to finance from the formal sector given the data available.

in pooling funds providers and users by improving their ability to curb information and agency problems (Tirole, 2010). Firms face further constraints as a result of differing pattern and extent of finance needed by different firms in various countries (Becks and Honohan, 2008). Economists and policy makers place particular interest on the unavailability of external finance resulting from imperfect financial market because they have important implications for monetary policy transmission mechanism and tax policy (Chen, 2010).

According to Siedschlag et al. (2014) access to external finance is an essential factor for promoting investment and innovation which are important elements of firms' productivity.

Some of the channels through which improved access to external finance affect firms' productivity and ultimately economic growth according to Beck et al. (2008) are: (i) the availability of external finances increases the number of start-ups – an essential measure of entrepreneurship, innovation, and dynamism of firms (Aghion et al., 2007, Ayyagari et al., 2011), (ii) finance is required by existing firms to allow them benefit from investment and growth opportunities and be able to achieve bigger equilibrium size (Beck et al., 2006b), (iii) for the acquisition of assets portfolio that are more efficient and productive and the choice of efficient forms of organization like incorporation (Demirgüç- Kunt et al., 2006).

Although, relatively ignored in existing literature, the availability of internal finance also affects firms' productivity. Firms experiencing difficulties in accessing external finance have to rely on their own internal finance (Chen and Guariglia, 2013). Particularly, limited access to external finance is usually available for firms in their infancy stage (i.e. start-up phase), thereby restricting them to internal equity capital and bank borrowing (Segarra-Blasco and Teruel, 2009). Access to internal finance helps to improve entry growth, reduces risk, promotes innovation, and increases equilibrium size (Beck et al., 2008). It also enhances the performance of the aggregate economy via stronger financial systems (Chen and Guariglia, 2013). Chen (2010) states that readily available internal funds would facilitate investment in productivity enhancing projects by innovative firms. The availability of internal funds is essential for the daily operations of the firm and the achievement of long-term development goals and investment opportunities (Kira, 2013).

The contributions of this study are: firstly, it provides an empirical study on the effect of access to finance on firms' productivity in Africa. The review of existing literature shows that empirical analysis of this effect on African countries is almost non-existent. Secondly, while most existing literature on other countries focuses only on external finance, this study focuses

on the links between both internal and external finance and firms' productivity in Africa. Thirdly, this study uses more direct measures of access to finance, such as having a checking or savings account, the presence or absence of overdrafts and lines of credit. Fourthly, several firm-level studies estimate firms' productivity using only the Total Factor Productivity (TFP) model. This study improves on the existing literature by measuring firms' productivity using the TFP model, labour productivity, and the stochastic frontier Cobb-Douglas and translog model. To address potential endogeneity and OLS estimation bias, instrumental variable (2SLS) model is used to estimate the TFP model using growth in sales and type of ownership as instruments.

This paper is structured as follows. Section 2 provides an analysis of the composition of finance across firms in Africa. Section 3 reviews existing theoretical and empirical literature. Section 4 provides details of the econometric methodology used and describes the data in the study. Section 5 reports and discusses the findings of the study. While the summary of findings and policy implications are presented in session 6.

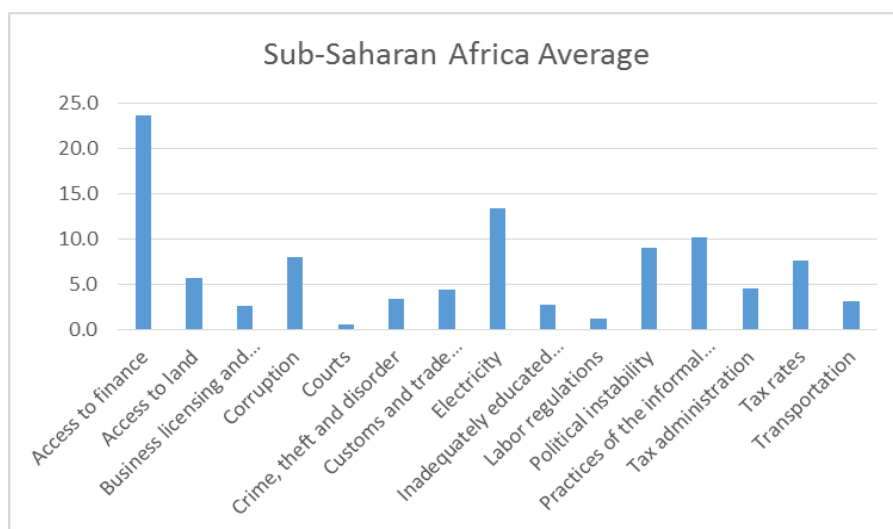
2. The Composition of Finance across Firms in Africa

It is informative to provide a brief review the sources of finance commonly used by firms in Africa and what type of finance firms have access to in carrying out their operations in evaluating the effect of finance on firm's productivity. These section attempts to answer the following research questions:

1. What types of finance are relevant for, and what composition is used by, firms in Africa?
2. Do firms access to external sources of finance available and how does the access differ across enterprises and industries?

Figure 1 below shows the largest percentage of firms in Africa reported access to finance as the biggest obstacle they faced in their operations. Approximately 25% of firms surveyed in Sub-Saharan reported that access to finance was one of the biggest obstacles they face. This shows that access to finance is an essential element for firms' productivity in Africa.

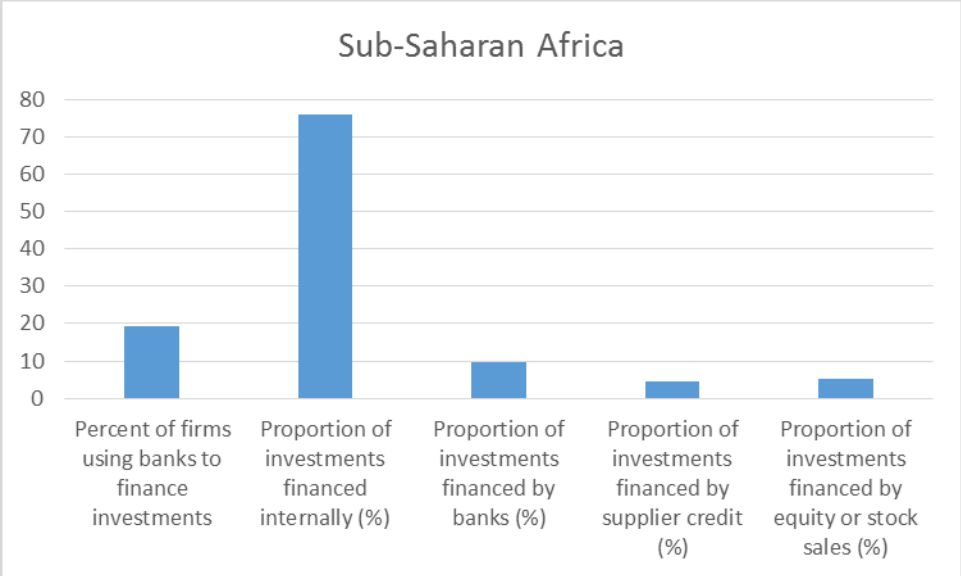
Figure 1: Biggest Obstacles faced by firms in Sub-Saharan Africa (%)



Source: World Bank Enterprise Survey (ES)

Figure 2 below shows the proportion of each source of finance used by firms in Sub-Saharan Africa for investment in fixed assets and financing working capital. The figure indicates that internal funds were the most utilised source of finance. Internal funds finance more than 70% of investment projects, a marginal 10% is being funded by banks, while just an average of 5% of investments is financed by supplier credit and equity or stock sales.

Figure 2: Proportion of Investments Financed by Various Sources of Finance

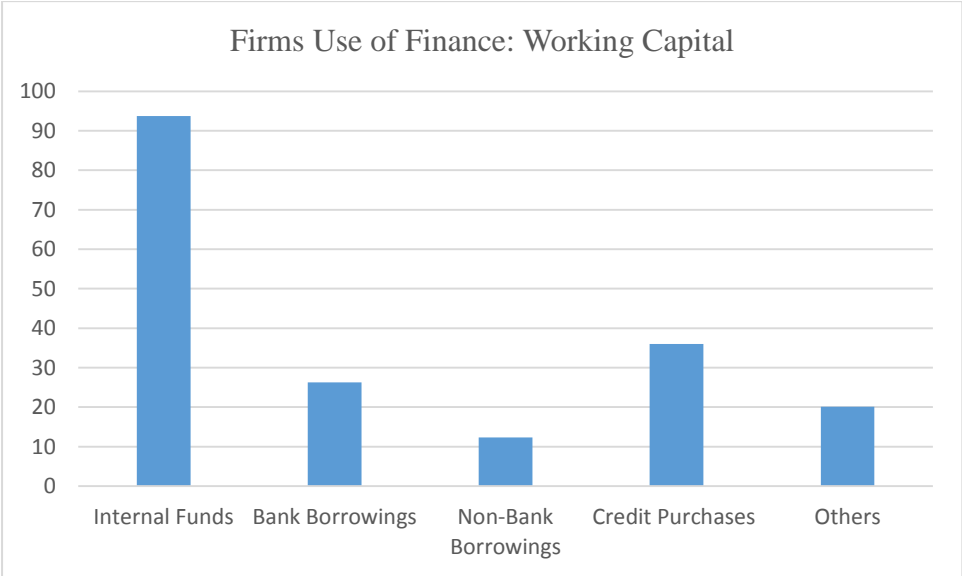


Source: World Bank Enterprise Survey

2.1 Usage of Finance Sources

This section provides information on the usage of various sources of finance by firms for working capital and for investment. The survey provides five sources (options) of finance that can be used to finance working capital and investment in fixed assets.

Figure 3: Percentage of firms using financing for Working Capital

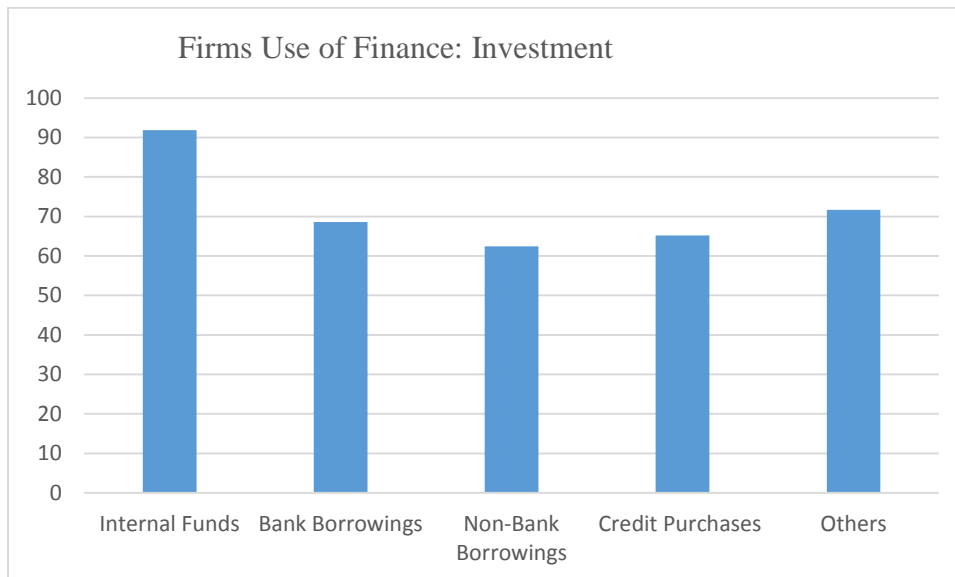


Source: Author’s estimates using ES data

The figure above shows the percentage of firms in this study that used each source of finance for working capital either alone or combined with other sources of finance. Figure 3 shows that approximately 94% of the firms sampled used internal funds to finance working capital.

