Growth, learning, entry and exit among African exporters.*

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Abstract

This paper investigates whether African manufacturing exporters are more productive than non-exporters and whether these productivity differences precede entry into the export market. We find that exporters are more productive but that productivity does not matter for entry into the export market – suggesting that learning-by-exporting is important. We investigate the nature of this relationship and find that exporters do not have higher rates of productivity growth than non-exporters. This suggests that those firms that remain in the export market are able to learn or that exporting sorts firms by productivity with only the more productive firms remaining as exporters. A robust finding is that entry into the export market is associated with a significant increase in employment – a 56 percent increase over seven years. This helps to explain why exporters are larger than non-exporters.

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1. Introduction

There is a growing body of empirical evidence that exporters are more productive than non-exporters. Many of these studies find that these productivity differences precede entry into the export market – more productive firms self-select into exporting. However, particularly amongst developing countries, there is evidence that learning-by-exporting occurs – firms become more productive through participation in the export market – often in conjunction with self-selection. Previous studies on African firms find that both self-selection and learning-by-exporting are present among African manufacturers.[1]

This paper begins by examining the relationship between exporting and productivity among African firms. However, because we have longer runs of data than previously available for African firms we are able to examine the dynamic or long-run relationship between exporting and productivity. We investigate whether exporters have higher rates of productivity growth than non-exporters. Most previous work has investigated the difference in the level of productivity between exporters and non-exporters rather than the difference in growth rates that may help explain these levels. This is the first paper to investigate this in the African context.

A robust finding in almost all studies of exporting firms is that exporters are larger in terms of size and output than non-exporters. We investigate whether this might be the result of higher growth in output and employment among exporters. We also investigate whether exporters have higher rates of capital and raw material growth than non-exporters.

Finally, we investigate the determinants of entry into and exit from the export market. The longer time span of data available to us allows for previous export status to be controlled for. We specifically investigate whether the factors influencing entry into exporting differ from those affecting exit.

[1] See for example Bernard and Jensen (1995, 1999a, 1999b, 2001) for evidence on the US, Clerides, Lach and Tybout (1998) for Colombia and Mexico, Kraay (1999) for China, Bigsten *et al* (2002), van Biesebroeck (2003) and Rankin, Söderbom and Teal (2005) for Sub-Saharan Africa.

The nature of the productivity-exporting relationship for African firms has important consequences for industrial policy. In most African countries the size of the domestic market is limited and volatile necessitating the development of viable export industries (Easterly and Kraay, 2000). Understanding what constrains firms from exporting, and particularly the exporting-productivity relationship is a step towards this. For example, if there is no self-selection and firms learn-by-exporting then firms should be able to enter the exporting market easily and experience productivity improvements because of this. However, if self-selection is important then firms may have to reach some productivity threshold to be able to enter exporting. Policy to encourage exporting would then have to focus on improving productivity. The nature of the learning process is important too. If exporters have higher rates of productivity growth than non-exporters – through say larger spill-overs in the international market – then we would anticipate a widening productivity gap between those in the export market and those outside it. This might suggest that the longer a firm stays out of the export market, the more difficult it is for it to get into exporting as the required productivity threshold may have increased. Alternatively, if learning is a once-off movement to a higher level of productivity then later entrants into the export market may be able to reach the productivity levels of earlier entrants.

This paper is structured as follows. The next section describes the modelling framework used to investigate the four aspects of the exporting-productivity-growth nexus: exporting and productivity levels; exporting and productivity growth; exporting and output and inputs growth; and entry into and exit from the export market. The third section describes the data. Section 4 presents the estimation results. Finally, Section 5 concludes.

2. The Modelling framework

2.1 Exporting and productivity levels

In order to investigate whether exporters have higher levels of productivity we estimate a Cobb-Douglas production function:

$$y_{it} = \ln(A_i) + \phi B_i + \gamma X_{it-1} + \alpha k_{it} + (\alpha + \beta + \delta + \varphi - 1)\ln(L_{it}) + \delta m_{it} + \varphi o_{it} + \mu_t + \eta_{it} \quad (1)$$

where:

y_{it} is log gross output per employee;

A_i is a vector of unobserved firm-specific characteristics;

B_i is a vector of observed firm-specific characteristics;

X_{it-1} is whether a firm exported in the previous period;

k_{it} is the log of the capital stock per employee;

L_{it} is the log of the level of employment;

m_{it} is the log of the level of raw materials used in the production process;

o_{it} is log of other indirect costs such as electricity, water and transport;

μ_t is a vector of time dummies to account for time varying productivity;

η_{it} is the standard disturbance with mean zero and variance σ_η^2.

