Performance of Small and Medium-sized Enterprises in Uganda: the Role of Innovation

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Bringing Rigour and Evidence to Economic Policy Making in Africa

Performance of Small and Medium-sized Enterprises in Uganda: the Role of Innovation

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Abstract

Using the 2013 World Bank Enterprise Survey data for Uganda, this paper employs the quintile estimation technique to explain the relationship between innovation and firm performance in small and medium-sized enterprises (SMEs). Innovation involves the introduction of a new or significantly improved production process, product, marketing technique or organizational structure. Our results indicate that individual processing, product, marketing and organizational innovations have no impact on labour productivity as proxied by sales per worker. However, the results indicate the presence of complementarity between the four types of innovation. Specifically, the effect of innovation on sales per worker is positive when an SME engages in all four types of innovation. Even then the complementarity is weakly positive with incidences of a negative relationship when using any combination of innovations that are less than the four types of innovation. Policy-wise the results suggest that efforts to incentivize innovation should be inclusive enough to encourage all four forms of innovation.

Key words: Innovation; firm performance; business environment; Uganda

1. Introduction

Small and medium-sized enterprises (SMEs)[1] can potentially play a critical role in enabling households to engage in income-generating activities, thereby making available decent employment opportunities. Also, through offering forward and backward linkages, SMEs create a space for households to participate in the economy. Backward linkages involve the supply of inputs to SMEs, while forward linkages could be buying the output from SMEs as inputs higher up the value chain. Furthermore, SMEs are partly incubators of new innovations that could enhance an economy's productivity and economic growth potential. In Uganda, for example, SMEs in the industrial, services and agricultural sectors employ about 2.5 million people (Government of Uganda, or GoU, 2011), and contribute approximately 18 per cent to the GDP (GoU, 2015). Uganda's tax-to-GDP ratio has persistently failed to rise above 13 per cent and SMEs are a potential source of revenue to enhance domestic resource mobilization, given that recent tax reforms have intensively and extensively targeted SMEs both in the formal and informal sectors.

Conscious of the role SMEs play, and in an attempt to fulfil their potential, the GoU has, among other things: 1) designed a policy instrument for SMEs with the rationale of streamlining activities in the sector to fulfil its potential (GoU, 2015); 2) set up eBiz, which is Uganda's one-stop centre for starting a business[2]; 3) set up a directorate of micro, small and medium enterprises (MSMEs) in the Ministry of Trade, Industry and Cooperatives, which had a budget allocation of US$593,000 in the financial year 2016/17 towards the Industrial Cluster Programme for MSMEs[3]; 4) also in the financial year 2016/17, US$593,000 was budgeted to enable the Uganda National Bureau of Standards to support MSMEs in acquiring quality marks and product certifications; 5) under the Uganda Investment Authority, an SME division has been set up with the overall goal of developing sustainable domestic investment and SMEs; and 6) supported Enterprise Uganda to adopt the Empretec model, which is designed as a one-stop capacity-building programme to provide an integrated and comprehensive range of business support services for SMEs using a hands-on approach.[4]

While the aforementioned efforts by GoU to enable SMEs to fulfil their potential are commendable, their success partly depends on understanding the effect of innovation on the performance of SMEs. In an attempt to partly fill that void, this paper uses the 2013 World Bank Enterprise Survey (WBES) dataset for Uganda to examine the effect of innovation on the performance of SMEs. Where innovation takes the form of

product, process, marketing and/or organizational innovation[5]. Marketing innovation could involve improvements in product design or packaging, product promotion, product pricing or even product placement. Product innovation typically involves improving a firm's existing goods or services, or simply introducing a new product or service. Organizational innovation could involve adopting new practices or policies, or a cultural re-orientation of a firm, while process innovation involves introducing a new or significantly improved method of manufacturing or offering services. Note that the 2013 WBES dataset for Uganda is composed of 698 SMEs, of which 66% and 34% are small and medium-sized firms, respectively. The data reveal that 72% and 83% of small and medium-sized firms, respectively, engaged in innovation. Disaggregating across different kinds of innovation, 67%, 69%, 63% and 60% of the medium-sized firms are reported to have engaged in process innovation, product innovation, marketing innovation and organizational innovation, respectively.[6] Conversely, the data show that 53%, 59%, 53% and 43% small scale firms engaged in process innovation, product innovation, marketing innovation and organizational innovation respectively. Overall, 59%, 62%, 56% and 48% of SMEs are engaged in process innovation, product innovation, marketing innovation and organizational innovation, respectively.

Engaging in marketing innovation involves improvements in logistical, distribution and marketing methods, which should result in market expansion. Process innovation involves new, efficient production methods leading to more product output at potentially lower unit cost. Product innovation involves product modification to reflect evolving customer preferences or bringing on board a completely new product. If successful, it is likely to attract new customers. Organizational innovation involves improvements in management practices and structures, which induces management efficiency gains that should be reflected in higher product output and increased market share. Therefore, irrespective of the nature of innovation, innovation could lead to increased sales per worker (labour productivity), higher value added per worker (labour productivity) and perhaps the growth and transition of a firm from small to medium sized or, better still, to a large firm, perhaps producing for both domestic and export markets.

Indeed, there is consensus in empirical literature on the developed world that innovation enhances labour productivity (Griffith et al, 2006; Griffith et al, 2004; Mairesse and Mohnen, 2010; Mairesse et al, 2005; and OECD, 2009). However, evidence in the developing world is rather contradictory, for example, using cross-sectional data from Kenya and Tanzania, Chowdhury and Wolf (2003), who proxied innovation using information and communication technologies (ICT),[7] argue that innovation dampens labour productivity and has no impact on the revenue of SMEs. Similarly, Goedhuys et al (2008) show that product or process innovation has no significant impact on labour productivity in Tanzania. Conversely, after distinguishing between formal and informal SMEs, Esselaar et al (2007), using a cross-country dataset for sub-Saharan African countries,[8] show that the adoption of ICT to proxy innovation enhances labour productivity in both formal and informal SMEs. The non-convergence of innovation and firm performance is equally prevalent in studies on other developing economies. For

example, authors of empirical studies on Latin America have argued that innovation has no impact on firm labour productivity (Perez et al, 2005; Benavente, 2006; Raffo et al, 2008; and Crespi and Zuniga 2012). Conversely, Raffo et al (2008) show that product innovation has a significant impact on labour productivity.

The lack of consensus on the relationship between innovation and labour productivity in developing economies could partly be associated with using inaccurate proxies for innovation such as ICT. In this regard, Lin and Chen (2007) argue that ICT may not be critical to firm performance, for example, when compared to organizational innovation. While in some instances, at least in Latin America, investment in research and Development (R&D) was used as a proxy for innovation, while it could be relevant to developed economics as they are at the frontier of innovation, this may not be the case for developing economies that typically engage in imitation of innovation[9] (Naudé et al, 2011). Investment in R&D as a proxy for innovation may not significantly impact firm performance in developing countries, but it enhances firm performance in developed economies (Crespi and Zuniga, 2012).