26% of firms used borrowings from banks, approximately 12% made use of non-banks financing, 36% used credit purchases as a source of finance and 20% used other sources of finance.

Figure 4: Percentage of firms using financing for Investment



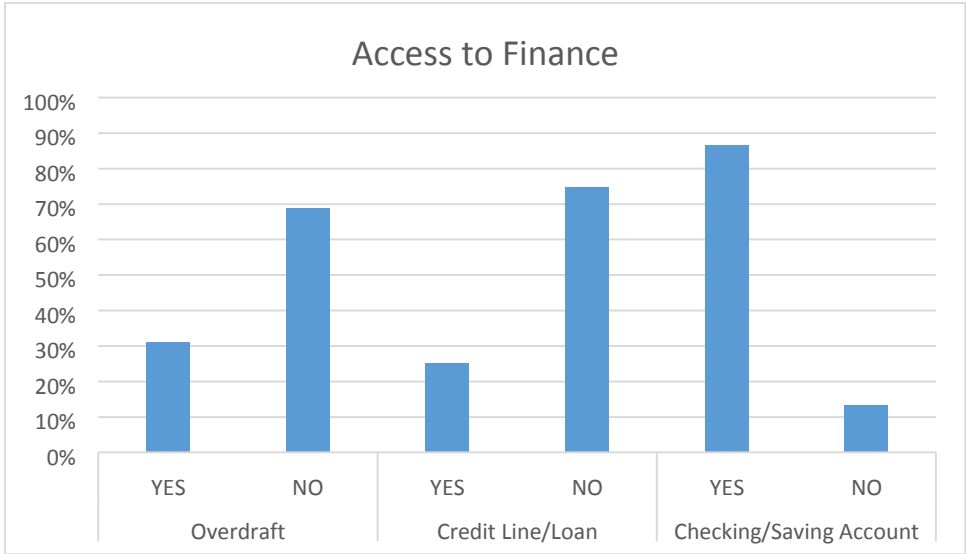
Source: Author's estimates using ES data

Figure 4 above shows the number of firms in percentages that used each source of finance either alone or combined with other sources to finance investment in fixed assets. Approximately 91% of firms in this sample used internal funds, 72% of firms used other sources of finance, 69% of firms used bank borrowings, 62% and 65% of firms used non-bank borrowings and credit purchases to finance investments in fixed assets respectively.

2.2 Access to Finance Sources

This section provides information on the access of firms in this study to external sources of finance. Figure 5 below shows the percentage of firms with access to available finance options: overdraft facility, credit line/loan facility and checking/saving account. Only 31% of firms in our sample reported having access to an overdraft facility at the time the survey was conducted while 69% do not have access to overdraft facilities. 75% of firms do not have a credit line or loan facility, only 25% have access to a credit line/loan facility from a bank. A large percentage of firms (87%) have checking/saving accounts while only 13% do not have.

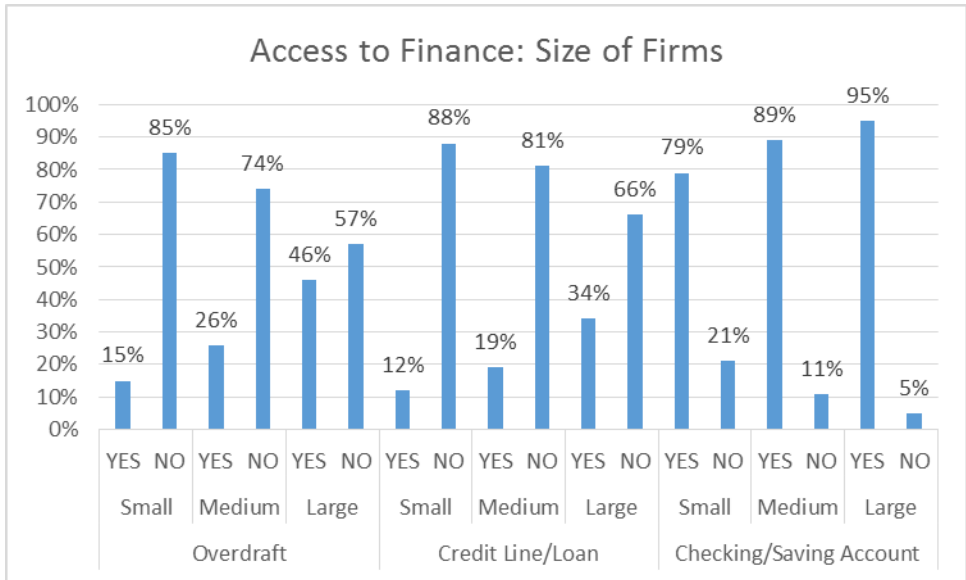
Figure 5: Firms Access to Finance.



Source: Author’s estimates using ES data

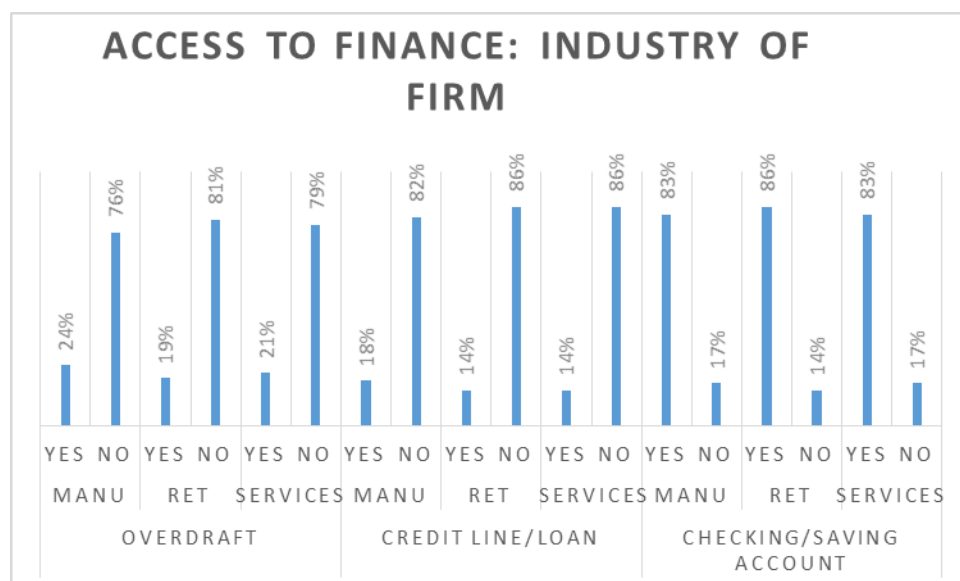
Figure 6 below shows how firms’ access to finance differs according to their sizes. Smaller firms record the lowest access to overdraft and credit line/loan facilities (15% and 12% respectively). The highest percentage of firms with access to overdraft and credit line/loan facilities are large firms (46% and 34% respectively). Also, large firms account for the least number of firms without checking/saving account while small firms record the largest percentage. This shows that the size of a firm influences its ability to access finance.

Figure 6: Access to Finance based on Firm’s Size



Source: Author’s estimates using ES data

Figure 7: Access to Finance based on Firm’s Industry



Source: Author’s estimates using ES data

Figure 7 above shows how firms’ access to finance differs based on the sector of they belong. Manufacturing firms record the highest percentage of firms with access to overdraft and credit line/loan facilities, firms providing other services have more access to overdraft facilities than firms in the retail sector. It is argued that manufacturing firms in comparison to firms in other sectors tend to have more access to finance because they undertake more innovation and R&D projects.

Table 1: Access to finance based on type of ownership

Type of Ownership	Overdraft		Credit Line/Loan		Checking/Saving Account	
	YES	NO	YES	NO	YES	NO
Incorporations With Traded Shares	35%	65%	28%	72%	90%	10%
Incorporations With Non-Traded Shares	36%	64%	28%	72%	93%	7%
Sole Proprietorship	14%	86%	11%	89%	79%	21%
Partnership	21%	79%	21%	79%	87%	13%
Limited Partnership	40%	60%	29%	71%	92%	8%

Source: Author's estimates using ES data

Table 1 shows firms' access to finance based on the type of ownership. Limited Partnership, incorporations with traded and non-traded shares firms have more access to finance compared to partnership and sole proprietorship. The following reasons were given by firms for not applying for loans or line of credit.

Reason 1: No Need for a Loan

Reason 2: Complex Application Procedures

Reason 3: Interest Rates Are Not Favourable

Reason 4: Collateral Requirements Are Too High

Reason 5: Size of Loan and Maturity Are Insufficient

Reason 6: Did Not Think It Would Be Approved

Reason 7: Other

The table above shows the reasons for the lack of access to loans or lines of credits for the whole sample and based on firm's size, the sector of the industry and ownership. For the whole sample, the most common reason for not applying was that the firm didn't need a loan, followed by unfavourable interest rates and complex loan application process. In terms of size, large firms were the highest proportion of firms who didn't need loans while small firms were the least. Also, small firms reported a higher percentage of firms affected by unfavourable interest rates, high collateral and the likelihood of loan not being approved. The reasons do not differ significantly based on the sector of the industry a firm belong to. Regarding ownership, sole proprietors are mostly affected while incorporations and limited partnership are least affected.

To sum up, internal funds are the most used source of finance for firms in this study. This could be because 66% of firms in our sample are small sized firms. The analysis above shows that small firms have less access to finance compared to medium and large firms and face more difficulties in obtaining finance. Also, the industrial sector and type of ownership of a firm affect its ability to access finance.

Reasons	All Sample	Small Firms	Medium Firms	Large Firms	Manu	Retail	Other Services	Traded Shares	NonTraded Shares	Sole Prio.	Partner ship	Ltd Partnership
1	47%	37%	52%	67%	43%	45%	46%	66%	60%	39%	49%	53%
2	14%	17%	11%	6%	15%	14%	13%	3%	10%	17%	11%	8%
3	17%	20%	16%	11%	17%	19%	16%	14%	15%	18%	18%	20%
4	10%	13%	9%	4%	10%	11%	12%	7%	6%	13%	9%	7%
5	2%	2%	3%	1%	2%	2%	2%	2%	2%	2%	3%	1%

Table 2: Reasons for not applying for loans or line of credit.

6	4%	5%	3%	1%	5%	4%	4%	3%	2%	5%	4%	3%
7	6%	6%	7%	8%	7%	6%	7%	5%	5%	6%	6%	8%

Source: Author's estimates using ES data

3 Literature Review

3.1 Theoretical Framework

This section explores the sources of finance available for firms and the theories or hypothesis on the major fundamental determinant factors most likely to limit firms' access to finance. Also, this section highlights the theoretical basis of the relationship between access to finance and firms productivity.

3.1.1 Sources of Finance

There are two main classifications of the sources of finance available to the firm: internal and external sources of finance. Internal sources are funds readily available within the firm while external sources of finance are funds that come from outside the business and are not easily accessible. The decision on the choice of finance depends on a number of factors such as: the type of the firm (e.g. sole proprietor, partnership, and listed company), the age of the firm, the size of the firm, the level of financial development in the economy that the firm is operating in, the business cycle stage the firm has reached, the cost of procuring and utilizing the funds, amongst others.

