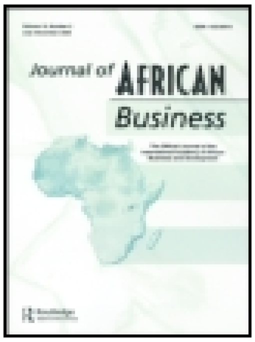

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Exports, Investment and Productivity Growth in Small Firms: A Firm-level Analysis from Tanzania and Ghana

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ABSTRACT

This paper examines the effect of firm-level investment in capital on export entry and productivity growth among different firm size classes using matching and difference-in-differences techniques. We find that firm-level investment in capital reduces the burden of sunk costs of export market entry, thereby inducing small firms to enter export markets with ease and increase their productivity as a result of export market participation. New entrants who survive their first year of exporting also grow their investment levels to consolidate market share. We show that micro and small firms that initiate exporting are more likely to implement firm-level investment as well, one way of technology upgrading, to remain competitive in export markets. Moreover, firm-level investment helps small exporters to generate higher productivity once they engage in export markets. This may suggest that the observed market selection and growth of small firms could be the outcome of distinctive productivity improvements in these firms. We note that investing in capital, especially plant and equipment, may help micro and small firms improve their productive capacity to produce more output at lower unit costs as a result of low-marginal costs of production. Export-led growth policies should be directed at supporting micro and small firms access the much needed financing to upgrade their production processes and improve their productivity.

KEYWORDS

Firm; investment; export markets; firm performance; manufacturing firms

1. Introduction

One remarkable feature of exporting activity, in both developed and developing countries is its rareness. Even in industries that are traditionally known to be export intensive, there is still a fraction of firms that do not export their products (Bernard, Eaoton, Jensen, & Kortum, 2003) implying that export market participation is a rare activity. A number of explanations have been advanced to explain why exporting is rare among firms; notably, the existence of sunk costs of export market entry (Roberts & Tybout, 1997). Exporting involves covering fixed costs (sunk), in addition to variable costs of export market entry. Sunk costs may be related to acquiring information about the export market, identifying a sales agent, or setting up a distribution channel, among others. These costs are sizable and may only be covered by more productive and established firms (Melitz, 2003; Roberts

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& Tybout, 1997) and explain why some firms remain to serve the domestic markets (non-exporters) while others sell in export markets (exporters). Consequently, the large and more productive firms self-select into the export markets because they possess superior characteristics before initiating exporting activity (Bernard & Jensen, 2004) and exporting is a source of increased productivity- learning-by-exporting (De Loecker, 2007; Esaku, 2019a, 2019b; Esaku, 2020a). Taken together, the above facts suggest that exporting is a costly venture that can be undertaken by the large and more productive firms.

However, some empirical evidence has shown that exporters are not generally large and productive. Eaton, Eslava, Kugler, and Tybout (2008) examine export patterns, at the firm-level, using Colombian export data and uncover unusual results that are at odds with the more established features of exporters. In their study, the above authors find evidence that domestic firms enter the export markets every year and that these new exporters are small. Moreover, these new exporters begin by exporting small quantities of their products to neighboring countries to gain experience of targeting other more distant export markets. This evidence clearly contradicts the more established tradition in the trade literature, that suggests exporters are large (in terms of their sales and employment level) and more productive (total factor productivity and labor productivity); and that it is only the large and more productive firms that self-select into export markets (Bernard & Jensen, 1999). If indeed self-selection into export markets is explained by productivity differences among firms, how then can we explain the fact that, relatively small and less productive firms enter export markets yearly, selling small quantities of their products to a nearby country, as shown by Eaton et al. (2008)? How do we reconcile this fact with the view that only the large and more productive firms engage in exporting activity?

In this paper, using firm-level data from Ghana and Tanzania, we examine the impact of firm-level investment in physical capital[1] on firm-level entry and productivity growth among different firm size classes. We are interested in assessing whether firm-level investment in physical capital explains export entry patterns of small firms. If this is the case, we should expect to see small firms that invest in physical capital increase their probability in switching status, from non-exporter to exporter, better than firms who have not invested. Extant literature shows that firm-level investment in physical capital facilitates entry into export markets (see Esaku, 2020b) and that export market participation generates further increases in firm-level investment (Esaku & Krugell, 2020a). Consequently, we assess the following specific research questions; (i) Do new firm-level investments increase small firms' probability of switching status- from non-exporter to exporter, thus explaining the entry patterns among small exporters? (ii) Do small firms that invest increase their productivity, when they initiate exporting, higher than those who do not? (iii) Do small firms that invest generate higher productivity growth rates as a result of export market participation?

To guide the empirical work, we exploit the uniqueness of our data in providing size classes of firms. Consequently, we follow Esaku (2020c), and classify firms into four size classes; (i) micro firms- being those that employ less than 10 workers (emp,1–9), (ii) small firms- employ from 10 to 49 workers (emp 10–49) (iii) medium firms- employ 50–99 workers (emp 50–99), (iv) large firm, employ 100 and more workers, (emp 100+).

[1]We use physical capital, capital or capital stock interchangeably. In this study, they have the same meaning.

We implement our econometric analysis using propensity score matching and difference-in-differences estimation methods. We choose two African countries because of the availability of panel data that spans 12 years, from 1991 to 2002, and with information on firm-level investment in plant, equipment and machinery. We devote our analysis to small firms because of the crucial role they play in creating employment (Esaku, 2020c). For example small and medium firms account for 80% of the workforce in Kenya, 70% in Nigeria and 70% of the total workforce in Ghana (Muriithi, 2017). Furthermore, with liberalization of most economies in Africa, export market participation has become an increasing pattern among small firms (Esaku & Krugell, 2020b). Their participation and performance in export markets has renewed research interests among scholars. Previous studies suggest that export market participation is a channel through which firms can grow and expand their productivity through acquisition of advanced production technology (Esaku & Krugell, 2020a). Therefore, examining the factors that stimulate entry and export market participation for small firms is important for policy formulation and implementation. This paper will provide insight into the factors and or channels that stimulate entry and export participation in small firms.

Our results show that new firm-level investment in physical capital induces small firms to initiate exporting activity and grow their productivity as a result of export market participation. The findings show that small firms that invest in capital raise their probability of entry into export markets by 1.3%, two years to entry, and 4.7% a year to export entry. These new exporters build their capital gradually over time, and may find it more profitable to enter the export markets once they reach a particular productivity level.

Our findings seem to suggest that new export entrants who accumulate capital stock slowly or gradually, are often erroneously grouped as unproductive by dynamic industry models of Melitz (2003), Jovanovic (1982) and Hopenhayn (1992), especially when they emphasize high productivity levels as a basis for export entry. Moreover, we find that new entrants who survive their first year of exporting increase further their investment levels to improve their probability of survival in the export markets. We show that micro and small firms that initiate exporting activities have high probability of carrying out firm-level investment as well.