Our contribution to the empirical literature is through using the 2013 WBES data where innovation is measured through whether a firm introduced a new or significantly improved: 1) marketing technique, 2) organizational structure, 3) product or 4) production process in the last three years prior to the survey, to explain the relationship between innovation and labour productivity proxied by sales per worker. First, we believe that our measures of innovation are better than ICT especially when ICT is measured as the use of email, a website or having a mobile phone or fax machine to proxy innovation, as explained in Esselaar et al (2007). ICT utilization has nothing to do with things such as product, process and organizational innovation. Second, investment in R&D may not be an appropriate innovation proxy, especially for a developing country like Uganda where innovation takes place through imitation (Naudé et al, 2011). We further contribute to the empirical literature by attempting to understand whether the relationship between labour productivity (proxied by sales per worker and value added per worker) and innovation could be associated with complementarity between the different innovation types. This study compares sales per worker and valued added per worker for firms that undertook only one innovation, two innovations, three innovations and all four innovations. We envisage that the degree of complementarity increases when a firm takes on all four innovations, as labour productivity is expected to be higher than when a firm has only one or two or even three innovations.

Our results suggest evidence of complementarity across product innovation, process innovation, marketing innovation and organizational innovation. When a firm engages in the four types of innovation, the results suggest that labour productivity increases as well, especially in low-productivity firms. The relationship becomes weaker when a firm engages in any three types of innovation, and becomes insignificant when a firm engages in only one type of innovation. With respect to business environment characteristics, the paper shows that sales per worker are depressed when firms perceive corruption and tax rate to be an obstacle. Furthermore,

when firms perceive the labour force to be inadequately educated, the sales per worker is equally compromised. In terms of firm specific characteristics, engaging in exports and utilization of ICT enhances sales per worker. Conversely, certification of a firm's product is inversely related to sales per worker.

The subsequent section is a review of the empirical literature. Section 3 presents the methodology where the empirical strategy and data characteristics are explained. Section 4 presents the results from the empirical model estimation, alongside a discussion. Finally, Section 5 presents the conclusion and policy recommendations arising from the paper.

2. Literature review

There is no consensus on the relationship between innovation and labour productivity in sub-Saharan Africa. For example, using a firm level dataset for Kenya and Tanzania, Chowdhury and Wolf (2003) find that innovation (proxied by ICT) is inversely related to labour productivity. However, with the aid of a cross-country dataset of 14 African countries, Esselaar et al (2007) argue that innovation (proxied by ICT) enhances labour productivity across both formal and informal SME firms. The contradiction in the relationship between innovation and labour productivity could partly be because administrative innovation as opposed to technological innovation, for example in ICT, is the most critical factor in explaining labour productivity (Lin and Chen, 2007). Furthermore, ICT is not a perfect match for process, organizational, product or marketing innovation. Indeed, as opposed to proxying innovation using ICT Goedhuys et al (2008), using cross-sectional firm level data on Tanzania from the World Bank Investment Climate Survey, measure innovation by whether a firm engaged in product or process innovation. Even then, engaging in product or process innovation was shown to have no significant impact on labour productivity (Goedhuys et al. 2008).

Similar studies in Latin America also show that innovation may not have a significant impact on firm productivity. For example, Raffo et al (2008), using a cross-sectional dataset for manufacturing firms in Argentina, show that engaging in product innovation does not significantly impact labour productivity. Similarly, using a Mexican firm level dataset, innovation was shown to not have a significant impact on labour productivity (Perez et al. 2005). Consistent with Perez et al (2005), using Chilean firm level data Benavente (2006) shows that innovation has no impact on labour productivity. Conversely, using cross-sectional data for six Latin American countries, Crespi and Zuniga (2012) show that engaging in product or process innovation enhances labour productivity. Similarly, Raffo et al (2008), using cross-sectional data for manufacturing firms in Brazil and Mexico, argue that product innovation enhances labour productivity.

The non-convergent relationship between innovation and firm performance in the developing world is in contrast to the consensus in literature on the developed world in which innovation is argued to enhance labour productivity (Griffith et al, 2006; Griffith et al, 2004; Mairesse and Mohnen, 2010; Mairesse et al, 2005; and OECD, 2009). This perhaps suggests that there is room to explore further the innovation-labour productivity relationship in developing countries. It is in that regard that

this paper undertakes to explain the relationship between innovation and labour productivity using the 2013 WBES data for Uganda. Consistent with Lin and Chen (2007), we measure innovation using data on whether a firm engaged in process, organizational, product and/or marketing innovation, as opposed to ICT utilization, which Chowdhury and Wolf (2003) and Esselaar et al (2007) used in explaining labour productivity in East Africa and sub-Saharan Africa, respectively. We further contribute to the empirical literature by exploring the potential of complementarity between process, product, marketing and organizational innovations and their relationship with labour productivity.

3. Methodology

Empirical strategy

Our analysis of the relationship between labour productivity and innovation assumes that innovation enters the production function as an input, and as in Lachenmaier (2007), we control for an additional observable variable X_{ij} and the non-observable random variable ε_{ij} of firm i in sector j (Equation 1).

$$Q_{ij} = f\left[Innov_{ij}, X_{ij}, \varepsilon_{ij}\right] \quad (1)$$

where i and j index the firm and sector, respectively. $Innov$ is a categorical variable that captures the number of innovations undertaken by a firm, that is no innovation, one innovation, two innovations, three innovations and four innovations. Q_{ij} denotes firm $i's$ labour productivity in sector j as proxied by sales per worker and valued added per worker.

We hypothesize that innovation has a positive association with labour productivity. An increase in labour productivity, corresponding with the adoption of innovation if all other inputs are constant, is defined as a "direct" effect of innovation on labour productivity. Therefore, it can generally be expected that an increase in labour productivity could result from the direct effect of innovation. Specifically, innovation is likely to result in reduced production or operational costs, for example a leaner workforce may lead to price reductions by the firm, which in turn increases firm sales and, therefore, leads to higher labour productivity.

However, whether a firm can gain more sales and, therefore, increase labour productivity as a result of adopting innovation depends on its market share and thus its initial monopolistic position. Note that an innovating firm with a high market share is likely to charge a higher product price, potentially resulting in more sales revenue, leading to higher labour productivity. Conversely, if an innovating firm has a small market share it is likely to benefit less, especially with the emergence or presence of existing highly competitive firms. This is because even with innovation the firm with a small market share has no power to influence prices in an already competitive product market thus rendering sales unchanged, which undermines changes in labour

productivity. Also, if a firm introduces a new or improved product that is not successful, perhaps because the new product is not accepted by the market or new processes do not result in the desired cost reduction, the innovation is likely to inversely affect labour productivity.

The preceding discussion suggests that the effect of innovation on labour productivity is indeterminate. Thus, one should expect that as a result of complementarity effects, innovation at firm level will produce alternative outcomes depending on the characteristics of the firm, in conjunction with auxiliary factors. Also, the different types and quality of innovation may vary in firms and have divergent effects on labour productivity, whether positive or negative. Understanding the relationship between labour productivity and innovation activity could provide useful insights for a firm's management towards enabling efficient resource allocation.

