

Firm Financing Options and Productivity in Sub Saharan Africa: Evidence from Firm Level Data

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Abstract

This study examines the effect of firm financing choices on firm performance. Firm performance is measured by firm productivity, specifically the Total Factor Productivity (TFP) of a firm. The study uses firm level data from the World Bank Enterprise Survey (WBES) to investigate the effect of different financing options on the productivity of SSA firms. Using data for the period 2005 - 2013 from 26 countries, the study employs a linear Cobb-Douglas production function to estimate total factor productivity (TFP.) It then uses both parametric and non-parametric methods to analyse the effect of financing options on TFP. The results indicate that firms that rely on bank debt rather than other forms of financing (e.g. internal finance, informal finance, private and public equity) are, on average, more productive. This can be partly attributed to the monitoring activities of banks and the threat of bankruptcy faced by firms.

1 Introduction

Finance plays a crucial role in the performance of firms by providing the necessary funds for investments. However, the financial structure in a country determines the financing options that are available to firms. As Girma & Vencappa (2015) note, the financial system stimulates economic efficiency and offers more profitable growth opportunities. But for this to happen, firms should be able to access finance from the financial system. The sources of firm finance vary from one country to another, and are dependent on a number of factors, including costs, benefits, accessibility (Myers 1984), institutional differences (Beck et al. 2008), and the legal and financial environment (Porta et al. 1998; Allen et al. 2012). The choice of firm financing is a conscious decision made by firms (Mallick & Yang 2011). Choices include acquiring debt, using equity, sourcing internal funds, obtaining trade finance, and informal funding (borrowing from friends and family), among others.

Even though the effect of firm financing choices on firm performance has been broadly studied in the corporate finance field, there has not been consensus, and what has emerged are conflicting predictions, given the different conclusions of the different theories of capital structure¹. For example, the Modigliani & Miller (1958) “irrelevance theory” postulates that capital structure has no effect on firm performance. On the other hand, the agency cost theory by Jensen & Meckling (1976) posits that firms with higher debt levels have higher productivity, because higher debt levels reduce the agency cost of equity, thereby increasing firm value, as managers are constrained to act in the interest of shareholders.

Rahaman (2011) further notes that our understanding of the real effects of financial structure at a more disaggregated level is limited. The sources of firm finance are by-products of financial development in the country (Mallick & Yang 2011). Theory states that countries with better developed financial systems ease external financing, especially the use of bank funds that are marked by information asymmetries between firms and banks. Other factors that determine firms’ decisions on which source of finance to utilize are highlighted in the corporate finance literature. These include conflict of interest between firms and providers of funds or between shareholders and managers of a firm, or between equity-holders and debt-holders within a firm. Another factor is market imperfections. Girma & Vencappa (2015) note that different types of finance have different properties, and their effect on firm productivity varies across firms.

¹ Capital structure and financial structure have been used interchangeably in the corporate finance literature, in reference to firm financing. See for example Davis & Stone (2004); Wipperfurth (1966); Salim & Yadav (2012)

Firms of different sizes have access to different sources of finance. For example, large firms often have access to both bank and market finance in countries with financial markets, while small and medium size firms² have limited access to market finance, given the stringent listing requirements. They instead have access to other forms of finance including (but not limited to) internal/retained funds, trade credit, borrowing from banks, family and friends, or owners' equity. Likewise, the legal and regulatory framework in a country has a direct influence on the financial system. Studies have shown that countries with well-developed legal systems are more likely to have well developed financial systems. As a result, firms in different countries are faced with different financial environments. While some countries are able to provide external finance to firms, others must rely on internal sources of finance. Cross listing of firms in different financial markets has also broadened the sources of firm financing. Firms are negatively affected when they have limited financing options and are forced to forego investment opportunities. Rahaman (2011) observes that firms resort to internal financing when faced with constraints in external financing. As these constraints are alleviated, firms move away from internal financing to reliance on external financing (Rahaman 2011). Overall, a firm's choice of finance source depends on its objective of minimizing the cost of finance while maximizing the value of the firm.

Few studies look at firm financing and productivity, especially in developing countries. For example, studies by Allen et al. (2012) and by Girma & Vencappa (2015) look at firm financing in India. While Allen et al. (2012) find that bank and market finance are not associated with higher growth rates for firms, Girma & Vencappa (2015) find that bank and non-bank finance have a positive effect on the productivity growth of firms, with bank loans having the largest effect. They confirm that the size of a firm is important in determining how finance affects productivity growth. They find that large firms rely more on non-bank finance, and small firms rely more on bank finance. Financial structure determines the financing options of firms. It is therefore important to go beyond analysing the effect of financial structure at the aggregate (economy) level and understand the effect of firm financing on firm productivity.

The overall objective of this study is therefore to investigate the effect of firm financing options on firm productivity. The contribution of this study is therefore threefold. First, it provides empirical evidence using both parametric and non-parametric estimation methods. Second, it focuses on a regions that has not been analysed in the context of firm financing and productivity and third, it makes use of a dataset that has not been fully exploited, made available by the World Bank. Using data obtained from the World

² Which form the majority in developing countries, (Beck et al., 2008)

Bank Enterprise Survey (WBES) for a sample of manufacturing firms in 26 countries in SSA, we consider firms that purchased fixed assets during the survey period. We are able to distinguish between internal sources of funds, bank loans, equity, informal sources of finance, as well as trade credit. We measure productivity as the firm's total factor productivity (TFP). This will be estimated at firm level for each of the countries in the sample, using both parametric and non-parametric methods. The parametric method follows the standard regression analysis, while the non-parametric method follows the relative distribution approach by Hancock & Morris (1998). To the best of our knowledge, this is the first study that combines both parametric and non-parametric estimation methods in analysing the effect of firm financing on firm productivity in SSA. We thus contribute to the existing literature by providing empirical evidence from SSA, a region that has not been studied due to data limitations.

The rest of the paper is organised as follows: Section 2 looks at the theoretical and empirical literature, while section 3 looks at firm financing in Africa. The data and methodology are presented in section 4, while the results are presented in section 5. Finally, section 6 concludes the work undertaken.

2 Literature review

2.1 Theoretical literature

Firms' financing decisions can be reviewed in the context of the theory of capital structure, which considers the decision between internal and external (debt and equity) sources of finance to fund investment projects. Even though our study extends beyond these two sources of finance, the theory of capital structure informs our analysis. Financing choice by a firm is a complex process and theories can only explain a facet of this complexity (Margaritis & Psillaki, 2010). A number of theories have been developed that help explain the link between the choice of firm financing, and the effect on performance³.

Ever since Modigliani & Miller (1958) developed their Irrelevance Theory, financial economists have come up with alternative theories that explain a firm's financial structure. The Irrelevance Theory states that financial policy is irrelevant for firm performance. The implication is that the cost of capital and the value of a firm do not change with a change in a firm's leverage position⁴. This means that a firm's

³ There are several measures of firm performance. They include those fashioned from financial statements or stock market indicators, such as return on assets (ROA), and stock price returns, margins. Others include revenues, profitability, production efficiency, labour and capital productivity, and employment growth. In this study, we focus on productivity.

⁴ Leverage is defined as the ratio of debt to equity in a firm, on the assumption that these are the only two sources of firm finance

financing decisions have no effect on the cost of capital or on the value or real operations of the firm (Yazdanfar & Ohman, 2015). This assertion is based on the assumption that a firm does not retain earnings, and all total earnings are paid out as dividends, nor does it pay corporate taxes. It also assumes the existence of perfect capital markets, and the absence of agency costs, moral hazard, and information asymmetry. Thus, one assumes that management acts in the best interest of stockholders, where common stock is a source of finance besides debt (Modigliani & Miller, 1958). However, this theory has been criticized for its unrealistic assumptions, with the assertion that altering the assumptions could produce results that show that indeed, a firm's financial structure matters (Stiglitz, 1988).

Contrary to the above theory, the seminal work by Jensen & Meckling (1976), argues that a firm may be under the management of an outsider. They state that an outsider is bound to engage in activities that do not necessarily maximise the value of the firm, and these can be seen in the financing decisions a firm undertakes. In this setting, a firm is governed by contractual arrangements between the owner(s) of the firm as the principal(s), and the manager(s) as the agent(s). Such an arrangement brings with it agency costs, which arise because managers will not always act in the interest of the principal, especially if they are both utility maximizers. When the manager's ownership claim on the firm is low, his incentive to increase the value of the firm decreases, and this could lead to reduced firm performance. Managers may also divert firm resources for their own gains, which may be in conflict with the interests of the owners. Principals must therefore incur monitoring costs to ensure agents do not divert from the core business. At the same time, agents can also bond themselves to the firm, so that they will not take any action that will harm principals, or will ensure that principals are well compensated. When firms are managed by their owners, theory states that they will behave differently, from a situation in which there is outside control, either from equity holders or debtors. In such situations, agency costs arise because of the existence of divergent interests between owner/managers and the shareholders.

The use of debt to finance firm activities is seen to reduce agency costs, in that it reduces the amount of free cash available to managers to use for personal gain (Jensen 1986; Stulz 1990). Creditors also increase their monitoring of firms in such cases, and managers respond by increasing firm profitability to ensure there are enough funds to meet the legal repayments (Ang et al. 2000). The use of debt, however, comes with the threat of bankruptcy. According to Grossman & Hart (1982), though, the threat of bankruptcy can ruin a manager's reputation and to avoid this, a manager may ensure the firm remains profitable. This would improve firm performance. Contractual arrangements between owners and managers, should ensure that managers work hard to make the firm profitable. These firms are thus more likely to be characterised by high productivity.

Another departure from the irrelevance theory is the trade-off theory of financial structure, which posits that there are costs and benefits to using debt to finance investments. The main departure of this theory from the irrelevance theory is the introduction of the notion of taxes which make debt more favourable because interest payments are tax deductible. According to Myers (1984), firms trade-off between the interest tax shields and the dead-weight bankruptcy costs introduced by debt. This means that a firm will consider whether to use debt or equity in its financial structure in a bid to arrive at an optimum mix that adds more value to the firm. Theoretically, it is postulated that high performing firms will opt for higher debt levels, up to the point where additional borrowing increases the probability of financial distress.

An alternative to the trade-off theory is the pecking order theory. The departure of this theory from the irrelevance theory is the introduction of asymmetric information. This theory is based on the premise that a firm prefers internal sources of finance over external sources, in the presence of adverse selection (Myers, 1984). In this case, it is assumed that managers know the true state of the firm better than outsiders. According to this theory, the first preference in terms of finance is internal finance, followed by debt, then equity. Where internal finance is not adequate for a firm's investment requirements, the firm will opt for low risk debt financing before resorting to equity finance. With adverse selection, the choice of finance acts as a signal to outside investors. When the manager believes the firm is overvalued, he will issue equity, as opposed to when the firm is undervalued. Likewise, when the probability of default is high, a manager may incur debt just before this information is available to others.