The following internal sources of finance are available to firms: owner's savings or equity capital, retained profit, working capital, and sale of fixed assets. Owner-manager's personal savings is an essential source of financing especially for SMEs in the start-up phase (Abdulsaleh and Worthington, 2013). Ou and Haynes (2006, pg. 157) defines equity capital as "that capital invested in the firm without a specific repayment date, where the supplier of the equity is effectively investing in the business". There are internal and external means of raising equity capital. Internally, equity capital is generated from existing partners, current owner/manager(s), and their relatives or from the retained profits within the firm (Abdulsaleh and Worthington, 2013). Retained earnings are profits generated by the business from undertaking a profitable trade. They are usually saved as back-up for times of financial need and may be used later for a company's development or expansion (Abdulsaleh and Worthington, 2013).

The advantages of internal sources of finance are: (i) they do not require collateral and are usually interest free or attract lower interest rate, (ii) most internal sources of finance do not incur any cost in obtaining them³, (iii) the owner/manager enjoys decision-making freedom as he doesn't need to seek approval before making changes or expanding. However, the following disadvantages are associated with the use of internal sources of finance: (i) they are not usually sufficient where very large amounts of funds are required and not suitable for long-term investment, (ii) start-up companies and businesses experiencing extending period of losses do not have readily available retained profits, (iii) opportunity costs are involved because funds may be exhausted, and other investment opportunities have to be forgone, (iv) cash flow problems might arise when using some sources of internal financing because there is an informal agreement and the owner can demand for the money.

The following external sources of finance are available to firms: trade credit, external equity financing, debt financing (i.e. bank finance, non-bank financial institutional debt). Trade credit is a very important source of external finance for firms. It is defined "as the delay in the payment of goods and services after they have been delivered or provided as a result of an agreement between the supplier and the firm" (García-Teruel and Martínez-Solano, 2010, pg. 215). Trade credit as a source of external financing is more significant for firms in countries with less developed banking and financial systems (García-Teruel and Martínez-Solano,

³ Some sources of internal finance require repayment with little or no interest payment (e.g. equity capital generated from relatives). Other sources such as owner's savings and retained profit do not require repayment.

2010). External equity financing involves raising capital from external channels other than existing partners and their relatives (Abdulsaleh and Worthington, 2013). The issuing of new equity usually involves a dilution of ownership and control. Debt financing involves borrowings from bank and non-bank institutions. Non-bank financial institutions include credit unions, finance houses/companies, insurance companies, and pension funds. Debt financing can be either short-term or long-term, and the former attracts a higher level of risk.

The advantages of external sources of finance are: (i) it allows firms to finance innovative or growth projects that they could not fund on their own, (ii) it permits the preservation of internal funds for other purposes that require cash payments and helps maintain sufficient cash flow, (iii) external financing can help small-scale business grow at a faster rate than using only internal funds, (iv) it provides higher economic scales and generates efficient profit when the interests are not high and payments are made on time. However, the following disadvantages are associated with the use of external sources of finance: (i) external financing can lead to the loss of ownership and control in exchange for capital, (ii) the cost of external funding are usually high. Debt financing is associated with high-interest payments, (iii) external financing can significantly affect cash flow and lead to loss of working capital. The availability of cash for day to day operation can be limited by the repayment of debts and dividends.

In sum, before deciding on the appropriate source of finance to use, firms should critically examine all the pros and cons of their choice and ensure that the benefit outweighs the cost.

3.1.2 Determinants of Firms' Access to Finance

This sub-section highlights some of the factors that determine firms' ability to access the sources of finance discussed above.

3.1.2.1 Country Characteristics: Financial Market Imperfection

In a perfect market, all market participants have complete information, and equal access to the capital markets is available to all firms (Ponikvar et al., 2013). This implies that finance is available for whichever investment project firms decide to undertake, and firms respond to changes in the cost of capital differently as a result of differences in investment demand (Ponikvar et al., 2013). These underlying assumptions indicate that the financial structure of a firm is independent of its real investment decisions (Sancak, 2002). Modigliani and Miller (1958) state that external financing (i.e. borrowing and new equity share issue) and internal

financing (i.e. cash flow and retained earnings) are perfect substitutes in a perfect market. Therefore, a perfect market implies that the selection of investment and decision to invest should not be influenced by the availability of internal funds (Siedschlag et al., 2014).

However, in reality, firms operate in imperfect markets, where internal financing brings a cost advantage over external funds and access to external finance is not equal for all firms (Ponikvar et al., 2013). When internal and external finance are not perfect substitutes, the problem associated with asymmetric information implies that the cost of financing associated with external financial makes it more expensive than internal finance (Sancak, 2002). From the existing literature on access to finance, financial market imperfection leads to the occurrence of ‘financing gaps’ or financial market failures where firms are unable to finance viable projects (O’Sullivan, 2005; Oxera, 2005; BIS, 2012; Siedschlag et al., 2014). Financing gap is defined as a measure of the difference at the firm level between the need of external funds and the availability of funds (Siedschlag et al., 2014). According to Siedschlag et al. (2014) information asymmetries, intangible assets, transaction costs, high uncertainty, and investor’s risk aversion are characteristics of an imperfect market. A financing gap is more likely to occur when:

- the uncertainty of the success of a project is high
- the level of information asymmetry between lenders and borrowers gets higher
- the firm has lower collateral
- the firm most likely has no track record
- the firm has minimal internal funds available

The presence of information asymmetry between lenders and buyers is one of the major causes of financial market imperfection which is linked to the financing gap (Siedschlag et al., 2014). These information asymmetries occur as a result of moral hazard (unobserved misbehaviour of borrowers) and adverse selection (unobserved borrowers’ risk type). This leads to higher cost of external financing in comparison to the price of internal financing and potentially viable firms underinvest due to restricted access and suboptimal capital allocation (Siedschlag et al., 2014).

Particularly, on the side of the lender who lacks information on the profitability of the investment (to be carried out by the borrower i.e. the firm), it increases financing cost to undertake collateral evaluation and monitoring. Due to the difficulties associated with

differentiating between high- and low-risk entrepreneurs, lenders base the decision to provide finance on collateral and track record (BIS, 2012). On the other hand, the borrower, who lacks insider information about external finance limits the demand for external financing due to lack of skills/capacity to evaluate opportunities and also fear of refusal (BIS, 2012). However, it is important to note that financial constraints linked to information asymmetries are more likely to affect start-ups, young, innovation and domestic enterprises (Siedschlag et al., 2014).

Other financial market imperfection characteristics such as moral hazards and positive externalities restrict firms' access to external finance. The separation of ownership and control generates moral hazard problems. Hall and Lerner (2010), argues that the presence of principal agency problem, resulting from owners and managers having conflicting goals could lead to investment strategies that lack the potential to maximise shareholder's value. In such situations, agency costs involving managers financing certain investments that benefit them and risk adverse managers being reluctant to invest in uncertain research and development projects may emerge (Eng and Shackell, 2001).

3.1.2.2 Country Characteristics: Financial System Development

The financial system (made up of financial markets and intermediaries) plays an important role in determining firms' ability to access finance. Financial markets and intermediaries help firms to manage project risk and liquidity, mobilize resources, and facilitate the screening and monitoring of investment projects (Gimet and Lagoarde-Segot, 2012). Beck et al. (2006a) show that the most significant country characteristic that can explain cross-country variation in firms' financing obstacles is the development of institutions (including banks and stock markets).

According to Beck (2007), financial system development assists in closing the gap between small and large firms by increasing external finance to small firms at relatively low cost. The development of the financial system improves the functioning of the financial markets. This allows firms with good investment opportunities to have easier access to external finance (Love, 2003). Also, Wurgler (2000) show that the development of the financial system improves the capital allocation process, therefore, firms operating in economies with a more developed financial system have increased access finance compared to firms in underdeveloped or less developed financial systems. A well-developed financial market can

diversify risks associated with investing in innovative ideas thus, reducing the cost of capital and improving firms' access to finance for innovative activities (King and Levine, 1993).

In sum, the level of development of the financial system plays an important role in firms' access to finance (Gatti and Love, 2008; Volz, 2013). According to Kira (2013), a well-developed banking system provides efficient services and ensures that resources are channelled to the most appropriate firms and investment opportunities. With a developed financial system, firms would be able to overcome the limitations lack of access to finance impose and contribute to the growth of the economy (Kira 2013).

3.1.2.3 Firm Characteristics

The characteristics of a firm affect its ability to access external finance. These conditions are presumably conditions laid down by the financial institution- they prefer to lend to some groups and not to others, assess some groups more favourable than others. Various firm characteristics such as: location of the firm, the industry in which the firm operates, the size and age of the firm, the legal status of the firm, and the firm's business information are all important factors in determining access to finance by firms (Kira and He, 2012). The geographical proximity between lender and borrowers is linked to the ability of a firm to access finance (Berger and Udell, 2002). Lenders who are geographically close to their customers can use this as an advantage to establish the credit credibility of the customer by using soft available qualitative information. An enhanced form of environmental scrutiny is created from physical closeness between lenders and borrowers, this improves the firm's access to credit from lenders. Also,

Fatoki and Asah (2011) argue that firms located in the rural area are less successful in obtaining finance compared to firms in the urban area because of lack of proximity⁴ between lenders (located in the urban area) and borrowers (in the rural area).

The size and age of a firm are associated with its ability to access external finance. Burkart and Ellingsen (2004) state that the debt proportion in a firm's capital structure is significantly influenced by the size of the firm. This is because access to long-term debt is influenced by real assets. The stability of large firms is linked to the fact that their operations are well diversified, therefore, Honhyan (2009) argues that the size of a firm can be a substitute for insolvency measures. Small firms would experience difficulties accessing external finance

⁴ Bad road networks, high transportation cost.

because the cost associated with solving information asymmetry problems is more expensive for them (Cassar, 2004). Regarding the age of a firm, it is more difficult for firms that are startups or still in the early stage of operation to have access to finance because of information disparities. Chandler (2009) states that the longer a firm is in operation, the greater its ability to overcome adverse economic situations. Start-up firms do not have sufficient credit history to create a reputation on. A good credit reputation creates a path to access external finance because it reduces the moral hazard dilemma.

Other firm characteristics that affect access to external finance are firm legal status and the gender of the owner. The process involved in becoming a limited liability (incorporated) implies that they are more developed in comparison to a sole proprietor or partnership firm (Harhoff et al., 1998). The following provides justification for the relationship between firms becoming an incorporation and access to debt financing: one, the commitment of managers' increases because of the separation of ownership and management affairs. Two, corporations are required by law to publish their financial statements, this gives public users information about the firm's status including their debt ratio and firm's assets (Kira and He, 2012). Therefore, lenders are more comfortable providing funds to limited liability firms. There is also the effect of gender discrimination on access to finance. Female owners face a wide range of constraints that limits their ability to obtain external funds. One of the reasons is the perceived belief that women lack the financial capability and confidence to manage their finances thus impeding them from being in a position to take advantage of opportunities (Making Finance Work for Africa, 2016). Therefore, firms with male owners would more likely be granted a loan than those with female managers.

3.1.2.4 Ownership Characteristics

Entrepreneurial characteristics such as managerial competency, networking, and relationship with the bank, experience, and educational background are important factors that affect firms' access to finance. This effect is more pronounced in SMEs because it is difficult to separate the business from the owner's characteristics (Kung'u, 2011). Particularly, the level of education of the manager affects lenders willingness to provide funds. Kumar and Francisco (2005) states that the higher the level of manager's education the less difficult it will be to access finance. The reasons are: (i) entrepreneurs with a higher level of education have the adequate knowledge to build strong business plans and present positive financial information. They also have the ability to a maintain a good interpersonal relationship with financial

institution compared to entrepreneurs with a lower level of education, (ii) the educated owners can acquire additional skills in finance, marketing, and human resources required for the management of the business. These skills result in the high performance of the business which helps those firms to access finance without difficulties, and (iii) from the supply side, in the loan approval process, lenders/bankers value higher education level of the owner/manager (Gabriel, 2015).

