Manufactured Exports in Sub-Saharan African Economies: Econometric Tests for the Learning by Exporting Hypothesis

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Abstract

Low growth of manufacturing exports has been identified as a major factor for poor economic performance in many Sub-Saharan African economies. Exports improvement in the manufacturing sector especially through the learning process is a necessary condition for growth and real development of less developed and developing economies in Sub-Saharan Africa (SSA). The study sought to establish empirical support in the SSA context for the "learning by exporting hypothesis" by employing Cobb-Douglas type of production functions and firm-level survey data from a sample of ten African countries (Nigeria, Ghana, Kenya, Tanzania, Ethiopia, South Africa, Cameroon, Botswana, Mauritius, and Zimbabwe). Furthermore, employing Ordinary Least Squares (OLS), Clerides, Lach and Tybout (CLT) and Non-parametric Maximum Likelihood (NPML) estimation techniques, the study found support for the learning by exporting hypothesis in Sub-Saharan Africa. The study recommended further investment in human resources and physical infrastructures as well as Research and Development (R&D) to boost Total Factor Productivity (TFP), which will ultimately increase efficiency and hence exports.

Key Words: Manufactured export, Learning by Exporting Hypothesis, Sub-Saharan Africa

Introduction

In general, primary commodities dominate Sub-Saharan African (SSA) exports and they are extremely vulnerable to variations in weather conditions, world demand and prices. If SSA is to enjoy optimum benefit from the integration and opening of the world economy, this heavy reliance on primary products must be reduced, which requires a new and important role for SSA manufacturing industries. Evidence has shown that rapid export growth provided the foundation for industrialisation in East and Southeast Asia. In Indonesia, Malaysia and Thailand, while primary exports played a prominent role in the 1960s and 1970s, the share of manufactured exports in total exports rose from 6 percent in 1965 to 41 percent, 61 percent and 77 percent respectively in 1992 but in SSA, the manufacturing share of exports was 7 percent in 1965 and 8 percent in 1990.

There is no doubt that manufacturing exports remain one of the most powerful engines for economic growth. It acts as a catalyst to transform the economic structure of countries, from simple, slow-growing and low-value activities to more productive activities that enjoy greater margins driven by technology and having higher growth prospects (Albaledjo, 2003). But its potential benefits are even greater today. With rapid technological change, sweeping liberalisation and the increased internationalization of production, manufacturing has become the main means for developing countries to benefit from globalisation and be able to bridge the income gap with the industrialized world. This is evident in the rapid development of Asian Tigers. South Korea's 25% of GNP derives from manufacturing industry which has recently broadened its scope to become very successful in high-tech precision manufacturing in the consumer electronics, multimedia computers/notebooks, aerospace and defense markets.

Manufacturing sector exhibits a 'pull effect' on the other sectors of the economy by stimulating the demand for more and better services in banking, insurance, communications and transport. An insight into the sector benefits implies that if SSA manufacturing sector is vibrant just like that of China or other developing economies, it can stimulate a more productive agricultural sector, making use of technological advances and a boost in human capital. The industrial sector has been confirmed the main vehicle for technological and human development. Today, the sector represents the hub of technical progress, not just in developed countries but also in developing ones.

A good example is in countries like Argentina, Brazil, Colombia, Indonesia, and Vietnam where manufacturing accounts for 30% to 55% of merchandise exports while in Hungary, Mexico, Pakistan, the Philippines, and Turkey, manufacturing accounts for more than 80% of merchandise exports (Hanson and Roberts, 2007). Industry uses technology in many forms and at different levels to increase returns to investment, by shifting from low to high productivity activities. This entails a process of constant technological upgrading and learning. Apart from that, skills are a potential determinant of manufacturing exports and investment (Soderbom and Teal, 2001). According to the duo, both dimensions of skills should increase the return on physical capital and thus, the incentive to invest and export and this can be achieved through technological progress thereby making manufacturing a catalyst to technological progress and the main means to achieve higher and more sustainable industrial margins.

The industrial sector drives and diffuses innovation through Research and Development (R&D) financed by manufacturing enterprises, which accounts for the bulk of innovative activities being carried out in the developed world. But R&D expenditure is only a tip of the iceberg in technological efforts. Manufacturing also offers great potentials for informal innovative activities, or 'clever gimmicks', such as incremental improvements in products and processes. A strong R&D is important for Nigeria and African firms to absorb and modify technologies more quickly and efficiently, adapting them to the local conditions and needs.