The pecking order theory posits that the capital structure is designed to mitigate the inefficiencies in the firm's investment decision caused by asymmetric information (Harris & Raviv 1991). A firm characterised by little tangible assets relative to its value, and subject to severe information asymmetries will have a high debt value, compared to one with more tangible assets and less severe information asymmetries. This arises because of under-investment in new projects financed through equity, when investors believe that the firm is of low quality. Moreover, since the preferred source of finance is internal finance, the theory predicts that most profitable firms will have lower debt levels, since they do not require external finance. Where external finance is required, debt finance is preferred to equity as debt acts as a signal to investors of the profitability of the firm. Debt also signals that the current stock price of firms that issue shares is undervalued. It is therefore expected that firms that rely on internal funds are more productive than those relying on debt and equity, because use of internal finance signals that the firm is of high quality. Likewise, firms relying more on debt to finance project are expected to be of better quality, thus more productive, because debt signals that a firm is profitable enough to be able to repay the debt.

2.2 Empirical literature

There is a large amount of empirical evidence, with varying conclusions, on the influence of firm financing on firm performance (Nucci et al., 2005; Rahaman, 2011; Berger & Di Patti, 2006; Margaritis & Psillaki, 2010; Allen et al., 2012). Performance in these studies is measured using different variables. These include profitability (Ramadan, 2015), financial ratios obtained from balance sheets and income statements that include among others, return on investment (ROE), earnings per share (EPS), stock market returns and their volatility, Tobin-q (Berger & Di Patti, 2006), and productivity (Gatti & Love, 2008). These variables are obtained from financial statements, except productivity, which is estimated from the production process. These studies are based on the premise that the financing choices of firms can influence both managerial and firm behaviour, with implications for firm performance.

For example, Nucci et al. (2005) provide evidence that profitable firms in Italy tend to borrow less, and mainly rely on internal finance. While this supports the pecking order theory of financial structure, it contradicts the trade-off theory. Berger & Di Patti (2006) on the other hand show that firms with higher debt than equity perform better than firms with lower debt than equity. The explanation for this is that higher debt levels reduce the agency cost of equity, thereby increasing firm value as managers are constrained to act in the interest of shareholders.

Some empirical evidence also shows a negative relationship between productivity and certain sources of financing. For example Pushner (1995), using distributional analysis on Japanese firms, finds that firms with low leverage show above average levels of productivity. Their analysis follows from an examination of the distribution of productivity residuals within firms' leverage ratios. The study also finds that firms with moderate levels of leverage seem to have less-within firm variation in productivity. This contrasts the hypothesis that higher leverage can discipline management to operate firms as efficiently as possible by ensuring high levels of productivity. This cannot be generalised to all countries, as firm financing choice is dependent on the financial structure of the country, as well as the cost and accessibility of finance.

High debt levels can have a negative effect on productivity because firms engaged in more innovative activities are not likely to be funded by banks if they lack tangible assets. These results hold in countries with developed financial markets, which offer an alternative to debt finance. In countries with underdeveloped or inactive financial markets, the option of equity becomes very limited (Nucci et al. 2005). Lower debt levels are associated with higher intangible assets because innovative firms are more likely to make use of equity than debt. Equity finance does not require collateral in the form of tangible

assets. These conclusions contrast with findings by Margaritis & Psillaki (2010). They find a positive and significant relationship between firm performance and leverage, in their study of French firms, in which they measure leverage as the debt to total asset ratio). This supports the agency cost hypothesis that higher leverage is associated with improved firm performance.

However, it is not only debt that is associated with higher firm performance. In a study of both quoted and unquoted firms in the UK, Rahaman (2011) finds a positive effect of both external and internal finance on firm growth. They do, however, argue that firms with external credit constraints are most likely to use bank credit, with increased use of internal finance acting as a signal for future bank credit. They also show that small firms are more likely than large firms to use internal funds. The study concludes that the effects of firm financing on growth are statistically significant and quantitatively important, and that reliance on internal finance declines as constraints to external finance are eliminated, an indication that financial structure matters at firm level. Rajan & Zingales (1995) also reveal that firms relying on external finance grow faster, but that this requires a well-developed financial market.

Another branch of related literature investigates the effect of bank influence on firm growth and financing options, and finds that firms influenced by banks benefit from increased access to credit. These studies also find that debt has a negative influence on profitability, with no indication that bank influence on a firm promotes its growth or profitability (Agarwal & Elston 2001). As noted, some studies postulate that firms that make use of bank loans perform better. They postulate that banks monitor firms and therefore it is expected that they will have stronger growth than those without bank relations, whose performance is not monitored. However, this was not the case in India, one of the largest growing economies in the world. Allen et al., (2012) find that bank and market (equity) finance were not associated with higher growth rates. They show that the single most important form of finance for Indian firms is non-bank and non-market external finance. They test the hypothesis that informal finance is associated with start-ups which then shift to formal finance. They still, however, find persistence in the use of non-bank and non-market finance for both small and large firms. Thus, for developing countries like India, non-formal finance that is not dependent on legal institutions, and which is backed by mechanisms outside the formal financial system, may be more advantageous in promoting growth and productivity. Such findings show that, indeed, financial structure matters. Alternative forms of finance are a common feature of less developed countries which have underdeveloped financial systems to support bank and market finance. Instead, these countries are characterised by weak legal institutions, and extensive informal sectors supported by informal sources of finance.

It has also been noted that there is a high correlation between firm growth and productivity (Lööf & Heshmati 2002) and research has shown that finance plays a crucial role in enhancing firm productivity and productivity growth (Levine & Warusawitharana 2014). These studies show that there is a positive link between external finance and future productivity growth. We note however the observation by Mallick & Yang (2011) that there is no unique and unambiguous equilibrium relationship between financial structure and firm performance. As observed in the literature, while some theories predict a negative relationship, others predict a positive relationship. Still other show no relationship between firm finance and firm performance. Most of these studies use regression analysis, postulating a linear relationship between leverage and firm performance, while controlling for firm characteristics that have been shown to have an effect on performance.

From the above literature, it is evident that finance is an important factor in the performance of firms and the choice of firm finance is crucial. The role of firm financing options on firm productivity is under-researched, with most studies focusing more on the effect of leverage on firm performance. Besides, most studies derive firm performance from financial statements. In developed countries, firms that rely on equity are more likely to be more productive, but this is not necessarily the case in developing countries. Instead, firms in developing countries are more likely to benefit from an increase in access to credit in an economy that is more bank-based than one that is more market-based, because of limited access to formal financial markets. Given the stringent conditions for listing in a formal stock market, small and medium size firms in developing countries are locked out of the formal financial market. However, they resort to other forms of financing that, like equity and bank loans, have an effect on their productivity. The role of these additional sources of finance on firm performance is not widely researched, yet it has been shown that these sources can exert an influence on firm performance.

3 Firm Financing in Sub Saharan Africa⁵

Firm financing patterns differ across countries, and this is due to differences in the development of banks and stock markets, as well as the differences in legal institutions (Demirgüç-Kunt & Maksimovic 1999) These differences are considered to be more important than differences in industrial affiliation, which too, results to differences in financing patterns (Fan et al. 2012).

⁵ Based on pooled data from the World Bank Enterprise survey (WBES) collected between 2005 and 2013 for different countries in SSA.

Firms in Sub Saharan Africa are as diverse as the countries in this region. Furthermore, this diversity is also seen in the financial systems, and the extant literature on financial structure suggests that firm financing is dependent on the level of financial development in a country, the quality of institutions as well as the legal and financial environment (Beck et al. 2008). The rest of this section provides an overview of the financial environment in SSA, aiming to highlight peculiarities and specific features of firm financing in SSA.

3.1 Access and Sources of Finance

In general, developing countries tend to have less-developed financial systems, with limited financing options for firms. Yet, financial constraints have a direct implication on firm performance as well as growth. Surveyed firms from SSA were asked to state how financially constrained they are, and stark differences can be seen between large and small firms. It is expected that small firms face more constraints than large firms. Small firms are defined in the survey as those with between 5 - 19 employees, medium firms as those with between 20 - 99 employees, and large firms as those with over 100 employees. From table 1, we see that a larger percent of respondents for small firms view access to finance as a major to very severe obstacle, compared to respondents from both medium and large firms (47%, 35% and 25% respectively). This is mirrored by the larger percent of responses from large firms that see access to finance as no obstacle (34%) compared to small firms (16%).

Table 1: Obstacles to finance by firm size (% of responses)

Size	No obstacle	Minor obstacle	Moderate obstacle	Major obstacle	Very severe obstacle	Total
Small firms	16.28	16.55	19.86	26.88	20.44	100
Medium firms	24.75	18.86	21.64	20.84	13.91	100
Large firms	34	21.34	19.95	14.83	9.89	100
Total	22.13	18.14	20.45	22.81	16.48	100

Source: World Bank Enterprise Survey

Notes: The table represents responses to the question: How much of an obstacle is access to finance.

Table 2 shows the percent of firms that have ties with a financial institution, and we see that fewer small firms (14%) have ties with financial institutions compared to medium and large firms (29% and 41% respectively). This is not surprising, as small firms face major constraints in accessing finance. These findings echo studies that have shown that providing finance to small firms is considered a riskier undertaking than financing large firms. As Beck, et al. (2008) note, inadequate access to external finance is largely attributed to market imperfections, including high transaction costs and information

asymmetries. What this means is that small firms are forced to resort to alternative forms of finance, as shown in table 3.

Table 2: Bank ties by firm size

Establishment has a line of credit or loan from a financial institution (% of responses)		
	No	Yes
Small firms	85.94	14.06
Medium firms	70.71	29.29
Large firms	58.96	41.04
Total	76.27	23.73

Source: World Bank Enterprise Survey

Many firms in Sub Saharan Africa rely on internal finance, which accounts for 73% of the total financing options⁶. This is followed by bank finance, accounting for 14% of total financing needs. Complete reliance on equity was the least used option, at 3% of the total financing requirement. Collier (2009) notes that growing firms do not rely on retained earnings because growth squeezes cash flows. If productivity drives growth, then the conclusion is that firms in SSA are, on average, not productive and therefore are not growing, given their strong reliance on internal finance.

Differentiating the sources of finance by firm size, we see that the pattern is somewhat different, even though the major source of finance for all firms is still internal funds. These results are shown in table 3 below. A significant proportion of investment is financed from internal funds for all firms, with small enterprises utilising this option more than both medium and large enterprises (77%, 68% and 66% respectively). The second major source of finance is bank loans, and this was observed across all firms. Likewise, for all firms, very little investment is financed using equity finance (3% across all firms). This is not surprising, as Sub Saharan Africa is mainly characterised by small and mostly inactive financial markets, except Kenya, Mauritius, Nigeria, and South Africa.

