FIRM PERFORMANCE AND INNOVATION IN THE DEVELOPING COUNTRIES: EVIDENCE FROM FIRM-LEVEL SURVEY

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Abstract

This paper investigates the relationship between firm performance and innovation in developing countries using micro data from enterprise surveys. The purpose is to empirically test the importance of firm performance in terms of sales, for a firm's proneness to innovate specifically in developing countries. A two-stage least squares (2SLS) model is applied to a sample of 2356 firms from the manufacturing and service sectors. Results show that firm performance, defined as sales, is found to be a significant factor contributing to innovation among firms. This relationship holds in manufacturing firms even when distinguished from the services sector. The findings underline the importance of firms' performance through increased sales. The paper adds to the existing limited research literature on performance and innovation studies in developing countries especially Africa. The paper results differ from previous research studies where focus has been on innovation impact towards performance. As a policy option, developing countries need to improve and promote an increase in firms' sales that would spur them to introduce a new or substantially improved product or process.

Keywords: Firm, Performance, Innovation, Developing Countries, Manufacturing, Services

1. INTRODUCTION

Innovation is one of the fundamental instruments of a firm growth strategy to increase market share and maintain a competitive edge. With increasing competition in the global market, firms in developing countries have realized the importance of innovation that swiftly changes the value added of products and services Bigsten et al (2016). Innovations provide firms with a strategic orientation to overcome the problems they encounter while they strive to achieve sustainable competitive advantage (Kuratko et al., 2005). Firms with the capacity to innovate can respond to environmental challenges faster and better than non-innovative firms can (Brown and Eisenhard, 1995). Innovation is widely regarded as critical for the economic viability of firms and nations and is one of the key drivers of long-term success and competitive advantage (Baker and Sinkula, 2002; Lyon and Ferrier, 2002). Recent meta-analytical studies have provided evidence of a positive relationship between a firm's innovation performance and its overall performance (Rubera and Kirca, 2012).

Firms lacking the capability to innovate easily may choose to improve their performance with external assistance from other foreign firms (Hull, *et al.,* 2008). Firms that innovate this way, find that learning capability gained through their experiences in developing greater performance makes it easier to create subsequent innovations. Firms in developing countries face many challenges toward efforts to innovate, which may include, need to increase expenditures on R&D, while at the same time suffering from low levels of technology and limited access to external financing among other factors. Despite the challenges and difficulties, firms in developing countries through greater performance could induce innovations that stimulate firm growth.

The purpose of this paper is to empirically test the importance of firm performance in terms of sales, for a firm's proneness to innovate. This research study will try to answer a key question on whether firm's business performance in developing countries leads to new or significantly improved good or service or production and delivery method. The motivation of this paper is twofold; 1) most studies and literature have focused on the role on how innovation affects firm performance, and 2) the same studies have largely placed their studies on developed countries. This paper, therefore, fills an important gap in the literature where few studies have looked at the effect of performance on

innovation, particularly in developing countries. Those that have attempted to have mainly focused on causality (e.g. Lööf & Heshmati, 2008).

In this paper, a firm is categorized as innovative if it has introduced a new or substantially improved product or service on the market for the last three years before 2012, following the enterprise survey carried out by the World Bank in developing countries.[13] In this case, 'new' means new to the firm but not necessarily new to the market or other firms.

The main contribution of this study is the in-depth performance-innovation analysis of firms in developing countries based on survey data, estimated with a two-stage least squares model, which not only revealed significant and positive effects of firm performance on innovation but also yielded similar relations among these variables at sector (manufacturing and service) level. The paper provides evidence that firm performance in terms of sales, is strongly related to firm innovation. Innovation in firms is multi-dimensional and this study supports integrates firm performance and innovation into a single analytical model. Regarding the sector, the results show that firms in the manufacturing sector are more innovative, benefiting from performance than in service firms in developing countries. The findings imply a need for developing countries, especially the East African countries to improve firms' performance as a virtual attempt to spur innovative efforts

The remaining part of the paper is organized as follows. Section 2 presents a brief review of the theoretical background and findings from the recent literature on firm performance and innovation at the firm level. Section 3 describes the data used, empirical model along with estimation procedures. Section 4 states the empirical results and section 5 concludes this study.

2. THEORY AND LITERATURE REVIEW

Firms enhance their level of competition and capacity to earn profits once they invest in R&D (Lööf & Heshmati, 2008). It is widely viewed that innovation through R&D makes a vital contribution to firms' sales performance productivity and profit (Romer, 1990; Jones, 1995; Van Reenen, 1997). Ericsson and Pakes (1995) show that the stochastic outcome of the firm's own investments in R&D, physical capital, human capital, marketing and competitive pressure from other firms within or outside the industry determines the sales performance of a firm. Despite the existence of significant literature on the influence of R&D on performance, very little contemplation has been given on the reverse relationship. Existing empirical results are not conclusive on the nature of the relationship or the effects of firm performance on innovation. The importance of the reverse link between firm performance and innovation through R&D also connects to the recent empirical findings suggesting that R&D activities are difficult to finance through external funding sources. Due to limited access to external finance, investment in R&D activities for firms in developing countries, tend to be low, thus yielding little innovation. Literature within industrial organization research has investigated the presence of "liquidity" constraints and importance of cash-flow for R&D investments (Brown, 1997; Harhoff, 1998; and Cincera, 2002).

Firm performance provides individual firms with incentives like higher returns to invest in innovation, mobilize resources to invest in innovation and probably greater returns from innovation. As a result, performance has a positive effect on firm innovation (Lööf & Heshmati 2008). Previous studies indicate that few new ventures possess all the knowledge and perform innovative activities in house (Bauma, Calabrese and Silverman, 2000); Lee, Park, Yoon, and Park, 2010) and research and development investments by firms in developing countries are generally low (Padilla-Perez and Gaudin, 2014). The possibility for these firms would be to increase sales and gain market share. In the early stage of technological development in developing countries, an increase in R&D expenditure was considered vitally important for firm growth. Many firms in developing countries traditionally relied on imitation as a catch-up strategy for their growth (Hobday, 2005). Firms in a developing country can focus on increasing their performance through sales with their under-developed technologies. As performance through sales gradually increases, they can increase R&D expenditure.