Most SSA economies are very unstable due to their dependence on primary good like oil and agricultural products. Economic growth has often coincided with peaks in oil prices but in the longer run however, primary goods exports face declining terms of trade due to their low value added to manufactured goods (Prebisch-Singer hypothesis), and the constant fluctuations in world prices.

Motivating factors to enter or expand manufacturing exports are different for each firm, depending on export behaviour, commitment, and the priorities of different exporters. In addition, organisational characteristics play a significant role in determining the success or failure of a firm export effort. The relationship between size and export performance is one of many relationships that have been extensively studied, although there has not been any definitive conclusion on the issue (Moini 1995). Bonarcossi (1992) noted that there is a clear and strong explanation for the relative weakness of small firms in international markets. Most firms that export soon after establishment have been found to be small. According to a study of Zimbabwe's textile and clothing exporters, newly established manufacturers start exporting early in their life, as opposed to large established companies that have a strong domestic presence (Muranda, 1999).

In the words of Bigsten *et al* (2002), exporting offers the maximum scope for increased discipline of competition and contact with foreign customers, which in effect provide the maximum scope for learning opportunities. Thus if exporting induces efficiency, it should have done so in Nigeria in particular and Africa generally. Current arguments suggest that African economies need to export manufactures because of the size of the African domestic market (less than China or India), hence the fastest possible way to industrialize is through exports. SSA manufacturing export figures is a telling indicator of a substantial competitive gap and an unclear learning by exporting situation. Therefore such a gap can be reduced endogenously through increased international trade.

It is interesting to note that the development of the SSA manufacturing sector has seriously stagnated over the same period, except in a few countries like South Africa and Mauritius. The share of manufacturing value added in Gross Domestic Product (GDP) in SSA is 15 percent, which is the lowest share in the world paralleling South Asia. According to UNIDO (2004) if South Africa is excluded, which is an exceptionally industrialized country accounting for about 60 percent of manufacturing production in Africa, the figure drops to 13 percent and well below the average for low income countries of the world. The SSA share of manufacturing exports in total exports excluding South Africa is 21 percent, which is less than half of that in low-income countries.

Comparing the ratio of manufacturing exports to GDP, the average (6 percent) is just over half of the average for the low-income countries confirming that in Africa, manufacturing export performance is particularly poor and one of the sources of stagnation in Africa. Table 1 below presents the picture of SSA manufacturing sector performance in terms of export contribution and value added when compared with other middle and low-income countries of the world.

Table 1: Average Performance of Manufacturing Sector in SSA in Percent [2001-2005]

	Manufacturing Value Added/GDP	Manufacturing Exports/ Commodity Exports	Manufacturing Exports/GDP	Manufacturing Exports/ Value Added
Middle and Low income countries	22	60	15	67
Low income countries	18	52	11	59
Sub-Saharan Africa	15	33	10	64
Excluding South Africa	13	21	06	50

Source: World Bank, World Development Indicators 2006

It is often argued that trade liberalisation and export-oriented strategy should increase firm-level efficiency (Krugman, 1987; Rodrik, 1988, 1991; Grossman and Helpman, 1991) which has been supported by some evidence describing the association between exporting activities and efficiency (Nishimizu and Page, 1982; Haddad, 1993; Harrison, 1994; Aw and Hwang, 1995). Have there been positive improvements among SSA manufacturers who export? In other words, is there any support to the "learning by export hypothesis" in SSA?

If the above question is answered and solutions provided for the problems, there will definitely be an improvement in SSA's manufacturing export, thereby reducing the dilemma of depending on primary commodity or resource curse. Macro-data have a limit in answering such questions, hence the use firm-level data in this present study. Therefore, this study is set to test the hypothesis "Do SSA firms learn as they export?" The hypothesis is stated in the right format thus:

H_0: There is no support for the learning by exporting hypothesis among African firms.
H_1: There is support for the learning by exporting hypothesis among African firms.

Learning by Exporting and Productivity Catch Up

Developing countries with high productivity growth typically do not achieve this in isolation. Advanced technology is primarily developed in the very rich nations and based on their R&D input and innovations. Openness to foreign markets influences productivity growth through several mechanisms beyond imports of advanced technology, such as the discipline of the world market, incentive effects of competition, transfer of knowledge, foreign direct investment, etc. The broader learning associated with openness influences all aspects of production capabilities. The importance of international spillovers for productivity growth has been investigated in a comprehensive empirical literature and with analyses both at the national, sectoral and firm level.