Between the two formal sources of external finance (bank and equity), we see that bank funds are the most utilised form of external finance, compared to equity finance for all firms. For example, 9% of investments of small firms are financed from bank loans compared to 3% financed from equity. 19% of the investments of medium and large firms are financed from bank loans, compared to 3% from equity.

⁶ Results are shown in appendix A.2

Table 3: Firm financing patterns by firm size (% of responses)

Size	Bank loan	Equity	Internal funds	Hybrid	Others (Informal)	Total
Small firms	9.29	3.32	77.28	5.89	4.23	100
Medium firms	18.94	3.11	68.12	5.69	4.14	100
Large firms	18.7	2.71	66.82	5.58	6.18	100

Source: World Bank Enterprise Survey

The table represents the proportion of investment financed from the various sources

Comparing sources of finance by country and firm size⁷, we see a huge cross country difference in firm financing. For example, small and medium firms in Lesotho rely heavily on bank loans, while large firms rely almost entirely on internal finance. Firms in Mauritius rely more on bank loans than internal finance. The use of bank finance in Nigeria is low for all firm sizes. Burkina Faso has a higher reliance on equity finance for large firms, while small and medium firms did not utilise equity finance. No South African rely on equity finance. This large variation in firm financing is expected, as countries are characterised by diverse levels of financial development as well as by legal institutions of varying strength, which has been shown to have a large impact on how firms finance their investments. The significant use of internal finance is not a unique feature of SSA firms. For example, Beck et al. (2008) show that firms in Germany, the UK and the US use internal finance for a significant portion of their investments.

3.2 Legal and Institutional Framework

The prevailing view is that efficient and effective legal institutions are instrumental in promoting developed financial systems. The law and finance literature emphasizes the need for a strong legal and regulatory framework that can protect the rights of financial players. It is theorized that when property rights are protected, and rules and regulations are enforced, a country's financial system benefits and develops (Porta et al. 1998; Rajan & Zingales 1998). Respect for the rule of law is thus crucial for well-functioning financial markets, as well as operational banking institutions. Allen, et al. (2012) posit that the lack of effective legal and other regulatory institutions is one reason financial markets have not played a more prominent role in the Indian economy.

Studies on developing countries have shown that there is a difference between recorded legislation and practice. For example, Allen, et al. (2012) show that, while India has a long history of British common law⁸, the level of investor protection and the quality of legal institutions is below the average for former

⁷ Selected country results are shown in appendix A.3.

⁸ Studies show that countries with legal systems inherited from English common law provide stronger legal protection than countries whose legal systems are of French civil law origin

British colonies. They show that these are only slightly better than such protections and institutions in former French colonies. They attribute these differences to the slow and inefficient legal system and corruption in government. This is a common feature in many developing countries.

To proxy for institutional framework, we look at the responses of the firms to the question “How much of an obstacle is corruption”. Literature on institutions shows that rent seeking behaviour by interest groups can turn legal institutions into barriers for efficient business operations. The responses are shown in table 4 below.

Overall, we see that there are concerns about corruption, with 30% of respondents for large firms reporting that corruption is a major to severe obstacle. Likewise, 33% and 37% of respondents for medium and small firms respectively reported that corruption is a major to severe obstacle. We can infer that small firms are more affected by corruption than large firms. While corruption is not the only measure of inefficiency in financial institutions, it is an indication of a firm’s views about the legal and business environment in which they operate. Providing an enabling environment for business ensures that firms will survive, and offers a level playing field for firms to thrive.

Table 4: How much of an obstacle is Corruption (% of responses)

	Small Firms	Medium Firms	Large Firms
No obstacle	26.43	28.49	28.95
Minor obstacle	20.37	20.72	21.4
Moderate	16.49	17.84	19.27
Major	21.61	17.99	18.29
Very severe	15.09	14.96	12.08

Source: Author’s computation from World Bank Enterprise Survey

Notes: The responses have been averaged over all firms

We also look at the responses to the question on “fairness and impartiality of the court system”. The literature suggests that banks and financial markets that are backed by legal institutions are more accessible to large and listed firms than to small and private firms in most countries (Allen et al. 2012). From the results on table 5, we see that respondents for large firms tend to agree or strongly agree more on the impartiality and fairness of the court system, compared to both small and medium firms. For example, 43% of the large firms agree that the courts are fair, compared to 36% and 32% of respondents for medium and small firms respectively.

Table 5: Question: The court system is fair, impartial & uncorrupted (% of responses)

	Small Firms	Medium Firms	Large Firms
Strongly disagree	23.99	22.66	20.22
Tend to disagree	28.14	28.37	23.86
Tend to agree	32.03	35.79	42.87
Strongly agree	15.84	13.18	13.05

Source: Author's computation from World Bank Enterprise Survey
Notes: The responses have been averaged over all firms

Firm financing in Sub Saharan Africa is a major concern for policymakers, as firms are important for economic growth. It is therefore crucial that barriers to finance are removed to aid financial development.

4 Methodology, Model specification and Data

4.1 Estimating productivity

The traditional approach for analysing productivity is to estimate a production function (Ghosh 2009). This is the approach adopted in this study. We quantify a firm's productivity as the Total Factor Productivity (TFP), in line with studies that evaluate the effect of financing options on firm productivity (Girma & Vencappa 2015; Nucci et al. 2005). TFP is defined as the efficiency with which firms convert inputs into outputs (Saliola & Seker 2011) and is endogenously determined, using either the gross value of sales or the value added and input choices (Dabla-Norris et al. 2010). Variations in the specification of the equation depend on the inputs used, as well as on the dependent variable used. The starting point in all specifications is the general Cobb Douglas production function, with TFP estimated as the residual from the estimations. This is what is commonly referred to as the Solow residual. In this study, we use both gross sales and value added, and compare the results for robustness checks, and include only labour and capital as the factor inputs.

The general specification is expressed as:

$$Y = K^{\alpha k} (AL)^{\alpha l} \quad (1)$$

Where Y = Output; K = Capital; A = TFP; L = Labour; αk , & αl are the factor shares for capital and labour respectively. Expressing equation (1) in logarithmic form gives us:

$$Y_i = \alpha_0 + \alpha_1^k K_i + \alpha_2^l L_i + \varepsilon_i \quad (2)$$

Equation (2) is estimated for each country. Since the data was collected at country level, the values of the above variables were expressed in terms of the nominal local currency. To make the data comparable, we need to convert it to a numeraire currency. We therefore use the US dollar and convert amounts to the 2009 United States Dollar (USD) equivalent. To do this, we first convert the local currency into USD using the average exchange rate for the year in which the survey data was collected. We then deflate using the 2009 US GDP deflator. This method of deflation is similar to the method used by the World Bank (2015).

Labour services are adjusted for human capital, following Caselli (2005). Our survey provides data on the average education level for full time production workers. Thus, human capital is measured as shown in equation (3) below.

$$H = L \exp \varphi(s) \quad (3)$$

Where;

H is human capital

L average number of employees

s average number of years of schooling.

$\varphi(s)$ is assumed to be piecewise linear⁹.

TFP is thus calculated as the residual from equation (2), given by

$$TFP_i = y_i - \tilde{y}_i \quad (4)$$

Where y_i are the actual values and \tilde{y}_i are the predicted values.

Endogeneity of factor inputs

The traditional OLS estimation of equation (4) above assumes away any possible correlation between productivity shocks and the error term. As stated in the literature, unobservable firm level productivity shocks are positively correlated with the error term (Levinsohn & Petrin 2003). Firms choose both physical and human capital based on their levels of productivity, and this will be captured in the error

⁹ Specifically, as in Caselli (2005), we have $\varphi(s) = 0.134*s$ if $s \leq 4$; $\varphi(s) = 0.134*4+0.101*(s-4)$ if $4 < s \leq 8$; $\varphi(s) = 0.134*4+0.101*4+0.068*(s-8)$ if $8 < s$

term of equation (2). The methods that have been proposed in the literature to deal with endogeneity of factor inputs and productivity include the Olley & Pakes (1996) method, and the Levinsohn & Petrin (2003) method. However, as noted in Waldkirch (2014), these methods require time-series information, and this is not available in our data, making the use of these methods infeasible.

To correct for this type of endogeneity, Schiffbauer & Ospina (2010) propose using the previous period values of labour and capital as instrumental variables. Our data contains data on the number of permanent, full-time employees at the time of establishment of the firm. We therefore use the initial labour to instrument for the current period's labour. As noted in the existing literature, investment in physical capital is usually determined at the beginning of the production period.

Thus, to instrument for physical capital, we use the net current book value of fixed assets, on the assumption that this value depends on the amount of capital held at the beginning of the production period.

4.2 Methodology and data

We use both a parametric and a non-parametric approach to determine the role of a firm's financing options in productivity. The parametric approach follows the usual regression estimation analysis, while the non-parametric approach looks at the distribution of productivity across the different firms using different financing options. Both ought to tell the same story.

4.2.1 Non-parametric estimation method

The objective of non-parametric estimation is to examine the distributional differences between and within groups that go beyond a description of statistical summaries of the data. We follow (Handcock & Morris (1998) and compare the distribution of firm productivity corresponding to the different financial choices. This way, we are able to establish the stochastic dominance as well as a ranking for the compared distributions. This methodology has been used mainly to compare income distributions (Petrarca & Ricciuti 2015). It has also been applied to the distribution of productivity of exporting vs non-exporting firms for Spanish manufacturing firms (Delgado et al. 2002) and the productivity distribution of foreign owned vs domestic firms in the SADC region (Dunne & Masiyandima, 2016). The methodology is, however tailored to our application, using the distribution of firm productivity based on firm financing choices.

Given the different sources of finance, we need to establish a reference group¹⁰ as well as a comparison group. This allows us to compare the productivity of users of one source of finance against the productivity of users of another source. The first step is to compute the Cumulative Distribution Function (CDF) of productivity, in which case our productivity measure, TFP, is as defined above. The sources of finance available in the data are as defined in section 4.3, which include bank loans, equity funds, internal funds, informal sources, and a hybrid of the sources.

We denote the CDF of productivity for the reference group as $F_0(y)$ and $F(y)$ for the comparison group. We choose bank funds as the comparison group and each category of the other sources will be used as the reference group. Let Y_0 and Y denote random samples from F_0 and F respectively. The grade transformation of Y to Y_0 is defined as the random variable

$$R = F_0(Y) \quad (5)$$

The realisation of R , is referred to as the relative data, r whose CDF can be expressed as;

$$G(r) = F(F_0^{-1}(r)) \quad (6)$$

Where $0 \leq r \leq 1$.