We can observe that, firms that accumulate more export experience seem to gain more market information that may require them to make additional improvements to their production processes by way of upgrading their technology and skills. In line with these results, we emphasize that export entry decisions and firm-level investment evolve endogenously and underlie a firm's conscious efforts to harness resources in its environment to increase the chances of survival and success. Our findings also might seem to indicate that firm-level investment in capital helps exporting firms to generate higher productivity levels once they engage in export markets. We find that micro and small firms grow their productivity levels by 22.3% and 52.9% once they start exporting. Consequently, we argue that the small firms' market selection and growth could be viewed as the outcome of distinctive productivity improvements undertaken by profit maximizing firms. We note that when micro and small firms invest in capital, especially plant and equipment, they improve their productive capacity to produce more output at lower unit costs as postulated in our theoretical model. Export-led growth policies should be directed at supporting micro and small firms to access the much needed financing to upgrade their production technologies and improve productivity and profitability to gain increased chances of survival.

We follow recent literature that examines how firm-level actions affect export decisions. A number of studies show how firm-level actions, like investment in research and development influence the decision to export (Aw, Roberts, & Xu, 2011; Constantini & Melitz, 2008), while others study the effect of firm innovation on productivity and export dynamics (Caldera, 2010; Cassiman & Golovko, 2011; Damijan, Kostevc, & Polanec, 2010; Jorgenson, 2011). Moreover, Rho and Rodrigue (2016) and Esaku and Krugell (2020a) advance a new strand of literature that examines how firm-level investment in physical capital affects export market dynamics. For example, Rho and Rodrigue (2016) estimate a structural model to explain the impact of firm-level investments on export dynamics. They show that small firms that accumulate capital may be stimulated to be productive over time, and survive longer in the export markets. Esaku and Krugell (2020a) examine the effect of firm-level investment in physical capital using data from two African countries and find that these productivity-enhancing actions play an important role in raising firms' productivity.

From the theoretical perspective, dynamic industry models of Jovanovic (1982), Hopenhayn (1992), and their extension by Melitz (2003) argue that the firm's productivity in period *t*, can be assigned to it from a common distribution, by luck of the draw. They emphasize that once the firm makes a low productivity draw, it becomes difficult for it to change its future productivity. The above models of firm dynamics do not seem to present convincing arguments on why small, sometimes, less productive exporters venture into the export markets despite possessing inferior firm characteristics. The main focus of the above theoretical frameworks seems to be directed at firm heterogeneity while other salient features of exporters are ignored. Our study fills this gap by focus on productivity enhancing activities at the firm-level to attempt to explain observed entry patterns among small firms.

This study contributes to the literature on firm selection and growth in new markets, as was first suggested by Luttmer (2007) and recently extended by Arkolakis (2016) who presents an analytical framework for studying firm and exporter growth, with special focus on small firms. To the best of our knowledge, this study is the first to analyze the impact of firm-level investment in capital on the decision to export and firm export performance, with focus on small firms in Africa.

The rest of the paper is structured as follows; Section 2 presents the literature review. Section 3 describes the data used to conduct empirical exercises, while Section 4 presents the theoretical and empirical frameworks. Section 5 reports and discusses the results, while Section 6 concludes the paper.

2. Literature review

The recent study of firm-specific export patterns by Eaton et al. (2008) have uncovered stylized facts among new exporters. Eaton et al. (2008) show that new exporters are small and exhibit similar patterns of entry into the export markets. These new entrants start by vending small quantities of their products to nearby countries with the aim of gaining experience of selling to distant markets. This observed export pattern by the Colombian exporters seems to be at odds with the standard trade theory of Melitz (2003) and the empirical work of Roberts and Tybout (1997) that present evidence that exporting is an expensive venture that can only be carried out by the large and most productive firms. Accordingly, Roberts and Tybout (1997) show that exporting is expensive because new entrants will have to pay sunk costs, in addition to other variable costs of production. These sunk costs may be related to establishing distribution channels, research on market demand and customer preferences, upgrading the quality of products to match international levels, among others. These costs are sizable and may not be recovered even when the firm decides not to enter the export markets, as such can only be covered by large and more productive firms.

Subsequently, a number of studies have suggested that the presence of sunk costs explains why exporting is a rare activity, even among industries thought to be more export-oriented. Some studies have attempted to account for this observed export behavior using endogenous growth theory to posit that firm-level enhancing activities do explain the observed pattern in the micro-data (Esaku, 2020b; Esaku & Krugell, 2020a). These studies identify firm productivity and link it to firm-level productivity enhancing activities like engaging in research and development (R&D), innovation, firm-level investment in physical capital, technology upgrading, or investment in workers' training to give a possible explanation of their importance in export market entry (Aw, Roberts, & Winston, 2007; Aw et al., 2011; Bustos, 2011; Damijan et al., 2010; Esaku, 2020b; Esaku & Krugell, 2020a). Taken together, the above studies seem to suggest that firm-level decisions influence the firm's choice to enter export markets, hence providing evidence of market selection in small firms.

In a related development, Luttmer (2007) presents a model that reflects the size distribution of firms and argues that firm growth is due to the selection of productive firms and increased technology imitation of entrants. Just like Luttmer (2007), Arkolakis (2016) shows that firm selection across markets can be explained by firm-level decisions that are geared toward productivity improvements. This would suggest firms find it meaningful to sell products in the export market if it is gainful to cover additional cost of selling the product to initial customer and other additional customers. Similarly, Rho and Rodrigue (2016) study firm-level investment and export dynamics among Indonesian manufacturing firms and show that firm-level investment in physical capital allows new exporters to grow into the export markets. Once firms make enough firm-level investment in physical capital, they expand their capacity to produce and utilize the production inputs to meet their market demands. Similarly, new firms that make enough firm-level investments in physical capital are capable of mitigating their exposure to demand disturbances across markets as they have adequate capacity to respond to these demand shocks. Consequently, small firms that have adequate investment in physical capital have higher investment rates in the year of initiating exporting activity and continue till fourth year making these new exporters gain the ability to survive longer in the export markets (Rho & Rodrigue, 2015, 2016). Likewise, Ahn and Mcquoid (2012) study capacity constrained exporters and present micro and macro evidence to show that exporters face financial and capacity constraints, which lead to increasing marginal costs among exporters. If exporters address the issue of financial and physical capacity constraints, they can adequately respond to market demand shocks and reduce aggregate output volatility.

3. The data and descriptive statistics

To facilitate the empirical analysis in this study, we use a panel of firm-level data from two African countries; Ghana and Tanzania. The data are from a panel survey of firms operating in the manufacturing sector of the two countries. The industries covered include: textile, wood, furniture, garment, metal and machinery, and food and bakery. The data are from a random selection of privately owned manufacturing firms operating in these countries. The firms are both informal (unregistered) and formal (registered). The data on Ghana manufacturing firms cover a period of 12 years from 1991 to 2002 while for Tanzania, the data are from 1992 and 1999. The data were collected under the Regional Program on Enterprise Development (RPED) organized by the World Bank, jointly with the Center for the study of African Economies (CSAE)[2] and University of Oxford, using stratified sampling strategies within each country and firm size. The original data covered five countries, that is; Kenya, Tanzania, Ghana, South Africa and Nigeria, but we exclude Kenya, South Africa and Nigeria from analysis due to lack of information on firm-level investments. The dataset we use has information on input use, production, output, employment, firm-level investment, firm age, ownership status, among others. We present the descriptive analysis of our data.