3.1.3 Relationship between Access to Finance and Firms' Productivity

The previous section highlights the various sources of finance and some of the fundamental factors that determine firms' ability to access external finance. The next agenda is to establish the channels through which access to finance affects firms' productivity and ultimately economic growth. There are various channels through which access to finance affects firms' productivity, some of them would be discussed in this section.

The violation of the Modigliani Miller (1958) theorem provides the foundation of the link between finance and firms activities (Chen, 2010). According to Myers and Majluf (1984), the advent of agency cost, information asymmetry, and tax policies resulted in creating a difference between the cost of internal and external funds, thereby favouring debt financing over equity financing⁵ (Chen, 2010). As a result, there has been ongoing debates amongst economic scholars on the links between finance and economic growth (Favarra, 2003; Levine, 2005;

Becks, 2012). It is argued that one of the possible channels through which finance affects economic growth is via its effect on firms' productivity (Gatti and Love, 2008; Chen, 2010). Therefore, it is important to explore the mechanism through which finance fosters growth by promoting productivity, which is an essential intermediate link between firms activities and growth (Chen, 2010; Becks, 2012).

Gatti and Love (2008) state that the theoretical justification for the proposition that finance affects economic growth through its effects on productivity has been provided by several models. Some models postulate that technological innovation an important element of economic growth results from firm-level productivity brought about by access to external finance (Chen and Guariglia, 2013). In these models, information and transaction costs

⁵ Issuing additional equity to satisfy the firm's financial needs would lead to a dilution in ownership and control. The separation of ownership from professional management usually creates asymmetric information and agency cost. To retain full ownership and control of their firms, firm owners are more willing to source for debt financing over equity financing.

associated with external finance are alleviated following the provision of real services by the financial sectors to firms (Gatti and Love, 2008). The financial system plays an essential role of supplying innovative firms with capital and provides efficient services, thereby, making projects with longer gestation and higher return more attractive to firms (Levine, 1991; Bencivenga et al., 1995; Ayygari et al., 2007; Gatti and Love, 2008; Chen, 2010).

It is also important to study the effect of finance on productivity because at the macro-level total factor productivity (TFP) accounts for the cross-country differences in the level or growth of gross domestic product (GDP) per capita (Easterly and Levine, 2001). Total factor productivity (TFP) is assumed to be an essential element in enabling the understanding of economic growth. An increase in productivity infers that higher level of output is produced with the same amount of capital and labour input in an economy, which technically implies economic growth (Levine and Warusawitharana, 2014). Therefore, the evidence of a link between finance and productivity growth in the firm-level provides an important and additional mechanism through which the financial system can affect overall economic growth (Levine and Warusawitharana, 2014). Based on these, it becomes important to examine how finance affects growth through the direct promotion of firms' productivity.

Nevertheless, research and development (R&D) activities that enhance firms' productivity are associated with high risks and uncertainty; requiring substantial investments (Chen and Guariglia, 2013). In addition, firms committed to carrying out such innovative activities encounter difficulties in obtaining loans from banks because of the nature of the intangible assets they hold (Brown et al., 2009). Innovative firms have more intangible assets, which cannot be used as collateral. They relatively hold more "skilled labour assets" such as patents and knowledge than physical assets (i.e. lands and buildings) that are accepted as collateral. Therefore, it would be expected that the unavailability of external finance would strongly affect the productivity of these firms (Chen and Guariglia, 2013). According to Becks and Honohan (2008), one of the major challenges of firms' growth and productivity in developing countries is access to external sources of finance and the financial sector supports the development and growth of developing economies by providing financial services to firms with good growth prospects.

The magnitude of the effect of finance on firms' productivity is not uniform across all firms. Based on the size and structure of firms, the extent of the effect of financing constraint differs. Start-up, young, innovative, small-scale domestic firms, and more technologically

advanced industries are assumed to feel the impact of these constraints more on their productivity (Siedschlag et al., 2014). Access to internal and external finance is positively related to the success of firms' start up and the possibility of firms' survival (Becks and Honohan, 2008). Barney (1991) builds on the strategic management literature and suggests that the productivity of a firm is determined by both the external analysis (environment) and internal analysis (characteristics) of a firm. The external analysis focuses on analysing a firm's opportunities and threats within its competitive environment while internal analysis involves the creation and implementation of strategies using individual firm resources (such as human capital, physical capital and organizational capital) to improve the firms' competitiveness (Barney, 1991). Therefore, the success, and in the long-run firms' productivity is directly affected by the lack of both internal and external financial resources (Stucki, 2014).

According to Beck and Robert (2014), a vast majority of firms in Africa fall into the category of SMEs with more than 50 percent of the labour force employed in companies with fewer than 100 employees and 95 percent of enterprises belong to the category of SMEs (Ayyagari et al., 2011). Siedschlag et al. (2014) states that Small and medium-sized enterprises (SMEs) tend to depend highly on banks loans and credit lines from domestic markets to finance their investment projects, contrary to large multinational enterprises that can obtain funds from international markets. Evidence from theoretical and empirical analysis indicate that SMEs encounter higher constraints concerning capital costs and credit conditions compared to larger enterprises. This is because SMEs are prone to a higher probability of failure and asymmetric information resulting from insufficient collateral, inadequate track record, and absence of credit guarantees (Siedschlag et al., 2014). Therefore, although SMEs constitute an important component of the private sector in the developing world, they report significantly higher obstacles to their operations and growth than large enterprises (Beck et al., 2006a).

For firms to be able to increase productivity and impact economic growth, there is the need to invest in fixed capital expenditure. Investing in productivity-enhancing inputs improves efficiency gains for the firm, also the productive capacity of the economy is enhanced (Siedschlag et al., 2014). Finance is required by already existing firms to be able to take advantage of investment opportunities and increase production capacity (Becks and Honohan, 2008). Access to external finance affects firms' ability to invest in tangible assets (Siedschlag et al., 2014; Becks and Honohan, 2008). The presence of market imperfections

creates a disparity between the internal and external cost of financing, hence, firms may only be able to invest until internal funds are depleted (Stiglitz and Weiss, 1981). The responsiveness of investment to external finance is linked more to young and micro-sized firms. These firms are more likely to run short of internal funds and are unable to convince lenders to provide funds as a result of lack of collateral, track record or increased risk. This results in adverse effects on their growth potentials and chances of survival (Siedschlag et al., 2014).

The lack of access to finance implies that firms facing financial constraints are less able to sustain unexpected losses, even for a short period (Mata et al., 1995). Also, financially constrained firms are forced to cut costs to generate the resources they cannot obtain from the financial market. Therefore, lack of access to finance restricts the ability of a firm to invest in productivity-enhancing activities, leading to an adverse effect on firm success (Holtz-Eakin et al., 1994; Aghion et al., 2007). Also, a firm's productivity is affected by the lack of access to finance because financially constrained firms have limited access to other value-creating services that accompany external financing especially venture capital investments (Jain and Kini, 2000; Manigart et al., 2002).

Another channel through which access to finance affects firms' productivity is via employment of labour. Highly skilled and competent workers are required to undertake productive activities and for the daily functioning and management of a firm. Nickell and Nicolitsas (1999) state that the hiring of employees reduces as a result of increasing cost of borrowing. Lack of access to finance leads to a decrease in labour employment as a means of sustaining working capital. Also, already employed workers in firms see the lack of access to finance as a threat to their jobs. This could naturally lead to workers reducing their level of dedication to the job which impacts on the goods and services produced and in turn affects the firm's productivity.

Caggese and Cunat (2008), further argues that access to finance affects the terms of contract (that is fixed-term and permanent contracts) firms are willing to enter with employees. Financially constrained firms are more willing to employ fixed-term workers that are less productive compared to permanent workers. The effect of this is that fixed-term workers are flexible and do not have any firing cost associated with their contracts. They could easily leave half-way in a production process thereby hampering productivity. This indicates that access to finance affects the quality of workers a firm seeks to employ (Milanez, 2013). Firms

that are financially constrained would encounter difficulties in employing workers with firm-specific knowledge but would be willing to employ workers with general skills because they are less expensive. Employees with high firm-specific skills are less likely to quit their job and bring in more expertise to the production process (Milanez, 2013).

Lastly, access to finance affects firm's productivity via export behaviour and export performance. The 'learning- by-exporting' hypothesis states that firms gain new knowledge and expertise because they enter the export market, which in turn improves their efficiency level and productivity (De Loecker, 2007). Access to finance has been considered as one of the factors that determine the differences in export behaviour and export performance across firms in an industry (Manova, 2008; Berman and Hericourt, 2010; Bellone et al., 2010; Chaney, 2013). Particularly, increased access to external financing enhances the effect of productivity on the selection of firms into export in imperfect financial markets, (Siedschlag et al., 2014).

Chaney (2013) states that due to the significant sunk cost linked with participating in export, only firms with easy access to finance can engage in export activities. On the other hand, engaging in export activities provides access to external funds in the international market (Bellone et al, 2010). Lastly, exporting can facilitate the reduction of information asymmetries because of lenders/investors perceived notion of export as a sign of external competitiveness.

(Ganesh-Kumar, 2001). Therefore, access to finance affects firms' productivity via exporting through more stable cash flows derived from international diversification of sales and lowering exposure to demand-side shocks (Bridges and Guariglia, 2008).

To sum up, it has been established in the theoretical literature that access to finance affects the productivity of the firm. Lack of access to finance impedes investment in high-quality projects leading to lower firm productivity (Moreno-Badia and Miranda, 2009). The mechanism of this effect is based on the role of well-developed financial markets in allocating funds to productivity-enhancing investments and that long-term productivity-enhancing projects are facilitated by liquid financial markets (King and Levine, 1993; Bencivenga et al., 1995; Levine, 2005). Also, export behaviour and performance affect firms' productivity because exporting improves the ability of a firm to access external finance. On the other hand, firms that are financially constrained are not able to participate in exporting activities, thereby hampering their productivity (Bricongne et al., 2012).

3.2 Empirical Review

This section reviews some existing literature on the determinants of access to finance and its effect of firms' productivity.

3.2.1 Determinants of Firms' Access to Finance

Hall et al., (2000) in a study of 3500 small and medium sized enterprises (SMEs) in the United Kingdom found that the access to external finance is determined by the industrial sector in which a firm conducts business. Providers of external financing are more attracted and willing to provide funds to firms operating in huge capital-intensive sectors such as manufacturing and construction. Using data from U.K's manufacturing firms from 1989 to 1999, Bougheas et al., (2006) found that several firm-specific characteristics such as size, collateral, riskiness, age, and profitability are important determinants of access finance. They also found that smaller, riskier, and younger firms felt the impact of monetary policy conditions in obtaining external finance. Beck et al., (2006a) studied 80 developing and developed countries for the period 1999 and 2000 using firm-level data from the World Business Environment Survey (WBES). The results showed that countries with higher levels of financial intermediary development, more efficient legal systems, higher GDP-per-capita and more liquid stock market report lower financing obstacles.

Lago et al., (2007), examined the determinants of access to finance for 60,000 Spanish firms for the period 1992 to 2002. Using dynamic panel data estimation techniques and four measures of external financing, results obtained showed that the availability of collateral and the nature of the relationship between borrowing firms' and the bank affected firms' access to external finance. Also, firm characteristics had a marginal effect on external financing because Spanish firms depend majorly on short-term non-bank financing (such as trade credit). Canton et al., (2010) studied the determinants of access to finance for firms in the European Union and found that the ownership structure of firms and the age of firms are the most important determinants of access to finance. Other factors that determined firms' access to finance include: the relationship between the bank and the firm and the banking sector degree of competition. Ferrando and Grieshaber (2011) used a new set of data obtained from the ECB- European

Commission Survey on the 'Access to Finance of small and medium-sized Enterprises' (SAFE) to study more than 5000 firms in the Euro Area. They found that only firm age and ownership are important factors in determining access to finance in the euro area.