The relative data, r , which represents the proportion of values, is interpreted as the percentage rank that the original comparison value would have in the reference group. The relative distribution is therefore defined as the fraction of firms in the reference group to the fraction of firms in the comparison group in each decile of the distribution of productivity. $F^{-1}(r)$ is the quantile function of F_0 . The relative probability density function (PDF) of R is given by;

$$g(r) = \frac{f(F_0^{-1}(r))}{f_0(F_0^{-1}(r))} \quad (7)$$

If the distributions of the reference and comparison groups are identical, the CDF of the relative distribution is a 45⁰ line and the PDF of the relative distribution is the uniform PDF (Handcock & Morris, 1998). From the above, we are able to graphically establish if there exists stochastic dominance in the productivity of firms financed from a particular financing option. The relative PDF, the density ratio, is

¹⁰ Group refers to firms utilising a given financing option.

the ratio of the fraction of firms in the comparison group to the fraction of firms in the reference group at a given level of productivity.

4.2.2 Parametric estimation

Given the lack of data for more than a single period for most of the SSA countries, we make use of a static model as use of a dynamic model is not possible¹¹.

We model a linear relationship between a firm's productivity and its sources of finance, taking into account other firm characteristics that have an influence on productivity. We specify the equation as follows:

$$prod = \beta_0 + \beta_1 finance + \beta_2 X_i + \delta_l + \lambda_t + \nu_j + \eta_s + \epsilon_i \quad (8)$$

Where; *prod* = productivity estimated from equation (2) above;

finance = The financial structure variable and it is identified as the proportion of investment financed from the various sources of finance. These sources include bank loans (from commercial banks and non-bank financial institutions), equity finance (including owners' equity for private firms and public equity for publicly listed firms), internal funds, trade credit and informal sources which include borrowing from family, friends and other informal money lending sources. To classify a firm as bank financed, most of their investment must have been financed from bank loans, obtained from banks or from non-bank financial institutions. Equity financed firms as those with most of their investment financed from equity. Internally financed firms are those with most of their investment financed from retained earnings and the same applies for informal funds, which combines trade credit, borrowing from friends, family and other informal sources. However, where firm's investment is financed by an equal share of a combination of sources, these have been classified as hybrid.

X = Firm characteristics that that have been shown to have an effect on firm performance¹². These include size of the firm, experience of their top manager, age of the firm, type of firm ownership, informal competition, operating capacity of the firm, and average education of production workers. We measure the size of the firm by the number of employees. Large firms are expected to be more productive than small firms (Girma & Vencappa 2015). It is also expected that more experienced

¹¹ For some countries, data exists for more than one period. However, we are not in a position to exploit the panel aspect of the data because of too few time periods.

¹² See Pushner (1995); Margaritis & Psillaki (2010) among others.

managers can steer a firm's productivity better than an inexperienced manager. Well-established firms are expected to have survived the teething problems encountered by new firms. Older firms are therefore considered to be more productive. Foreign owned firms are expected to be more productive than government owned, or privately owned domestic firms (Waldkirch 2014). To capture this, we use data on the type of firm ownership, which includes private domestic, private foreign, government owned and other (e.g. sole proprietorship). Studies have shown that exporting firms are more productive than non-exporting firms (Delgado et al. 2002). We therefore control for the level of exports by including a variable that captures the percent of exports in a firm's sales.

δ_l represents location¹³ fixed effects on the assumption that firms located in one region share certain characteristics. It is also assumed that financial institutions are more likely to be concentrated in a region that is viewed to be more productive, making it easier for firms to access finance.

To account for characteristics that are common to all the firms, but vary across time, we include time fixed effects represented by λ_t .

v_j represents country fixed effects

η_s accounts for industry fixed effects.

4.3 Data

The data used in this study is the Enterprise Survey data, collected by the World Bank. A standardized sampling framework was used for data collected from 2005, making the data comparable across countries. The data is cross sectional, and the unit of observation is the firm. We focus on the manufacturing firms in Sub-Saharan Africa for our analysis. Stratification was based on firm size, with more emphasis on small and medium firms. Our sample therefore consists of 43% small firms, 34% medium firms, and 23% large firms across Sub-Saharan Africa.

Since only a subset of the data is used, the firms are filtered as follows: First, firms must have purchased fixed assets in the period under survey. Second, the firms must have data on financing choices for fixed assets. Third, firms must have data on the variables used to compute productivity, including net book value of assets to proxy physical capital and average years of school for a typical production worker, to proxy human capital. Countries for which these variables are missing are dropped. This leaves us with

¹³ Location refers to main business city.

data from 26 countries. For the survey, interviewers were asked to give their opinion on the reliability of the data. The responses ranged from truthful, to somewhat truthful, to unreliable. Observations for which data was described as unreliable were dropped.

All the major manufacturing industries listed in the International Standard Industrial Classification (ISIC) revision 3.1. are covered in the data. To achieve a sufficient number of firms in each classification, we have combined some industries, based on similarities in the type of activity and factor intensity. This reclassification is similar to Saliola & Seker (2011) but in our case, we combine textiles, garments and leather into one industry as well as Chemicals, Plastics and rubber. This gives us a total of five major industries. Industries that fall outside the five major categories are classified as other. As noted in Saliola & Seker (2011), the sample design of the enterprise survey was such that the selected industries were targeted to facilitate industry level analysis, which we employ in our study.

Table 6: Industry classification

ISIC Code	Industry	Obs	Proportion (%)
15 & 16	Food & Tobacco	668	25.08
17, 18 & 19	Textiles, Garments & Leather	384	14.41
24 & 25	Chemicals, Plastics & rubber	314	11.79
26 & 27	Non-metallic & Basic metals	212	7.96
28 & 29	Fabricated metal & Machinery	376	14.11
-	Other Manufacturing	710	26.65
Total		2664	100

Source: World Bank Enterprise Survey

These responses are based on data from firms that purchased fixed assets and whose productivity could be estimated based on data availability. As noted earlier, firms that did not have data on labor and capital, and therefore whose productivity could not be estimated were dropped.

Descriptive statistics

The sample comprises firms that purchased fixed assets during the survey period, as our outcome variable of interest is tied to firms financing choices. It is evident that a large proportion of the firms rely on internal finance, with banks being the second most popular option. With limited access to finance for many enterprises in SSA, the heavy reliance on internal funds by firms in the sample is not surprising. The “other” category comprises trade credit, and, borrowing from informal sources and we see more reliance on this source of finance compared to equity finance. Stock markets in SSA are not well

developed, and are characterised by low levels of activity compared to stock markets in other developing countries and globally. It is therefore no surprise that there is little reliance on equity finance.

Table 7: Financing Choices

Financing options	Obs	Mean
Bank Loan	379	15.02
Equity	72	2.85
Internal funds	1798	71.26
Hybrid	121	4.8
Others	153	6.06
Total	2523	100

Source: World Bank Enterprise Survey

Responses are for firms that purchased fixed assets and whose productivity could be estimated based on data availability. Firms with missing data on capital and labor were dropped as productivity could not be estimated.

As seen on table 8, the sample includes newly established firms that have been in operation for less than one year, and well-established firms, with the oldest having been in operation for 189 years. Average years of education for production workers is about 8¹⁴ years, with some firms having unskilled workers. This could be explained by the growing population in SSA or the growth in the size of the labour force, coupled with low skills levels compared to other parts of the world. The average exports amount to 12 percent, an indication that most of the firms surveyed sell to the domestic market.

Table 8: Summary Statistics

Variable	Obs	Mean	SD	Min	Max
TFP (Using gross revenue)	2,641	12.97	2.47	7.06	23.24
TFP (Using Value added)	2,641	12.7	2.35	6.64	21.9
Age	3,043	18.92	16.96	0	189
Average education	2,419	7.66	4.9	0	26
Management experience	3,042	16.5	10.24	1	60
Capacity	2,515	0.88	0.33	0	1
Informal competition	3,015	1.76	1.38	0	4
Size	2,961	1.81	0.79	1	3
Exports	3,032	11.85	25.31	0	100
Ownership	2,961	0.22	0.42	0	1

¹⁴ Represents completion of primary education.

Notes: Size: 1=Small; 2=Medium; 3=Large; Capacity=1 If a firm utilizes at least 50% of its capacity; Informal competition=0 if firms faces no obstacle from the practices of competitors in the informal sector, and it equals 4 for those facing very severe obstacles. Ownership=1 for firms with at least 10 percent foreign ownership and 0 otherwise.

Correlation coefficients

The correlation coefficients reported in table 9 below show that firms that rely more on bank funds and hybrid sources to finance most of their investments are associated with a positive TFP, compared to firms relying on equity funds, internal funds and informal funds (categorised as other). However, correlation coefficients are not enough evidence to confirm that bank financed firms are more productive than those using other sources of finance. This is because we have not controlled for other variables that could drive productivity. The positive correlation between productivity and firm age, management experience, capacity utilisation, firm size, and foreign ownership is expected, as well as the negative correlation between productivity and informal competition. Exporting firms are also expected to be more productive than non-exporting firms and this is also seen in the positive correlation between exports and productivity. Further analysis is, however, needed to confirm causation.

Table 9: Correlation coefficients

Variable	TFP (Using gross revenue)	TFP (value added)	bank loan	equity fund	internal fund	hybrid	Others	Age	Average educ	Managemen t exp.
TFP (Using gross revenue)	1									
TFP (value added)	0.99	1								
bank loan	0.17	0.16	1							
equity fund	-0.05	-0.04	-0.07	1						
internal fund	-0.13	-0.13	-0.71	-0.26	1					
hybrid	0.07	0.07	-0.1	-0.04	-0.36	1				
Others	-0.05	-0.05	-0.1	-0.04	-0.34	-0.05	1			
Age	0.4	0.4	0.05	-0.02	-0.04	0	0.02	1		
Average educ	0.04	0.06	0	0.04	0.04	0	-0.06	0.08	1	
Management exp.	0.19	0.19	0.09	-0.02	-0.07	0.02	-0.03	0.31	0.01	1
Capacity	0.09	0.09	0.01	-0.03	0.06	-0.03	-0.1	0	-0.02	0.01
Informal comp	-0.2	-0.18	-0.08	0.02	0.05	-0.02	0.04	-0.06	0.07	-0.02
Size	0.71	0.71	0.15	-0.01	-0.15	0.06	0	0.36	0.09	0.17
Exports	0.17	0.17	0.08	0.02	-0.1	0	0.05	0.12	0.03	0.04
Ownership	0.19	0.19	-0.04	0.03	0.02	-0.01	0.01	0.09	0.11	0.03
	Capacity	Informal comp.	Size	Exports	Ownership					
Capacity	1									
Informal comp.	-0.04	1								
Size	0.03	-0.18	1							
Exports	-0.04	-0.1	0.23	1						
Ownership	-0.04	-0.05	0.21	0.11	1					

5 Estimation Results

As noted in the literature, financially constrained firms are likely to overlook productive investments because of lack of funding opportunities, and are therefore likely to be less productive. We expect that large firms, which face less severe obstacles in accessing finance, are more productive than small and medium firms. As noted, too, in the literature, we expect that firms financing most of their investments using bank funds are more productive.