3.1 Percentage investment shares by exporting and non-exporting firms

In this section, we present percentage shares of investment levels by exporting and non-exporting firms, according to class size, in Table 1. We note that 71.2% of non-exporters do not engage in any form of firm-level investment, while 28.8% of them engage in firm-level investment. Correspondingly, 52.2% of exporters do not engage in firm-level investment while 47.8% of them have invested. These results may suggest that firm-level investment could be a costly venture and is mostly undertaken by established firms as can be seen from the number of firms that engage in it.

TABLE 1 Percentage of Firms by Their Investment Status.

Firms	Size class	Non-exporters (%)	Exporters (%)
Do not engage in firm-level investment (%)	Micro (Emp <10)	30.7	6.1
	Small (Emp≥10&emp<50)	28.8	18.6
	Medium (Emp≥50&emp<100)	6.4	8.4
	Large (Emp≥100)	5.3	19.1
	Sub-sample of non-investing firms	71.2	52.2
Engage in firm-level investment (%)	Micro (Emp <10)	7.1	2.6
	Small (Emp≥10&emp<50)	12.6	14.3
	Medium (Emp≥50&emp<100)	4.4	5.6
	Large (Emp≥100)	4.7	25.3
	Sub-sample of investing firms	28.8	47.8
All firms (%)	Total	100	100

Source. Own calculations from the data. The percentages should sum up to 100%.

[2]We thank the Center for the study of African Economies for making the data available for download for free to researchers. We are grateful to you for this assistance without which, it would not have been possible to conduct this study.

4. The methodology

4.1 Theoretical framework

To guide the econometric analysis, we assume that the goal of the firm is to maximize profits given expectations about industry competition. In each period, a firm decides on its business status; either to serve the domestic market as a domestic supplier or to engage in the export market as an exporter. As in Esaku and Krugell (2020a), a firm i starts each period t_0 either as an exporter, firm $i = 1$ or non-exporter, firm $i = 0$ with a predetermined investment in capital stock $k \geq 0$. The firm operates in a competitive market environment and takes exporter price P_1 and non-exporter price P_0 as given. In this set up, firm i that has intentions to enter an export market will then choose to increase its investment in capital stock with the aim of increasing firm efficiency, decrease marginal costs and consequently initiate exporting activity. We can also express the firm's capital stock in the following period as given by:

$$k_{it} = (1 - v)k_{it-1} + \lambda_{it-1} \tag{1}$$

Where$k_{it}$is the current capital stock holding, $v\epsilon$ (0, 1) is the per-period rate of capital depreciation, $\lambda_{it-1}$is the firm's total investment in physical capital in period t-1. Each year a firm is faced with some decisions; whether to invest and serve the domestic market or to invest and serve the export market. Each of these decisions involves incurring some costs. If the firm decides to invest in order to engage in the export market, it has to decide how much investment will lead to the production of optimum output for the export market, in this case, $\lambda \geq 0$. Similarly, in each period, a firm producing product, x, that is non-exporter choosing to become an exporter incurs a switching cost,$s_x > 0$ which is sunk in nature and irrecoverable should the firm decide to exit the export market (Melitz, 2003).

The switching costs can then be expressed as:

$$\eta_{it} = \begin{cases} s_{x,} & if \;\; i = 0, \;\; E = 1 \\ 0, & \quad Otherwise \end{cases}$$

Where η_{it} are the total fixed capital and all other costs associated with export market entry and conditional on the firm selecting export status E in the current period, when it begins with export status i. However, when a firm chooses to either export and or invest it incurs additional costs. As shown by Esaku and Krugell (2020a), if the firm chooses to invest we can express its investment cost function as:

$$C\{i_{it}, k_{it}, \theta_t\} = c\{i_{it}, k_{it}, \theta_t\} + F_{it}^{\theta_t} 1\{i_{it} > 0\} \tag{2}$$

Where θ_t, is an indicator variable denoting ownership status of the firm, set equal one if the firm has foreign ownership and zero otherwise. We assume convexity of investment costs, that is:$c(0, k_{it}, \theta_t) = 0, \;\; c_a = \frac{\partial C}{\partial i_{it}} > 0, \;\; c_b = \frac{\partial C}{\partial k_{it}} < 0, \;\; c_{aa} = \frac{\partial C^2}{\partial i_{it}^2} > 0, \;\; c_{bb} = \frac{\partial C^2}{\partial k_{it}^2} > 0.$ The above would imply that firms have to incur fixed investment costs, denoted by $F_{it}$to be able to acquire physical capital. Consequently, starting to export would imply covering additional sunk entry costs, denoted by $C\{e_{it}, e_{it-1}, \theta_t\}$, assumed to be influenced by export experience. Thus:

$$C\{e_{it}, e_{it-1}, \theta_t\} = F_{it}^{\theta_t} e_{it} e_{it-1} + S_{it}^{\theta} e_{it}(1 - e_{it-1}) \tag{3}$$

Where e_{it}denotes indicator variable taking value one if firm i exports in period t and zero otherwise. Consider that rational firms are motivated by profit maximization objective, the profit function before covering investment cost can be expressed as $\pi_{it} = \pi(k_{it}, \omega_{it}, e_{it}, e_{it-1}, R, R*)$ where R and$R*$ being demand shifters specific to the market. We can then express the firm's dynamic decision problem by the Bellman equation as:

$$V_{it}(k_{it}) = \max_{e_{it}, i_{it}} \pi_{it}(k_{it}, e_{it}) - C(i_{it}, k_{it}, \theta_t) - C(e_{it}, e_{it-1}, \theta_t) + \beta E_t V_{it+1}(k_{it+1}) \quad (4)$$

where $E_t V_{it+1}(k_{it+1}) = \int_{\omega'} V_{it+1}(k') dF(\omega' | \omega_{it})$. The above would imply that not carrying out investment causes a decline in the firm's capital stock which increases the firm's marginal costs of production with the same output level. But investing in capital stock increases future capital stock thereby decreasing the firm's marginal costs of production in period *t + 1*. In line with the above, choosing whether to invest or not, for both an exporter and non-exporter firm can be expressed as:

$$C(i_{it}, k_{it}, \theta_t) = \beta E_t \frac{\partial V_{it+1}(k_{it+1})}{\partial i_{it}} \quad (5)$$