It is important to understand the dimension of firm innovation as it's likely to be related to two crucial outcomes: the level of research and development undertaken by the firm and the performance of the product and services sales on the market. I hypothesize that firms are most likely to continue the development of products or services that closely draw more sales from the market and best fit in firm's resources. Studies incorporate diversification have a fund that firms tend to expand in the direction of current resources in order to utilize productive resources that are surplus to current operations (Chatterjee & Wernerfelt 1991). March (1991), argue that firms have a tendency to exploit their existing resources than to explore new ones. This implies that firms will tend to utilize their resources from the increased performance and focus on the innovation of existing products or services to increase market share. This suggests that possibly performance affects firm innovation, through sales, that generate financial performance.

Diverse inputs are often required to develop innovation. Firm performance provides the opportunity for new and diverse ideas from a variety of market perspectives (Tushman, 2004). This suggests that good performing firms could learn from their success and the new knowledge can lead to innovation. The ability to produce innovation in this way may be important to achieve strategic competitive advantages. Firms that invest more resources to develop innovative capabilities would likely be able to perform better in the long term. Increased investment in sales performance in firms, gain competitive advantage and provides incentives for firms to innovate and maintain innovation abilities. Furthermore, through improved sales performance, firms may generate the financial resources and develop new performance knowledge that is necessary to produce innovation.

In a reverse causality literature of innovation on performance which this paper is not focusing on,

[13] www.enterprisesurveys.org

innovation is broadly conceded to be positively related to performance and, indeed essential to survival (Brown and Eisenhardt, 1995; O'Reilly and Tushman, 2004). Firms that cling to old ways tend to lag-behind while firms that introduce new ideas to the market may find themselves prospering as new ideas replace old ones. Innovation is a source of competitive advantage for a firm. Clarelli-O'Connor (1998) defines "really new" products as innovation in terms of their ability to offer greater functionality, distinguished from incremental products by the leap in performance they provide. Performance is likely to lead to the introduction of new products based on the market demands. The new products in such a case are new innovations originating from firm performance and resources. One of the productive uses of firm resources is in product innovation (Danneels and Kleinschmidt 2001). Resources that enable a firm to develop new products include sales, R&D, knowledge of customer needs and competitive situations, market research skills production facilities and so forth (Danneels and Kleinschmidt 2001). For example, if a firm has a great market share, e.g. sales, may further leverage that market by developing more products.

Research has implicitly identified two complementary strategic orientations to the use of firm resources for innovation performance (Day, 2011). The first approach the inside-out orientation, focus on firm-specific internal sources and capabilities (Barney, 1991; Day, 2011; Miller, Eisenstat, & Foote, 2002). The success of the orientation is based on a firm's ability to leverage and deploy its existing knowledge and capabilities through the inside-out process, that is, a process that begins with the firm and looks outward (Day, 2011). The second approach, the outside-in orientation, centers on knowledge and resources that reside outside the firm such as customers, suppliers, competitors and end-product market positions as the linchpins of innovation (Paladino, 2007). This paper analyses performance based on the inside-out orientation, the focus of which lies on how a firm achieves innovation by developing superior performance possessing, capitalizing on strategic firm-specific resources. Griliches (1994) found that half of the growth rate per year is likely to be associated with performance growth in the quality of sales, labor force, economics of scale and various reallocations of capital between assets and industries, with the other half attributed to advances in knowledge commercialized as innovations. The concept of performance involves complementarity between knowledge advancement, economies of scale and strong firm foundation. In capital-scarce developing countries such as the Sub-Saharan Africa, with relatively weak institutions, social and political risks, inadequate infrastructures and other less attractive structural characteristics may discourage foreign investor (Riddle et al., 2008) which implies that firms should rely on the local investors, for better performance results.

Firms producing innovation have the motivation to geographically diversify to achieve more and higher returns on investments in producing the innovation (Caves, 1982). This is exceptionally true in a new competitive world in which global competition in markets has placed more emphasis and importance on innovation to develop a competitive advantage (Bettis & Hitt, 1995). Innovation resulting from improved firm performance may lead a firm to achieve a competitive advantage in international markets (Porter, 1990). Crepon *et al.* (1998) in a recursive model estimate innovation inputs in an investment function. They show that a firms' decision to invest in innovation increases with market share, diversification, and with demand pull and technology push forces. Using indicators of economic performance such as sales, firm's labor productivity and market value, studies in this vein have recurrently shown performance leads to superior firm innovation. Evidence in regard to the ability of firms in developing countries to transform R&D into innovation is much more mixed than in case of firms in industrialized countries, which prompts a suggestion that firms in developing countries may refocus on performance that would transform into innovation.

3. METHOD, DATA, AND VARIABLES

3.1. Data and Method

The data for the analysis in this study come from the enterprise survey[14] database, World Bank. Contrary, previous studies (Lööf & Heshmati, 2008; Jones, 1995; Van Reenen, 1997 Griffith, et al., 2006) have estimated models on the relationship between innovation and performance using the CDM-model which in recent years have been frequently used for analyzing CIS data. Further, the same studies on innovation and performance relationships have used National Innovation Surveys, Community Innovation Surveys and panel data for developed countries specifically European countries. The Enterprise survey data used in this paper is a multi-topic firm-level survey that collects data of firms' characteristics, balance sheet and firms' experience of the business environment. The survey was implemented in 2013 and yields a cross-section data set from there countries; Uganda, Kenya, and Tanzania in the East African region. This type of data provides a suitable possibility for conducting research with firms as the units of observation. Enterprise data has been used in other studies in the like Yang, (2017). Enterprise survey data are increasingly being seen as a key data for the study of innovation at the firm level in developing countries. The enterprise survey questionnaire is extensive and covers different aspects of a firm and enables researchers to explore the relationship between firm performance and innovation strategies. The total population in this study consists of 2356 firms from the service and manufacturing sectors. The total number of firms is based on country surveys from each country with 781 firms from Kenya, 762 firms from Uganda and 813 from Tanzania. The data from firms consist of information on, for example, total sales, total expenditures, number of employees, exports and ownership structure. Monetary values are for 2013 as a fiscal year and were converted from the local currency units to USD, using exchange rates from

14 An enterprise survey is a firm-level survey of a representative sample of an economy's private sector collected by Enterprise Analysis Unit, the World Bank Group.

the World Bank Indicators (official exchange rate; local currency unit per USD, period average.