Therefore, to investigate the relationship between innovation and labour productivity, we employ quintile regression techniques. Quintile regression is preferred over the standard least-squares method for this analysis for a number of reasons. First, unlike OLS that is prone to outliers, quintile regression results are characteristically robust to outliers and heavy-tailed distributions. As noted by Buchinsky (1994), the quintile regression solution $\hat{\beta}$ is invariant to outliers of the dependent variable that tend to $\pm\infty$. Also, unlike a conventional regression that focuses on the mean, quintile regressions are able to describe the entire conditional distribution of the dependent variable. In the context of this study, SMEs have different levels of labour productivity that are of interest in their own right. We therefore don't want to dismiss firms with low labour productivity or high labour productivity as outliers. Nonetheless, we believe it would be worthwhile to study them in detail by calculating coefficient estimates at various quintiles of the conditional distribution. In addition, quintile regressions avoid the restrictive assumption that the error terms are identically distributed at all points of the conditional distribution. Relaxing these assumptions implies an accommodation of firm heterogeneity in SMEs so that the estimated slope parameters vary at different quintiles of the distribution. From Equation 1, the quintile model follows that of Koenker and Bassett (1978) and is given as:

$$Q_{ij} = X'_{ij}\beta_\theta + \varepsilon_{ij} \; with \; Quant_\theta\left[Q_{ij}|X_{ij}\right] = X'_{ij}\beta_\theta \tag{2}$$

In Equation 2, Q_{ij} denotes firm $i's$ labour productivity in sector j as proxied by sales per worker and value added per worker, X_{ij} is a vector of regressors of firm i in sector j, β is the vector of parameters to be estimated and ε_{ij} is a vector of residuals. $Quant_\theta\left(Q_{ij}|X_{ij}\right)$ denotes the θ^{th} conditional quintile of Q_{ij} given X_{ij}. Where $0 < \theta < 1$, the following problem is solved:

$$\frac{Min}{\beta}\frac{1}{n}\left\{\sum_{ij,Q\geq X'_{ij\beta}}\theta\left|Q_{ij} - X'_{ij\beta}\right| + \sum_{ij,Q<X'_{ij\beta}}(1-\theta)\left|Q_{ij} - X'_{ij\beta}\right|\right\} = \frac{Min}{\beta}\frac{1}{n}\sum_{ij=1}^{n}\rho_\theta\left(\varepsilon_{\theta_{ij}}\right) \tag{3}$$

In Equation 3, $\rho_\theta(.)\rho_\theta(.)$ denotes the model check function and this is defined in the following expression as:

$$\rho_\theta\left(\varepsilon_{\theta_{ij}}\right) = \begin{Bmatrix} \theta\varepsilon_{\theta_{ij}} \; if \; \varepsilon_{\theta_{ij}} \geq 0 \\ (\theta-1)\varepsilon_{\theta_{ij}} \; if \; \varepsilon_{\theta_{ij}} < 0 \end{Bmatrix} \quad (4)$$

From Equation 4, we note that as θ increases continuously from $0 \; to \; 1$, one is able to trace the entire conditional distribution of Q, conditional on X when Equation 4 is solved using linear programming techniques.

To, therefore, examine the impact of innovation on labour productivity in line with the reviewed literature, the following empirical model is estimated:

$$Q_{ij} = \beta_0 + \beta_1 Innov_{ij} + \beta_2 Z_{ij} + \beta_3 X_{ij} + \beta_4 \delta_{ij} + \beta_5 \gamma_{ij} + \varepsilon_{ij} \quad (5)$$

where, Q is a measure of labour productivity; $Innov$ is a categorical variable that captures the number of innovations undertaken by a firm that is no innovation (Innovation_0), one innovation (Innovation_1), two innovations (Innovation_2), three innovations (Innovation_3) and four innovations (Innovation_4) where no innovation is the reference category; X is a vector of business climate characteristics that is land access, labour education, credit access, electricity supply, corruption and tax rate; Z is a vector of firm characteristics such as firm age, experience, gender, ICT, certification and export; γ captures regional fixed effects; δ captures sectoral fixed effects; and ε are error terms that are assumed to be identically and independently distributed.

Note that out of a dataset of 698 observations the dependent variables "sales per worker" and "value added per worker" as proxies for labour productivity have 247[10] and 570 missing values, respectively (see Appendix 4). The existence of missing values from the dependent variables suggests a risk of selection bias in estimation; this is because the missing values are generated through a non-random process. To address the risk of selection, first we omit estimating the relationship between value added per worker as an alternative proxy for labour productivity and its covariates as there are too many missing value added per worker values.

However, with regard to labour productivity as proxied by sales per worker, we first examine the pattern of those that are missing, and how frequently this occurs in our variables of interest. It was established that only 347 firms have non-missing values among all the variables of interest, excluding value added per worker[11] and labour cost.[12] We further generate variable m_sales per worker, which takes a value of '1' for a firm where the value of sales per worker is missing, otherwise '0'. Therefore, following Svensson (2003) and Mawejje and Okumu (2016), we attempt to understand whether firms with missing or non-missing sales per worker values differ significantly across

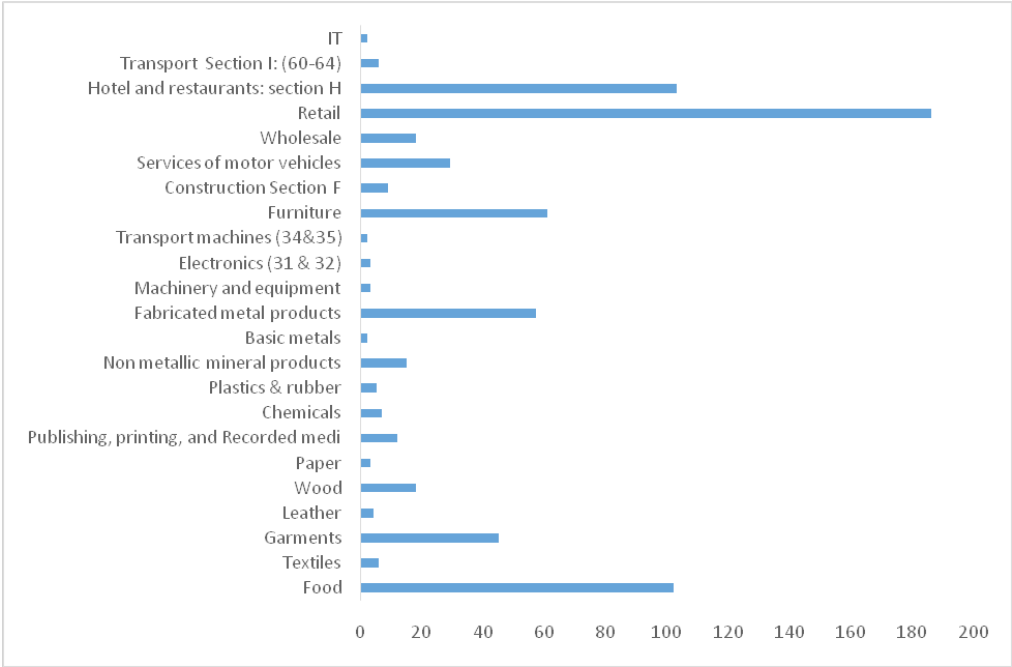
observed firm characteristics such as: Age, Experience, Certification, Labour cost[13], Export, Innovation_0, Innovation_1, Innovation_2, Innovation_3 and Innovation_4. We thus estimate logit models where these firm characteristics are the independent variables while m_sales per worker is the dependent variable (Appendix 5). From the missing variable models 1 (logit coefficients) and 2 (odds ratio), there is no evidence that firms missing the sales per worker values differ significantly in light of observable characteristics when compared to firms that do have sales per worker values. We therefore proceed to analysing the relationship between firm sales per worker and its covariates.