Where $C(i_{it}, k_{it}, \theta_t)$denotes the adjusted marginal costs free from the export history or choice of the firm, while the component on the right-hand side of Equation (5) denotes the expected additional gain from exporting. Therefore, we can express the net gain related to exporting dependent on the firm's decision to invest as:

$$MBE_{it} = \underbrace{\pi_{it}(k_{it}, e_{it} = 1) - \pi_{it}(k_{it}, e_{it} = 0) - C(e_{it}, e_{it-1}, \theta_t)}_{Gain/Loss\ at\ the\ begining} + \underbrace{\beta E_t[V_{it+1}(k_{it+1}, e_{it} = 1) - V_{it+1}(k_{it+1,} e_{it} = 0)]}_{Gain/Loss\ for\ the\ future} \quad (6)$$

Equation (6) shows the marginal gain from exporting includes both the profits in period t (current) and that in period *t + 1* (future) associated with export market participation. Further, Equation (6) indicates that investment decision in period t determines the variability in firm-level capital stocks, productivity, ownership and survival. The prediction from the above model is that any further gains from investment activities are associated with the export decision of the firm. Any sunk entry costs would imply increase in propensity to continue exporting, which increases the marginal value of capital hence stimulating higher levels of investment. Given the above, small firms that export should also increase their likelihood of investing once they start to export. In this way, investments should increase the probability of entering export markets, especially for small firms who would otherwise find it a challenge to start exporting. Further, this implies that a firm benefits if it chooses to take investment decisions to increase its capital stock in the following period, *t + 1*. If the firm does not invest in the current period *t*, the firm's capital stock is likely to fall and its marginal costs of production, given the same quantity of output, will rise in the following period. However, a firm that makes optimal investments will raise the level of its capital stock in period *t + 1*; as a result, its marginal costs will fall. This argument is line with the recent strand of trade literature that documents that a number of firms are constrained by their capacity (Ahn & Mcquoid, 2012).

4.2 Empirical strategy

Following the insights from our theoretical model, we evaluate the impact of firm-level investment in capital on the probability of switching firm export status, from non-exporter to exporter. We also assess whether firms that export have probability of engaging in firm-level investment, and whether firm-level investment leads to increased performance among exporters. We assume that, in each period, non-exporters that change their status to exporters must incur a switching cost, $S_x > 0$ which is sunk. When firm i, producing product x switches exporter status $i = 1$, it incurs a one-time sunk cost and marginal costs of exporting each unit of product x, incurring increasing marginal costs of production and investment. These costs may become export constraints to small firms with constrained production capacity unless these firms possess higher productivity to minimize the cost constraint. However, relative to firms with smaller capital stocks, firms that have made new firm-level investment in capital and have built larger capital stocks grow faster into export markets, survive longer and face lower marginal costs (Esaku, 2020b; Rho & Rodrigue, 2016). Using propensity score matching, we analyze the effect of the treatment (firm-level investment) on the outcome variable (ΔZ); where ΔZ represents the change in either export status or investment status. Denote the export status of firm i by $Exp_{it} \in \{0, 1\}$ the dummy variable equal one if firm i entered the export market in time t, and zero otherwise. Therefore, the aim is to evaluate the causal effect of firm-level investment on the propensity to export on the outcome measure ΔZ, the causal effect of exporting on firm-level investment such that:

$$\Delta z_{it} = z^1_{it+\gamma} - z^0_{it+\gamma} \tag{7}$$

Where $\Delta z^1_{it+\gamma}$ is the outcome at period $t + \gamma$, $\gamma \geq 0$ following export market entry, $\Delta z^0_{it+\gamma}$ is the outcome if the firm had not invested and started exporting.

Consistent with the evaluation literature (see Heckman, LaLonde, & Smith, 1999), we define the average treatment effect on the treated as:

$$ATT = E\left\{\Delta z^1_{it+\gamma} - \Delta z^0_{it+\gamma} invest_{it} = 1\right\} = E\{\Delta z^1_{it+\gamma} invest_{it} = 1\} - E\{\Delta z^0_{it+\gamma} invest_{it} = 1\} \tag{8}$$

And

$$ATT = E\left\{\Delta z^1_{it+\gamma} - \Delta z^0_{it+\gamma} \exp_{it} = 1\right\} = E\{\Delta z^1_{it+\gamma} \exp_{it} = 1\} - E\{\Delta z^0_{it+\gamma} \exp_{it} = 1\} \tag{9}$$

The main challenge of causal inference is that, for each firm, we can see only $\Delta z^1_{it+\gamma}$ but not $\Delta z^0_{it+\gamma}$ because each firm in a certain point in time gets either treatment or will be in control group, but not both (Holland, 1986). Consequently, it is impossible to observe the outcome of the firm if it had decided not to invest and export in the future. To overcome this counterfactual, we generate a control group in such a way that every treated unit is matched to an untreated unit with the same characteristics at the time before the treatment.

Equations (8) and (9) are helpful in the estimation of the observed outcome $E\left\{\Delta z^1_{it+\Upsilon} | invest_{it} = 1\right\}$ and $E\left\{\Delta z^1_{it+\Upsilon} | exp_{it} = 1\right\}$, however the causal inference will be meaningful only if proper construction of the counterfactual for the unobserved portion of Equations (8) and (9); $E\{\Delta z^0_{it+\Upsilon}|invest_{it}=1\}$ and $E\{\Delta z^0_{it+\Upsilon}|exp_{it}=1\}$ is done, which are the average outcomes entrants would have received had they not invested and initiated export activity. To estimate $E\{\Delta z^0_{it+\Upsilon}|exp_{it}=1\}$, we analyze a corresponding average value of never exporters such that:

$$E\{\Delta z^0_{it+\gamma}invest_{it}=0\} \tag{10}$$

And;

$$E\{\Delta z^0_{it+\gamma}\mathrm{exp}_{it}=0\} \tag{11}$$

We can then specify a valid control group based on the observable characteristics and pre-entry level value of the outcome variable $z_{\text{it-}\gamma}$.

Before implementing the matching, we first estimate the export probability function using a probit model based on our knowledge of determinants of productivity growth. As in Rosenbaum and Rubin (1983), we use propensity score matching approach, as follows:

$$P(invest_{it}=1)=G(invest_{it-\gamma},X_{it}) \tag{12}$$

Where invest_{it}, denotes the lagged firm-level innovation status, while X_{it}, is the outcome variables of interest, including the control variables (size, firm age, ownership status, sector, year and country). Based on the propensity score, we match firms that invested against those that did not in period *t-γ* and examine the effects of lagged firm-level investment on the current exporting status in period *t*. Similarly, we match exporters and non-exporter firms basing on their probability to export and test whether the exporters engage in firm-level investment once they start to export, thus:

$$P(Exp_{it}=1)=G(Exp_{it-\gamma},X_{it}) \tag{13}$$

Where $\text{Exp}_{it\text{-}\gamma}$, represents the lagged firm-level exporting status, while X_{it} is the outcome variables of interest, including the control variables (size, firm age, ownership status, sector, year and country).