3.2. Variables

For the purpose of this paper, two dependent variables are used as they are interrelated. The first is the performance measured at firm level as total annual sales. To be able to analyze firm performance, I consider firm total sales as a measure of performance, even though it's the crudest, it's the best available measure from surveys. Total sales as a measure of performance have been previously used in economics and firm studies (e.g. Yang, 2017; Friesenbichler and Peneder, 2016). The second dependent variable is a binary and states whether or not the firm has introduced a product or process innovation sometime in the last three years. In this paper, it is hypothesized that both the dependent variables simultaneously determine each other. Innovation through R&D determines firm performance and firm performance through productivity measures affect positively innovation levels (Lööf & Heshmati, 2008). Jones (1995), Van Reenen, (1997) are of the view that innovation through R&D makes a vital contribution to firms' sales performance, productivity, and profit. There is a strong relationship between innovation and performance (Lööf & Heshmati, 2008).

The independent variables include among others performance in the equation 1 in a measure firm innovation. In recent years, research has indicated that performance has been divided into financial and non-financial indicators and measured in different ways. Lööf & Heshmati (2008) use different performance indicators including sales, value added, capital structure, employment, and profit. Klomp and Leeuwen (1999) use total sales growth and employment growth Calantone et al, (2002) focus on profitability, and Cainelli et al. (2004) measured firm performance by the annual average growth rate of sales, employees and labor productivity. In this paper, the performance of a firm is measured as the value of the total annual sales of a firm. Research and development are considered important variables that determine firm innovation, and performance. R&D stimulates innovation. Lööf & Heshmati (2008) find that firms invest in R&D to innovate, increase their competitiveness and thus earn profits. But, Cincera (2002) argues that the presence of liquidity constraints limits R&D undertaking among firms. It is relatively important to argue that firms whose profits increase through increased sales, may have liquidity thus potential to innovate.

Control variables are a number of competitors, firm size, age, the share of exports, the experience of top managers, dummies for ownership structure, a dummy for a firm owning a loan or credit, a dummy if a firm is part of a large firm, and a dummy denoting whether employees are offered on-job training. I created a dummy variable of whether the firms have any R&D expenditures or not. For consistency, I assign firms that have no R&D expenditures with 0 and 1 to firms with R&D expenditure. Additional information on variables is given in Table 1.

Table 1. Summary of variables

Variable	*Definition*
Innovative	Dummy =1 if a firm has introduced a new or substantially improved product or process, 0 otherwise. Dependent Variable
Performance (ln)	Firm's total sales, log transformed. Dependent Variable, (endogenous in the innovation model)
Research and Development	Dummy =1 if a firm made an expenditure on R&D, 0 otherwise
Competition	Number of competitors for a firm's main product
Training	Dummy =1 if a firm offers on-job training for employees, 0 otherwise
Loan or credit	Dummy = 1 if a firm own a loan or credit, 0 otherwise
Foreign technology	Dummy =1 if a firm has licensed technology from abroad, 0 otherwise
Foreign ownership	Dummy =1 if a firm is part of a foreign firm, 0 otherwise
Age	Number of years since establishment
Exports	Percentage of exports to foreign markets
Size(ln)	Number of employees (full-time equivalents), log transformed
Management experience	Number of years of experience by top managers

3.3. Empirical Model and Estimation

The empirical model presented in the paper considers two dependent variables, a continuous (sales) and a dichotomous variable (innovation). Specifically, innovation and performance are interrelated, which should be jointly analyzed (Lööf & Heshmati, 2008). For instance, performance through sales or labor productivity can induce demand for new products thus, a pathway to innovation (Therrien *et al.* 2011). In the present case, a two-stage least square probit estimation is applied with innovation probability expressed as:

$$\Pr\left(I_i = \frac{0}{X_{i,\gamma}}\right) = 1 - f(-X_{i\gamma}) \qquad (1)$$

where, f is a function that can have a real value between 0 and 1, *Pr* is the probability, I is innovation variable, X_i are explanatory variables and γ are parameters to be estimated. In such a case, Maximum Likelihood Estimate (MLE) can be used for parameter estimation. Specifying the dependent variable (I_i) as 1 or 0 implies that the expected value of I_i is the probability that I_i =1. Estimated probit model takes the form;

$$\Pr\left(\frac{I_i}{X_{i,\gamma}}\right) = 1 - \phi(-X_{i\gamma}) = \phi(X_{i\gamma}) \qquad (2)$$

where, ϕ is a cumulative density function of the standard normal distribution.

$$I_i = \eta + \gamma\Sigma_{n=1}^{10} X_i + \tau P^f + v_i \qquad (3)$$

The performance model is specified as:

$$P^f = a + \beta_i\Sigma_{n=1}^{2} X^* + \varepsilon_i \qquad (4)$$

where, P^f is performance, X^* are instrumental variables and ε_1 is the error term. The two models in equation 3 and equation 4 are then estimated with a two-stage least squares (2SLS) an extension of OLS method. It is used when the dependent variable's error terms are correlated with the independent variables. It is mainly applied to address a problem of simultaneity that results in biased and inconsistent estimates (Keshk, 2003), which appears when the endogenous variables' error term is correlated with the other dependent variable error term. The appropriate way to address the issue is to specify some instrumental variables which are highly correlated with performance but less correlated with innovation. The selected instrumental variables for performance are size, exports and management experience of a firm with correlation coefficients of 0.3451, 0.2653 and 0.2428 respectively as against their correlation of 0.0767, 0.0789 and 0.0623 with innovation. To test for exogeneity of the endogenous variable, I use the Wald test of exogeneity statistical significance. The results for this test which shows statistical significance (p<0.05), indicate that selected instruments properly addressed the problem of endogeneity.