Descriptive statistics

This study uses the 2013 WBES data for Uganda, which was collected between January and August 2013. The survey employed a stratified random sampling technique in order to: 1) eliminate biased estimates for the entire population; 2) eliminate biased estimates for different subdivisions of the population with a given degree of informed precision; 3) ensure that different sectors are well represented in the final sample; and 4) benefit from the precision associated with population estimates in stratified sampling as opposed to simple random sampling techniques, among other things. The survey was based on a sampling framework obtained from the Uganda Bureau of Statistics. In terms of stratification, the survey employed three levels of stratification, that is: region, size and industry. Specifically, in terms of region, the survey was undertaken in Jinja (central Eastern Uganda), Kampala (city in central Uganda), Lira (Northern Uganda), Mbale (Eastern Uganda), Mbarara (Western Uganda) and Wakiso (Central Uganda). In terms of size, the survey covered small, medium and large enterprises. Small enterprises comprised firms with five to 19 employees and medium enterprises compromised firms with 20 to 99 employees, while large firms had 100+ employees. The data were collected only from formal (registered) companies with five or more employees.

For this study, a sample of 698 SMEs is used, of which 324 SMEs were surveyed in the manufacturing sector that included: food, textiles, garments, tobacco, leather, wood, paper, publishing, printing and recorded media, refined petroleum products, chemicals, plastics and rubber, non-metallic mineral products, basic metals, fabricated metal products, machinery and equipment, electronics, precision instruments, transport machines, furniture and recycling (see Figure 1 and Appendix 1). Within the manufacturing sector, the number of small and medium-sized firms totalled 180 and 144, respectively. While the service sector had a total of 374 firms surveyed, which included: retail, wholesale, information technology (IT), hotels and restaurants, services of motor vehicles, construction and transport, among other things (see Figure 1 and Appendix 1). Specifically, 280 and 94 small and medium-sized firms were surveyed, respectively.

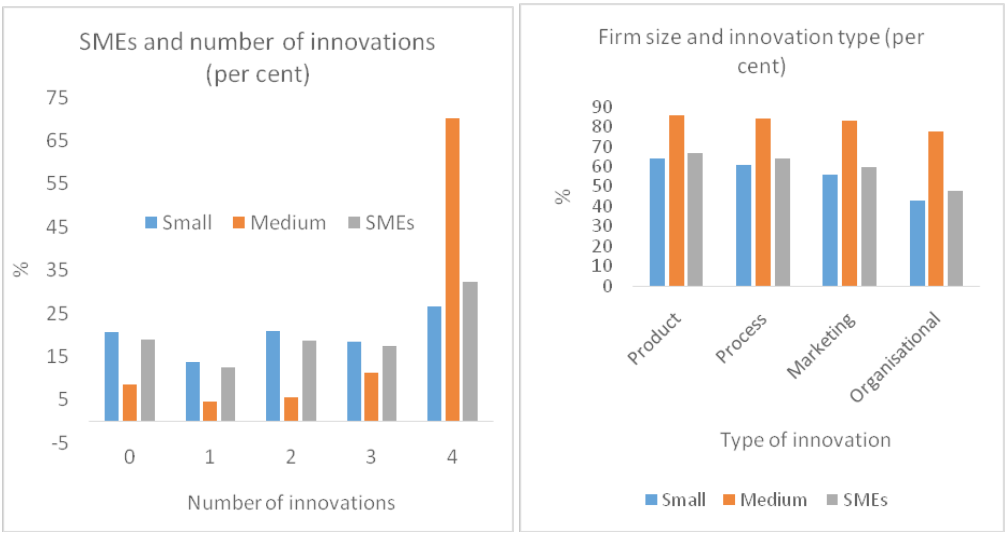
Figure 1: Number of firms surveyed by activity



Source: World Bank, 2013

In order to describe the data nationally, the observations were scaled to the population using the median weight. With the median weighting there are 6,607 SMEs, of which 5,709 and 898 are small and medium-sized firms, respectively. Also, 79% and 92% of small and medium-sized firms, respectively, undertook at least one kind of innovation while on aggregate 81% of SMEs undertook some innovation (Figure 2). Specifically, across the different kinds of innovation, medium-sized firms engaged in more innovation compared to smaller firms (Figure 2).

Figure 2: Innovation and firm type

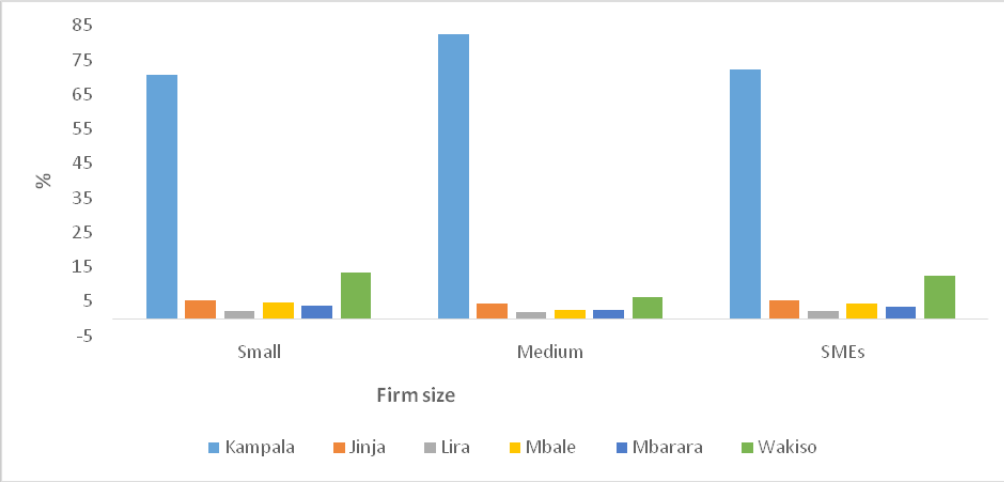


Source: World Bank, 2013

Overall, medium-sized firms innovated more across the different types of innovation than smaller firms. Indeed, 70% of medium-sized firms engaged in all four innovation types compared to only 27% of small-sized firms, while small-sized firms were more selective about which kind of innovation to undertake. More small-sized firms engaged in one or two or three innovations than medium-sized firms. Aggregately, 32%, 18%, 19%, 13% and 19% of SMEs engaged in four, three, two, one and zero innovations, respectively (Figure 2).

Most of the firms, 72% of SMEs, are located in Kampala, followed by Wakiso, Jinja, Mbale, Mbarara and Lira with 12%, 5%, 4%, 3% and 2%, respectively. Disaggregating medium and small-sized firms, the aforementioned trend with Kampala having the highest number of firms is maintained, followed by Wakiso, Jinja, Mbale, Mbarara and Lira, respectively (Figure 3).