Consequently, Equations (12) and (13) indicate the probability that a firm invests or initiates exporting activity based on function G ($\text{invest}_{\text{it}}$ = 1 or Exp_{it} = 1), which denotes the predicted probability of investing or exporting at *t* for firm *i*, who then is an ultimate exporter. We then use the psmatch2 suite of Leuven and Sianesi (2003) nearest-neighbor matching method with common support, and select a non-exporter firm that is "closest" to ultimate exporter in terms of its propensity score. More formally though, for individual new entrant firm *i*, exporting to country *f*, a non-exporter firm *j* can be selected such that:

$$\left|p^f_{it}-p^f_{jt}\right|=\min_{k\in\{\mathrm{exp}=0\}}\left\{p^f_{it}-p^f_{jt}\right\} \tag{14}$$

This method of matching has the advantage of being easy to implement and less likely to be affected by selection bias. Moreover, the nearest neighbor matching nearly estimates the Average Treatment of the Treated (ATT) always because it matches control individuals to the treated group and discards controls that are not selected as matches. Additionally, common support condition in the matching algorithm is used and requires discarding entrants whose propensity score is not stable in the control group. We then estimate Equations (8) and (9) using difference-in-differences method to enhance the reliability of our outcomes. Blundell and Dias (2000) observe that integrating matching and difference-in-differences (DID) substantially improve the quality of non-experimental evaluation studies.

Formally, the difference-in-differences estimation can be written as:

$$\Delta z_1 = (z_{11} - z_{10}) - (z_{01} - z_{00}) \tag{15}$$

Where Δz_1 represents the impact or outcome variable, $(z_{11} - z_{10})$is the outcome for the treated group and $(z_{01} - z_{00})$ denotes the outcome for the control group.

Therefore, we write down our difference-in-differences equations for investment and exporting based on the sample of matched firms as

$$\Delta z_{it} = \alpha z_{it-2} + \beta X_{it-2} + \sum_{\gamma=-1}^{2} \lambda_\gamma invest_{it-\gamma} + D_{jkt} + \varepsilon_{it} \tag{16}$$

And,

$$\Delta z_{it} = \alpha z_{it-2} + \beta X_{it-2} + \sum_{\gamma=-1}^{2} \lambda_\gamma Exp_{it-\gamma} + D_{jkt} + \varepsilon_{it} \tag{17}$$

Where Δzdenotes the change in the outcome variables (total factor productivity, labor productivity, employment or wages), *i,t,j* and *k* index firms, time periods, sectors/industries and countries respectively, while D denotes the full set of industry, regions and time dummies. *X* is a vector of control variables, and $invest_{it}$ and Exp_{it} are dummy variables set equal one if firm *i* made firm-level investments or switches to exporting, at point *t*, and zero otherwise. To evaluate the impact of investment on exporting and exporting on investment, we also use an indicator to predate investment $(invest_{it-\gamma})$ and exporting $(Exp_{it-\gamma})$; estimating Equations (16) and (17); and use an indicator to predate investment ($invest_{it-1}$), to further control for any relationships in pre-periods not captured by matching process.

4.3 Estimating total factor productivity (TFP)

In this section, we present how we derive the estimates of TFP. We generate consistent estimates of the production function using the Levinsohn and Petrin (2003, henceforth LP) method by help of the "levpet" STATA command, which uses intermediate inputs as controls for unpredicted productivity shocks, and we predicted TFP.

We consider a firm that produces good, *x*, using a cobb-Douglas production functions in logs:

$$v_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_i im_{it} + z_{it} + \varepsilon_{it} \tag{18}$$

v_{it} is the value added (the difference between gross output and intermediate inputs), $k_{it}$is the log of capital input, $l_{it}$is the log of labor input, im_{it} is the intermediate inputs, z_{it} is the TFP component and $\varepsilon_{it}$is the error component.

Using LP, we can recover the predicted firm-level productivity estimates and generate an index of the firm's TFP, thus:

$$\widehat{z_{it}} = TFP_{it} = va_{it} - \widehat{\beta}_1 k_{it} - \widehat{\beta}_2 l_{it} - \widehat{\beta}_3 im_{it} \tag{19}$$

Where $\widehat{z_{it}}$ is the predicted TFP, va_{it} is value added, k_{it}, l_{it}, im_{it}, denote the recovered estimates from capital, labor and intermediate materials.

Overall, we present the results in some chronological order. First, we present the export and investment premia; second, we report the results of average treatment effects on the treated, estimates of the DID; third we report the results of effect of firm-level investment on export participation, and finally report the results firm-level invest on post-entry productivity growth rates of firms engaged in exporting.

5. Estimation results and discussion

5.1 Does firm-level investment induce export market entry among small firms?

In this section we examine whether small firms that invest in capital in periods, *t-2 and t-1*, increase their probability of exporting in period *t*. We estimate Equation (12) by matching non-exporting firms that engage in firm-level investment with non-exporting firms that do not in periods, *t-2* and *t-1* to estimate average treatment effects on the treated. Analogously, we estimate Equation (13) by matching exporters and non-exporters in periods, *t-2 and t-1* and evaluate whether previous exporters that do not engage in firm-level investment activities are more likely, than non-exporters who do not, to engage in firm-level investment. We report our results in Table 2. Column 1–2, are treatment variables and firm size classes respectively. Columns 3–4, report the treatment outcomes, average treatment on the treated (ATT), without and with covariates. We report and discuss the results of difference-in-differences with covariates.

In Table 2, panel (a), we show that non-exporters who invest in physical capital have high probability of switching status to being exporters. We find that previous new investments, two years ago, raises the probability of micro and small firms, that is a non-exporter, switching status to exporter by 19.2% and 2.8% respectively. In the run-up to export entry, period *t-1*, this probability rises to 24% and 7% for micro and small firms, respectively. When we observe the probability of other firm size classes switching export status, we find that large firms that have invested in capital have the highest probability, 9.2% of remaining as non-exporters, that is to say, not switching export status. We observe similar patterns among medium firms, with a probability of remaining a non-exporter by 3.5%. Our results indicate that these firms are unlikely to switch status, from non-exporters to exporters, regardless of firm-level investment in capital.

Correspondingly, in panel (b), last column, we report results for the probability of new export entrants investing in capital stock to improve their survival chances in the export market. From Table 2, we note remarkable results; new entrants that initiate exporting also engage in firm-level investments to boost their chances of success. Most interestingly is the probability of micro firms that are new exporters; one year after first export, they are 33.1% more likely to engage in firm-level investment to increase their success and survival in the export markets. This probability is higher than any firm size class, followed by small firms with 8.2% probability of engaging in investments. Two years into exporting, we observe that new entrants may face intense competition in the export markets that forces them to expand their production capabilities and upgrade their technologies.

TABLE 2 Effects of Firm-level Investments (Exporting Experience) on Probability of Exporting (Investing).