For studies on African countries, Harrison and McMillan (2003) used 399 firm data in Ivory Coast to show that domestic firms experience more difficulties in accessing external funds compared to state-owned and foreign firms. Firms listed on the stock exchange experienced lesser financial constraints in comparison to unlisted firms. Fatoki and Assah (2011) studied the impact of firm and entrepreneurial characteristics on access to finance in South African firms using self-administered questionnaire. The results obtained suggested that availability of collateral, maintaining proper business information and managerial competence were important factors for sourcing external funds.

Kira (2013), studied the determinants of financial constraints in five East African countries in the East African Community (EAC) region. Using World Bank's Business Enterprise Survey of 1993 Small and Medium-sized Enterprises (SMEs), the results showed that firm characteristics such as firm age, firm size, incorporation, type of ownership, the sector of economic activity or country were all binding factors across all firms, but SMEs are mostly affected. Kacem and Zouari (2013) examined the effect of socio-economic factors on the access to external finance in microfinance institutions in Tunisia. They found that age, level of education of manager and risk aversion were important factors that determined access to external finance. They also found that female managers experienced more difficulties in accessing external funds, and the absence of a guarantor was the primary barrier to accessing finance for microfinance institutions in Tunisia.

In summary, these studies show that the ability of a firm to access external finance is determined by several factors and small and medium-sized enterprises (SMEs) are mostly affected.

3.2.2 Relationship between Access to Finance and Firms' Productivity

There is only a small literature that has attempted to examine the effect of access to finance on firms' productivity. Most of the existing literature on the relationship between finance and productivity focus on the role of financial development and are conducted at the macro level.

Nickell and Nicholitas (1999) studied 670 manufacturing companies in the UK from 1972-1986 using data from EXSTAT data table. The results obtained show that firms productivity is positively affected by the measure of financial pressure (defined as the ratio of interest payments to cash flow). Schiantarelli and Sembenelli (1999) used data on firms in the UK and Italy to show that the performance of firms (measured as TFP, profitability, and sales

growth) with a higher proportion of long-term debt in their capital structure increased. The results obtained are similar to studies for Ecuador by Schiantarelli and Jaramillo (1999) and India by Schiantarelli and Srivastava (1999).

Using World Bank survey data from Bulgaria, Gatti and Love (2008) estimated the effect of access to credit (proxy by a dummy variable indicating whether firms have access to a credit or overdraft) on productivity. The results obtained showed that access to credit positively and significantly affects productivity across firms. In contrast, Moreno-Badia and Sloomakers (2009) in a study of firms in Estonia developed new methodologies to provide evidence of the relationship between access to finance and firm-level productivity. Results obtained showed that although many Estonian firms are financially constrained, this does not affect the level of productivity in most of the sectors except R&D.

Chen and Guariglia (2013) evaluated the effect of internal finance on firm's productivity. Using data from annual accounting reports of industrial firms in China over the period 2001-2007, they found that the productivity of Chinese firms is positively affected by the availability of internal finance. The results suggest that at the firm-level, an increase in the accessibility of finance improves productivity. Ferrando and Ruggieri (2015), using firm-level data for euro area countries evaluated the effect of access to financial constraints on labour productivity for the period 1990-2011. The results obtained showed that the lack of access to external finance negatively affects labour productivity. The impact of this effect is felt mainly in the Energy, Gas, Water Supply, R&D, Communication and Information sectors, also on small and micro firms.

In contrast, Nunes et al., (2007) and Nucci et al., (2005) obtained results showing that access to finance negatively affects labour productivity. Nunes et al., (2007) applied a quantile approach in a study of 162 Portuguese firms for the period 1999 to 2003, results obtained showed that debt financing tends to decrease labour productivity for firms with low labour productivity and increase productivity for firms with high labour productivity. Using data on Italian firms, Nucci et al., (2005) found that the productivity of firms is negatively affected by debt-financing. The results obtained show that there exists a negative causal relationship between the level of debt in a firm's capital structure and its ability to be innovative.

Empirical studies on the effect of access to finance on firms' productivity are almost non-existent for African countries. The few existing studies investigate the effect of access to finance on efficiency (Ferdinand and Dasmani 2010). They used 2007 data from the World

Bank Enterprise Survey to calculate firm level efficiency scores for 270 firms in Ghana. The study found that increase in access to finance makes firms inefficient. Another study on Nigeria by Obembe (2011), studied the effect financial constraints on productivity growth in 76 listed non-financial firms for the period 1997 to 2007. The results obtained showed that bank loans have positive effects on the productivity of firms. From a sample of micro and small firms in Kenya, Mwangi (2014) used data from the 2007 World Bank Enterprise Survey to show the insignificant effect of access to finance on firm productivity.

This study fills the gap in the literature by providing an empirical analysis of the effect of access to finance on firms' productivity in a number of African countries. It also uses more direct measures of access to finance, such as having a checking or savings account, the presence or absence of overdrafts and lines of credit.

4. Methodology and Analytical Framework

This section provides a description of variables and the methodology used in this study.

4.1 Model Estimation

4.1.1 OLS Estimates

The effect of access to finance on firms' productivity is estimated by regressing the equation below:

$$Y_i = \beta_0 + \beta_1 AC_i + \beta_2 OB_i + \beta_3 F_i + \beta_4 C_i + \varepsilon_i \quad (1)$$

Where subscripts *i* and *t* denote the firm and year respectively. Y is the dependent variable measured by estimates of labour productivity and total factor productivity, AC is the main explanatory variables (the three measures of access to internal and external finance), OB is also an explanatory variable capturing firms' perceived effect of finance constraints, F is firm-level characteristics, C captures country characteristics and ε is the error term. We run various OLS estimation models to check for robustness and minimize possible biases.

4.1.2 IV: Instrumental Variable Model

From equation 1, potential econometric issues i.e. endogeneity might arise. Particularly, measures of access to credit are potentially endogenous because banks are more willing to provide finance to firms with higher levels of productivity. Therefore, OLS estimates may be biased, a negative coefficient on access to credit can imply that less productive firms are less likely to access credit than lack of access to credit negatively affects productivity. Following Gatti and Love (2008) and Mwangi (2014), we also estimate an instrumental variable model to address potential endogeneity bias between access to credit and firm productivity. Accordingly, we assess the effects of access to finance on productivity through a 2 Stage Least Square (2SLS) estimation technique.

However, the shortcoming of this method is finding the appropriate instrument. “A good instrument” is required to be both valid and relevant, correlated with the endogenous explanatory variable and orthogonal to the error term at the same time (Baum et al., 2003). The effect of a good instrument on the dependent variable should be felt through no other channel other than through the endogenous explanatory variable (Mwangi, 2014). This study uses the loan application by firms in a last fiscal year as instruments for access to credit.

***Correlation Table**

4.1.3 Stochastic Frontier Model

To solve the possible simultaneity bias and other measurement errors of OLS estimation, we run stochastic frontier analysis for Cobb-Douglas and translog production functions. The stochastic frontier approach makes allowance for stochastic errors due to statistical noise or measurement errors. The model was first introduced by Aigner et al., (1977) and Meeusen and van den Broeck (1977) and specifies output, cost, etc. in terms of a response function and a composite error term. The stochastic frontier model decomposes the composite error term into a two-sided error representing random effects outside the control of the firm (decision making unit) and the one-sided technical efficiency component.

According to Aigner et al., (1977), the random error effects represents random variations in the economic environment (such a weather, luck, machine breakdown, and variable input quality: measurement errors and omitted variable) that firms’ face in the course of production. The efficiency component represents a range of features (such as skills and effort of management and employee, firm-specific knowledge, work stoppages, and material bottlenecks) that reflects if a production process is efficient or inefficient. Aigner et al.,

(1977) and Meeusen and Van den Broeck (1977) assumes that the distribution of the efficiency error component is asymmetric and has an exponential and half-normal distribution.

The stochastic frontier model can be specified as:

$$Y_i = (X_i \beta) + \varepsilon_i \quad (2)$$

Where Y denotes the maximum output obtainable from X_i , a vector whose values are functions of inputs (non-stochastic inputs), β is a vector of unknown parameters to be estimated, and ε_i is the disturbance term. However, ε_i is equal to $V_i - U_i$, V_i refers to the random part of error, with normal distribution, independent and identically distributed and U_i is the part relating to technical inefficiency in production. In this study, the Cobb-Douglas functional form for the stochastic frontier is given as:

$$\ln Y_i = \beta_0 + \sum i \beta_1 \ln X_{ji} + \beta_2 AC_i + \beta_3 OB_i + \beta_4 F_i + V_i - U_i \quad (3)$$

And the trans-logarithmic functional form for the stochastic frontier is given as:

$$\ln Y_i = \beta_0 + \sum i \beta_1 \ln X_{ji} + \frac{1}{2} \sum i \sum k \beta_{i,k} \ln X_{ji} + \beta_2 AC_i + \beta_3 OB_i + \beta_4 F_i + V_i - U_i \quad (4)$$

Where Y represents the quantity of output produced, X_1 represents the total labour cost (including wages, salaries and bonuses), X_j is the net book values of machinery vehicles, equipment, land and building or the cost of raw material and intermediate goods used, AC is the main explanatory variables (the three measures of access to internal and external finance), OB is also an explanatory variable capturing firms' perceived effect of finance constraints, and F is firm-level characteristics.

4.2 The Method: Estimating Productivity

The productivity of a firm is an unobservable firm characteristic (Gatti and Love 2008). In this study, firms' productivity is estimated using three measures: (i) Labour productivity, (ii) Total Factor Productivity, and (iii) Stochastic frontier Cobb-Douglas and translog model. Labour productivity measures the amount of goods and services produced by one hour of labour. In this study, labour productivity is equal to the total annual sales in the last fiscal year divided by the number of permanent, full-time employees in the firm at the end of last fiscal year.

Comin (2010, pg.1) defines “Total factor productivity (TFP) as the portion of output not explained by the amount of inputs used in production.” TFP growth is usually measured by the Solow residual. Estimates of productivity can be gotten as the difference between actual output and output estimated by a production function using actual input quantities (Gatti and Love 2008). Productivity can be obtained from the regression of:

$$\ln Y_i = \alpha + \beta_K \ln K_i + \beta_L \ln L_i + \varepsilon_i \quad (5)$$

Where Y_i is firm’s output, K and L are capital and labour, β_K and β_L are capital and labour shares and ε_i is the error term. TFP, the estimated residual, is obtained in this model as the difference between actual and predicted output, or $\hat{\varepsilon}_i = \ln Y_i - \ln \hat{Y}_i$. In this model labour is captured using the total labour cost (including wages, salaries and bonuses) and capital is captured using either the addition of net book values of machinery vehicles, equipment, land and building or the cost of raw material and intermediate goods used in production in the last fiscal year.

There has been an on-going debate by researchers on which measure is the ‘best’ for capturing productivity growth. On the one hand, there are those who argue that TFP is the appropriate measure of productivity growth, and that labour productivity is a much cruder measure. On the other hand, there are those who argue that TFP depends too much on arbitrary assumptions, and that labour productivity is more closely related to current living standards, which is what society ultimately cares about (Sargent and Rodriguez, 2001). Note that all cost, sales, and net book values are converted to USD using prevailing exchange rate and consumer price index in the year of survey. This is similar to the methodology adopted by Gatti and Love (2008) and Chen and Guariglia (2013).