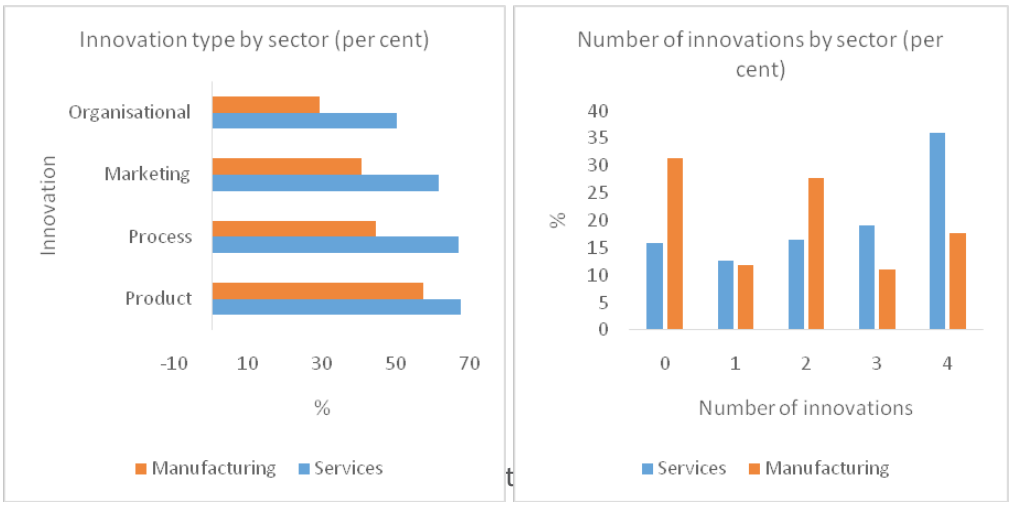
Figure 3: Firm size and location (per cent)



Source: World Bank, 2013

Eighty per cent of SMEs are in the service sector. Furthermore, 87% and 85% of the SMEs in the service and manufacturing sectors, respectively, are classified as small. In light of the sectoral distribution of innovation, firms in both the service and manufacturing sectors are engaged in some form of innovation (see Figure 4). Specifically, even while firms in the service sector innovated more than firms in the manufacturing sector, across the two sectors innovation was undertaken most in the introduction of new or significantly improved products[14] followed by process innovation, and then marketing innovation and organizational innovation (Figure 4). Overall, 16% of service sector firms did not undertake any innovation, otherwise they undertook at least one innovation with most firms undertaking at least four innovations. With regard to manufacturing firms, 32% did not undertake any innovation. Otherwise 12%, 28%, 11% and 18% of manufacturing firms, respectively, undertook one, two, three and four innovations (Figure 4).

Figure 4: Innovation and sector characterization



Source: World Bank, 2013

Variable description

For purposes of empirical estimation weights are not used, and as such the subsequent variable description is entirely based on the data sample as is done in econometric analysis. Labour productivity as proxied by sales per worker is measured as a firm's total annual sales in the fiscal year prior to the survey divided by the number of permanent full time employees at the firm in the fiscal year prior to the survey. The mean labour productivity is 329 million Uganda Shilling (USh). The minimum and maximum labour productivity is USh24,000 million and USh39,000 million, respectively. On average, Lira has the highest labour productivity (USh848 million) while, on average, Jinja has the lowest labour productivity (USh19 million). Kampala, which is both the capital and main commercial city, has an average labour productivity of USh430 million. However, in the estimation we consider labour productivity in logarithms to avoid using labour productivity in levels as this would increase heterogeneity effects in the distribution. That is, by using logarithms we re-scale the effects, thus avoiding such amplification. The data characteristics of labour productivity in logarithms are captured in Appendix 3.

Innov is a categorical variable that captures the number of innovations undertaken by a firm, that is no innovation (Innovation_0), one innovation (Innovation_1), two innovations (Innovation_2), three innovations (Innovation_3) and four innovations (Innovation_4). Innovation_0. Specifically, Innovation_0 captures firms that did not undertake any innovation in the 3 years prior to the survey. On average, 24% of firms did not engage in any kind of innovation. Innovation_1 measures firms that undertook one innovation in the 3 years prior to the survey. On average, 12% of firms undertook one innovation. Innovation_2 captures firms that undertook two types of innovation

in the 3 years prior to the survey. On average, 13% of firms undertook two types of innovation. Innovation_3 captures firms that undertook three kinds of innovation in the 3 years prior to the survey. On average, 19% of firms engaged in three kinds of innovation. Innovation_4 captures firms that undertook all four types of innovation in the 3 years prior to the survey. On average, 32% of firms engaged in four innovations (see Appendix 3). In the empirical estimation Innovation_0 is the reference variable.

Firm age defines the number of years a firm has been in existence. The mean age of firms is 15 years, which suggests that, on average, many of the firms are mid-aged. The youngest and oldest firm is 2 and 87 years old, respectively. Gender measures if the firm manager is a female and it takes a value of '1' if yes, otherwise '0'. On average, 17% of firms have female managers. Export measures a firm's export status and it takes a value of '1' if a firm exports, otherwise '0'. One average, 8% of firms engage in exports. ICT is a measure of ICT usage, which takes a value of '1' when a firm has either an email account or website or both, otherwise '0'. On average, 18% of firms have either an email account or website or both. Certification measures if a firm has an internationally recognized quality certification. It takes a value of '1' if yes, otherwise '0'. On average, 15% of firms have an internationally recognized quality certification. Experience measures the number of years of experience that the top management has in the sector. The average years of experience of top management is 13 years.

With regard to business environment characteristics, land access measures whether land access is a constraint as perceived by a firm. It takes a value of '1' if land access is a constraint, otherwise '0'. On average, 41% of firms perceive land access to be a constraint. Tax rate measures whether a firm perceives the tax rate to be an obstacle. It takes a value of '1' if tax rate is an obstacle, otherwise '0'. On average, 64% of firms perceive the tax rate to be a constraint. Labour education measures whether an inadequately educated labour force is an obstacle. It takes a value of '1' if the inadequately educated labour force is an obstacle, otherwise '0'. On average, 41% of firms perceive labour education to be a constraint. Transport measures whether a firm perceives transport to be a constraint. It takes a value of '1' if transport is a constraint, otherwise '0'. On average, 51% of firms perceive transport to be a constraint. Corruption measures how much of an obstacle corruption is, as perceived by a firm. It takes a value of '1' if corruption is an obstacle, otherwise '0'. On average, 54% of firms perceive corruption to be a constraint. Electricity measures how much of an obstacle electricity supply is, as perceived by a firm. It takes a value of '1' if electricity supply is an obstacle, otherwise '0'. On average, 60% of firms perceive electricity to be a constraint. Credit access measures how much of an obstacle access to finance is, as perceived by a firm. It takes a value of '1' if credit access is an obstacle, otherwise '0'. On average, 71% of firms perceive credit access to be an obstacle.

Sector fixed effects controls for the sector in which a firm conducts its business and takes on a value of '1' if manufacturing sector, otherwise '0'. Regional fixed effects controls for the location of a firm, where Kampala is a reference region and thus compared to a firm located in Wakiso, Mbale, Jinja, Mbarara and Lira, and ε_{ij} is the random error term.

4. Results and discussion

From Table 1, while our paper provides better measures for innovation in the form of a product, marketing, organizational and/or process innovation, the OLS estimation (Model 1) result for innovation_1 indicates that engaging in any one form of innovation has no significant impact on labour productivity. This suggests that firms that engage in only one form of innovation are not significantly different from non-innovating firms in terms of labour productivity. We further sought to understand whether the relationship between innovation and labour productivity is uniform across different quintiles; even then, at the 25th percentile (low labour productivity firms), 50th percentile (medium, which is similar to the OLS) and 75th percentile (high labour productivity firms), engaging in any one form of innovation is not associated with an increase or decrease in labour productivity. Implying that irrespective of a firm's level of labour productivity, firms that engage in only one innovation are not significantly different from non-innovating firms in terms of labour productivity.