5.1 Non-parametric estimation results

The non-parametric results detailed below are based on a probability distribution analysis of the productivity of firms in relation to their choice of finance. This will give us a visual display of any heterogeneities in their productivity.

The productivity distribution of all firms based on sources of finance are shown in figure 1. As stated earlier, firms that did not purchase any fixed assets during the sample period are excluded from the analysis. At a first glance, we see the productivity of firms relying more on bank funds is distinguishably higher than that of firms relying on internal funds, equity funds, informal sources, and hybrid sources of finance. This is especially so for firms at the bottom end of the distribution. At the upper end of the distribution, the productivity of firms financing most of their investment using a hybrid source of funds and other informal sources appears higher than firms relying more on bank, equity, and internal funds. This is surprising, as we expect firms using formal sources of finance to perform better.

Figure 2a, which shows a comparison of the probability distribution of small and medium firms, indicates that, on average, firms that finance most of their investment using bank funds are more productive than firms using other sources of funds. Large firms, on the other hand, are on average more likely to have similar levels of productivity except for firms relying on a hybrid of sources of finance, as seen from figure 2b. These results clearly point to the heterogeneities that exist in the productivities of firms that could be a result of firm characteristics not accounted in the graphical analysis.

Figure 1 Probability distribution: All firms

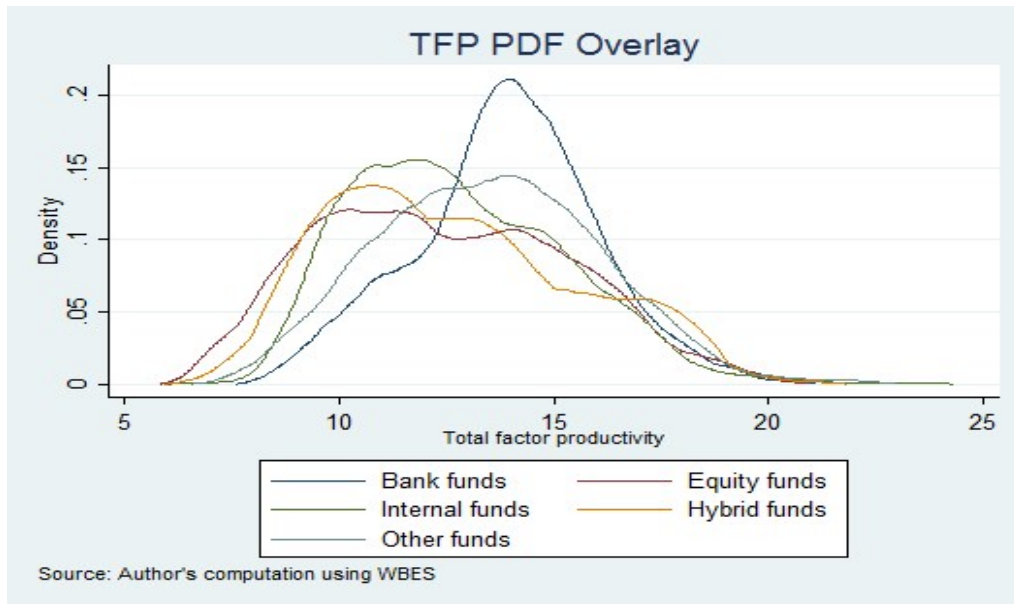
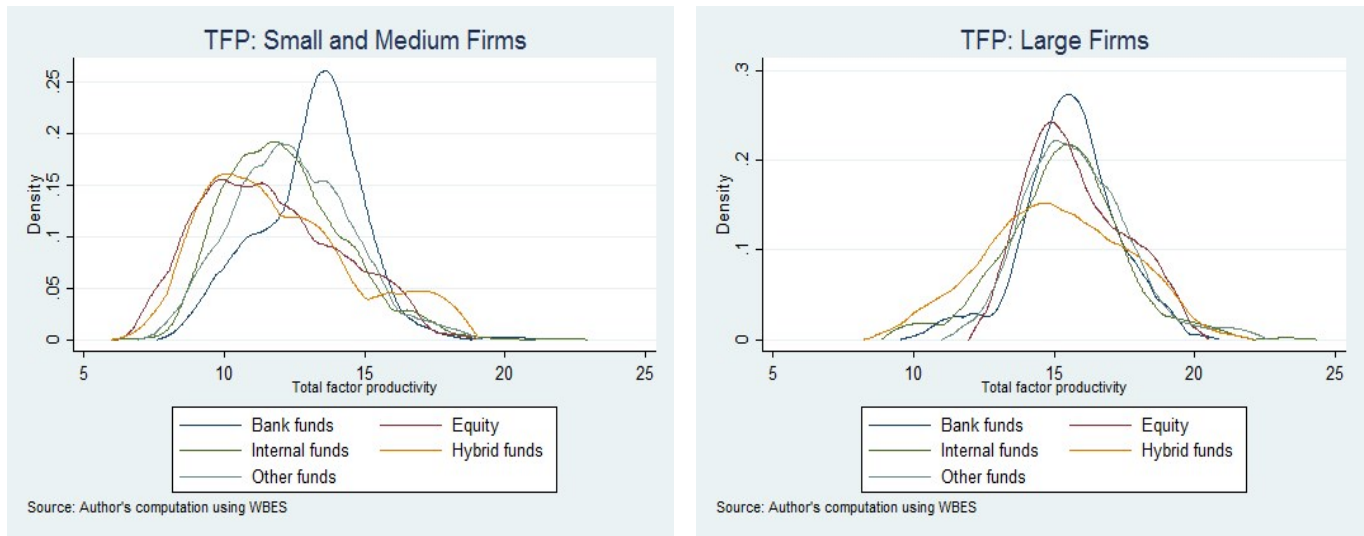


Figure 2: Probability distribution by firm size

(a) Small and Medium Firms

(b) Large Firms



The graphical analysis above is in line with the agency cost theory that postulates that firms that rely on debt perform better than firms relying on other sources of finance. The reasons for this is that banks are in a better position to monitor the performance of firms funded by them (Levine 2002), and also the fact that managers of firms with large amounts of debt fear bankruptcy as it damages their reputation, and therefore put more effort into ensuring firm profitability.

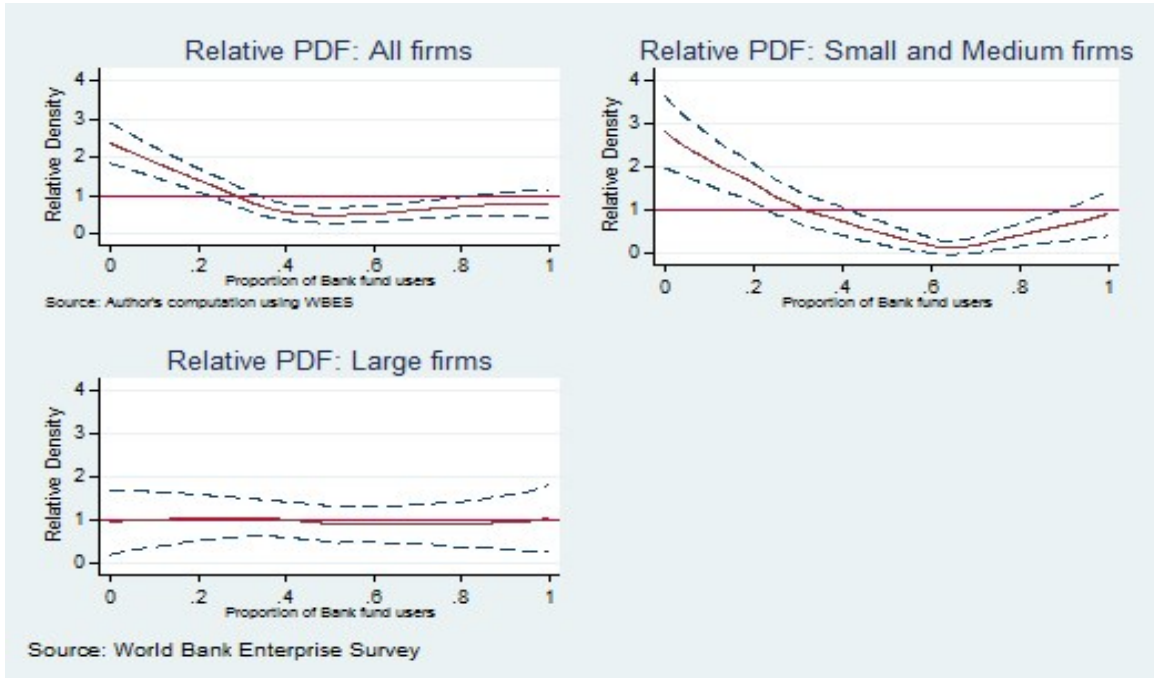
However, we cannot make quantitative interpretations from the distribution analysis. To be able to make statistical inferences of the productivity distributions, we turn to the relative distributions. Firms relying on bank funds have higher productivity, especially the small and medium firms. We thus proceed by comparing bank funded firms with firms relying on each of the other sources¹⁵.

The relative distribution of the productivity of firms relying on bank funds and those relying on equity fund is shown in figure 3. The dotted lines are the 95% confidence intervals. The first graph on the first row of figure 3 is for all firms, while the other 2 are disaggregated by firm size. The first graph shows that productivity of firms relying on equity funds falls below that of firms financing most of their investment with bank funds. Specifically, the 95% confidence interval of the first graph in row one shows that the productivity of firms relying on equity funds is approximately 2 to 3 times likely to fall below that of firms relying more on bank funds. Small and medium firms that rely on equity are 3 to 4 times

¹⁵ To limit the number of graphs, we only present results for the relative distribution of firms using banks vs those using equity funds, and firms using bank finance vs those using internal funds. The rest of the graphs are available on request.