η_{it} is the residual or the part of the log of gross output per employee not explained by firm-specific characteristics, export participation, or other inputs. It therefore can be interpreted as the productivity of the firm once all these other factors are accounted for. Differences in productivity will be the result of unobserved characteristics of the firm such as skills, technology, market structure, or managerial ability.

γ the coefficient on lagged exports can be interpreted as learning-by-exporting.

The OLS estimator will be biased if the regressors are contemporaneously correlated with the error term. In this context there are three reasons why this may be so. These are: potential endogeniety of inputs and export participation; measurement error in one, or more, of the regressors; and firm heterogeneity. The first reason – the potential endogeneity of inputs and export participation – will occur if firms choose how much

they produce, their input mix and whether to export at the same time. If this is the case there will be contemporaneous correlation between these variables and the error term, thus violating one of the key assumptions of OLS estimation.

The second possible source of contemporaneous correlation between the error term and the regressors may be due to measurement error in one, or more of the explanatory variables.

An instrumental variable (IV) estimator is used to control for possible contemporaneous correlation between the regressors and the disturbance term. This deals with the potential problems of endogeneity and measurement error. Lagged values of the potentially endogenous variables are used as instruments.

The third possible cause of contemporaneous correlation between the regressors and the error term, is firm heterogeneity. The productivity of a firm will affect its input decisions, introducing correlation between firm-level efficiency and the input coefficients. Although observed firm-specific effects, such as foreign ownership, which may influence firm-level efficiency, can be controlled for, unobserved firm effects, such as good management or the human capital present in a firm, cannot. If a straightforward OLS estimation technique is used these unobserved characteristics, which are potentially correlated with the other explanatory variables, will be part of the error term. There is therefore potential contemporaneous correlation between the explanatory variables and the error term.

Unobserved firm effects can be controlled for by using a fixed-effects estimation procedure. However, this does not deal with the potential measurement error and endogeneity problems. To overcome these problems we use an estimation technique developed by Griliches and Hausman (1986) which combines the coefficient estimates from various levels of differences. This technique uses information present in longer differences, where the signal to noise ratio should be higher, to identify the coefficients. Griliches and Hausman (1986) have demonstrated that with panel data 'internal' values

may be used as valid instruments. The set of valid instruments depends crucially on the stationarity of the measurement errors and their 'partial' correlation (the MA process). In the most simple case of non-stationary v's (measurement errors) and no correlation, first-differenced independent variables may be instrumented by the levels of these variables in the periods two periods prior to and/or the level of the variable in the next period i.e., x_3-x_2 may be instrumented by x_1 and/or x_4. Likewise second-differenced RHS variables can be instrumented by all levels of variables except those two periods prior. Griliches and Hausman (1986) estimate separate equations for each level of difference and each period. The estimates are then combined in a systems estimator where the coefficients are constrained to be equal and the covariance of the stochastic disturbances (the covariance of η_{it}) is taken into account in weighting them and computing the resulting coefficient. The Generalised Method of Moments (GMM) estimator, developed by Hansen (1982) and White (1982), is used to combine 2SLS estimates of individual period and difference equations.

As with the fixed-effects method the drawback of using the Griliches and Hausman (1986) differenced method to examine the impact of export participation on productivity is that the results are driven by firms which switch into or out of the export market. Taking differences eliminates both continuous exporters and firms that never export. A further drawback is that at least three consecutive years of data are required. This reduces the number of observations considerably and eliminates all observations from South Africa and most from Nigeria. Furthermore, because the panel is unbalanced and contains many more shorter runs of data than longer runs this may cause the shorter differences, which are likely to have a higher noise to signal ratio, to have a larger influence than the longer differences. In order to check this the Griliches and Hausman (1986) estimations have been run on a sample that excludes the first-differences. Similar results, to those reported here, are obtained.

In the estimation, variable values one period prior to the earliest difference are used as instruments. This makes the assumption of no correlation in measurement error. Both 1-step and 2-step GMM estimation is used. This is because Monte Carlo studies have

found that the estimated asymptotic standard error of the 2-step GMM procedure are severely downward biased in small samples, whereas the standard errors of 1-step GMM estimators are virtually unbiased (Windmeijer, 2000)[2]. We treat the 2-step coefficient estimates as our preferred coefficient estimates and the 1-step standard error estimates as our preferred estimates of the standard errors.