Table 1: Innovation and SME performance in Uganda

	Model 1	Model 2	Model 3	Model 4
Variables	OLS	0.25	0.50	0.75
Innov				
Innovation_1	0.181	0.026	0.181	-0.345
	(0.445)	(0.917)	(0.445)	(0.163)
Innovation_2	-0.258	0.190	-0.258	-0.711***
	(0.292)	(0.456)	(0.292)	(0.006)
Innovation_3	0.217	0.405*	0.217	-0.482**
	(0.309)	(0.069)	(0.309)	(0.030)
Innovation_4	0.641***	0.968***	0.641***	-0.040
	(0.001)	(0.000)	(0.001)	(0.845)
Firm age	0.056**	-0.004	0.056**	-0.020
	(0.011)	(0.854)	(0.011)	(0.375)
Firm age squared	-0.880**	0.201	-0.880**	1.111***
	(0.029)	(0.631)	(0.030)	(0.007)

continued next page

Table 1 Continued

Variables	Model 1 OLS	Model 2 0.25	Model 3 0.50	Model 4 0.75
Managers' years experience	0.007	0.049***	0.007	0.005
	(0.506)	(0.000)	(0.506)	(0.633)
Certification	0.077	-0.424*	0.077	-0.502**
	(0.710)	(0.050)	(0.710)	(0.021)
Exporter (1=Yes)	0.703**	1.460***	0.703**	1.301***
	(0.019)	(0.000)	(0.019)	(0.000)
Use ICT (1=Yes)	1.534***	1.315***	1.534***	1.496***
	(0.000)	(0.000)	(0.000)	(0.000)
Gender	0.150	-0.208	0.150	0.033
	(0.364)	(0.228)	(0.364)	(0.849)
Tax rate burden	-0.553***	-0.619***	-0.553***	-0.762***
	(0.000)	(0.000)	(0.000)	(0.000)
Transport burden	-0.202	-0.217	-0.202	0.619***
	(0.172)	(0.159)	(0.172)	(0.000)
Land access	-0.084	-0.022	-0.084	-0.096
	(0.566)	(0.885)	(0.566)	(0.533)
Corruption	0.102	-0.083	0.102	-0.621***
	(0.513)	(0.606)	(0.513)	(0.000)
Labour education	-0.283*	-0.073	-0.283*	-0.493***
	(0.075)	(0.659)	(0.075)	(0.003)
Electricity burden	-0.0641	0.033	-0.064	-0.023
	(0.649)	(0.822)	(0.649)	(0.874)
Credit access	0.320**	-0.169	0.320**	0.467***
	(0.041)	(0.302)	(0.042)	(0.005)
Sectoral fixed effects	YES	YES	YES	YES
Regional fixed effects	YES	YES	YES	YES
Constant	15.350***	15.340***	15.350***	17.940***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	347	347	347	347
R-squared	0.138	0.118	0.138	0.161

P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Our results are consistent with findings for other emerging economies. For example, Benavente (2006) shows with the aid of Chilean firm level data that innovation has

no significant impact on labour productivity. Similarly, Perez et al (2005) show that innovation has no impact on labour productivity in Mexico. Also, Raffo et al (2008) show that product innovation has no effect on labour productivity in manufacturing firms in Argentina. Our finding is also consistent with Goedhuys et al (2008) who use firm level data from Tanzania to show firm engagement in either product or process innovation has no significant impact on value added per worker (labour productivity). The consistent findings of Benavente (2006), Perez et al (2005) and Goedhuys et al (2008) could be attributed to a limited time lag between adoption of innovation and measuring its effects on labour productivity (Benavente, 2006). However, although our dataset implicitly allows for a time lag between innovation and its potential impact on labour productivity, it shows that innovation has no effect on labour productivity. It is possible that innovation is associated with embodied technical change, which is not captured by the dataset, hence limiting this study to sales per worker as a proxy of labour productivity.

In an attempt to understand whether the relationship between labour productivity and innovation could be better captured when considering complementarity between different kinds of innovation, it is shown that *Innov* has three more categories that capture firms that engage in any: two (Innovation_2), three (Innovation_3) and four (Innovation_4) kinds of innovation. From Table 1, the OLS model indicates that compared to non-innovating firms, engaging in all four forms of innovation is associated with an increase in labour productivity. The relationship remains strong and positive in firms with low labour productivity (25th percentile), although no impact is shown in firms with high labour productivity (at the 75th percentile). Our results thus suggest that engaging all four forms of innovation is associated with increased labour productivity, especially in long labour productivity firms. This implies the presence of complementarity between the four different kinds of innovation in how they relate to labour productivity, especially in low productivity firms.

Furthermore, engaging in any two or three forms of innovation has mixed results. For example, the OLS results show that compared to non-innovating firms, engaging in either two or three forms of innovation has no impact on labour productivity. In essence, firms engaging in any two or three forms of innovation are not significantly different from non-innovating firms in terms of labour productivity. However, compared to non-innovating firms, engaging in any three forms of innovation is weakly associated with an increase in labour productivity in firms with low labour productivity, while it is strongly associated with a reduction in labour productivity in firms with high labour productivity. The inverse relationship between labour productivity and innovation is further strengthened in firms with high labour productivity when a firm engages in any two kinds of innovation.

Overall, the results indicate that firms engaging in only one kind of innovation are not significantly different from non-innovating firms in terms of labour productivity. This finding is consistent with previous literature on developing countries, which has until now not settled the debate about the relationship between labour productivity and innovation. Indeed, Perez et al (2005), Benavente (2006) and Goedhuys et al

(2008) show that innovation has no impact on labour productivity. However, from the empirical analysis we are able to establish that there is an element of complementarity between product, marketing, process and organizational innovations, to the extent that when a firm engages in all four forms of innovation it is associated with an increase in labour productivity, especially in firms with low productivity. However, the results become mixed when a firm engages in only three forms of innovation, and negative when a firm engages in only two forms of innovation. Specifically, engaging in any three and two forms of innovation is associated with an increase in labour productivity in low labour productivity firms. However, engagement in any two or three forms of innovation is associated with a reduction in labour productivity in high labour productive firms. The results thus suggest that understanding the relationship between innovation and labour productivity ought to allow for a distinction between high and low labour productivity firms.

With regard to other firm specific characteristics, the ICT and export variables have the expected outcomes as they both enhance labour productivity. The positive relationship between ICT and labour productivity is consistent with Esselaar et al (2007), who show that irrespective of whether a firm is formal or informal, ICT enhances labour productivity. However, a rather intriguing variable is certification, which takes a value of '1' if a firm has an international certification for its products, otherwise '0', where our results indicate that compared to firms without certification, firms with a certification are associated with low labour productivity at the 25th and 75th percentiles. The rationale of certification is that it signals to buyers the quality of the product, especially in foreign markets for economies with weak institutional frameworks, but only to the extent that the quality marks by their bureaux of standards may have lower levels of trust (Goedhuys and Sleuwaegen, 2016). However, owing to the fact that there are only 69 firms engaged in exporting out of 698 firms suggests that the effect of certification on labour productivity is compromised by 90% of the firms whose focus are domestic consumers and who may not be sensitive to certification.