	Firm size	Without covariates			With covariates		
		ATT	R^2	Obs.	ATT	R^2	Obs.
Panel (a)- probability of entry							
Invest(t-2)	Micro	0.188	0.01	116	0.192	0.01	115
		(0.003)***		(471)	(0.003)***		(457)
	Small	0.072	0.01	264	0.028	0.01	273
		(0.001)***		(548)	(0.009)***		(511)
	Medium	0.002	0.01	102	0.035	0.09	95
		(0.991)		(153)	(0.221)		(142)
	Large	−0.138	0.01	180	−0.092	0.02	166
		(0.552)		(190)	(0.703)		(143)
Invest(t-1)	Micro	0.250	0.01	129	0.245	0.02	128
		(0.001)***		(620)	(0.001)***		(598)
	Small	0.080	0.01	296	0.070	0.02	296
		(0.004)***		(651)	(0.009)**		(631)
	Medium	−0.223	0.02	109	−0.172	0.08	100
		(0.041)**		(163)	(0.178)		(155)
	Large	0.152	0.01	197	0.159	0.01	183
		(0.181)		(213)	(0.232)		(181)
Panel (b)- probability of investing							
Exports(t-2)	Micro	0.448	0.02	42	0.441	0.05	32
		(0.008)***		(571)	(0.009)***		(409)
	Small	0.344	02	134	0.312	0.03	134
		(0.034)**		(684)	(0.056)*		(673)
	Medium	0.043	0.00	45	0.005	0.02	44
		(0.625)		(219)	(0.258)		(204)
	Large	0.283	0.01	163	0.110	0.06	143
		(0.098)*		(206)	(0.151)		(184)
Exports(t-1)	Micro	0.338	0.03	45	0.331	0.07	45
		(0.038)**		(651)	(0.043)**		(641)
	Small	0.231	0.02	148	0.082	0.04	147
		(0.019)**		(807)	(0.004)***		(729)
	Medium	−0.182	0.01	63	−0.314	0.02	63
		(0.512)		(210)	(0.217)		(194)
	Large	0.204	0.02	196	0.142	0.10	177
		(0.254)		(200)	(0.171)		(203)

Note. We report bootstrapped standard errors (250 replications) with the number of the matched controls and the number of the treated on the common support; values are estimated using DID. P-values in parenthesis where significance levels are at: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

We can see that all the new entrants increase their probability of engaging in firm-level investment in capital stock. To take the most pronounced examples, we observe that micro and small firms are now, 44.1% and 31.2%, respectively, more likely to engage in firm-level investment in capital.

Overall, this section reports results that are consistent with findings that show that firms who engage in any productivity enhancing activities like innovation, Research and Development or technology upgrading at the firm-level receive a stream of benefits that accrue from such investments (Aw et al., 2007; Esaku, 2020b; Esaku & Krugell, 2020a). Consequently, these firms are able to restructure their production processes by improving the production technology, which in turn raises production efficiency and lowering average marginal costs of production; raising performance of firms (Bustos, 2011; Caldera, 2010; Damijan et al., 2010; Jorgenson, 2011).

5.2 The effect of firm-level investment on export market performance

Next, we consider the fact that firm-level investment helps small firms improve their performance and survival in the export market. Our assumption is that firm-level investment in capital is a catalyst that upgrades the production technology used by small firms, helping them to improve the organization and restructuring of the production processes. We estimate Equation (13) and match exporting firms that engage in firm-level investment with non-exporters who do not, to evaluate their productivity differences. We also augment the results by estimating Equation (17), which gives us the results of difference-in-differences. We present the results of difference-in-differences, with covariates and without covariates in Table 3.

Our findings reveal that firm-level investment is another channel that may explain the large productivity differences between exporters and non-exporters. This channel may also provide a key to explaining why small firms enter the export market even though they are not established, that is to say, they are not productive and large, in terms of their sales volumes and employment level, as suggested by Bernard and Jensen (1999). We note from Table 3, last column that all new entrants who invested in capital, before entry or invest during exporting, increase their productivity levels, with small and micro firms gaining disproportionately, 52.9% and 22.3%, respectively. We also note that, large firms also possess higher productivity levels, 28.5% but we can argue that these firms may have already possessed superior productivity levels even before entry into the export markets; so entry into export markets instead raises their productivity further. When we examine labor productivity levels among these new exporters, we show that micro and small firms have remarkably high levels of labor productivity, 75.4% and 46.4%, respectively. We observe that firm-level investment in capital stock does not only facilitate firm entry into the export markets for small firms, but also increases TFP and labor productivity among new exporters who are micro and small, in terms of their employment level.

We confirm that firm-level investment is another crucial channel for productivity enhancing effects of trade, implying that small firms that invest in physical capital strengthen their ability to raise productivity and performance in export markets (Constantini & Melitz, 2008). Furthermore, these findings are in agreement with evidence presented by Yeaple (2005) emphasizing the view that heterogeneous differences between exporters and non-exports arise because of differences in production

TABLE 3 The Effect of Firm-level Investment on Export Market Performance.

	Firm characteristics	Without Covariates			With Covariates		
Size Class		ATT	R^2	Obs.	ATT	R^2	Obs.
Micro	TFP	0.334	0.00	112	0.223	0.01	116
		(0.016)***		(375)	(0.063)*		(388)
	Labor productivity	0.631	0.00	130	0.754	0.01	117
		(0.036)**		(458)	(0.024)**		(405)
	Capital intensity	0.759	0.01	130	0.629	0.01	116
		(0.007)***		(456)	(0.044)**		(402)
	Wages	0.359	0.01	77	0.316	0.03	65
		(0.414)		(315)	(0.500)		(281)
	Employment	0.112	0.01	132	0.223	0.03	127
		(0.467)		(482)	(0.050)**		(542)
Small	TFP	0.874	0.00	247	0.529	0.06	117
		(0.043)**		(452)	(0.001)***		(422)
	Labor productivity	0.382	0.03	274	0.464	0.05	260
		(0.086)*		(515)	(0.029)**		(437)
	Capital intensity	0.766	0.03	275	0.785	0.20	260
		(0.004)***		(509)	(0.004)***		(434)
	Wages	−0.184	0.01	149	−0.140	0.04	138
		(0.633)		(329)	(0.727)		(275)
	Employment	0.139	0.02	276	−0.187	0.10	260
		(0.016)**		(526)	(0.065)*		(442)
Medium	TFP	0.180	0.01	101	−0.318	0.04	90
		(0.808)		(146)	(0.746)		(112)
	Labor productivity	0.205	0.03	95	0.888	0.09	90
		(0.726)		(139)	(0.072)*		(113)
	capital intensity	1.706	0.06	101	1.441	0.09	90
		(0.090)*		(150)	(0.002)***		(116)
	Wages	0.325	0.02	54	0.676	0.18	51
		(0.698)		(92)	(0.051)*		(77)
	Employment	0.011	0.01	102	0.063	0.03	90
		(0.906)		(153)	(0.513)		(117)

(Continued)

TABLE 3 (Continued).