2.2 Exporting and productivity growth

In the static production function (1) firm-specific effects can be differenced out. Thus if equation:

$$y_{it} = a_i + \gamma X_{it} + \alpha k_{it} + (\beta - 1 + \alpha + \delta + \varphi)\ln(L_{it}) + \delta m_{it} + \varphi o_{it} + \eta_{it} \quad (2)$$

is lagged one period:

$$y_{it-1} = a_i + \gamma X_{it-1} + \alpha k_{it-1} + (\beta - 1 + \alpha + \delta + \varphi)\ln(L_{it-1}) + \delta m_{it-1} + \varphi o_{it-1} + \eta_{it-1} \quad (3)$$

and the two equations differenced, the firm specific effect a_i is eliminated.

$$\Delta y_{it} = \gamma \Delta X_{it} + \alpha \Delta k_{it} + (\beta - 1 + \alpha + \delta + \varphi)\Delta \ln(L_{it}) + \delta \Delta m_{it} + \varphi \Delta o_{it} + \Delta \eta_{it} \quad (4)$$

Although in this equation the variables are growth rates, or changes between the two periods, the coefficients are equal to the original coefficients equation (2) and can be interpreted as levels effects. Lagging equation (2) by longer than one period produces similar results. We extend this idea to investigate the impact of exporting on productivity growth. In order to investigate whether export participation has an impact on the growth of productivity we include export participation on the right hand side. We also include variables to control for country, sector and observed firm characteristics. The specification to be estimated takes the form:

[2] This is because 1-step GMM estimators use weight matrices that are independent of the estimated parameters, whereas the 2-step GMM estimator weights the moment conditions by a consistent estimate of their covariance matrix. This weight matrix is constructed using an initial consistent estimate of the parameters of the model. Windmeijer (2000) offers an in depth explanation and a correction for the 2-step variance.

$$\Delta^d y_{it} = A_i + \gamma_1 X_d^{continuous} + \gamma_2 X_d^{entrant} + \gamma_3 X_d^{exit} + \alpha \Delta^d k_{it} + (\beta + \alpha + \delta + \varphi)\Delta^d \ln(L_{it}) + \delta \Delta^d m_{it} + \varphi \Delta^d o_{it} + \Delta^d \eta_{it} \quad (5)$$

Where: A_i represents firm specific effects, which include country and sector dummies, and is included to allow for growth rates to differ across firms, X_d is a vector of export status dummies, d is the level of difference. Unlike the levels specification this model is not integratable to a Cobb-Douglas levels production function. The impact of observable firm-specific effects, such as age and ownership, on growth can be examined by including these in A_i. The relationship between growth and country- and sector-specific effects can also be investigated by including dummies for these variables.

Firms can be classified into four groups depending on their export status: non-exporters, continuous exporters, entrants, or exits. The coefficient on the export status dummy measures productivity growth of that group relative to a base category. In (5), and our estimations, this is relative to non-exporters.

By varying the length of difference the impact of exporting, and other factors on productivity growth over different periods can be examined. Over short periods it is likely that growth in the variables will be obscured by measurement errors. This is particularly the case if there is little growth in these variables. Over long periods the signal to noise ratio should diminish.

2.3. Exporting and output, input and profit growth

Exporting may also affect the growth rate of inputs or of output. This may be the case even if there is no change in productivity. In order to examine the impact of exporting on output growth the following equation is estimated:

$$\Delta^d y_{it} = A_i + \gamma_1 X_d^{continuous} + \gamma_2 X_d^{entrant} + \gamma_3 X_d^{exit} + \beta \overline{\ln(L_{it})} + \Delta^d \eta_{it} \quad (6)$$

where: d is the level of difference, A_i are firm-specific characteristics and can include observed characteristics such as age and ownership, sector- and country-effects, and unobserved characteristics. The average size, as measured by average employment, is included in order to investigate whether size matters for growth. It is important to control for size because this may proxy for a number of unobserved characteristics such as access

to finance, skills or market power. It is also important to be able to separate the impact of size on growth from the impact of export participation on growth.