4. EMPIRICAL RESULTS

To estimate the effect of performance through sales on firm innovation, I used conventional probit and two-stage probit models. This allows discussing the economic significance of the results. The results of the empirical estimation on firm innovativeness are presented in Tables 2 and 3, with Table 3 showing separate regressions for each sector. Table 2 shows that a firm's performance, in terms of sales has a strong positive relationship and the high probability that a firm will innovate. This is valid for the instrumented 2SLS model than in the ordinary probit regression where performance is significant but negative. The nature of the broader performance, a firm seeks to pursue is critical in determining the level of innovation it ought to have. This observation holds from the estimation of the model for both 2SLS probit and ordinary probit where they have different signs but significant.

The results show that firm performance, in terms of sales performance has a strong and positive relationship that a firm introduced a product or process innovation. An increase in a firm's sales increases the predicted probability of being innovative by 0.0951%. This indicates how a firm's decision regarding the scope of its sales impacts its innovation. This is valid for firms in developing countries, mainly the East African region, although manufacturing firms benefit relatively more than service firms. Increase in sales unlike exports (Bigstenet al, 2016) in developing countries and specifically in manufacturing firms increase product or process innovation. The results are in line with empirical findings in previous studies which established that as firms' performance increased, the probability of firm introducing a new product or process increased (Therrien *et al.* 2011). Baumol and

Wolff (1983) found that high performance improves access to external resources through securities for investment in R&D, which is essential for innovation. This implies that high performance increases incomes and profitability that is partially channelled for innovation. Consistent with the results, I find that innovation element in firms is ultimately dependent on performance (measured as sales) which coincides with the findings of Lööf, & Heshmati (2006). However, they highlight that performance through sales and profits, increases firm innovation capabilities. They find that sales performance increases profits and employment, which directly impacts on innovation. This relationship which is positive highlights the possibility that firms with a better performance today could be the same high performing firms tomorrow due to new innovation generated.

4.1. Control variables

Regarding the control variables, the results show that research and development in firms are positive and significant indicating that firms undertaking research and development increase the probability of being innovative by 0.496 %. This supports the findings of Lööf, Heshmati (2006) that increase in R&D investment increases innovation. Increased R&D in developing countries could probably increase innovations which could induce growth in the industrial sector. Griffith et al, (2006) find that firms decisions to engage in R&D intensively increases innovation and productivity across European countries. They further find that the R&D intensity is mainly for firms that operate in international markets, firms receiving government funding and firms that strategically protect innovation. Conventional reasoning that firms engaged in R&D are more innovative seems to be less applicable in developing countries setting, due to challenges associated with applying and developing theory, especially given the fact that technology advancement in developing countries is still limited (Wright et al. 2005) thus prompting alternatives, that this paper has highlighted which include performance. Research and development in developed countries mainly depend largely on government funding (Griffith et al, 2006). In most developing countries, R&D is required to stimulate innovation. However, capital investments in R&D limit firms' innovation capabilities.

Regarding competition and training as measures of innovation, results show that both variables are positive and significant. As the number of competitors increases, a firm increases the probability of being innovative by 0.00477 %. This may be due to knowledge spillovers that result from more competition among the firms. Secondly, increase in competition reduces market share for each firm. Markets are often characterized by intense competition, thus inducing firms to be innovative to capture the biggest market shares with new products or services through diversification. Firms that pursue product diversification strategies with foreign partners to avoid competition and vulnerability (Suzuki and Kodama, 2004) place a greater emphasis on the diversity of innovation than the depth of innovation. This observation suggests that firms can, indeed take advantage of their already existing market share to diversify with new products and services. However, Griffith et al, (2006), finds that competition provides less

important information for innovation. They stress more importantly the role of supplier and customers in their findings. The results indicate a small percentage influence of competitors on the innovation of firms in developing countries.

Table 2. Marginal effects results of innovation measured on performance

Variables	*Instrumented 2SLS probit model*	*Ordinary probit regression*
Performance (ln)	0.0951** (0.0289)	-0.00780* (0.00378)
Research and Development	0.496*** (0.148)	0.676*** (0.0750)
Competition	0.00477*** (0.00115)	0.00525*** (0.000988)
Training	0.433** (0.157)	0.673*** (0.0632)
Loan or credit	0.285*** (0.0703)	0.296*** (0.0705)
Foreign technology	0.0215 (0.0805)	0.166** (0.0626)
Foreign Ownership	-0.00166 (0.00149)	0.00148 (0.00123)
Age (ln)	0.176*** (0.0369)	0.158*** (0.0360)
Age-squared	-0.000125*** (0.0000315)	-0.0000441 (0.0000342)
Athrho |	-0.923 ** (0.420)	
Lnsigma	1.975*** 0.009	
Wald Chi Square	783.40***	330.63
Wald test (exogeneity)	4.84***	-
Log likelihood	-9365.2242	-1373.149
Number of Observations	2356	2356

*Note: * p<0.05, ** p<0.01, *** p<0.001, Robust standard errors in parentheses*

Similarly, as on-job training of employees by firm increases the probability of the firm to be innovative by 0.433 %. Increasing training is one form of providing internal knowledge that contributes to innovations in a firm. This finding suggests that training as means of extending knowledge strengthens firm's incentives to innovate. The finding supports results of Acemoglu (1997) who argues that training is an essential knowledge advancement investment when new technologies are adopted. Similarly, training by firms provides appropriate skills that are a key determinant if innovation. Hashimoto (1991) find that the efficient adoption of technologies by Japanese firms is attributed to their effective training strategies. Therefore, training by firms to both skilled and unskilled employees generates innovation and technology adoption decision, as skills for workers are more valuable to firms.