Although the econometric evidence is controversial, most authors conclude that openness is to the advantage of productivity growth. Coe, Helpman, and Hoffmeister (1997) is an influential cross-country study. The conclusion is reinforced in a study of East Asian countries by Frankel, Romer, and Cyrus (2003) taking into account the endogeneity of foreign trade. Productivity growth is a complicated process and modeling the productivity mechanism necessarily must be very stylized. Following recent econometric evidence suggesting that the export sector has been a key channel of productivity growth, rapid export growth certainly has been an important characteristic of Thailand's economic growth. An early demonstration of the inter-sectoral beneficial externalities of the export sector is shown by Feder (1982). Such analysis assumes that social marginal productivities are higher in the export sector and that the export sector confers positive effects on the productivity of other sectors in the economy.

More recent econometric evidences have looked into possible documentation of learning by exporting. The econometric challenge is to separate between the selection into exports and the productivity improvement of being an exporter. Studies comparing exporters and non-exporters tend to conclude that the selection effect dominates. Fernandes and Isgut (2005) concentrated on young plants to get around the problem that firms already established in exporting may have less scope for further learning. They found strong positive productivity growth effect of exports participation, and the result is consistent with studies of young firms by Delgado, Farinas, and Ruano (2002) and Baldwin and Gu (2003). Westphal (2002) reported 'ample case study evidence of links between export activity and technological change cum development' in East Asia.

Export-Based Technological Catch-Up

Export-based technological catch-up is reflecting in falling production costs or rising Total Factor Productivity (TFP) proportionate to expansion in exports in the most knowledge-intensive sector (s), where the technology followed already holds its comparative advantage. The relative wage in the export sector rises as the follower's exports expand (Dike, 2007). The Newly Industrialized Countries (NICs) (East Asian and Latin American) particularly portray this problem.

Again, it is necessary to examine the nature of firms that underpin export-based technology catch-up. Firms in the NICs generally have exploited know-how licensing, reverse engineering and production learning to acquire export capabilities in consumer durables, automobiles, etc. apart from earlier capabilities in traditional labour-intensive manufactures. Export markets have permitted production of scale-intensive consumer durables and other bulk materials (e.g. steel and glass). Through exposures to foreign markets, technologies and products, technology followers that have acquired potentials in manufactured exports may specialise.

Export Trade Channels

Exporting is another important mechanism through which firms in developing countries can absorb world technology via international trade channels. Through exposure to foreign markets, technologies, and products, developing-country firms may specialise in products with high learning potential. This view is supported both by case studies and empirical evidence, showing that export-based firms experience higher productivity growth than firms that supply domestic markets (Arnold, and Hussinger 2004).

At the cross-country level, there is a positive correlation between trade openness and speed of adoption of new technologies (Greenaway, and Kneller 2004) or investment in research and development (R&D). Exporting firm can learn about new technologies or products via their interaction with more knowledgeable foreign buyers in external markets. Alternatively, they may exposed to more competitive markets and, consequently, be forced to improve their technology much more frequently than otherwise would be the case. Exporters may benefit from scale economies in innovation: access to large markets may encourage firm to undertake R&D and/or deploy equipment with higher output capacities which may lead to internal economies of scale.

Foreign purchases of exports are found to transmit critical information on changes in export markets, on improvements in processes, products and organisation from other firms. Such information keep export-based firms to adjust their technologies to meet changing market conditions (see Aw, Chung and Roberts 2000). Firm develop the skills and linkages needed to access foreign channels of technology investments thus achieve lower costs and higher quality. Design, product specification and free technical assistance for such improvements are often part and parcel of such contracting agreements between exporters and foreign buyers.

It is not quite clear from the literature the direction of causality between firms exporting status and their productivity. That is, it is not quite clear whether productivity follows in the wake of entry into export markets or exporters improve productivity as they begin to interact with foreign markets. Do firms become more productive through learning by exporting, or is it that firms that are more productive already enter export market in the first place?

In the literature studying the nexus of firms' productivity and entry into export markets, there is strong evidence of self-selection of the most productivity firms into exporting (Clerides, Lach and Tybout 1998) but there exist also some evidence of a learning-by-exporting effect (Delgado, Fariňas, and Ruano 2002; Fernades and Lsgut 2005). But exporting firms will have contact with more knowledgeable foreign buyers generating an increased access to (or demand for) leather technologies. As well, firms may have to frequently upgrade their technological capability in anticipation of strong competition in export markets.