This study equally controls for the firms' perception of the quality of the business environment, such as transport, electricity supply, land access, credit access, educated labour force, tax rate and institutional framework as proxied by corruption. The variables are binary, taking a value of '0' when a firm reports that the business environment variable is not a constraint, otherwise '1'. The results indicate that irrespective of whether the variables electricity and land access are a constraint to firms, they have no impact on labour productivity. However, the results indicate that lower levels of corruption are associated with higher labour productivity in firms with high labour productivity. The inverse relationship between corruption and labour productivity is partly explained by lower corruption resulting in higher firm investment (Mauro, 1995, 1996 and Knack and Keefer, 1995) and efficient resource allocation within a firm (Bah and Fang, 2015). In light of whether an inadequately educated labour force is an obstacle, the results indicate that inadequately educated labour is inversely related to labour productivity at both the 50th and 75th percentiles. This result is consistent with Kampelmann and Rycx (2012) who, using employer–employee panel data for Belgian firms, show that

firm productivity increases in firms with employers where a higher level of education is required. With regard to tax rate, which measures whether the tax rate is an obstacle or not, the results indicate that in firms that report the tax rate to be an obstacle, it undermines labour productivity at the 25th, 50th and 75th percentiles.

However, with regard to credit access, which is a measure of whether credit access is an obstacle taking a value of '1', otherwise '0', the empirical estimations indicate that going from firms that find credit accessible to those that find credit inaccessible, labour productivity is shown to increase at both the 50th and 75th percentiles, at a 5% and 1% level of significance, respectively. This result suggests that even with credit access rigidities firms are likely to have higher labour productivity. While the number of firms reporting on interest rates is not enough to undertake substantive empirical analysis, the result suggests that firms are better off without credit than with credit perhaps because the cost of credit could act as a constraint on effective labour productivity. Indeed, the post-2011 to end of 2016 lending rates averaged upwards of 20%. To put it in perspective, Uganda's average lending rate in 2015 was 15% and 12% higher than those in Vietnam and Zambia, respectively (World Bank, 2017).

Furthermore, Uganda compares unfavourably with its regional peers regarding the ratio of loan accounts to deposit accounts at commercial banks as of 2015. For example, while Uganda's ratio of loan accounts to deposit accounts is 10.9%, it is less than that of both Kenya and Rwanda by 6.7% and 6.6%, respectively (World Bank, 2017). The situation is more stark considering that Kenya has 1,346 deposit accounts at commercial banks per 1,000 adults, compared to 230 deposits accounts per 1,000 adults in Uganda in 2015 (World Bank, 2017). While specific to individuals, this characterization of credit utilization in Uganda suggests a higher reliance of firms on personal savings to undertake investment as opposed to borrowing from the financial system. It is, therefore, not surprising that firms report that credit access is an obstacle, yet they still experience higher labour productivity.

Another unconventional result regards the transport variable, which takes a value of '1' if transport is perceived to be an obstacle, and '0' otherwise. While transport takes the expected negative sign in the OLS model, at the 25th and 50th percentiles, it is has no impact on labour productivity; however, at the 75th percentile it is shown to be directly related to labour productivity. That implies that at the 75th percentile while transport may be perceived to be an obstacle, it would not undermine firm sales. Note that transport as an obstacle could be mean impassable roads or traffic jams, or even expensive freight costs or infrequent flights. Nonetheless, the positive outcome at the 75th percentile suggests that firms in this percentile are potentially able to circumvent the transport-related rigidities by paying higher costs for transport to have their merchandise or services reach various market destinations as opposed to firms in the lower percentiles.

Finally, we test for the robustness of the study results, including firm size, in the empirical model estimated (see Table 2), and observe that firm size does not affect the overall results reported. Therefore, the quantile results clearly show that labour productivity is explained by the selected set of variables included in the empirical model.

5. Conclusion

This paper set out to explain the relationship between innovation and labour productivity as proxied by sales per worker and value added per worker. However, because too many values were missing, we could not estimate the relationship between innovation and labour productivity as proxied by valued per worker. Rather, the empirical estimation was only the relationship between innovation and labour productivity as proxied by sales per worker. The results suggest that: 1) engaging in any one form of innovation has no impact on labour productivity; 2) there is evidence of complementarity between product innovation, process innovation, marketing innovation and organizational innovation in their relationship with labour productivity. Therefore, the implication of this study is that if a firm seeks to enhance labour productivity through innovation, due consideration ought to be given to product innovation, process innovation, marketing innovation and organizational innovation, otherwise each innovation on its own may not result in encouraging improvements in labour productivity.

For policy purposes, this study suggests that efforts to induce innovation should ensure inclusiveness. The presence of complementarity between the four kinds of innovation suggests that the government cannot choose to incentivize marketing innovation at the expense of product, organizational or processing innovations. Innovation incentives should be designed in such a way that firms can embrace the four dimensions of innovation in order to guarantee a positive outcome for labour productivity.

Finally, while the results suggest that having an international certification does not guarantee an increase in labour productivity, this should not result in the government withdrawing its support of SMEs' development through enabling the acquisition of quality marks and product certification. This is because having a product certification is a seal of approval that a product is suitable to be sold in the market. This protects the government from incurring costs arising from households consuming products that are not suitable for human use.

Notes

1. Small enterprises and medium enterprises denotes firms employing 5–19 and 20–99 persons, respectively.

2. https://www.ebiz.go.ug/

3. Note that the recruitment of staff in the directorate is on-going.

4. http://enterprise.co.ug/about-us/

5. With regard to marketing innovation, firms responded to the question "During the last three years, has this establishment introduced any new or significantly improved logistics, delivery, or distribution methods for inputs, products, or services?" and "During the last three years, has this establishment introduced new or significantly improved marketing methods?" With respect to organizational innovation, firms responded to the question "During the last three years, has this establishment introduced any new or significantly improved organizational structures or management practices?" Regarding product innovation, firms responded to the question "During the last three years, has this establishment introduced any new or significantly improved methods of manufacturing products or offering services?" Concerning process innovation, firms responded to the question, "During the last 3 years, has this establishment introduced any new or significantly improved method of manufacturing product or offering services?"

6. Note that one of the data constraints is that firms that had innovated three years prior to the survey are also coded as not having undertaken any innovation.

7. Such as mobile phones, internet, computers, telephones and fax machines.

8. This study considered Botswana, Cameroon, Ethiopia, Ghana, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and Zimbabwe.

9. Imitating innovation involves the purchase of innovation as opposed to actually investing in research and development with the rationale of coming up with new ideas.

10. The "missingness" value in sales per worker is largely attributed to non-reporting of sales, which had 238 missing values.

11. As defined in Appendix 2.

.2 With regard to labour cost, the number of firms that have all values would be 261 when excluding value added per worker. The two variables are defined in Appendix 2.

13. As defined in Appendix 2

14. Note that the service sector includes the retail sector and banking sector. However, while banking services can engage in product development through development of new financial products, this may not be possible for the retail part of the services sector.

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Appendix

Appendix 1: Industries surveyed within SMEs

Industry sampling sector	Frequency	Per cent
Food	102	14.61
Textiles	6	0.86
Garments	45	6.45
Leather	4	0.57
Wood	18	2.58
Paper	3	0.43
Publishing, printing, and recorded media	12	1.72
Chemicals	7	1
Plastics & rubber	5	0.72
Non-metallic mineral products	15	2.15
Basic metals	2	0.29
Fabricated metal products	57	8.17
Machinery and equipment	3	0.43
Electronics (31 & 32)	3	0.43
Transport machines (34 & 35)	2	0.29
Furniture	61	8.74
Construction: Section F	9	1.29
Services of motor vehicles	29	4.15
Wholesale	18	2.58
Retail	186	26.65
Hotel and restaurants: Section H	103	14.76
Transport Section I: (60–64)	6	0.86
IT	2	0.29
Total	698	100

Appendix 2: Variable description

Value added per worker:	is the logarithm of the ratio of the difference between a firm's total annual sales in the fiscal year prior to the survey and the total cost of raw material in the fiscal year prior to the survey to the number of permanent full-time employees at the firm in the fiscal year prior to the survey.
Labour cost:	measures the natural log of the total labour cost, which includes wages, salaries and bonuses.