4.3 Description of Data

To analyse the effect of access to finance on firms' productivity in Africa this study uses the World Bank Enterprise survey data. The Enterprise surveys (ES) are an ongoing project by the World Bank. The studies are implemented using firm level surveys and involve the collection of both objective and subjective data based on firms’ experiences and enterprises’ perception of the environment they operate. The survey began in 2002 and has since evolved over the past years, making use of standardized methodology of implementation, sampling and quality control in most client-countries of the World Bank.

The Enterprise surveys interviews business owners and top managers and has currently covered 125,000 firms in 139 countries, of which over 94,000 interviews in 126 countries have been surveyed under the global methodology. In each country, the ES assesses the constraints to job creation and private sector growth. It also links the performance of firms and other firm characteristics with the business environment they operate in. The questionnaire covers the following topics: firm characteristics, corruption, crime, finance, gender, informality, infrastructure, innovation and technology, performance, regulation and taxes, trade and work force.

The focus of this study is on finance, and the ES ask firms questions relating to the characteristics and method of financing their operations. The following indicators are provided from the ES survey (i) a comparison of the relative usage of various sources of finance for working capital and investment, (ii) the measure of firms' access to the various sources of finance, and (iii) a measure of the obstacle finance poses to the operation of the firm. The following sources of finance are included in the ES:

- Internal sources of finance which include: internal funds or retained earnings, owners' contribution, other, friends, relatives, etc.
- External sources of finance which include: borrowings from private and state owned banks, borrowings from non-bank financial institutions such as credit cooperatives, microfinance institutions, and credit purchases from suppliers and advances from customers.

Specifically, the measure of firms' access to the sources of finance are derived by asking the following questions:

1. The proportion of working capital financed from each of the sources of finance.
2. If they have a line of credit or loan from a financial institution.
3. The proportion of investments (purchase of fixed asset) financed from each of the sources of finance
4. The value of collateral needed for a loan or line of credit as a percentage of the loan value or the value of the line of credit.
5. The proportion of loans requiring collateral and the type of collateral required.
6. How much of an obstacle is: Access to finance.

This study is carried out on 38⁶ countries in Africa and consists of pure cross-sectional data for which information is available on all variables for our baseline regression. The descriptive statistics on the sample countries and survey year as well as the number of firms surveyed in each country is shown in table 1.

Further analysis based on the size of the firms indicates that about 56.36% of firms in our sample are small firms (5 to 19 employees), 29.69% are medium (20 to 99 employees) and only 13.95% are large firms (more than 100 employees). Also, approximately 67.1% and 78.96% of firms in our sample do not have overdraft facilities and loan respectively, while only 15.82% do not have checking/savings accounts.

4.4 Description of Variable

This study uses firm-level data from World Bank Enterprise Survey. We collect individual country data from 38 African Countries and build a pure cross-sectional data for the years ranging from 2006-2016. The total number of firms with data on all the required variables is 19068.

We construct the following three variables to measure the access to finance from the Enterprise Survey: (i) Overdraft - is a dummy variable equal to one if the firm has no overdraft facility at the time of the survey and zero otherwise, (ii) Credit line/loan - is a dummy variable equal to one if the firm has no line of credit or loan from a financial institution at the time of the survey and zero otherwise, and (iii) Checking Account - is a dummy variable equal to one if the firm has no checking or savings account at the time of the survey and zero otherwise. In this study, we assume that overdraft and credit line/loan capture firms' access to external finance because they are short-term (overdraft) and long-term (credit line/loan) debt services provided by financial institutions. Checking/saving account is used to capture access to internal finance based on the assumption that firms would keep retained earnings in a current account with banks or in a savings account to earn some interest until when the funds are needed.

We also construct variables to rank how firms perceive finance as an obstacle in their business operations. The following variables are constructed: (i) No obstacle is a dummy

⁶ Gambia and Guinee Bissau (2006); Mozambique and South Africa (2007); Liberia, Sierra Leone, and Niger (2009); Angola and Botswana (2010); Rwanda and Central African Republic (2011); Djibouti, Kenya, Madagascar, Morocco, Tunisia, Zambia, Uganda, Tanzania, DRC, and Ghana (2013); Burundi, Malawi, Mauritania, Namibia, Nigeria, Senegal, Sudan, and South Sudan (2014); Benin, Cameroon, Cote d'Ivoire, Egypt, Guinea, Lesotho, Mali, Togo, Zimbabwe (2016).

variable equal to one if finance is no obstacle to the firms' operation at the time of the survey and zero otherwise, (ii) Minor obstacle is a dummy variable equal to one if finance is a minor obstacle to the firms' operation at the time of the survey and zero otherwise, (iii) Moderate obstacle is a dummy variable equal to one if finance is a moderate obstacle to the firms' operation at the time of the survey and zero otherwise, (iv) Major obstacle is a dummy variable equal to one if finance is a major obstacle to the firms' operation at the time of the survey and zero otherwise, and (v) Very Severe obstacle is a dummy variable equal to one if finance is a very severe obstacle to the firms' operation at the time of the survey and zero otherwise.

Also, we use information from the Enterprise Survey to control for firm-level characteristics that might affect a firm's productivity and ability to access financial services. Particularly, dummy variables are constructed to capture firms' size (small, medium and large), publicly listed firms, sole proprietorships, and firms' age (log values). We also control for level of country's economic and financial development by augmenting GDP per capita and domestic credit to the private sector (% of GDP) in our estimation equation.

5. Empirical Results

5.1 OLS Estimates: Total Factor Productivity Model

The baseline regression results for TFP model is presented in tables 3 and 4, while the results for the labour productivity model is provided in table 8.

Table 3: Base Regression Results (OLS): Whole Sample

Dependent Variable: Total Factor Productivity (TFP)				
4	Model 1	Model 2	Model 3	Model
Overdraft==No 0.181***	-0.235*** (-5.78)	-0.216*** (-5.26)	-0.0866* (-2.13)	- (-4.25)
Checking account==No 0.265***	-0.242*** (-5.07)	-0.250*** (-5.22)	-0.151** (-3.16)	- (-
5.35) Credit Line==No -0.101*		-0.193***	-0.177***	-0.0746

	(-4.41)	(-4.04)	(-1.73)	(-2.28)
Finance obstacle==Moderate		0.0590		0.0983*
0.0512				
		(1.26)	(2.15)	(1.08)
Finance obstacle==Major		-0.121**	-0.0467	-
0.0940*				
		(-2.66)	(-1.05)	(-2.01)
Finance obstacle==Very severe		-0.230***	-0.154**	-
0.228***				
		(-4.12)	(-2.82)	(-3.93)
Small Firm				0.461***
0.399***				
			(4.50)	(3.78)
Medium Firm				0.806***
0.739***				
			(7.84)	(6.92)
Large Firm				1.211***
1.119***				
			(11.47)	
(10.06)		Firm	age	(Log)
0.106**				
				(3.76)
Domestic credit (Log)				-
0.404***				
				(-13.03)
GDP		per		capita
0.287***				
				(9.65)
Constant	0.331***	0.353***	-0.570***	-
1.496***				
	(9.13)	(8.89)	(-5.40)	(-7.82)
5275	Observations	5727	5641	5641
0.106	Adj R-squared	0.025	0.029	0.077
	Country Dummy	NO	NO	NO
	NO			

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

The table above presents results for the whole sample in this study using total factor productivity as the measure of firms' productivity. To derive total factor productivity (TFP) - capital is measured as the net book value of machines, lands and building. Labour is measured as the cost of labour. However, the data on net book value is limited and leads to

loss of significant dataset, therefore, we proxy using cost of raw materials following studies like Ferdinand and Dasmani (2010); Mwangi (2014).⁷

The OLS estimates showing the relationship between firms' TFP and lack of access to finance (proxied by the absence of credit line/loan, overdraft facility, and checking account) is reported in table 3. From the table, it is observed that lack of access to finance by firms negatively affects their productivity in all the models estimated. When only access to finance and the perceived effect of financial constraint are measured (i.e. Model 2), the results shows that firms' productivity is reduced by 21.6%, 25% and 17.7% as a result of lack of access to overdraft facilities, credit line/loan and checking account respectively. Also, firms who perceive finance as a very severe obstacle experience a reduction in productivity by 23% while productivity increases by about 6% (albeit insignificant) for firms who rank finance as a moderate obstacle.

In terms of directional effects of a lack of access to finance on firms' productivity, the conclusion and interpretation of Model 1 and 2 results are not significantly affected when control variables are added to capture firm-level characteristics and country's financial and economic development (in Model 3 and Model 4). However, major significant change is observed in terms of magnitude in Model 3. Notably, the effects of lack of access to finance on productivity reduce substantially when only variables measuring firm-level characteristics (i.e. size of firm and firm age) are captured. Nevertheless, the models maintain consistent negative effects of a lack of access to finance by firms on firms' productivity. It is also shown that among the proxies measuring financial access constraints by firms, lack of checking and or saving account shrinks productivity the most.

The result output in Table 3 shows that the size and age of a firm significantly affect its productivity. Based on the empirical estimates, firms irrespective of size category (small, medium, large) exert positive and significant effect on productivity. However, large firms have greater effects, followed by medium firms, and then small firms. It is also indicated that the longer a firm is in existence, the higher the level of productivity of the firm.

In table 4 country dummies are included to account for country differences in TFP. As can be observed, the inference from the estimation seems not substantially different from the

⁷ The (TFP) results using net book value and cost of labour are reported in Appendix 5 for robustness check.

conclusion in Table 3. However, the impact of the lack of access to finance on firms' TFP seems larger than the one without country effects on productivity.

Table 4: Base Regression Results (OLS): Whole Sample with Country Dummy

Dependent Variable: Total Factor Productivity (TFP)				
	Model 1	Model 2	Model 3	Model 4
Overdraft==No 0.205***	-0.362*** (-9.45)	-0.339*** (-8.79)	-0.206*** (-5.36)	- (-5.12)
Checking account==No	-0.334*** (-7.09)	-0.332*** (-7.01)	-0.200*** (-4.25)	-0.212*** (-4.40)
Credit Line==No	-0.189*** (-4.73)	-0.184*** (-4.62)	-0.0966* (-2.45)	-0.0919* (-2.26)
Finance obstacle==Moderate		-0.142*** (-3.35)	-0.106* (-2.55)	-0.0803 (-1.86)
Finance obstacle==Major		-0.180*** (-4.35)	-0.120** (-2.96)	-0.102* (-2.41)
Finance obstacle==Very severe		-0.251*** (-4.86)	-0.180*** (-3.55)	-0.152** (-2.87)
Small Firm			3.379*** (24.47)	-0.282 (-1.82)
Medium Firm			3.737*** (27.17)	0.0639 (0.41)
Large Firm 0.448**				4.123*** (29.89)
Firm 0.0923***		age		(Log) (3.56)
Domestic 8.239***		credit		(Log) (7.01)
GDP per capita (log)				-0.322 (-1.16)
Constant	3.399*** (30.78)	3.564*** (30.62)	-0.401*** (-4.25)	-19.05* (-13.55)
Observations	5727	5641	5641	5275
Adj R-squared	0.25	0.25	0.28	0.29
Country Dummy	YES	YES	YES	YES

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Also, as against the evidence in Table 3, Table 4 suggests that absence of overdraft facility to firms constitutes the strongest constraints to firms' productivity (as shown in Model 1 – 3 in Table 4).