It is clear from the evidence, that firms' entry into export markets will differ across countries affected by individual country's export policies, among other factors. Aw, Chung and Roberts (2000) find, in the use of Korea, that export development was very much influenced by government policy in deregulation. Citing empirical findings by various researchers, Aw, Chung and Roberts (2000) concluded that Korea government subsidies to Korea firms significantly influenced their capacity to enter export markets. These polices have resulted in the channeling of credit at negative interest rates to Korea's conglomerates and provided them with insurance against business risk, particularly in the export market.

In this context, Korean producers are less likely to base their decision on productivity when they consider entering, continuing or exiting the export market. Their decision will reflect whether they have access to the necessary finance, contacts, and insurance provided by the government (pp.85). The nature and type of networks developed by firms also help them to gain entry into export markets, ceteris paribus. Import substitution firms in postcolonial Africa could not develop export capabilities because, among others, they lacked globalised networks. But the import substitution firms produced solely for domestic markets shielded from import competition and technological influences from the world market. But because the import substitution firms lacked export networks, they were denied the market contacts to supply information about quality, design, technological change trends, quantities, etc. By the end of the 1980s, Sub-Saharan Africa firms were beginning to make "the long march back" towards producing for every export markets, which will involve establishing globalised networks to be able to gather information on quality, design, technology, etc.

Soderbom and Teal (2001) in another study on the way forward for African countries to become more successful exporters, considered exporting from the policy angle in enabling three African countries namely Tanzania, Uganda and Zambia improve their performance as they are classified among the least developed countries. The study found that though macroeconomic policy is important in creating the pre-conditions for growth, it is not a sufficient condition. There was also evidence that the efficiency with which firms operate is important in understanding whether firms can be successful exporters, hence policies which improve efficiency at the firm-level may greatly enhance the potential for macro-reform to impact on overall performance in African economies.

Soderbom (2001) in trying to find the drive behind manufacturing exports in Africa, found there is a subtler picture of exporting behaviour in African manufacturing than implied in trade theory. African firms according to the study, even within the same industries are highly heterogonous in their ability to transform inputs into outputs, and this kind of ability is important for firms to be able to export and compete in world markets. The study found that in Kenya and Zimbabwe, industries are poor predictors of exporting intensity. This implies that policy measures designed to enhance such skills along with measures taken to facilitate export entry may therefore be particularly rewarding in terms of improving the export performance of African manufacturing firms.

The survey whose results form the basis of the analysis was conducted in early 1995 as part of the African Economic Research Consortium's (AERC) collaborative research project on Regional Integration and Trade Liberalisation in Sub-Saharan Africa. A number of country case studies were undertaken as part of this project, most of which involved the conduct of a small, selective survey of manufacturing enterprises. These surveys were principally intended to collect information on the extent to which firms were engaged in international trade, and on how they were affected by changes in trade policy and by local regional integration arrangements. However, they also collected a lot of information on the characteristics of the enterprises themselves.

Soderbom and Teal (2003) tried to find whether openness to trade and higher levels of human capital promote faster productivity growth. That they do is a key implication of several versions of endogenous growth theory. They answered the question using panel data on 93 countries spanning the 1970-2000 periods and controlling for fixed effects as well as endogeneity. The results show a significant effect of openness on productivity growth. If the level of openness of an economy is doubled, the underlying rate of technical progress will increase by 0.8 percent per annum. They also found an effect, significant at the ten percent level, of the level of human capital on the level of income, but no effect on underlying productivity growth. Their preferred estimator combines high and low frequency differences of the data with some discussions on why this estimator is well suited for empirical analysis of economic growth.

Soderbom (2004) in another study on productivity, exports and firm dynamics in Kenya over the period 1999-2002 found only modest changes in labour productivity and there has been at very best, modest productivity growth over the period. The results also show a high relationship between the firm size and export, with an increase of employment by one percent being associated with an increase in the estimated likelihood of exporting of 0.17 percentage points.

Bigsten, & Gebreeyesus (2008 & 2001) traced the trajectory of total factor productivity and other productivity measures of groups of firms classified by their export history. The study tested learning-by-exporting using a one-step system-general method of moments approach with the export-status included directly in the production function.

The study found strong evidence of not only self-selection but also learning-by-exporting. Depending on the specification previous exporting appears to have shifted the production function by 15-26 per cent. Exporters had on average three times more employees, and paid 1.6 times higher average wage than non-exporters.