	Firm characteristics	Without Covariates			With Covariates		
Size Class		ATT	R^2	Obs.	ATT	R^2	Obs.
Large	TFP	0.047	0.01	197	0.285	0.04	155
		(0.946)		(209)	(0.002)***		(169)
	Labor productivity	0.991	0.01	197	0.334	0.06	155
		(0.050)**		(209)	(0.017)**		(169)
	capital intensity	1.135	0.04	197	0.749	0.04	155
		(0.071)*		(211)	(0.002)***		(169)
	Wages	0.200	0.01	95	0.215	0.05	79
		(0.074)*		(123)	(0.052)*		(90)
	Employment	0.032	0.02	197	0.284	0.12	160
		(0.899)		(213)	(0.010)**		(161)

Note. We report bootstrapped standard errors (50 replications) with the number of the matched controls and the number of the treated on the common support; values are estimated using DID. P-values in parenthesis where significance levels are at: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

technology. Firms that endogenously improve production technology of producing product x improve their efficiency and reduce the marginal costs of producing additional units of that product. Firm-level investment in capital stock is analogous to improving small firms' technology and productive capacity, thus increasing firm production efficiency.

5.3 Firm-level investment and growth rates of new exporters

In this section, we report the growth rate estimates for new exporters who have carried out firm-level investment in the past one year. We estimate an equation of the following type:

$$\Delta z_{it} = \frac{1}{z_{it-1}}(z_{it} - z_{it-1}) = \alpha_{it} + \beta X_{it} + \sum_{\gamma=-1}^{2} \lambda_\gamma Exp_{it-\gamma} + D_{jkt} + \varepsilon_{it} z \tag{23}$$

Where Δz denotes the change in the outcome variables (total factor productivity, labor productivity, employment or wages), and the rest of the terms are labeled as before; i,t,j and k index firms, time periods, sectors/industries and countries respectively, while D denotes the full set of industry, regions and time dummies. X is a vector of control variables, and Exp_{it} is dummy variables set to one if firm i is an exporter, at point t, and zero otherwise.

We present the estimation results in Table 4. From Table 4, column 4, we can see that TFP, labor productivity and employment growth rates for micro firms that are new exporters and have invested are 3.3%, 6.5% and 10.2%, respectively. These growth rates are positive and statistically significant at 10%, 5% and 1% for TFP, labor productivity and employment respectively. When we examine growth rates among small firms, we note that the TFP, labor productivity and employment growth rates are at 16.3%, 1.1% and 1.3%, respectively, all significant at 1% level. Consequently, the main message that we report in Table 4 is that firm-level investment is a key catalyst of productivity growth among new exporters who are either small or micro in nature. Thus, new exporters who have upgraded their technologies receive higher productivity premia which further drives productivity differences between exporters and non-exporters (Bustos, 2011; Esaku, 2020b; Esaku & Krugell, 2020a).

Our results seem to suggest that, although productivity differences between exporters and non-exporters may be explained by self-selection and learning-by-exporting patterns, firm-level investments in capital stock may also be another channel that further explains these observed differences. We show that firm-level investment in capital stock induces export market entry for micro and small firms and generates productivity growth. Consequently, we point out that theoretical models that emphasize that productivity differences between exporters and non-exporters are explained by self-selection and learning-by-exporting mechanisms only may be underestimating the role played by firm-level investment in capital. Consistent with Rho and Rodrigue (2016) and Esaku (2020b), we show that firm-level investments help small and less productive firms to increase productivity and raise their odds of export entry, and grow faster and survive in the export markets.

TABLE 4 Firm-level Investment and Growth Rates of Exporters.

Size class	Firm Measures	Without Covariates			With Covariates		
		ATT	R^2	Obs.	ATT	R^2	Obs.
Micro	TFP	0.267 (0.040)**	0.00	116 (357)	0.033 (0.067)*	0.00	137 (449)
	Labor productivity	0.051 (0.019)**	0.00	115 (365)	0.065 (0.018)**	0.01	137 (458)
	Capital intensity	0.022 (0.000)***	0.01	116 (376)	0.024 (0.012)**	0.08	116 (366)
	Wages	−0.010 (0.867)	0.00	58 (216)	−0.011 (0.866)	0.01	58 (214)
	employment	0.102 (0.000)***	0.01	116 (380)	0.102 (0.000)***	0.01	116 (369)
Small	TFP	0.133 (0.015)**	0.00	259 (420)	0.163 (0.009)***	0.00	259 (414)
	Labor productivity	0.008 (0.074)*	0.00	258 (417)	0.011 (0.003)***	0.00	258 (411)
	Capital intensity	−0.009 (0.082)	0.00	259 (421)	−0.007 (0.280)	0.00	259 (415)
	Wages	0.015 (0.702)	0.00	118 (224)	0.029 (0.536)	0.01	118 (218)
	employment	0.013 (0.000)***	0.01	259 (432)	0.013 (0.000)***	0.00	259 (422)
Medium	TFP	0.353 (0.122)	0.00	97 (110)	0.299 (0.169)	0.01	90 (104)
	Labor productivity	0.075 (0.124)	0.01	96 (111)	0.045 (0.222)	0.05	89 (105)
	Capital intensity	−0.022 (0.047)**	0.01	96 (111)	−0.007 (0.612)	0.18	89 (105)
	Wages	−0.025 (0.809)	0.00	41 (65)	−0.026 (0.713)		41 (61)
	employment	0.013 (0.000)***	0.01	97 (113)	0.006 (0.000)***	0.01	90 (107)

(*Continued*)

TABLE 4 (Continued).

Size class	Firm Measures	Without Covariates			With Covariates		
		ATT	R^2	Obs.	ATT	R^2	Obs.
Large	TFP	0.374	0.00	136	0.106	0.00	166
		(0.001)***		(175)	(0.009)***		(122)
	Labor productivity	0.022	0.00	133	0.014	0.01	166
		(0.186)		(175)	(0.435)		(119)
	Capital intensity	0.000	0.01	136	0.006	0.02	166
		(0.974)		(175)	(0.341)		(122)
	Wages	0.285	0.02	67	0.311	0.01	65
		(0.001)***		(80)	(0.001)***		(64)
	Employment	−0.017	0.02	140	−0.012	0.02	166
		(0.000)***		(175)	(0.127)		(126)

Note. We report bootstrapped standard errors (50 replications) with the number of the matched controls and the number of the treated on the common support; Values are estimated at the 0.5 Quantile. P-values in parenthesis where significance levels are at: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

6. Conclusion

In this study, we analyzed the effect of firm-level investment in capital stock on export entry and productivity growth among small firms. Using firm-level data from two selected Sub-Saharan African countries, we show that for small and new exporters who engage in firm-level investments, firm-level investment capital stock is associated with a high level TFP and labor productivity. Moreover, our findings are consistent with others showing that engaging in any productivity enhancing activities like innovation, Research and Development or technology upgrading at the firm-level receive a stream of benefits that accrue from such investments, as firms can restructure their production processes by upgrading production technologies, consequently raising production efficiency. We show a clear indication that when small firms invest in physical capital, especially plant and equipment, they are able to upgrade their productive capacity, consistent with the view that more productive firms can produce more output at lower unit costs as postulated in our theoretical model. We find evidence that small firms who invest in physical capital receive a positive, statistically significant premium when they engage in exporting and once they survive their first year of exporting, grow faster.