5.2 Robustness Checks

To access the robustness of the results above alternative measures of total factor productivity are used (capital is measured as net book value of machinery vehicles and equipment and labour is measured as the number of fulltime employees). Table 5 present results using alternative measures and the results obtained still shows that the lack of access to finance negatively affects firms' productivity. In Model 1, a pooled OLS regression with no country effects, lack of overdraft, credit line/loan, and checking account are negative and significant at 1%, 1%, and 5% respectively. This means that a 1% increase in firms with no overdraft, loan facility, and checking/savings account would experience a productivity decline by approximately 35%, 28%, and 15% respectively.

Further estimation is carried out to show how the effect of access to finance on firms' total factor productivity would differ based on the size and ownership of the firm (tables 6 and 7). Results showing only the coefficients of measures of access to finance and ranking of financial constraint is reported in these estimations.

Table 5: Base Regression Results (OLS)

Dependent Variable: Total Factor Productivity (TFP)		
	Model 1	Model 2
Overdraft==No	-0.353*** (-5.49)	-0.261*** (-4.35)
Checking account==No	-0.281*** (-3.49)	-0.0307 (-0.41)
Credit Line==No	-0.147* (-2.25)	-0.117 (-1.94)
Finance obstacle==Moderate	-0.235** (-3.26)	-0.254*** (-3.89)
Finance obstacle==Major	-0.271*** (-3.77)	-0.291*** (-4.49)
Finance obstacle==Very severe	-0.391*** (-4.36)	-0.373*** (-4.56)
Small Firm	0.629*** (3.76)	1.477*** (5.80)
Medium Firm	0.600*** (3.55)	1.579*** (6.15)
Large Firm	0.265 (1.52)	1.385*** (5.30)
Firm age (Log)	0.0332 (0.79)	0.0126 (0.32)
Domestic credit (Log)	0.145** (2.98)	-37.45*** (-19.35)
GDP per capita	-0.00829 (-0.18)	9.645*** (20.24)
Constant	-0.519 (-1.77)	33.23*** (15.22)
Observations	4028	4028
Adj R-squared	0.05	0.24
Country Dummy	NO	YES

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 6: Base Regression Results (OLS): Size of the Firms

Dependent Variable: Total Factor Productivity (TFP)			
	Small	Medium	Large
Overdraft==No	-0.157* (-2.28)	-0.154* (-2.52)	-0.230** (-3.05)
Checking account==No	-0.174** (-2.80)	-0.236* (-2.46)	-0.178 (-1.23)
Credit Line==No	-0.107 (-1.41)	-0.0537 (-0.89)	-0.136 (-1.87)
Finance obstacle==Moderate	0.0282 (0.42)	-0.111 (-1.62)	-0.219* (-2.46)
Finance obstacle==Major	-0.0375 (-0.61)	-0.199** (-2.92)	-0.279** (-2.82)
Finance obstacle==Very severe	-0.0778 (-1.06)	-0.265** (-3.03)	-0.354** (-2.74)
Constant	3.802*** (20.01)	3.215*** (16.21)	2.579*** (12.32)
Observations	2481	1825	1167
Adj R-squared	0.29	0.25	0.16
Country Dummy	YES	YES	YES

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 6 shows that the productivity of all sizes of firms is negatively affected by the lack of access to overdraft facilities. While the lack of access to overdraft significantly and negatively affects the productivity of all sizes of firms, however, only small and medium firms' productivity is negatively affected by lack of checking account. Also, only medium and large size firms who rank finance as major and very severe obstacle experience a decrease in their productivity.

Table 7: Base Regression Results (OLS): Ownership of the Firms

Dependent Variable: Total Factor Productivity (TFP)					
	Traded Shares	Non-Traded	Sole Shares	Partnership	Limited Proprietor
Partnership					
Overdraft==No	-0.319 (-1.95)	-0.189** (-3.27)	-0.255*** (-3.80)	-0.231* (-2.31)	-0.0818 (-0.84)
Checking account	0.579 (1.62)	0.0429 (0.38)	-0.160** (-2.76)	-0.202 (-1.91)	-0.223 (-1.48)
Credit Line==No	-0.173 (-1.05)	-0.121* (-2.07)	-0.0844 (-1.11)	-0.0760 (-0.66)	-0.0456 (-0.45)
Fin obstacle=Moderate	-0.0275 (-0.14)	-0.0502 (-0.70)	-0.0805 (-1.17)	-0.212 (-1.90)	-0.0836 (-0.71)
Fin obstacle==Major	-0.250 (-1.29)	-0.248*** (-3.36)	-0.0315 (-0.49)	-0.0521 (-0.48)	-0.173 (-1.47)
Fin obstacle==V. severe	-0.227 (-0.78)	-0.228* (-2.32)	-0.0675 (-0.90)	-0.0606 (-0.49)	-0.333* (-2.25)
Constant	0.808*** (5.58)	0.427*** (8.73)	0.106 (1.38)	0.272** (2.60)	0.382*** (3.92)
Observations	322	1529	2328	658	715
Adj R-squared	0.09	0.23	0.05	0.09	0.07
Country Dummy	YES	YES	YES	YES	YES

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 7 shows that lack of access to finance has an insignificant effect on incorporations with traded shares and limited partnerships. However, the productivity of sole proprietorships, partnerships, and entities with non-traded shares is significantly negatively affected by the

lack of access to overdraft facilities. On the average, a 1% lack of overdraft would reduce these entities' TFP by about 25.5%, 23.1%, and 18.9% respectively. While lack of checking account and or saving account also significantly constrain TFP of sole proprietorships, however, absence of credit/loan facilities shrinks TFP of non-traded shares business entities. It is also indicative in the empirical results that firms with non-traded shares who face moderate and severe finance obstacle have their TFP significantly affected than other business categories.

5.3 OLS Estimates: Labour Productivity Model

Table 8: Base Regression Results (OLS): Whole Sample

Dependent Variable: Labour Productivity (LP)				
	Model 1	Model 2	Model 3	Model 4
Overdraft==No	0.518*** (22.20)	0.511*** (21.74)	0.141*** (9.75)	0.134*** (8.90)
Checking account==No	0.417*** (14.38)	0.408*** (14.01)	0.101*** (5.66)	0.0973*** (5.32)
Credit Line==No	0.378*** (15.52)	0.385*** (15.76)	0.0906*** (6.60)	0.0990*** (5.88)
Finance obstacle==Moderate		0.143*** (5.69)	0.0442** (2.89)	0.0481** (3.05)
Finance obstacle==Major		0.203*** (8.20)	0.0427** (2.83)	0.0353* (2.26)
Finance obstacle==Very severe		0.218*** (7.08)	0.0292 (1.56)	0.0240 (1.23)
Small Firm			0.958* (2.09)	0.863 (1.89)
Medium Firm			-0.153 (-0.33)	-0.213 (-0.47)
Large Firm			-1.686*** (-3.68)	-1.731*** (-3.79)
Firm age (Log)				-0.142*** (-14.36)
Domestic credit (Log)				-2.801***

				(-6.76)
GDP per capita				0.838***
				(8.83)
Constant	-1.345***	-1.466***	-0.683	1.365*
	(-20.81)	(-21.43)	(-1.49)	(1.96)
Observations	13506	13277	13277	12409
Adj R-squared	0.19	0.20	0.70	0.71
Country Dummy	YES	YES	YES	YES

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

In table 8 above labour productivity is used as a measure of firms' productivity. Labour productivity is derived by dividing the total annual sales by the number of permanent, full-time employees. The results show that lack of access to finance significantly increases labour productivity in all the models considered. This is because small and informal firms often have very low labour productivity and increasing debt or leverage tends to negatively affect labour productivity in firms with relatively low labour productivity. This is similar to the results obtained by Nunes et al (2007) and Nucci et al. (2005), access to debt financing would decrease the productivity of low and medium productivity firms but would increase the productivity of high-productivity firms.

Table 9: Base Regression Results (OLS): Size of the Firms

Dependent Variable: Labour Productivity (LP)			
	Small	Medium	Large
Overdraft==No	0.0636*** (3.98)	0.104*** (4.20)	0.197*** (3.92)
Checking account==No	0.0669*** (4.19)	0.167*** (4.23)	0.123 (1.22)
Credit Line==No	0.0665*** (3.83)	0.0660** (2.67)	0.167*** (3.49)
Finance obstacle==Moderate	0.0146 (0.92)	0.0369 (1.35)	0.0597 (1.03)
Finance obstacle==Major	0.0153 (1.01)	0.0633* (2.30)	0.127* (2.07)
Finance obstacle==Very severe	0.0273	0.0422	0.0556

	(1.50)	(1.18)	(0.69)
Constant	-0.0382	-0.614***	-1.927***
	(-0.81)	(-8.21)	(-15.65)
Observations	7251	3867	1945
Adj R-squared	0.07	0.09	0.16
Country Dummy	YES	YES	YES

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

5.4: Instrumental Variable Model

Endogeneity tests of the endogenous variable are implemented under the null hypothesis that the specified variable can be treated as exogenous. Endogenous explanatory variable (access to credit) is instrumented using **loan application by firms in a last fiscal year**. This study uses a two-stage estimator and the results without country dummies are presented in table 11. It is also important to highlight that the GMM-type of the estimations above were carried and the results mirror the above findings. Evidence on this is available on request. The Hansen-Sargan's over identification test shows that the instruments are valid and table 10 presents the correlation between the instrumental variable and explanatory variable.

Table 10: Correlation Analysis

	TFP	Credit Line	Overdraft	Checking Account	Loan app
TFP	1.0000				
Credit Line==No	-0.1071	1.0000			
Overdraft==No	-0.1264	0.4141	1.0000		
Checking account==No	-0.1061	0.1961	0.2789	1.0000	
Loan application==No	-0.0594	0.4889	0.2670	0.1521	1.0000

The results in table 11 below show that the lack of access to finance reduces the level of firms' productivity. In model 1, 1% increase in lack of access to overdraft facility reduces firms' productivity by approximately 55%. Also, lack of access to credit line and checking account (model 2 and 3) have negative and significant effect on firm productivity. In addition, firms who perceive finance as a very severe obstacle experience a reduction in their level of productivity by 22%, 30%, and 28% respectively. Although, the results obtained for the main

explanatory variables are robust with the OLS method, the IV-2SLS method gives a more reliable and consistent results.