Finaly, Bigsten *et al*. (2002), found a support for "learning by exporting" hypothesis using Ordinary Least Square (OLS) which is a "random effect" estimator. Unfortunately, this approach is likely to yield misleading results if exports and productivity are correlated for reasons other than causality running from exports to efficiency. This was emphasised by Clerides, Lach and Tybout (CLT) model, arguing that the positive association between export status and productivity can be due to the self-selection of the relatively more efficient plants into foreign markets, rather than learning. Their study employed the CLT model as well as Non-Parametric Bivariate Firm Effects (NPLM) estimates where the bivariate distribution of μ and ψ is taken to be discrete with 3 x 3 points of support (increasing the number of support points further resulting in a very small increase in the log likelihood value). This extension was to take care of the lapses in Bigsten et al (2002) and other similar studies that have concentrated in the use of OLS or Generalised Least Squares.

From the empirical literature, there is substantial evidence to show that export of manufactures in Africa in general and SSA in particular is still very low. The common factor in the collapse of many African economies in the period since independence has been the collapse of their exports. The most prominent feature of the Asian tigers was the growth of their exports, in particular their manufacturing exports. The issue as to how success in Africa can be achieved thus divides into two related questions. The first is how closely export and income growth are linked; the second is whether or not it matters if the exports are manufactures.There is also strong evidence that the last two decades have witnessed major changes in economic policy in many African countries. A common factor in these changes has been the transition from economies where government controls were extensive to more open, market-oriented, regimes. In parallel with economic changes have been political and social transitions, and an increasing concern with issues of governance and transparency in the policy-making process.

In summary, from the reviewed studies in Africa and SSA, the performance of manufacturing sector on the continent displays structural relationships similar to those found in other developing regions. For example, comparisons with three Asian economies clearly indicated that, in both Asian and SSA manufacturing sectors, smaller firms are not necessarily more labour-intensive than large firms. In addition, the SSA firms display the same relationships between factor intensities and partial factor productivities as seen in the Asian countries. The present study adopted OLS, CLT and NPML and increased the number of SSA countries to ten (10) to make the result more robust and acceptable.

Modeling for Learning by Export

The present study followed and adopted Bigsten *et al* (2002) model with some modifications and extension because several methodological problems have arose when attempting to test for, and distinguish between, learning-by-exporting and self-selection effects. The study's approach involves simultaneous estimation of a dynamic production function and a dynamic discrete choice model for the decision to export, where the study allows for causality running both from efficiency to exporting and from exporting to efficiency. This strategy enables us to control for unobserved heterogeneity in the form of firm specific effects that are correlated across the two equations. In addition, the study considers an instrumental variables estimator in order to see if our results are robust. A methodological issue to which the study devotes considerable attention is the manner in which this unobserved heterogeneity should be modelled since alternative models can give radically different results, hence the reliance on the model applied by the team comprising Bigsten, Collier, Dercon, Fafchamps, Gauthier, Gunning, Oduro, Oostendorp, Pattillo, Söderbom, Teal and Zeufack (2002) in trying to answer the same question for four countries. According to the model, the link between exporting and efficiency is analysed, using a production function approach with a baseline production function taken to be dynamic Cobb-Douglas, modelling output as a function of capital, labour and intermediate inputs thus:

$$y_{it} = \lambda y_{i,t-1} + (1-\lambda)\{\beta_n n_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_e e_{it}\} + \log A_{it} + \eta_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where y_{it} is log of output, $y_{i,t-1,}$ is lag of log of employment, n_{it} is the log of employment, k_{it} is the log of capital stock, m_{it} is the log of raw materials, e_{it} is the log of indirect cost (e.g. electricity, water, transport, etc), A_{it} is the total factor productivity or efficiency, λ and β denote parameters to be estimated, η_{it} is a residual, assumed serially uncorrelated, that captures efficiency shocks, and $i = 1,2,\ldots,N$ *and* $t = 1,2,\ldots,T$ are firm and time indices respectively.

In the empirical analysis, the study considers the effects of allowing for a more flexible specification than Cobb-Douglas, as well as modelling value-added rather than gross output.

Based on the learning-by-exporting idea, the study hypothesises that *Ait* depends on exporting and, as learning is unlikely to be instantaneous, that this effect operates with a one-period lag. The study allows for heterogeneity in *Ait* by including dummy variables for country, industry, time and firm status (ownership), summarised by the vector C*it*, and for unobserved heterogeneity in the form of firm specific effects. The study hence writes *Ait* in logarithmic form as:

$$\log A_{it} = \delta.\exp orts_{i,t-1} + c_{it} + \mu_i, \quad \text{..... (2)}$$

where *exports* is a dummy variable equal to one if there is some exporting and zero if there is none. Substituting this expression into the production function yields:

$$y_{it} = \lambda y_{i,t-1} + (1-\lambda)\{\beta_n n_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_e e_{it} \} + \delta.\exp orts_{i,t-1} + c_{it} + \mu_i + \eta_{it} \text{ .....(3)}$$

which forms the basis for our econometric test for learning effects that are due to exporting. A simple empirical approach would be to estimate (3), using OLS or the standard panel Generalised Least Squares (GLS), which is a "random effect" estimator. Unfortunately, this approach is likely to yield misleading results if exports and productivity are correlated for reasons other than causality running from exports to efficiency. This is emphasised by Clerides, Lach and Tybout (CLT) model, arguing that the positive association between export status and productivity can be due to the self-selection of the relatively more efficient plants into foreign markets, rather than learning. In the econometric analysis, CLT deals with this problem by formulating a model for export participation in which they control for unobserved firm effects that are potentially correlated with the unobserved firm effects in the productivity equation just as used in this research work.

The Dynamic Probit Model

Because of the binary nature of the export data for the study, this study formulated a latent variable hence export equation becomes thus:

$$\exp orts^{*}_{it} = \gamma.\exp orts_{i,t-1} + \theta_y.n_{it} + \theta_y(y_{i,t-1}) + \theta_k.(k_{i,t-1} - n_{i,t-1}) + d_{it} + \psi_i + \omega_{it}, \quad \text{..... (4)}$$

Where the study observes *exports* $_{is}$ *=1 if* ≥ 0, otherwise zero. Here γ and θ denote parameter to be estimated, ψ_i is an unobserved firm specific time invariant effect affecting the decision to export and ω_{it} is a homoskedastic, serially uncorrelated and normally distributed residual whose variance the study normalises to one. These assumptions about the residual imply that parameters of interest can be estimated, using a dynamic probit model. The study assumes that self-selection into exporting operates with a one-period lag, reflected in (4) by the *t*-1 subscripts on labour productivity and capital-intensity. The coefficient θ thus represents the self-selection effect.

In estimating equation (3) and (4) the study sheds light on, *inter alia* i) if there is support for the learning-by exporting hypothesis, i.e. that firms improve efficiency as a result of exporting (in which case δ would be positive); ii) if there is support for self-selection-into-exporting, i.e. that efficient firms become exporters (in which case θ_y would be positive); iii) if there are fixed costs associated with exporting, so that firms tend to continue exporting once they have entered the international market (in which case θ_y would be positive; Roberts and Tybout, 1997). Because the models contain lagged dependent variables, it is crucial to control for heterogeneity between firms or expect the estimates to be upward biased, reflecting 'spurious' state dependence (Heckman, 1981a, 1981b).

Data and Sources

Data for the study are from the first and second waves of Nigerian manufacturing survey of 2001 and 2005. This data were collected by the United Nations Industrial Development Organisation (UNIDO) in collaboration with the respective ministries of Industry in selected African countries. The first wave have firm level data from 1998-2000 while the second wave have data from the same firms for 2001-2003. African countries included in the survey were Ghana, Kenya, Nigeria, Tanzania, Ethiopia, Cameroon, Botswana, Mauritius, Zimbabwe and South Africa. Other African countries like Algeria, Tunisia, Egypt, Malawi, Uganda, Senegal, Zambia and Ivory Coast were part of the survey but could not be included in the study because of incomplete data.

Learning by Exporting Hypothesis Results for SSA Manufacturing Firms

In estimating equations (3) and (4) as shown above, the study mainly relies on Maximum Likelihood (ML) methods, although the study considers a Generalized Methods of Moments (GMM) estimator. The study uses three distinct ML models, one of which assumes that there is no unobserved heterogeneity in the form of firm specific effects, while the remaining two assume the μi and ψi can be modeled by means of a random effects approach. Equations (3) and (4) contain four random terms, namely μi, ηit, ψi and $\acute{\omega} it$. The study's simplest model imposes a restriction, which amounts to assuming that there is no unobserved heterogeneity in the form of firm specific effects. In this special case, the likelihood function can be written ignoring the panel nature of the data altogether. While this model is straightforward to estimate, the presence of the dynamic terms in the regression means the consistency of the estimates hinges crucially on the absence of unobserved heterogeneity. Even though the model thus is rather restrictive, it is useful as a benchmark. The study uses data from ten different African countries namely Nigeria, Cameroon, Ghana, Zimbabwe, Kenya, Tanzania, South Africa, Botswana, Ethiopia and Mauritius. Result is presented in Table 2. The dependent variable in the production function is the log of Gross Output. The dependent variable in the export is a dummy variable equal to one if the firm exports and 0 otherwise. All regressions include dummy variables for country, industry, ownership, and time. The numbers in parenthesis are t-statistics based on asymptotic standard errors. Significance at the one percent, five percent and ten percent is indicated by *, **, and + respectively.