Firms that have accessed funding through a loan or credit, have 0.285 % probability for a firm to introduce a new or substantially improved product or process innovation. Access to loan or credit is usually a constraint to firms in developing countries. This finding suggests that access to external finance has an impact on firm's innovation efforts and illustrates the importance of access to financing for firms in developing countries. Interestingly, firms with limitations in accessing credit would have less potential for innovation. This result is more likely to be true in developing countries where access to external finance and government funding are limited. This latter argument is supported by the findings of Griffith et al, (2006), European firms mainly the large firms; undertake innovations backed by government funding. This further confirms the findings of Hall (2002), who argues that larger firms with physical assets to secure loans and higher economies of scale can be expected to have better performance.

The estimated parameter of a firm owning a foreign technology is insignificant and positive, an indication that firms in developing countries are less likely to have or adopt the foreign technology. The findings confirm to those of Raffo et al, (2008) that technologically lagging multinational firms do not invest in innovation at all if the market size is not sufficiently larger, or if there is no specific national academic attractiveness. Firms having foreign ownership indicate results that are negative and insignificant, which contradicts the findings of Crespi & Zuniga (2012) who argue that firms that have foreign ownership greater than 10 % of capital show a high propensity to invest in innovation. It is possible that firms that have foreign ownership rely heavily on the innovations from the foreign parent firms or owners' other innovations. This remains a concern for developing countries whose firms rely on foreign technology. It means that firms may not internally develop innovations that would lead to growth.

Age is positive and significant, indicating that the more experience a firm has, the higher the probability of innovating at 0.176 % level. However, at a certain point, the probability of innovation at 0.000125 percentage as illustrated by the variable age-square decreases. This confirms the findings of Foster-McGregor et al. (2016) where the finds age having a small positive relationship with performance-productivity. However, this contradicts the findings of Jefferson et al. (2006) who find age (as a proxy for experience) of a firm insignificant.

They attribute this finding to the fact that older firms are typically state-owned enterprises. Similarly, Rosli et al. (2013) find firm age not significantly affecting a change in performance, mainly because half of the sample in their study was ten years old and less. Firms that have been established for a longer period are more likely to innovate than newly established ones.

This study further analyzes how firm performance affects innovation at the sector level. The existing studies that have studied the performance innovation nexus have mainly concentrated on manufacturing firms only. Even though manufacturing firms play an important role in the growth of developing countries accounting for more than 40 % of GDP (Foster-McGregor et al. 2016; Van Biesebroeck, 2005), the service sector has greatly improved on recent contributing significantly to developing countries' GDP. The analysis of the sectors in this paper, further assumes that manufacturing and services firms in developing countries innovate differently and at different levels. Studying the performance effects on innovation would add to the existing literature. To test for the differences between manufacturing and service firms, I apply the same 2SLS model, in separate regressions to categorize services and manufacturing firms. Table 3 shows the results from the manufacturing and services sectors.

Table 3. Marginal effects results of innovation measured on performance using sector groups

Variables	*Manufacturing Sector*		*Service Sector*	
	Instrumented 2SLS probit model	*Ordinary probit regression*	*Instrumented 2SLS probit model*	*Ordinary probit regression*
Performance (ln)	0.026*** (3.342)	-0.004 (0.006)	-0.105* (0.0528)	-0.0105* (0.00523)
Research and Development	0.585*** (0.138)	0.729*** (0.105)	0.360 (0.316)	0.588*** (0.110)
Competition	0.005*** (0.001)	0.005*** (0.105)	-	-
Training	0.405*** (0.125)	0.586*** (0.089)	0.516 (0.355)	0.753*** (0.0901)
Loan or credit	0.247** (0.088)	0.266** (0.095)	0.0792 (0.214)	0.278* (0.109)
Foreign technology	0.253** (0.119)	0.372** (0.115)	-	-
Foreign Ownership	-0.000 (0.002)	0.003 (0.002)	0.00229 (0.00262)	-0.000953 (0.00186)
Age (ln)	0.181*** (0.058)	0.194** (0.057)	-0.0140 (0.115)	0.111* (0.0474)
Age-squared	-0.000** (0.000)	-0.000 (0.000)	0.000133 (0.0000968)	-0.00000441 (0.0000599)
Athrho	-0.733*** (0.287)		0.938 0.939	
Lnsigma	1.932*** (0.014)		2.012*** 0.010	
Wald Chi Square	357.33	177.78	491.20***	144.81
Wald test (exogeneity)	6.51 ****		1.00 ***	
Log likelihood	-4831.0548	-690.03201	-4515.0888	-676.88409
Number of Observations	1237	1237	1119	1119

*Note: * p<0.05, ** p<0.01, *** p<0.001, Robust standard errors in parentheses*

There is a positive and a negative relationship between performance and innovation in manufacturing and service sectors respectively. The results indicate that performance increases the probability of a firm being innovative by 0.026 % in the manufacturing sector and decreases the probability of a firm to introduce a new or substantially improved product or process of by 0.105 % in the service sector. This coincides with the findings of Cohen and Levin (1989) who emphasizes the importance of innovative activity as anything but constant across manufacturing industries. However, the results contradict with findings of Lööf et al. (2001) in their study of innovation and performance, find that sales were not significant to innovation.

The results of the study suggest that there a positive relationship between research and development and innovation, and significant in the manufacturing sector. An increase in R&D increases the probability of the firm being innovative. This confirms the findings of Friesenbichler & Peneder (2016) where intensive R&D Increased innovation levels. Interestingly, the relationship between firm's foreign technology and innovation was found to be significant (0.253) and positive in manufacturing firms. This result is in the same line as the finding of Crepon *et al.* (1998) who find technological advancements appear to have positive effects innovation through R&D and its intensity. Perhaps in manufacturing firms, require technology in the manufacturing process, being the reason to why they need foreign technology from foreign sources and firms.