Table 11: IV-2SLS: Instrumental Variable Model

Dependent Variable: Total Factor Productivity (TFP)			
	Model 1	Model 2	Model 3
Overdraft==No	-0.556*** (-3.20)		
Finance obstacle==Moderate	0.0699 (1.43)	0.0171 (0.33)	0.00720 (0.13)
Finance obstacle==Major	-0.0787 (-1.63)	-0.0906 (-1.74)	-0.0677 (-1.24)
Finance obstacle==V.severe	-0.223*** (-3.74)	-0.300*** (-4.66)	-0.283*** (-4.19)
Small Firm	0.339*** (3.18)	0.387*** (3.51)	0.629*** (4.22)
Medium Firm	0.660*** (6.04)	0.757*** (6.71)	0.786*** (6.66)
Large Firm	1.011*** (8.44)	1.192*** (10.01)	1.215*** (9.76)
Firm age (Log)	0.0930*** (3.22)	0.0990*** (3.14)	0.0946** (2.86)
Domestic credit (Log)	-0.431*** (-9.73)	-0.310*** (-9.57)	-0.397*** (-7.29)
GDP per capita (Log)	0.305*** (8.64)	0.207*** (6.69)	0.228*** (6.42)
Credit Line==No		-0.296***	

		(-3.01)	
Checking account==No			-1.531*** (-2.71)
Constant	-1.332**** (-6.35)	-1.235**** (-5.80)	-1.186**** (-5.22)
Observations	5160	5603	5610
R-squared	0.09	0.08	.
Country Dummy	NO	NO	NO
Endogeneity (Durbin chi ²)	3.32*	1.95	5.77**
P-value	0.06	0.16	0.02

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01, **** p<0.001

5.5: Stochastic Frontier Model

To contribute to existing literature, firms' productivity is also measured using stochastic frontier Cobb-Douglas and translog production functions. The result of the log likelihood ratio test shows that the translog production function is the best specification to measure firms' productivity:

Log Likelihood-ratio test	LR chi2 (3) = 2285.99
(Assumption: Cobb-Douglas nested in translog)	Probability > chi2 = 0.000

Tables 10⁸ below shows results for the trans-logarithmic production functions. The results show that both log of labour cost and material cost are statistically significant at the conventional significance level of 1%, implying the suitability of the translog function for the firms studied. The results obtained for the measures of lack of access to finance on firms' productivity are robust to those for the OLS and IV-2SLS estimates. The lack of access to overdraft and credit line/loan facilities negatively affects firms' productivity and reduces firms' productivity by 19% and 36% respectively. Also, firms who rank finance as a moderate and major experience a decrease in their productivity levels. Small and medium sized firms also experience decreasing levels of productivity by approximately 39% and 27% respectively.

⁸ Appendix 6: Cobb-Douglas results.

Table 9: Stochastic Frontier Normal/Half Normal Model Regression

Dependent Variable: Translog Production Function	
Variables	Coefficients
Material Cost (β_1) (Log)	0.435*** (0.034)
Labour Cost (β_2) (Log)	0.798*** (0.036)
Material Cost2 ($(1/2) \beta_1 \beta_1$)	0.194*** (0.011)
Labour Cost2 ($(1/2) \beta_2 \beta_2$)	0.176*** (0.014)
Output = $\beta_1 * \beta_2$	-0.194*** (0.012)
Overdraft	-0.193** (0.096)
Credit Line/Loan	-0.356*** (0.091)
Checking Account	0.278 (0.215)
Moderate Obstacle	-0.279* (0.150)
Major Obstacle	-0.367** (0.168)
Very Severe Obstacle	0.050 (0.157)
Small Firm	-0.386*** (0.145)

Medium Firm	-0.271*
	(0.141)
Age of Firm (Log)	-0.208**
	(0.104)
Managerial Experience (Log)	0.068
	(0.068)
Observations	4682
Log Likelihood	-5334.0593
Wald Chi2	1914336.84
Probability > chi2	0.0000

Note: Standard errors in brackets. ***, **, * denotes significance levels at 1%, 5% and 10% respectively

6. Conclusion and Policy Implication

Although there exists a limited literature on the relationship between finance and firms' productivity, the evidence of this relationship is almost non-existent for African countries. This study contributes to the literature by providing empirical evidence of the link between finance and firms' productivity. To do this, cross-sectional firm level data from World Bank Enterprise Survey data for thirty eight (38) African countries are used. Empirical analysis is conducted on the effect of lack of access to internal and external finance on firms' productivity. Three constructed dummy variables measure access to finance: the absence of overdraft facilities, credit line/loan facilities, and checking/savings account. We capture firms' productivity using three measures: labour productivity, total factor productivity (TFP), and stochastic frontier translog functions.

For the whole sample, the results obtained are robust for TFP models and stochastic frontier translog functions. The lack of access to finance, especially overdraft facilities negatively affects the productivity of firms in Africa. Also, smaller firms and sole-proprietorships are mostly affected because they have less access to finance. In addition, firm characteristics such as size and age of firm affect its productivity. The level of economic growth and development of the financial system a firm operates in affects its productivity and ability to access finance. However, labour productivity (output per unit of labour) is negatively affected by access to finance because small and medium firms (92% of firms in this study) have low labour productivity which is negatively affected by increasing access to debt financing.

The results obtained have important policy implications. First, they are consistent with the idea or hypothesis that total factor productivity (which attempts to capture the relative efficiency of the usage of capital and labour inputs) is negatively affected by firms' inability to access finance in Africa. Second, firm characteristics such as size, age, and managerial experience can influence firms' ability to access finance and its effect on productivity. These points imply that the sensitivities of firm-level productivity to finance suggest that access to external finance is still not sufficiently wide-spread in Africa. Further development of a balanced financial system is required. To reduce the pressure on banks, stock and bond markets in particular should be equally developed. This would ensure that more finance is channelled towards those firms whose productivity is highly dependent on the availability of finance irrespective of their characteristics. If this were to happen, these firms would be able

to increase their investments in productivity-enhancing activities, which would benefit long-term economic growth.

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APPENDIX

Appendix 1: Descriptive Statistics: The summary statistics of the variables

Variable	Mean	Std. Dev.	Minimum	Maximum	Obs
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<i>A. TFP calculation</i>					
Net Book Value (logs)	11.5739	3.796	-6.77	28.36	4206
Sales (logs)	12.1949	3.0511	-4-19	27.58	23989
Material cost (logs)	11.6186	4.1770	-5.44	26.91	6275
Labour cost (logs)	10.7085	3.8540	-5.44	26.30	12321
<i>B. Firm-level characteristics</i>					
Age of Firm (logs)	2.6665	0.6404	0	4.897	8742
Managerial Experience (logs)	2.3030	0.7490	0	5.707	25072
Dummy = 1 if firm has no overdraft	0.7883	0.4085	0	1	23253
Dummy =1 if firm has no loan	0.8325	0.3734	0	1	24900
Dummy = 1 if firm has no account	0.1525	0.3595	0	1	14978
Dummy = 1 if firm size is small	0.6553	0.4752	0	1	23470
Dummy = 1 if firm size is medium	0.2631	0.4403	0	1	23470
Dummy = 1 if firm size is large	0.0814	0.2735	0	1	23470
Dummy = 1 if Manufacturing sector	0.4979	0.5000	0	1	16607
Dummy = 1 if Retail Sector	0.2303	0.4210	0	1	16607
Dummy = 1 if Other services	0.2716	0.4448	0	1	16607
Dummy = 1 if finance is no obstacle	0.2080	0.4059	0	1	24730
Dummy = 1 if finance is Minor obstacle	0.1569	0.3637	0	1	24730
Dummy = 1 if finance is Moderate obstacle	0.1794	0.3837	0	1	24730
Dummy = 1 if finance is Major obstacle	0.2486	0.4322	0	1	24730
Dummy =1 if finance is Very Severe obstacle	0.2068	0.4050	0	1	24730
<i>C. Country-level characteristics</i>					
GDP per capital (log)	7.470	0.9214	5.5314	8.7393	25946
Private Credit (% GDP)	30.053	30.6356	3.9223	160.125	25946

Appendix 4: Percentage of Firms with access to Bank Financial Services

Country	Year	Overdraft		Credit Line/Loan		Checking/Saving Account	
		YES	NO	YES	NO	YES	NO
Angola	2006	2%	98%	4%	96%	80%	20%
	2010	12%	88%	10%	90%	87%	13%
Botswana	2006	36%	64%	31%	69%	96%	4%
	2010	54%	46%	52%	48%	99%	1%
Burkina Faso	2006	37%	63%	30%	70%	95%	5%
	2009	58%	42%	29%	71%	98%	2%
Cameroon	2006	41%	58%	43%	57%	95%	5%
	2009	57%	43%	35%	65%	93%	7%
DRC	2010	15%	85%	14%	86%	74%	26%
	2013	24%	76%	9%	91%	56%	44%

Ghana	2007	15%	85%	19%	81%	83%	17%
	2013	23%	77%	22%	78%	95%	5%
Kenya	2007	42%	58%	41%	57%	94%	6%
	2013	36%	64%	39%	61%	91%	9%
Malawi	2009	56%	44%	40%	60%	98%	2%
	2014	41%	59%	28%	72%	82%	18%
Mali	2007	7%	93%	8%	92%	71%	29%
	2010	48%	52%	17%	83%	85%	15%
Niger	2005	50%	50%	48%	52%	94%	6%
	2009	73%	28%	40%	60%	97%	3%
Nigeria	2007	7%	93%	4%	96%		
	2009	17%	83%	14%	86%		
	2014	4%	96%	8%	92%	70%	30%
Rwanda	2006	34%	66%	35%	65%	81%	19%
	2011	47%	53%	49%	51%	74%	26%
Senegal	2003	51%	49%	41%	59%	94%	6%
	2007	13%	87%	11%	89%	79%	21%
South Africa	2003						
	2007	53%	47%	29%	71%	96%	4%
Tanzania	2006	17%	83%	20%	80%	85%	15%

	2013	10%	90%	19%	81%	75%	25%
Uganda	2006	14%	86%	18%	82%	87%	13%
	2013	10%	90%	21%	79%	87%	13%
Zambia	2007	39%	61%	16%	84%	93%	7%
	2013	19%	81%	14%	86%	89%	11%

Source: Author's estimates using ES data

Appendix 5: Base Regression Results (OLS): Whole Sample with Country Dummy

	(1)	(2)	(3)	(4)
Dependent Variable: Total Factor Productivity: Labour Cost and Net Book Value of Machines. Land and Buildings (Log Value)				
Overdraft	-0.060*** (0.056)	-0.053*** (0.051)	-0.078** (0.053)	-0.152*** (0.053)

Credit Line/Loan	-0.012** (0.053)	-0.006* (0.054)	-0.012 (0.054)	- 0.001 (0.053)
Checking Account	-0.070*** (0.057)	-0.167 ** (0.059)	-0.131*** (0.058)	- 0.139*** (0.058)
Moderate Obstacle		0.213*** (0.063)	0.176 *** (0.062)	0.131** (0.062)
Major Obstacle		0.084 (0.059)	0.061 (0.058)	-0.040* (0.058)
Very Severe Obstacle		-0.162* (0.063)	-0.181*** (0.063)	-0.275*** (0.063)
Small Firm			-0.012** (0.071)	-0.033** (0.069)
Medium Firm			0.028 (0.069)	-0.010 (0.067)
Age of Firm (Log)			-0.269*** (0.051)	-0.265*** (0.050)
Managerial Experience (Log)			0.104*** (0.031)	0.079*** (0.031)
GDP Per Capita (Log)				0.373*** (0.032)
Domestic Credit				0.002*** (0.0005)
Observations	2665	2,430	2401	2401
R-Squared	0.0089	0.0156	0.0238	0.0696

Note: Standard errors in brackets. ***, **, * denotes significance levels at 1%, 5% and 10% respectively

Appendix 6: Stochastic Frontier Normal/Half Normal Model Regression

Dependent Variable: Cobb-Douglas Production Function

Variables	Coefficients
Material Cost (β_1) (Log)	0.569*** (0.015)

Labour Cost (β_2) (Log)	0.556*** (0.017)
Overdraft	-0.464*** (0.113)
Credit Line/Loan	-0.433*** (0.103)
Checking Account	-0.002 (0.302)
Moderate Obstacle	-0.795*** (0.198)
Major Obstacle	-0.902*** (0.218)
Very Severe Obstacle	-0.326 (0.206)
Small Firm	-0.467*** (0.117)
Medium Firm	-0.323*** (0.119)
Age of Firm (Log)	-0.111 (0.093)
Managerial Experience (Log)	0.073 (0.061)
Observations	4682
Log Likelihood	-6477.0563
Wald Chi2	513362.44
Probability > chi2	0.0000

Note: Standard errors in brackets. ***, **, * denotes significance levels at 1%, 5% and 10% respectively