Our findings may imply that firm-level investments in capital stock are associated with increased probability of export entry, and better export market performance and growth rates among small firms. At the policy level, we note that export-led policies or strategies will have meaningful impact if supporting micro and small firms access the much needed financing to upgrade their production technologies is the core of such policies.

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Data availability

The data associated with the results of the paper were downloaded from website of Centre for the study of African Economies at oxford, available at https://www.csae.ox.ac.uk/data

References

Ahn, J., & Mcquoid, A. F. (2012). *Capacity constrained exporters: Micro evidence and macro implications capacity constrained exporters : Micro evidence and macro implications* (Economics Research Working Paper series 2. Florida International University).
Arkolakis, C. (2016). A unified theory of firm selection and growth. *Quarterly Journal of Economics*, (1), 1–49. doi:10.1093/qje/qjv039.Advance
Aw, B. Y., Roberts, M. J., & Winston, T. (2007). Export market participation, investments in R & D and worker training, and the evolution of firm productivity. *The World Economy*, *30*(1), 83–104.
Aw, B. Y., Roberts, M. J., & Xu, D. Y. (2011). R & D investment, exporting, and productivity dynamics. *American Economic Review*, *101*(4), 1312–1344.
Bernard, A. B., Eaoton, J., Jensen, J. B., & Kortum, S. (2003). Plants and productivity in international trade. *American Economic Review*, *93*(4), 1268–1290.
Bernard, A. B., & Jensen, J. B. (1999). Exceptional exporter performance : Cause, effect, or both? *Journal of International Economics*, *47*(1), 1–25.
Bernard, A. B., & Jensen, J. B. (2004). Why some firms export. *Review of Economics and Statistics*, *86*(2), 561–569.
Blundell, R., & Dias, M. C. (2000). Evaluation methods for non- experimental data. *Fiscal Studies*, *21*(4), 427–468.
Bustos, B. P. (2011). Trade liberalization, exports, and technology upgrading : Evidence on the impact of MERCOSUR on Argentinian firms. *American Economic Review*, *101*(1), 304–340.
Caldera, A. (2010). Innovation and exporting: Evidencefrom Spanish manufacturing firms. *Review of World Economics*, *146*(4), 657–689.
Cassiman, B., & Golovko, E. (2011). Innovation and internationalization through exports. *Journal of International Business Studies*, *42*(1), 56–75.
Constantini, J. A., & Melitz, M. J. (2008). The dynamics of firm-level adjustment to trade liberalization. In E. Helpman & T. Verdier (Eds.), *The organization of firms in a global economy*. Cambridge: Harvard University Press, pp.107–141.
Damijan, J. P., Kostevc, C., & Polanec, S. (2010). From innovation to exporting or vice versa? *World Economy*, *33*(3), 374–398.
De Loecker, J. (2007). Do exports generate higher productivity? Evidence from Slovenia. *Journal of International Economics*, *73*(1), 69–98.
Eaton, J., Eslava, M., Kugler, M., & Tybout, J. (2008). The margins of entry into export markets: Evidence from Colombia. In E. Helpman, D. Marin, & T. Verdier (Eds.), *The organization of firms in a global economy*. Cambridge, MA: Harvard University Press, pp. 231–272
Esaku, S. (2019a). *Trade liberalization, firm dynamics and export participation in Sub-Saharan Africa* (Unpublished manuscript). North-West University Press, South Africa.
Esaku, S. (2019b). Export markets and firm productivity in Sub-Saharan Africa. *Journal of African Business*, 1–20. Advance online publication. doi:10.1080/15228916.2019.1695190
Esaku, S. (2020b). Investments, export entry and export intensity in small manufacturing firms. *Journal of Industrial and Business Economics*, *47*(4), Advance online Publication, 677–697.
Esaku, S. (2020c). Job creation, job destruction and reallocation in Sub-Saharan Africa: Firm-level evidence from Kenyan manufacturing sector. *Congent & Finance*, *8*, 1782113.
Esaku, S., & Krugell, F. W. (2020a). Firm-level investment and exporting: New empirical evidence from Ghana and Tanzania. *International Economic Journal*, *34*(1), 125–143.
Esaku, S., & Krugell, F. W. (2020b). Trade liberalization and productivity growth: A firm-level analysis from Kenya. *Review of Economic Analysis*. forthcoming. Advance online Publication. Retrieved from https://openjournals.uwaterloo.ca/index.php/rofea/article/view/1791/2086

Esaku, S. (2020a). Does firm size affect learning-by-exporting? Empirical evidence from Sub-Saharan Africa. *Cogent Economics & Finance*, *8*(1), 1754150.
Heckman, J. J., LaLonde, R. J., & Smith, J. A. (1999). The economics and econometrics of active labor market programs. In O. C. Ashenfelter & D. Card (Eds.), *Handbook of labor economics, 3A* (pp. 1865–2097). Amsterdam: North-Holland.
Holland, P. W. (1986). Statistics and causal inference. *Journal of American Statistical Association*, *81*(396), 945–960.
Hopenhayn. (1992). Enty, exit, and firm dynamics in long run equilibium. *Econometrica*, *60*(5), 1127–1150.
Jorgenson, D. W. (2011). Innovation and productivity growth. *American Journal of Agricultural Economics*, *93*(2), 276–296.
Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrica*, *50*(3), 649–670.
Leuven, E. M., & Sianesi, B. (2003). *PSMATCH2: Stata module to perform full mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing*. Retrieved from http://EconPapers.repec.org/RePEc:boc:bocode:s432001
Levinsohn, J., & Petrin, A. (2003). Estimating production functions using inputs to control for unobservables estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, *70*(2), 317–341.
Luttmer, E. G. J. (2007). Selection, growth, and the size distribution of firms. *Quarterly Journal of Economics*, *122*(3), 1103–1144.
Melitz, M. J., (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695–1725.
Muriithi, S. (2017). African Small and Medium Enterprises (SMEs) contributions, challenges and solutions. *European Journal of Research and Reflection in Management Sciences*, *5*(1), 36–48.
Rho, Y., & Rodrigue, J. (2015). Growing into export markets : The impact of exporting on firm-level investment in Indonesia. *Review of International Economics*, *23*(1), 62–85.
Rho, Y., & Rodrigue, J. (2016). Firm-level investment and export dynamics. *International Economic Review*, *57*(1), 271–304.
Roberts, B. M. J., & Tybout, J. R. (1997). The decision to export in Colombia : An empirical model of entry with sunk costs. *American Economic Review*, *87*(4), 545–564.
Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41–55.
Yeaple, S. R. (2005). A simple model of firm heterogeneity, international trade, and wages. *Journal of International Economics*, *65*(1), 1–20.