Table 2: Selected Maximum Likelihood Estimates: Cobb-Douglas Output Production Function and Export Probit

	[1] No firm effects	[2] Bivariate normal firm effects (CLT)	[3] Non-parametric Bivariate firm effects (NPML)
THE PRODUCTION FUNCTION			
Yt-1	0.155	0.098	0.118
	(8.398)**	(5.166)**	(6.396)**
Exportt-1	0.069	-0.001	0.067
	(2.111)*	[0.126]	(2.147)*
k1	0.023	0.027	0.034
	(2.300)*	(2.521)*	(3.474)**
n1	0.103	0.142	0.112
	(5.518)**	(6.626)**	(6.013)*
Et	0.093	0.089	0.083
	(37.763)**	(41.311)**	(40.631)**
THE EXPORT FUNCTION			
(yt-1-nt-1)	0.051	0.086	0.270
	[0.205]	[0.177]	[0.766]
exportt-1	2.022	-0.354	1.081
	(10.758)**	[0.908]	(3.046)**
Kt-1-nt-1	0.065	-0.053	0.039
	[0.868]	[0.436)	[0.446]
Mt-1-nt-1	0.203	0.641	0.061
	[0.849]	(1.713)+	[0.225]
et-1-nt-1	-0.111	-0.411	-0.142
	[1.062]	[2.122]	[1.138]
nt-1	0.273	2.096	0.593
	[3.418]**	(5.752)**	(3.284)**
	0.270	0.223	0.242
		0.160	0.126
		2.804	0.803
	0.076	-0.226	0.038
		0.330	-0.018
Log Likelihood value	-350.930	-323.570	-302.370
Number of firms	1289	1289	1289

The hypothesis formulated to guide the study was to discover if there is support for the learning by exporting hypothesis among African firms thus:

H_0: There is no support for the learning by exporting hypothesis among African firms.
H_1: There is support for the learning by exporting hypothesis among African firms.

The learning by exporting hypothesis is a strong hypothesis in terms of both macro and micro studies on export performance. In order to discover if there is support for this hypothesis among African firms, the study employed the production function, taken to be Cobb-Douglas that model gross output (column 1) in Table 2 above, which shows the results for the simplest model that is where firm effects are ignored altogether.

In the production function, all inputs were significant at the five percent level or better and sum to 0.85, which given that the coefficient on the lagged dependent variable is 0.16, implies that long run constant returns to scale can easily be accepted, though the test was not reported. The estimated coefficient on the lagged export variable is equal to 0.07 and significant at the five percent level, thus suggesting a positive effect of exporting onto efficiency.

In the export probit, the coefficient on $(y_{t-1} - n_{t-1})$ is positive but small and far from significant. Thus the study cannot reject the hypothesis that a change in efficiency at time *t* has no effect on the export probability at time *t+1*, suggesting that the self-selection mechanism is weak. However, $(y_{t-1} - n_{t-1})$ is quite strongly correlated with capital, raw material and indirect cost (all normalized by employment), and a joint test of hypothesis that the coefficients on these four terms are zero can be rejected at the ten percent level *(p-value: 0.054)*. It is thus possible that an increase in efficiency is associated with more intensive utilization of capital and intermediate inputs in such a way as to mask the direct effect on exporting. The coefficient on lagged export is equal to 2.02 and highly significant, indicating strong persistence in the exporting decision. Given the fact that the study does not control for time invariant firm effect, the effect might probably be upward biased, reflecting spurious state dependence (Heckman, 1981a, 1981b). The coefficient on employment was also positive and highly significant and the result that contemporaneous exports are affected by lagged exports and size can be interpreted as evidence for fixed costs.

When the study considers the effects of allowing for unobserved heterogeneity, the results of CLT model in which the firm effects were taken to follow a Bivariate normal distribution as shown in Table 2 (column 2). The increase in the log likelihood value compared to column 1 indicates that this model provides a far better fit than the simpler model. Strikingly, there is no evidence for learning by exporting, as the coefficient on lagged exports is far from being significant and the point estimate is even negative. There is unobserved heterogeneity both in the production function and in the export equation and the estimate $\rho_{\mu\psi}$ indicates that the correlation between μ and ψ is equal to 0.33. This suggests that the positive coefficient on the export variable in column 1 is upward biased due to the omission of unobserved heterogeneity, consistent with the argument of CLT. Further, in the export equation the coefficient on lagged exports is now negative but insignificant. The reason is that the estimate σ_ψ, the standard deviation of the random effect ψi, is very high indeed. This would imply that the observed persistence in the export data documented in column 1 is entirely due to unobserved time invariant heterogeneity and not driven by causal effect of past onto contemporaneous exporting as predicted by all sunk cost model.