Appendix 3: Summary statistics

Variable	N	mean	sd	p50	min	max
Sales per worker	451	16.31607	2.093108	16.13052	10.08581	24.38683
Value added per worker	128	15.98301	2.114016	15.90234	11.0021	24.38681
Firm size (Medium=1)	698	0.3409742	0.4743766	0	0	1
Labour cost	410	16.48001	1.932582	16.31032	3.912023	24.11104
Innov						
Innovation_1 (yes=1)	698	0.1174785	0.3222205	0	0	1
Innovation_2 (yes=1)	698	0.1318052	0.3385214	0	0	1
Innovation_3 (yes=1)	698	0.1848138	0.3884247	0	0	1
Innovation_4 (yes=1)	698	0.3237822	0.4682536	0	0	1
Age	646	15.16563	9.899125	14	2	87
Age squared	646	327.8375	554.779	196	4	7569
Experience	670	13.37313	8.208122	12	1	41
Certification (yes=1)	636	0.1509434	0.3582755	0	0	1
Export (yes=1)	698	0.0816619	0.2740453	0	0	1
ICT (yes=1)	698	0.1805158	0.3848923	0	0	1
Gender (yes=1)	698	0.8266476	0.3788231	1	0	1
Tax rate (obstacle=1)	693	0.6392496	0.4805651	1	0	1
Transport (constraint=1)	697	0.5093257	0.500272	1	0	1
Land access (constraint=1)	671	0.414307	0.4929695	0	0	1
Corruption (obstacle=1)	692	0.5375723	0.498947	1	0	1
Labour education (obstacle=1)	691	0.4109986	0.4923714	0	0	1
Electricity (obstacle=1)	697	0.6011478	0.4900139	1	0	1
Credit access (obstacle=1)	677	0.7060561	0.4559034	1	0	1
Sector (Manufacturing=1)	698	0.4641834	0.4990732	0	0	1

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Appendix 3 Continued

Variable	N	mean	sd	p50	min	max
Region						
Jinja (yes=1)	698	0.1217765	0.327262	0	0	1
Lira (yes=1)	698	0.0558739	0.2298428	0	0	1
Mbale (yes=1)	698	0.1117479	0.3152819	0	0	1
Mbarara (yes=1)	698	0.1332378	0.3400753	0	0	1
Wakiso (yes=1)	698	0.0959885	0.2947868	0	0	1

Appendix 4: Missing and non-missing observations

Variable	Number of missing observations	Number of non-missing observations
Sales per worker	247	451
Value added per worker	570	128
Labour cost	288	410
Age	52	646
Age squared	52	646
Experience	28	670
Certification (yes=1)	62	636
Tax rate (obstacle=1)	5	693
Transport (constraint=1)	1	697
Land access (constraint=1)	27	671
Corruption (obstacle=1)	6	692
Labour education (obstacle=1)	7	691
Electricity (obstacle=1)	1	697
Credit access (obstacle=1)	21	677

Appendix 5: Comparison of firms with missing and non-missing sales per worker

	(1)	(2)
Dependent variable	Logit coefficient	Odds ratio
Innov		
Innovation_1	0.766	2.151
	(0.563)	(1.210)
Innovation_2	-0.332	0.717
	(0.443)	(0.318)
Innovation_3	0.492	1.636
	(0.441)	(0.722)
Innovation_4	0.377	1.458
	(0.395)	(0.576)
Experience	0.0217	1.022
	(0.0222)	(0.0226)
Certification	-0.0444	0.957
	(0.430)	(0.412)
Export	0.776	2.173
	(0.780)	(1.694)
ICT	-0.0958	0.909
	(0.447)	(0.406)
Age	0.117	1.124
	(0.269)	(0.303)
Labour cost (natural log)	0.0536	1.055
	(0.0723)	(0.0763)
Constant	-0.251	0.778
	(1.242)	(0.966)
Observations	344	344

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 6: SMEs performance results controlling for firm size

Variables	OLS	0.25	0.50	0.75
	Model 1	Model 2	Model 3	Model 4
Innov				
Innovation_1	0.173	0.0146	0.173	0.0375
	(0.456)	(0.950)	(0.456)	(0.874)
Innovation_2	-0.185	0.260	-0.185	-0.546**
	(0.441)	(0.279)	(0.441)	(0.026)
Innovation_3	0.262	0.478**	0.262	-0.0376
	(0.212)	(0.024)	(0.212)	(0.860)
Innovation_4	0.639***	0.957***	0.639***	0.0840
	(0.001)	(0.000)	(0.001)	(0.672)
Firm age	0.0497**	0.00469	0.0497**	-0.0288
	(0.021)	(0.827)	(0.021)	(0.187)
Firm age squared	-0.802**	-0.0750	-0.802**	1.062***
	(0.042)	(0.850)	(0.042)	(0.008)
Manager's years' experience	0.0127	0.0481***	0.0127	0.00249
	(0.214)	(0.000)	(0.214)	(0.810)
Certification	-0.0194	-0.362*	-0.0194	-0.217
	(0.924)	(0.076)	(0.924)	(0.293)
Exporter (1=yes)	0.753**	1.360***	0.753**	1.515***
	(0.010)	(0.000)	(0.010)	(0.000)
Use ICT (1=yes)	1.175***	1.439***	1.175***	1.262***
	(0.000)	(0.000)	(0.000)	(0.000)
Female manager	0.125	-0.213	0.125	0.0692
	(0.443)	(0.193)	(0.443)	(0.676)
Tax rate burden	-0.540***	-0.570***	-0.540***	-0.930***
	(0.000)	(0.000)	(0.000)	(0.000)
Transport burden	-0.197	-0.177	-0.197	0.587***
	(0.174)	(0.221)	(0.174)	(0.000)
Land access	-0.122	-0.00248	-0.122	-0.224
	(0.400)	(0.986)	(0.400)	(0.129)
Corruption	0.0883	-0.102	0.0883	-0.325**
	(0.562)	(0.504)	(0.562)	(0.036)

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Appendix 6 Continued

Variables	OLS	0.25	0.50	0.75
	Model 1	Model 2	Model 3	Model 4
Labour education	-0.216	-0.0883	-0.216	-0.361**
	(0.164)	(0.571)	(0.164)	(0.023)
Electricity burden	-0.0981	0.0893	-0.0981	0.0139
	(0.477)	(0.519)	(0.477)	(0.921)
Credit access	0.295*	-0.188	0.295*	0.506***
	(0.056)	(0.222)	(0.056)	(0.001)
Medium firm	0.471***	-0.161	0.471***	0.484***
	(0.003)	(0.308)	(0.003)	(0.003)
Sectoral fixed effects	YES	YES	YES	YES
Regional fixed effects	YES	YES	YES	YES
Constant	14.92***	15.35***	14.92***	17.15***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	347	347	347	347
R-squared	0.143	0.118	0.143	0.166

P-values in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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