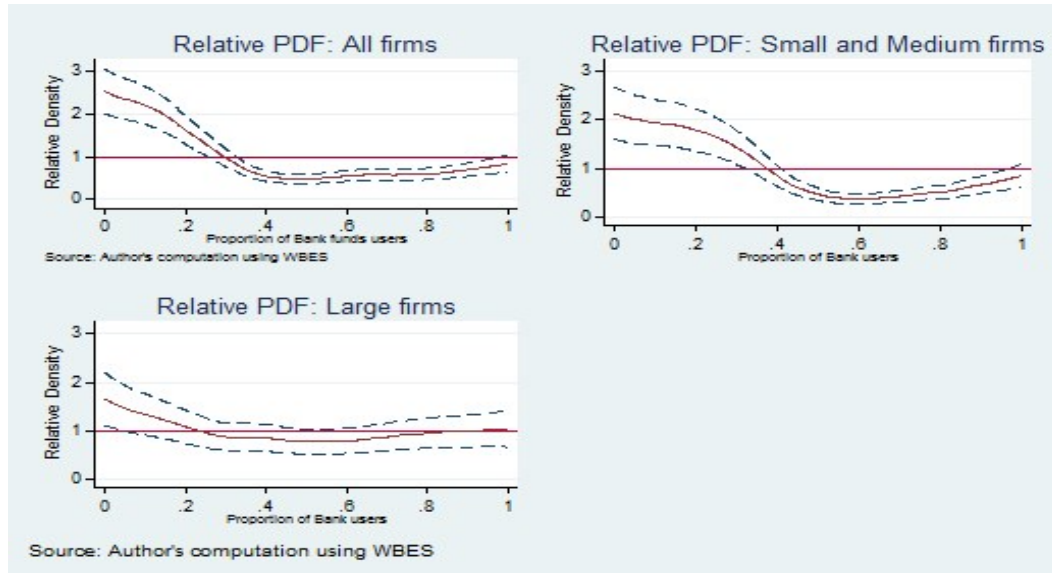
less productive than similar sized firms relying on bank funds. The picture is different for large firms, with the graphs depicting less difference in the productivity of firms relying on equity and bank funds.

Figure 3: Relative productivity distribution of Bank and Equity fund users



We compare the productivity of firms using mainly bank funds with that of firms using mainly internal funds. We see that, similar to results obtained from comparing firms relying on bank funds and those relying on equity funds, the productivity of firms relying on bank funds is still higher. Here, we however show that the productivity of large firms relying on internal funds is, on average, two times below that of firms relying on bank funds at the bottom end of the productivity distribution.

Figure 4: Relative productivity distribution of Bank and Internal fund users



The above analysis suggests that there is a positive association between debt and productivity. Given the heterogeneities of countries in SSA, and the inclusion of South Africa in the analysis, one would expect firms in South Africa would dominate the results. However, excluding South Africa did not alter the results¹⁶.

Many countries in SSA are characterised by low levels of growth and, as noted in section 3, the majority of firms face financial constraints, which limits their growth. It was noted that only about 14% of small firms have ties with financial institutions, compared to 41% of large firms. Banks have been shown to cherry pick customers and it may therefore be the case that firms relying more on bank funds are those with previous records of high profitability. The above analysis does not, therefore, give conclusive evidence that banks contribute to the productivity of firms. The parametric estimation enables us to further investigate this claim, by allowing us to control for other firm characteristics

5.2 Econometric estimation results

The results in table 10 are obtained from estimating the effect of firm financing options on productivity using regression analysis. Columns (1) through to (5) represent different specifications of the model. In column (1), we do not control for any fixed effects and instead run a pooled OLS. In columns (2) to (4),

¹⁶ Graphs can be made available on request

we have controlled for country, location and industry effects respectively, while column (5) shows results when we control for all fixed effects.

The results show that firms that finance a larger proportion of their investment using bank funds are more productive than firms that rely on other sources of finance. These results hold, even when we control for unobservable effects at country, location, and industrial classification levels. The assumption made in the literature is that banks are more likely to be concentrated in a location that has more productive firms. This has the possibility of leading to eventual relationship lending. Likewise, certain industries are more likely to be bank funded than others given the profitability associated with them. As Rajan & Zingales (1996) note, some industries are more dependent on external finance than others, hence the need to control for industry fixed effects. Time fixed effects control for the fact that the surveys were carried out during different fiscal years.

Column (1) shows that the lower productivity associated with equity, internal and informal funds is significant, even when we do not control for any unobservable fixed effects. Column (2) shows that, after controlling for country and time fixed effects, the lower productivity associated with equity becomes insignificant. Similar results are observed when we control for location and time fixed effects; the coefficient on equity becomes insignificant. However, when we control for industry fixed effects, shown in column (4), the negative coefficient on equity is significant. In column (5), where we control for all unobservable fixed effects (country, location, industry and time fixed effects), the results show that the lower productivity is only significant for firms that source internal and informal funds.

Table 10: Financial Structure and Total Factor Productivity for all Firms

OLS Estimates of the Effect of Firm Financing Options on Firm Productivity. Dependent variable: TFP estimated from gross sales

Variables	(1)	(2)	(3)	(4)	(5)
Financing options (base category=bank)					
1. Equity	-0.915*** (0.28)	-0.266 (0.26)	-0.194 (0.26)	-0.653** (0.26)	-0.217 (0.25)
2. Internal funds	-0.494*** (0.09)	-0.429*** (0.13)	-0.360*** (0.13)	-0.457*** (0.15)	-0.341** (0.13)
3. Hybrid	-0.00228 (0.18)	-0.0715 (0.21)	-0.0176 (0.19)	-0.0223 (0.20)	-0.0329 (0.19)
4. Others (Informal)	-0.887*** (0.21)	-0.647*** (0.23)	-0.709*** (0.22)	-0.850*** (0.22)	-0.699*** (0.22)
Age	0.0221*** (0.0024)	0.0164*** (0.0028)	0.0159*** (0.0029)	0.0157*** (0.0029)	0.0150*** (0.0029)
Management experience	0.00491 (0.0038)	-0.0042 (0.0044)	-0.00352 (0.0044)	0.00797 (0.0050)	-0.00182 (0.0043)
Average education	-0.00412 (0.0067)	0.0680*** (0.0224)	0.0626*** (0.0222)	0.0616*** (0.0184)	0.0641*** (0.0228)
Informal competition (base category= No obstacle)					
1. Minor obstacle	-0.629*** (0.1080)	-0.145 (0.1400)	-0.183 (0.1420)	-0.303** (0.1350)	-0.186 (0.1390)
2. Moderate obstacle	-0.630*** (0.1210)	-0.351** (0.1400)	-0.366** (0.1400)	-0.361** (0.1610)	-0.371** (0.1420)
3. Major obstacle	-0.530*** (0.1080)	-0.101 (0.1230)	-0.123 (0.1200)	-0.238* (0.1220)	-0.14 (0.1170)
4. Very severe obstacle	-0.481*** (0.1370)	-0.183 (0.1320)	-0.205 (0.1370)	-0.227 (0.1580)	-0.212 (0.1350)
exports	-0.000627 (0.0018)	0.00381* (0.0022)	0.00528** (0.0022)	0.00351 (0.0024)	0.00544** (0.0023)
capacity	0.411*** (0.1130)	0.296** (0.1150)	0.262** (0.1200)	0.375*** (0.1310)	0.247** (0.1230)
Firm ownership (base category = private domestic)					
1. Private foreign	0.00501*** (0.0011)	0.00404*** (0.0012)	0.00430*** (0.0012)	0.00320** (0.0014)	0.00346*** (0.0013)
2. Government owned firms	0.00271 (0.0077)	0.00546 (0.0060)	0.00356 (0.0065)	0.00766 (0.0068)	0.00478 (0.0071)
3. Other (e.g. sole proprietorship)	0.00205 (0.0031)	0.00162 (0.0034)	0.00259 (0.0037)	0.0036 (0.0047)	0.00243 (0.0037)
Size (base category = Small size)					
1. Medium size	1.820*** (0.0949)	1.463*** (0.1100)	1.390*** (0.1150)	1.539*** (0.1090)	1.323*** (0.1070)
2. Large size	3.720*** (0.1130)	3.053*** (0.1830)	2.927*** (0.1890)	3.183*** (0.1540)	2.840*** (0.1910)
Constant	11.35*** (0.1750)				
Observations	1,842	1,452	1,448	1,443	1,439
R-squared	0.555	0.639	0.667	0.567	0.673
Country FE	No	Yes			Yes
Location FE	No		Yes		Yes
Industry FE	No			Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes

*Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

The columns represent results with various effects fixed as shown at the bottom of the table. The base category for the financing choices is bank funds.

For a robustness check, we compare the above results with results obtained from different measures of TFP, as detailed in section 4.1. These results, using value added to measure productivity, are presented in appendix A.4. The results are comparable to those in table 4-10, which show that bank funded firms are significantly and consistently associated with higher productivity than firms funded from internal and informal sources, regardless of which fixed effects we control for.

As shown in the distribution analysis, the productivity differences for large firms was less distinct, especially for bank vs equity fund users. We thus proceed by splitting the analysis for large and small and medium firms in order to establish if such differentials can be identified in the regression analysis.

5.2.1 Firm financing options and firm productivity: Large firms

The results for large firms are shown in Table 11, while those for small and medium enterprises are shown in table 12. Overall, we see that the sign on the coefficient on equity is positive, though insignificant when we control for country and time fixed effects, and industry and time fixed effects. However, the productivity of large firms that finance most of their investment from bank funds is significantly higher than the productivity of those that finance investments using informal sources. These results are consistent when we control for country, location, industry and time fixed effects individually and collectively. Large firms are thus seen to exhibit different behaviour in this analysis, compared to the results that showed that firms that finance a their investments using internal funds have consistently lower productivity than those that use bank funds, regardless of the fixed effects we control for.

Table 11: Firm financing options and Total Factor Productivity for Large Firms

<i>OLS Estimates of the Effect of Firm Financing Options on Firm Productivity for Large Firms</i>					
<i>Dependent variable: TFP estimated from gross sales</i>					
Variables	(1)	(2)	(3)	(4)	(5)
Financing options (base category = bank)					
1. Equity	0.192 (0.4300)	0.198 (0.4380)	-0.0465 (0.3880)	0.333 (0.4140)	-0.0966 (0.3690)
2. Internal funds	-0.377** (0.1640)	-0.603* (0.3560)	-0.513 (0.3710)	-0.479 (0.3070)	-0.528 (0.3750)
3. Hybrid	0.295 (0.2970)	-0.0802 (0.4060)	0.0276 (0.4510)	-0.0424 (0.3440)	-0.146 (0.4350)
4. Others (Informal)	-0.787* (0.4440)	-1.097** (0.4380)	-1.066** (0.4370)	-1.252*** (0.3960)	-1.187*** (0.4390)
Observations	466	330	315	327	311
R-squared	0.245	0.417	0.469	0.364	0.499
Country FE	No	Yes			Yes
Location FE	No		Yes		Yes
Industry FE	No			Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes

*Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

In these results, we have controlled for other firm characteristics using the same control variables as those shown in table 9. They include age, management experience, average education of a typical production worker, informal competition, whether a firm is an exporter or not, capacity of the firm as well as the ownership structure of the firm, that is, if it is private domestic, foreign owned, domestic owned, government owned or other.

5.2.2 Firm financing options and productivity: Small and medium firms

Comparing the results for small and medium firms with those of large firms, we see that, unlike large firms, small and medium firms that finance most of their investment using bank funds are more productive than firms that finance most of their investment from internal sources. These results are consistent across all specifications. Columns (1), (2) and (4) of table 12 show that the lower productivity associated with equity funds is significant, when we do not control for any unobservable fixed effects, and when we control for country and time fixed effects, and control for industry and time fixed effects. The results also show that firms that finance most of their investment using internal and informal funds are less productive than firms that used mainly bank funds, and this is consistent across all specifications.