In the production function, all coefficients on the input factors are significant and the long-run elasticities sum to 1.03. In the export equation the coefficient on labour productivity is positive but insignificant, providing little evidence for self-selection. May be the study fails to obtain a direct self-selection effect due to the fact that labour productivity is strongly correlated with the factor input terms. The employment coefficient is positive and highly significant. Therefore the CLT results thus provide no evidence in favour of the learning by exporting hypothesis.

The study considered relaxing the assumption that μ and ψ are normally distributed and column 3 of Table 2 reports Non-Parametric Bivariate Firm Effects (NPLM) estimates where the bivariate distribution of μ and ψ is taken to be discrete with 3 x 3 points of support (increasing the number of support points further resulting in a very small increase in the log likelihood value). The resulting log likelihood value of 21 units, which is higher than the CLT model, indicates that the NPLM model provides a much better fit to the data than the other two models. Several results from the NPLM models are worth noting and they include:

1. The estimated coefficient on lagged exports is equal to 0.07 and significant at five percent level.
2. In fact, the point estimate is almost identical to the result shown in column 1 thus the study can now reject the hypothesis that exporting has no effect on efficiency.
3. The lower part of the table shows that the estimated standard deviations of μ and ψ are correlated. It is therefore not surprising that some of the coefficients in the production function and the export equation are rather different.
4. Further in the exports equation, the coefficient on lagged exports is now significant and much higher than the CLT model.
5. Finally, it also noted that the long-run elasticities in the production function sum to 1.02, that in the export equation the coefficient on labour productivity is positive but insignificant and that the employment coefficient is positive and highly significant

In conclusion, the study do not reject the null hypothesis, hence there is support for the learning-by-exporting-hypothesis among Sub-Saharan African manufacturing firms.

Summary and Implications of Findings

In trying to establish if the learning by exporting hypothesis is supported by the behaviour of Sub-Saharan African firms, the study reveals several results from the three models employed which include:

a. The estimated coefficient on lagged exports is equal to 0.07 and significant at five percent level.
b. The study can now reject the hypothesis that exporting has no effect on efficiency, therefore concluding that the null hypothesis of this study is accepted. In other words, the result supports the learning-by-exporting-hypothesis.
c. Long-run elasticities in the production function sum to 1.02, that is in the export equation the coefficient on labour productivity and this is positive but insignificant whereas that of the employment coefficient is positive and highly significant

The result that there is support for the learning by exporting hypothesis is an important one. Africa's domestic markets for manufacturers are so small, in fact, less than that of China or India. African has much more to gain from orienting its manufacturing sector towards exporting but need to increase expenditure in Research and Development (R&D) to maintain this.

Policy Recommendations and Conclusion

Based on the above findings, the study wishes to make some recommendations that will be useful in improving productivity, efficiency and export of manufactured commodities in SSA.

From the policy perspective, the finding that there is support for learning by exporting is an important one since SSA domestic market for manufactures is a small one, which has necessitated the need to industrialise especially towards exporting manufactures. With SSA being able to learn from exporting of manufactures, they have much gain from orienting their manufacturing sector towards exporting. The study recommends further research on the subject issue to clarify some debatable issues raised.

There is strong evidence that sound economic policies are enormous for economic development, while poor policies result in a nexus of constraints from which escape is difficult, if not impossible. Policies that can reduce indirect costs will be an asset to SSA manufacturing sector. This, aside from reducing both the production and transaction costs may also increase profitability, which will increase the fund at the disposal of the firms. With such funds the firms should be able to invest more in Research and Development (R&D), which is currently non-existent among most firms because they barely break even at the end of every fiscal year. Clearly improving macroeconomic policy, reducing the level of risk and the size of transaction costs are key ingredients of policy. High production and transaction cost (indirect costs) were found to constitute the constraints for exporting both in Nigeria and Africa at large. Firm-level issues are also important and they include the training of the workforce, the amount of capital equipment used in the firms and the efficiency of the firms.

Finally there is the need for extension of incentives given to foreign firms to indigenous firms since there is evidence of efficiency improvement, which the study believes will heighten their export propensity with the support of learning by exporting hypothesis.

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