Furthermore, manufacturing firms through competition can innovate. The relationship between competition and innovation is positive and significant. This is in conjunction with the findings of Lööf et al (2001), where they find competitors as cooperative partners in innovation significant and positively associated with innovation investment intensity. Conversely, competition is insignificant on innovation through R&D in a single equation model (Friesenbichler & Peneder, 2016) but significant and positive in the system of equations estimation.

Other controls: access to external finance, age and age-squared are all significant as in the main model. Firms that access external financing innovate significantly at 0.247 % than firms that do not. Results confirm those of Crespi & Zuniga (2012) who find that firms that receive external finance invest 80 % in innovation. This finding of access to external financing suggests a broader innovation policy on firms' innovative efforts is required in developing countries.

4.2. Robustness Checks

Even though variable performance is significant in Table 2 and 3, for the purpose of checking the robustness of the results, I perform a fixed effects logit model on a panel data of firms for only two countries (Tanzania and Uganda) available during 2006-2013. Kenya's panel was an odd with a panel 2007-2013. This is left out due to the being the only country with such a panel and due to the number of years in the same panel being less than for Tanzania and Uganda. The choices for the fixed effects, based on the results from the Hausman test, where I find fixed effects are consistent. The initial hypothesis that individual level effects are adequately modeled by a random effects model is resoundingly rejected. Thus, use of a fixed effects model, that will capture all temporary constant firm level effects. This leaves us with 360 observations from the panel. In comparison with initial models, results are generally similar to the previous findings. The basic variable performance remains significantly positively related to firm innovation. Interestingly under the fixed effects regression, foreign ownership turns to be significant and negative. Similarly, foreign technology turns to be significant and positive, whereas age changes the signs from positive to negative under fixed effects logistic model.

Table 4. Empirical results for innovation measured on performance using sector groups

Fixed-effects logistic regression			
Variables	***All sectors***	***Manufacturing***	***Services***
Performance (ln)	0.0772* (0.0348)	0.0841* (0.0417)	0.0586 (0.0786)
Competition	0.0525 (0.0740)	0.0217 (0.0857)	0 (.)
Training	0.486 (0.279)	-0.1763 (0.3366)	3.018** (1.164)
Loan or credit	0.293 (0.341)	0.6089 (0.4100)	-0.915 (0.907)
Foreign technology	1.598*** (0.435)	1.4936*** (0.4639)	0 (.)
Foreign Ownership	-0.0179** (0.00571)	-0.0217 (0.0080)	-0.0122 (0.0113)
Age (ln)	-0.958** (0.352)	-2.0332* (0.9693)	-0.427 (0.707)
Age-squared	-0.000000796 (0.00000899)	0.0011 (.0008153)	-0.00000179 (0.0000223)
Wald Chi Square	54.41	48.62	20.58
Log likelihood	-97.55	-64.41	-19.51
Number of Observations	360	256	86

*Note: * p<0.05, ** p<0.01, *** p<0.001, Robust standard errors in parentheses*

Finally, I re-estimate the same fixed effects model using stratified sector groups, which also leaves us with fewer observations than in the original model to 256 and 86 for manufacturing and services respectively. The results of these estimates indicate that performance remains significant and positive in manufacturing firms than in service firms. The results indicate foreign technology being significant and positive; the signs of foreign ownership remain negative but significant. Age is significant even if the sign is negative implying that as a firm gains more years of experience, the probability of being innovative reduces. None of the variables in service sector other than training is significant in the fixed effects model compared to the two-stage least squares model.

5. CONCLUSION

The paper estimates the influence of firm performance on innovation in three developing countries in sub-Sahara: Uganda, Kenya, and Tanzania using a two-stage least squares (2SLS) model based on survey data from enterprise survey-World Bank. Innovative firms are often regarded as drivers to economic growth, established as early as Schumpeter (1911). I have attempted to comprehend better the alternative notion of understanding different ways a firm may be innovative and empirically examine the dimension of firm innovation from the firm's perspective. I find strong evidence concerning the relationship between firm performance and firm innovation. Consistent with the literature, firms that increase their sales are more able to introduce new or substantially improved products or services or processes. This consistency in the results provides evidence that developing countries in the East African region could be more innovative if they emphasized performance through increased sales, increased research and development, have access to external financing and further training to employees.

The study provides new insights into why theoretical perspectives on performance and innovation that emerged from previous performance and innovation studies in developed economies cannot easily be applied in developing country settings. Existing literature has focused on innovation impact towards performance in developed countries; limited research has covered the opposite, with no concentration in developing countries. In the available literature, it is often argued that firms' performance in developing

countries especially in Africa, obtain efficiency gains from exports. This would be true if these exports have high and increasing sales returns. In this regard, this study highlights alternative formulation, to provide arguments related to the performance of firms being critical to innovation into a single analytical model. Firms in developing countries especially in the manufacturing sector are more placed at increasing their performance through increased sales to pursue innovative efforts. The paper provides a suggestion based on the results that micro-level theory on innovation can be developed further by emphasizing the interplay between performance, R&D, training, access to external finance by firms, and access to foreign technology than it has been to date. As a policy recommendation, developing countries need to improve and promote an increase in firm sales, to render them appropriate investments in innovation.

Despite its contribution, this study has some slight limitations to the data characteristics, where the data used in this study is cross-sectional, from one source. Even though the results of significant positive and negative interactions assuage common method bias concerns, future studies could use data from different sources for more robust causal deductions. It would be interesting in future research work to examine whether such relationships hold in other datasets like panel data.