Table 12: Firm financing options and Total Factor Productivity for Small and Medium Size Firms

OLS Estimates of the Effect of Firm Financing Options on Firm Productivity for Small and Medium Firms Dependent variable: TFP estimated from gross sales

Variables	(1)	(2)	(3)	(4)	(5)
Financing options (base category = bank)					
1. Equity	-1.603*** (0.3220)	-0.428* (0.2570)	-0.272 (0.2590)	-1.095*** (0.2820)	-0.289 (0.2560)
2. Internal funds	-1.014*** (0.1250)	-0.552*** (0.1440)	-0.397*** (0.1370)	-0.768*** (0.1830)	-0.332** (0.1290)
3. Hybrid	-0.430* (0.2480)	-0.174 (0.2580)	-0.0896 (0.2480)	-0.203 (0.2550)	-0.0599 (0.2460)
4. Others (Informal)	-1.303*** (0.2770)	-0.534* (0.2800)	-0.501* (0.2780)	-0.881*** (0.2760)	-0.447* (0.2680)
Observations	1,376	1,121	1,116	1,116	1,111
R-squared	0.158	0.421	0.48	0.274	0.499
Country FE	No	Yes			Yes
Location FE	No		Yes		Yes
Industry FE	No			Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes

*Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Notes: In these results, we have controlled for other firm characteristics using the same control variables as those shown in table 9. They include age, management experience, average education of a typical production worker, informal competition, whether a firm is an exporter or not, capacity of the firm as well as the ownership structure of the firm, that is, if it is private domestic, foreign owned, domestic owned, government owned or other.

From table 11, the overall observation is that, in SSA, firms that finance a large proportion of their investment using bank funds are more productive than firms that rely on internal and informal sources of finance. This is especially so for small and medium firms, which are the majority in SSA.

Our results compare favourably with results by Levine & Warusawitharana (2014), who find that firms that rely on external finance have higher productivity growth than those that rely on internal finance. However, they use a broader definition of financial structure, and categorise financing options into two broad categories of external vs internal funds. It differs from our analysis in that we further split external finance into either bank or equity finance. Our results also show that firms relying on internal funds are less productive than firms relying on bank finance, a form of external finance. However, this contradicts findings by Allen, et al. (2012) who maintain that, for India, bank and market finance are not associated with higher growth rates, and the single most important form of finance for Indian firms is non-bank and non-market external finance. Nevertheless, they note the importance of external finance (though not the

typical formal external¹⁷ finance) relative to internal finance. They further affirm that, for developing countries like India, non-formal finance that is not dependent on legal institutions, and which is backed by alternative mechanisms outside the formal financial system may better promote growth and productivity.

These results give greater insight into the effects of firm financing options on firm productivity than those obtained from the productivity distribution analysis. A shortcoming in the above analysis is its inability to account for causal effect running from productivity to choice of firm financing. It has been shown that some performance measures e.g. firm profitability, may influence a firm's demand for debt (Pushner, 1995), and that, while equity markets are more arm's length in their transactions with firms, banks closely monitor firms and identify promising entrepreneurs to fund. This means that only profitable firms have access to bank funds. This could explain the higher productivity among bank funded firms. However, Pushner (1995) subsequently notes that, while profitability may influence a firm's demand for debt in the long-run, one does not expect a direct causal link between productivity and a firm's financial structure in the short-run, despite the existence of a positive correlation between the two. Due to data limitations, in this study, we are not able to establish the long-run effects of firm financing options on productivity and are thus limited to the short-run, given that we cover only one sample period per unit (firm). We also argue that, while duality may be a possibility, the dynamic nature of the business environment in SSA is not conducive to long-term ties between financial institutions and firms, especially small and medium size firms. Government¹⁸ influence on financial institutions has been shown to negatively affect firms' access to credit, especially in SSA, where the legal and institutional framework is weak. It is for this reason that we have restricted our analysis to the one-way effect of firm financing options on productivity.

6 Conclusion

This study sought to investigate the relationship between firm financing options and firm productivity in Sub-Saharan Africa, using firm level data obtained from the WBES. The analysis proceeded by estimating firm productivity as a measure of firm performance following the method by Ghosh, (2009). A linear Cobb-Douglas production function was assumed, and total factor productivity was inferred from the residual of the first order approximation of the linear production function. Both distribution analysis and regression estimation methods were then used to establish the relationship between firm financing

¹⁷ Bank and equity finance

¹⁸ Where this refers to the government of the day

options and firm productivity. The distribution analysis, a non-parametric method of data analysis by Handcock & Morris (1998) was used. We examined the relative distribution of productivity of firms based on the sources of finance they use to fund their investments. We find support for the agency cost theory of firm financing, which postulates that firms that rely on debt rather than other forms of finance are, on average, more productive.

The distribution analysis showed that the productivity of firms relying more on bank funds is distinguishably higher than that of firms relying more on internal funds, equity funds, informal funding and a hybrid of the sources of finance. This is especially so for firms at the bottom end of the distribution. It was also observed that the differences in productivity of firms by their source of finance is more pronounced for small and medium firms, while there is no distinct difference between large firms relying on either bank funds or equity funds. The parametric results, based on regression analysis, also show that firms that finance most of their investments using bank funds are more productive, compared to firms that finance a significant proportion of their investments using other sources of finance. These results were mainly significant for small and medium firms, and they corroborate what the relative distribution of productivity shows. Like in the distributional analysis, the results from our regression analysis differ between small and medium firms and large firms. The productivity of bank funded small and medium firms is significantly and consistently higher than the productivity of firms funded from internal and informal sources, regardless of which fixed effects we control for. Large firms, on the other hand, showed less distinct results, with the productivity of firms relying on informal sources of finance being shown as consistently and significantly lower than that of firms using bank funds.

Overall, it appears that firms in SSA financing most of their investments using bank funds are significantly more productive than SSA firms utilising internal and informal funds. While the productivity of firms utilising equity funds was neither consistently nor significantly lower, we do find a consistently negative sign in all estimations for small and medium firms, even though the level of significance was dependent on the fixed effects that we controlled for.

One peculiarity of SSA is the under-development and under-performance of capital markets, coupled with stringent listing requirements. Small and medium firms are therefore less likely to rely on equity funds for their investment purposes, and instead opt for internal and informal sources of finance. From a policy perspective, countries in SSA would benefit from governments strengthening the banking sector and expanding access to credit for firms, rather than establishing capital markets, which could be left to a time when the banking sector is well developed.

We do, however, note that this study was limited to the use of cross sectional data because of the unavailability of panel data for a number of countries, which would have been useful in accounting for the dynamics in the analysis. The World Bank is expanding the availability of panel data, making it possible for future research to incorporate these dynamics and extend the analysis to the long-term effects of firm financing on productivity.

Appendix A

A.1 Variable definition

Variable	Definition	Source
Size	Size of the firm is based on number of employees, where 5 - 19 = Small; 20 - 99 = Medium and >100 = Large	WBES
Export	This includes the value of exports of a firm, ranging from 0% to 100%	WBES
Age	Age of the firm	WBES
Average education	This is the average education for a typical production worker	WBES
Management experience	These are the number of years of experience for the top manager	WBES
Capacity	Capacity utilisation =1 if a firm that use over 50% of its capacity and zero otherwise	WBES
Ownership structure	Has four categories as described below;	WBES
(i) Private foreign	Represents % owned by private foreign individuals, companies or organizations	
(ii) Private domestic	Represents % owned by private domestic individuals, companies or organizations	
(iii) Government	Represents % owned by government/state	
(iv) Other	Represents % owned by Other e.g. sole proprietorship	
Informal competition	Represents how much of an obstacle the practices of competitors in the informal sector are and is coded 1(No obstacle) to 5 (very severe obstacle)	WBES

World Bank Enterprise Survey

A.2

Firm Financing Patterns across Sub Saharan Africa

Proportion of fixed assets financed from the various sources (% of responses)							
Country	Bank loan	Equity	Internal funds	Others	Hybrid	Total	
1	South Sudan	2.5	5	87.5	2.5	2.5	100
2	Sudan	0	0	81.25	18.75	0	100
3	Angola	4.55	0	88.64	2.27	4.55	100
4	Benin	14.29	0	78.57	7.14	0	100
5	Botswana	24	8	56	2	10	100
6	Burkina Faso	14.29	2.86	74.29	5.71	2.86	100
7	Burundi	32	0	60	8	0	100
8	Central African Republic	0	5.88	88.24	5.88	0	100
9	Cote d'Ivoire	2.13	0	85.11	10.64	2.13	100
10	Cameroon	20.31	1.56	54.69	14.06	9.38	100
11	Cape	24.14	10.34	62.07	3.45	0	100
12	Chad	2.86	2.86	88.57	2.86	2.86	100
13	Congo	0	0	100	0	0	100
14	DRC	0	0	96.08	0	3.92	100
15	Eritrea	6.25	0	87.5	6.25	0	100
16	Ethiopia	5.15	7.22	82.47	0	5.15	100
17	Gabon	6.25	0	93.75	0	0	100
18	Gambia	12.5	0	62.5	12.5	12.5	100
19	Ghana	12.71	2.76	72.93	6.08	5.52	100
20	Guinea	0	0	94.87	3.85	1.28	100
21	Guinea Bissau	0	0	86.96	13.04	0	100
22	Kenya	27.81	4.28	56.15	3.74	8.02	100
23	Lesotho	16.67	9.52	57.14	11.9	4.76	100
24	Malawi	20.31	1.56	73.44	3.13	1.56	100
25	Mali	5.26	0	92.11	2.63	0	100
26	Mozambique	3.39	0	91.53	3.39	1.69	100
27	Namibia	25	3.33	63.33	0	8.33	100
28	Niger	6.25	3.13	78.13	3.13	9.38	100
29	Nigeria	5.5	8.59	60.14	20.27	5.5	100
30	South Africa	23.35	0	67.07	3.59	5.99	100
31	Rwanda	26.92	11.54	42.31	0	19.23	100
32	Senegal	11.29	0	74.19	6.45	8.06	100
33	Tanzania	25.49	3.92	65.36	1.96	3.27	100
34	Togo	4.17	4.17	87.5	4.17	0	100
35	Uganda	11.02	3.94	78.74	1.57	4.72	100
36	Zambia	9.43	3.14	79.87	4.4	3.14	100
37	Zimbabwe	7.63	0.85	85.59	5.93	0	100
38	Liberia	17.86	0	78.57	3.57	0	100
39	Mauritius	51.9	0	37.97	2.53	7.59	100
40	Sierra Leone	2.5	2.5	92.5	2.5	0	100
41	Swaziland	11.11	0	82.22	2.22	4.44	100
Total	14.22	2.95	72.6	5.7	4.53	100	

Source: World Bank Enterprise Survey

Notes: Figures presented above are country averages for all firms

A.3

Firm Financing Patterns by Country and Firm Size

Country	Bank loan	Equity	Internal funds	Others	Hybrid	Total
Small firms						
Botswana	20	6.67	60	0	13.33	100
Burkina Faso	7.14	0	85.71	0	7.14	100
Ghana	8.74	2.91	78.64	4.85	4.85	100
Kenya	18.18	9.09	60.61	3.03	9.09	100
Lesotho	26.83	12.2	43.9	14.63	2.44	100
Nigeria	3.93	5.74	33.53	54.38	2.42	100
South Africa	17.28	0	74.07	3.7	4.94	100
Tanzania	3.17	3.17	88.89	1.59	3.17	100
Uganda	11.43	5.71	77.14	1.43	4.29	100
Zambia	6.94	1.39	83.33	4.17	4.17	100
Mauritius	46.88	0	37.5	6.25	9.38	100
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All countries	8.88	3.08	68.58	16.03	3.44	100
Medium Firms						
Botswana	27.27	9.09	54.55	4.55	4.55	100
Burkina Faso	21.43	0	64.29	14.29	0	100
Ghana	14.04	1.75	70.18	7.02	7.02	100
Kenya	33.8	2.82	54.93	1.41	7.04	100
Lesotho	24.32	8.11	51.35	13.51	2.7	100
Nigeria	3.57	4.76	31.55	58.33	1.79	100
South Africa	30.5	0	61.7	2.13	5.67	100
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.
All countries	17.95	3.24	62.53	12.58	3.7	100
Large firms						
Botswana	23.08	7.69	53.85	0	15.38	100
Burkina Faso	14.29	14.29	71.43	0	0	100
Ghana	28.57	4.76	52.38	9.52	4.76	100
Kenya	26.51	3.61	55.42	6.02	8.43	100
Lesotho	0	8.33	75	12.5	4.17	100
Nigeria	5.19	2.6	41.56	50.65	0	100
South Africa	18.75	0	68.75	5.36	7.14	100
Tanzania	43.24	2.7	45.95	2.7	5.41	100
Uganda	23.81	0	66.67	4.76	4.76	100
Zambia	17.65	0	64.71	11.76	5.88	100
Mauritius	53.33	0	33.33	0	13.33	100
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All countries	17.46	2.93	63.97	9.92	5.73	100

Source: World Bank Enterprise Survey

Notes: This tables only shows a sample of countries used in the analysis. The selection of country results to display was not based on any criteria. Results for other countries are available on request.

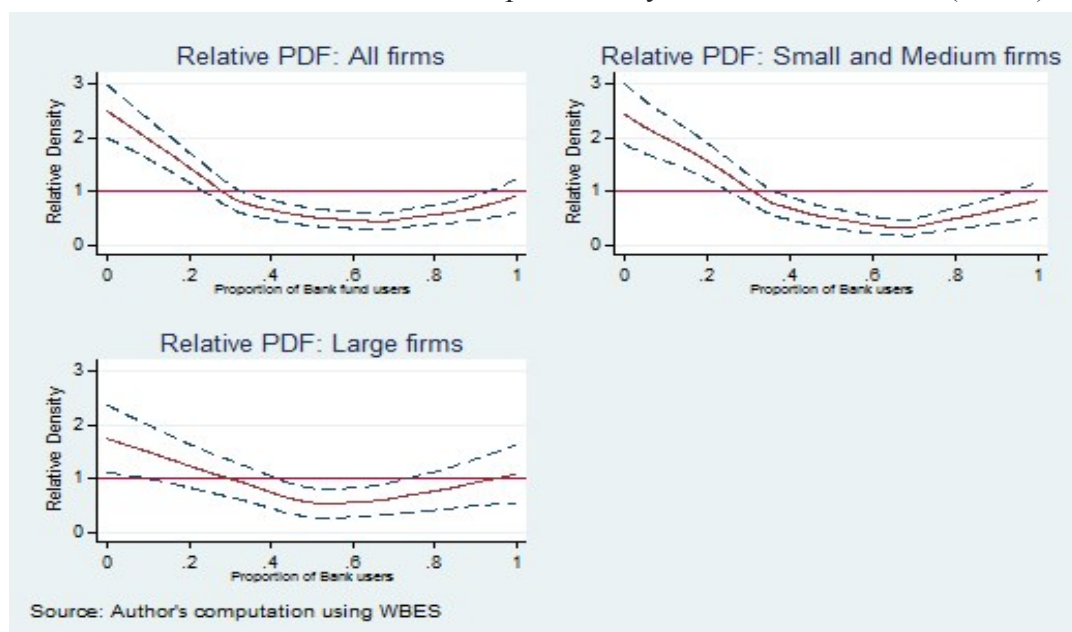
A.4 Estimation results using value added

OLS Estimates of the Effect of Firm Financing Options on Firm Productivity for all firms. Dependent variable: TFP measured using value added					
Variables	(1)	(2)	(3)	(4)	(5)
Financing options (base category = bank)					
1. Equity	-0.697*** (0.2610)	-0.167 (0.2330)	-0.11 (0.2280)	-0.538** (0.2420)	-0.13 (0.2220)
2. Internal funds	-0.426*** (0.0869)	-0.344*** (0.1230)	-0.292** (0.1240)	-0.392*** (0.1350)	-0.273** (0.1260)
3. Hybrid	0.0714 (0.1770)	-0.00458 (0.1970)	0.0455 (0.1810)	0.0529 (0.1880)	0.0364 (0.1820)
4. Others (Informal)	-0.816*** (0.1970)	-0.577*** (0.2160)	-0.640*** (0.2130)	-0.796*** (0.2160)	-0.629*** (0.2120)
age	0.0205*** (0.0023)	0.0146*** (0.0027)	0.0139*** (0.0028)	0.0146*** (0.0028)	0.0129*** (0.0027)
Management experience	0.00434 (0.0037)	-0.00438 (0.0043)	-0.00356 (0.0044)	0.00714 (0.0047)	-0.0019 (0.0042)
Average education	0.0028 (0.0063)	0.0593*** (0.0217)	0.0536** (0.0222)	0.0565*** (0.0173)	0.0552** (0.0228)
Informal competition:					
1. Minor obstacle	-0.572*** (0.1010)	-0.126 (0.1350)	-0.16 (0.1360)	-0.296** (0.1300)	-0.165 (0.1320)
2. Moderate obstacle	-0.533*** (0.1170)	-0.304** (0.1330)	-0.328** (0.1340)	-0.319** (0.1570)	-0.335** (0.1370)
3. Major obstacle	-0.414*** (0.1030)	-0.0503 (0.1250)	-0.0693 (0.1220)	-0.196 (0.1260)	-0.0868 (0.1180)
4. Very severe obstacle	-0.417*** (0.1310)	-0.135 (0.1330)	-0.169 (0.1380)	-0.236 (0.1690)	-0.178 (0.1360)
exports	-7.90E-05 (0.0017)	0.00348 (0.0021)	0.00490** (0.0021)	0.00372* (0.0022)	0.00513** (0.0022)
capacity	0.404*** (0.1070)	0.262** (0.1050)	0.229** (0.1100)	0.342*** (0.1260)	0.217* (0.1130)
Private foreign firms	0.00464*** (0.0010)	0.00397*** (0.0011)	0.00414*** (0.0011)	0.00250* (0.0013)	0.00333*** (0.0012)
Government owned firms	0.00325 (0.0077)	0.00635 (0.0055)	0.00396 (0.0060)	0.0071 (0.0066)	0.0053 (0.0065)
other (e.g. sole proprietorship)	0.00296 (0.0031)	0.000926 (0.0032)	0.00178 (0.0035)	0.00401 (0.0045)	0.00163 (0.0035)
Firm size: Medium	1.760*** (0.0904)	1.405*** (0.1070)	1.327*** (0.1120)	1.509*** (0.1130)	1.260*** (0.1030)
Firm size: Large	3.593*** (0.1070)	2.912*** (0.1720)	2.788*** (0.1780)	3.082*** (0.1480)	2.705*** (0.1800)
Constant	10.95*** (0.1680)				
Observations	1,842	1,452	1,448	1,443	1,439
R-squared	0.555	0.657	0.683	0.576	0.689
Country FE	No	Yes			Yes
Location FE	No		Yes		Yes
Industry FE	No			Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes

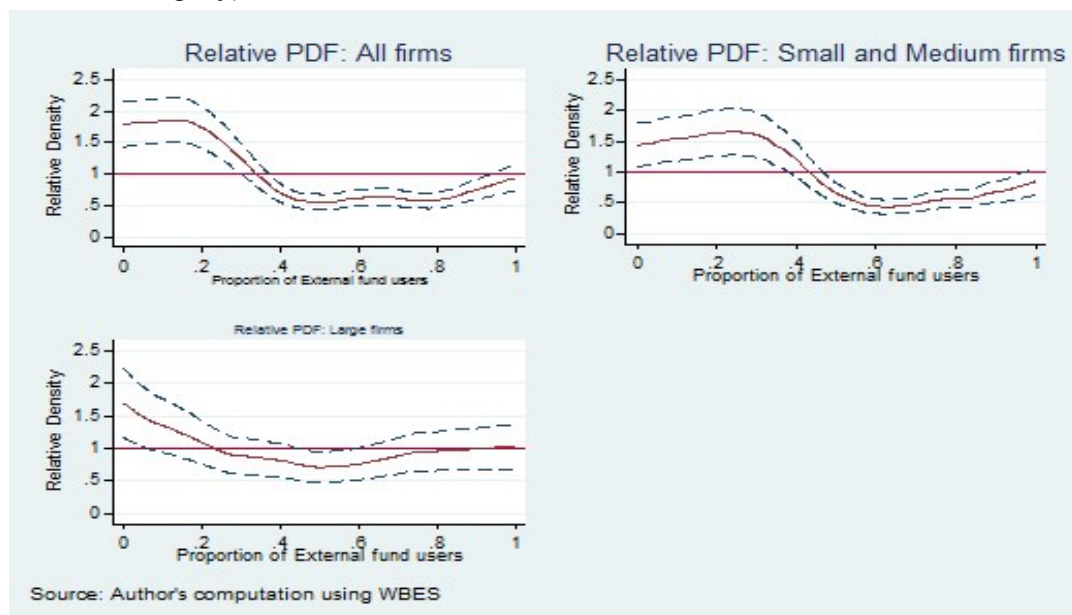
Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

A.5 Relative distribution of productivity

A.5.1 Relative distribution of productivity of bank and informal (others) funds users



A.5.2 Relative distribution functions of productivity of firms using external funds (bank and equity) vs internal sources of funds



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