REFERENCES

1. Acemoglu, D. (1997). Training and innovation in an imperfect labour market. *The Review of Economic Studies*, *64(3),* 445-464. https://doi.org/10.2307/2971723
2. Baker, W. E., & Sinkula, J. M. (2002). Market orientation, learning orientation and product innovation: delving into the organization's black box. *Journal of market-focused management*, *5(1),* 5-23. https://doi.org/10.1023/A:1012543911149
3. Baum, J., Calabrese, T., & Silverman, B. S. (2000). Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal 21,* 267–294. https://doi.org/10.1002/(SICI)1097-0266(200003)21:3<267::AID-SMJ89>3.0.CO;2-8
4. Baumol, W. J., & Wolff, E. N. (1983). Feedback from productivity growth to R & D. *The Scandinavian Journal of Economics*, *85(2),* 147-157. https://doi.org/10.2307/3439475
5. Bettis, R. A., & Hitt, M. A. (1995). The new competitive landscape. *Strategic management journal*, *16(S1),* 7-19. https://doi.org/10.1002/smj.4250160915
6. Bigsten, A., Gebreeyesus, M., & Söderbom, M. (2016). Tariffs and firm performance in Ethiopia. *The Journal of Development Studies*, *52(7),* 986-1001. https://doi.org/10.1080/00220388.2016.1139691
7. Bong Choi, S., & Williams, C. (2013). Innovation and firm performance in Korea and China: a cross-context test of mainstream theories. *Technology Analysis & Strategic Management*, *25(4),* 423-444. https://doi.org/10.1080/09537325.2013.774346
8. Brown, S. L., & Eisenhardt, K. M. (1995). Product development: Past research, present findings, and future directions. *Academy of management review*, *20(2),* 343-378. https://doi.org/ 10.2307/258850
9. Brown, W. (1997). *R&D intensity and finance: are innovative firms financially constrained?* (No. dp271). Financial Markets Group.
10. Cainelli, G., Evangelista, R., & Savona, M. (2004). The impact of innovation on economic performance in services. *The Service Industries Journal*, *24(1),* 116-130. https://doi.org/10.1080/0264206041233130116 2
11. Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial marketing management*, *31(6),* 515-524. https://doi.org/10.1016/ S0019-8501(01)00203-6
12. Caves, R. E. (1996). *Multinational enterprise and economic analysis*. USA: Cambridge university press.
13. Chatterjee, S., & Wernerfelt, B. (1991). The link between resources and type of diversification: Theory and evidence. *Strategic management journal*, *12(1),* 33-48. https://doi.org/10.1002/smj.4250120104
14. Cincera, M. (2002). *Financing constraints, fixed capital and R&D investment decisions of Belgian firms.* (National Bank of Belgium Working Paper No. 32)
15. Cohen, W. M., & Levin, R. C. (1989). Empirical studies of innovation and market structure. *Handbook of industrial organization*, *2,* 1059-1107. https://doi.org/10.1016/S1573-448X(89)02006-6
16. Crépon, B., Duguet, E., & Mairessec, J. (1998). Research, innovation and productivity: An econometric analysis at the firm level. *Economics of Innovation and new Technology*, *7(2),* 115-158. https://doi.org/10.1080/10438599800000031
17. Crespi, G., & Zuniga, P. (2012). Innovation and productivity: evidence from six Latin American countries. *World development*, *40(2),* 273-290. https://doi.org/10.1016/j.worlddev.2011.07.010
18. Danneels, E., & Kleinschmidt, E. J. (2001). Product innovativeness from the firm's perspective: its dimensions and their relation with project selection and performance. *Journal of Product Innovation Management*, *18(6),* 357-373. https://doi.org/10.1016/S0737-6782(01)00109-6
19. Ericson, R & Pakes, A. (1995). Markov-perfect industry dynamics: A framework for empirical work. *Review of Economic studies 62(1),* 53-82. https://doi.org/10.2307/2297841
20. Friesenbichler, K., & Peneder, M. (2016). Innovation, competition and productivity. *Economics of Transition*, *24(3),* 535-580. https://doi.org/10.1111/ecot.12100
21. Foster-McGregor, N., Isaksson, A., & Kaulich, F. (2016). Importing, productivity and absorptive capacity in Sub-Saharan African manufacturing and services firms. *Open Economies Review*, *27(1),* 87-117. https://doi.org/10.1007/s11079-015-9367-7
22. Griffith, R., Huergo, E., Mairesse, J., & Peters, B. (2006). Innovation and productivity across four European countries. *Oxford review of economic policy*, *22(4),* 483-498. https://doi.org/10.1093/oxrep/grj028
23. Griliches, Z. (1994). Patent Statistics as economic indicators: A survey. *American Economic Review 84,* 1-23.
24. Harhoff, D. (1998). Are there financing constraints for R&D and investment in German manufacturing firms? *Annales d'Économie et de Statistique*, *(49/50),* 421-456. https://doi.org/10.2307/20076124
25. Hobday, M. (2005). Firm-level innovation models:

perspectives on research in developed and developing countries. *Technology analysis & strategic management*, *17(2),* 121-146. https://doi.org/10.1080/09537320500088666
26. Hall, B. H. (2002). The financing of research and development. *Oxford review of economic policy*, *18(1),* 35-51. https://doi.org/10.1093/oxrep/18.1.35
27. Hashimoto, M. (1991). Training and employment relations in Japanese firms. In *Market failure in training?* (pp. 153-183). Berlin Heidelberg: Springer. https://doi.org/10.1007/978-3-642-76986-3_7
28. Hull, C. E., & Rothenberg, S. (2008). Firm performance: The interactions of corporate social performance with innovation and industry differentiation. *Strategic Management Journal*, *29(7),* 781-789. https://doi.org/10.1002/smj.675
29. Jefferson, G. H., Huamao, B., Xiaojing, G., & Xiaoyun, Y. (2006). R&D performance in Chinese industry. *Economics of Innovation and New Technology*, *15(4-5),* 345-366. https://doi.org/10.1080/10438590500512851
30. Jones, C. I. (1995). R & D-based models of economic growth. *Journal of political Economy*, *103(4),* 759-784. https://doi.org/10.1086/262002
31. Keshk, O. M. (2003). CDSIMEQ: A program to implement two-stage probit least squares. *The Stata Journal*, *3(2),* 1-11.
32. Klomp, L., & Leeuwen, G. (1999). *The importance of innovation for firm performance.* (CBS Statistics Nertherlands, LNM-series,9902)
33. Kuratko, D. F., Ireland, R. D., Covin, J. G., & Hornsby, J. S. (2005). A Model of Middle-Level Managers' Entrepreneurial Behavior. *Entrepreneurship theory and practice*, *29(6),* 699-716. https://doi.org/10.1111/j.1540-6520.2005.00104.x
34. Lee, S., Park, G., Yoon, B., & Park, J. (2010). Open innovation in SMEs - An intermediated networked model. *Research Policy,* 39*(2),* 290–300. https://doi.org/10.1016/j.respol.2009.12.009
35. Lööf, H., & Heshmati, A. (2006). On the relationship between innovation and performance: A sensitivity analysis. *Economics of Innovation and New Technology*, *15(4-5),* 317-344. https://doi.org/10.1080/10438590500512810
36. Lööf, H., & Heshmati, A. (2008). Investment and performance of firms: Correlation or causality? *Corporate Ownership & Control*, *6(2),* 268-282. https://doi.org/10.22495/cocv6i2c2p2
37. Lööf, H., Heshmati, A., Asplund, R., & Nåås, S. O. (2001). *Innovation and performance in manufacturing industries: A comparison of the Nordic countries* (No. 457). SSE/EFI working paper series in economics and finance.
38. Lyon, D. W., & Ferrier, W. J. (2002). Enhancing performance with product-market innovation: the influence of the top management team. *Journal of Managerial Issues*, *14(4),* 452-469.
39. March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization science*, *2(1),* 71-87. https://doi.org/10.1287/orsc.2.1.71
40. O'Connor, G. C. (1998). Market learning and radical innovation: A cross case comparison of eight radical innovation projects. *Journal of product innovation management*, *15(2),* 151-166. https://doi.org/10.1111/1540-5885.1520151
41. Padilla-Perez, R., & Gaudin, Y. (2014). Science, technology and innovation policies in small and developing economies: The case of Central America. *Research Policy 43,* 749–759. https://doi.org/10.1016/j.respol.2013.10.011
42. Porter, M. E. (1990). *The competitive advantage of nations.* New York. Free press. https://doi.org/10.1002/cir.3880010112
43. Raffo, J., Lhuillery, S., & Miotti, L. (2008). Northern and southern innovativity: A comparison across European and Latin American countries. *The European Journal of Development Research*, *20(2),* 219-239. https://doi.org/10.1080/09578810802060777
44. Riddle, L., Brinkerhoff, J. M., & Nielsen, T. M. (2008). Partnering to beckon them home: public-sector innovation for diaspora foreign investment promotion. *Public Administration and Development*, *28(1),* 54-66. https://doi.org/10.1002/pad.469
45. Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy*, *98(5, Part 2),* S71-S102. https://doi.org/10.1086/261725
46. Rosli, M. M., & Sidek, S. (2013). The Impact of Innovation on the Performance of Small and Medium Manufacturing Enterprises: Evidence from Malaysia. *Journal of Innovation Management in Small & Medium Enterprises, 2013.* https://doi.org/10.5171/2013.885666
47. Rubera, G., & Kirca, A. H. (2012). Firm innovativeness and its performance outcomes: A meta-analytic review and theoretical integration. *Journal of Marketing*, *76(3),* 130-147. https://doi.org/10.1509/jm.10.0494
48. Schumpeter, J. (1911). *The theory of economic development.* Leipzig: Duncker & Humblot.
49. Suzuki, J., & Kodama, F. (2004). Technological diversity of persistent innovators in Japan: Two case studies of large Japanese firms. *Research Policy*, *33(3),* 531-549. https://doi.org/10.1016/j.respol. 2003.10.005
50. Therrien, P., Doloreux, D., & Chamberlin, T. (2011). Innovation novelty and (commercial) performance in the service sector: A Canadian firm-level analysis. *Technovation*, *31(12),* 655-665. https://doi.org/10.1016/j.technovation.2011.07.007
51. Van Biesebroeck, J. (2005). Exporting raises productivity in sub-Saharan African manufacturing firms. *Journal of International economics*, *67(2),* 373-391. https://doi.org/10.1016/j.jinteco.2004.12.002
52. Van Reenen, J. (1997). Why has Britain had slower R&D growth? *Research Policy*, *26(4),* 493-507. https://doi.org/10.1016/S0048-7333(97)00026-7
53. Wright, M., Filatotchev, I., Hoskisson, R. E., & Peng, M. W. (2005). Strategy research in emerging economies: Challenging the conventional wisdom. *Journal of management studies*, *42(1),* 1-33. https://doi.org/10.1111/j.14676486.2005.00487.x
54. Yang, J. S. (2017). The governance environment and innovative SMEs. *Small Business Economics*, *48(3),* 525-541. https://doi.org/10.1007/s11187-016-9802-1

APPENDIX

Table A2. Correlation matrix

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1	Innovation	1.0000											
2	Performance (ln)	0.1578	1.0000										
3	Research and Development	0.2902	0.2538	1.0000									
4	Competition	0.0852	-0.0459	-0.0115	1.0000								
5	Training	0.2867	0.2644	0.2931	-0.0369	1.0000							
6	Loan or credit	0.1599	0.2221	0.2130	0.0110	0.1300	1.0000						
7	Foreign technology	0.0388	0.0457	0.0670	-0.4502	0.0791	0.0179	1.0000					
8	Age (ln)	0.1229	0.2789	0.1184	0.0296	0.1076	0.1745	-0.1377	1.0000				
9	Foreign owned	0.0571	0.2387	0.1275	0.0075	0.0689	0.0098	0.0212	0.0335	1.0000			
10	Exports	0.0789	0.2653	0.1815	-0.1233	0.1315	0.1081	0.0266	0.1498	0.1324	1.0000		
11	Experience	0.0623	0.2428	0.0488	0.0165	0.0851	0.1404	-0.1096	0.4757	0.0279	0.0962	1.0000	
12	Size	0.0767	0.3451	0.1706	-0.0234	0.1441	0.1266	0.0239	0.1546	0.1179	0.2303	0.0862	1.0000