The impact of exporting on the growth of factor inputs is estimated:

$$\Delta^d z_{it} = A_i + \gamma_1 X_d^{continuous} + \gamma_2 X_d^{entrant} + \gamma_3 X_d^{exit} + \beta\overline{\ln(L_{it})} + \Delta^d \eta_{it} \quad (7)$$

where the variables are as before except that z_{it} is a factor input, such as employment.

2.4 Entry and exit.

By explicitly modelling entry and exit we are able to investigate the role of productivity in exporting in more detail. The determinants of entry and exit can be expressed as:

$$X_{it}^{entry} = f(\eta_{it-1}, z_{it-1}^{'}, B_i, a_i), \text{ if } X_{it-1} = 0 \quad (8)$$

$$X_{it}^{exit} = f(\eta_{it-1}, z_{it-1}^{'}, B_i, a_i), \text{ if } X_{it-1} = 1 \quad (9)$$

Where the notation is as before but the superscript denotes the entry and non-exit equations.

Technical efficiency is represented as the residuals, or unexplained part, of a production function. However, instead of using a two-step process, the first step of which is to estimate the production function to obtain the residuals and the second to insert these residuals into the export participation function, we chose instead to manipulate the production function and to substitute the components of the production function into the export function.

Thus linearising (8) and (9) and substituting the arguments of the production function for the efficiency term gives:

$$X_{it}^{entry} = \xi_\eta y_{it-1} + (\xi_a - \xi_\eta)a_i + (\xi_B - \xi_\eta\phi)B_i + (\xi_z^{'} - \xi_\eta\theta_z^{'})z_{it-1}^{'} \text{ if } X_{it-1} = 0 \quad (10)$$

$$X_{it}^{exit} = \xi_\eta y_{it-1} + (\xi_a - \xi_\eta)a_i + (\xi_B - \xi_\eta\phi)B_i + (\xi_z^{'} - \xi_\eta\theta_z^{'})z_{it-1}^{'} \text{ if } X_{it-1} = 1 \quad (11)$$

The entry equation is estimated conditional on the firm not participating in the export market in the previous period and thus compares continued non-exporting to entry into the export market. The exit, or more specifically non-exit, equation is estimated

conditional on the firm exporting in the previous period, and thus compares continued exporting to exit. We estimate these two equations separately using a probit, as well as a random-effects probit, estimator.

As can be seen from equations (10) and (11) the impact of efficiency on export participation is measured by (ξ_η), the coefficient on lagged output per unit of labour (y_{it-1}). These equations also show that the coefficients on the observed firm-specific effects and factor inputs are a combination of two effects. The first of these effects is the efficiency effect (ξ_η). This efficiency effect has the opposite sign to the coefficient on y_{it-1}. (i.e. if there is a positive efficiency effect and no second effect, this will show up as a negative coefficient on the factor inputs and firm-specific effects). This efficiency effect is scaled by the coefficient on the variable in the production function (i.e. $\theta_z^{'}$ in the case of the factor inputs and ϕ in the case of the observed firm characteristics). In the case of constant returns-to-scale in the production function, which we can ascertain from the estimate of the coefficient on the employment variable in the production function, the coefficient on labour (θ_l in the $\theta_z^{'}$ vector of factor inputs) will be equal to 0. This means that there will be no efficiency effect present in the coefficient on labour. The second effect present in the coefficients is the direct effect of that variable on export participation (ξ_z). By using this one-step technique, we cannot isolate the direct effect unless the coefficient on the variable in the production function is equal to 0, as it will be on employment if we assume constant returns-to-scale.

Although the possible presence of these two effects in the coefficients on the factor inputs makes it difficult to isolate the individual effects, we can still draw conclusions from the coefficients on the factor inputs provided we are able to sign the efficiency effect. Since we know $\theta_z^{'}$ and ϕ from the production function estimates, we know the scaling factor, and thus can work out whether a direct effect exists.

Another factor to consider when analysing the results is the possible correlation between size, efficiency, capital-intensity and other factor inputs. The possible multicollinearity between these variables will increase their standard errors and subsequently lower their z-

statistics. In the estimations we attempt to deal with this by restricting some coefficients to be equal to 0.

3. Data

The data used in this paper comes from firm-level surveys conducted in five African countries during the 1990s. The surveys of the Ghanaian, Kenyan and Tanzanian manufacturing sectors were initiated by the World Bank in the early 1990s as part of a wider programme of surveys. These surveys, as part of the Regional Programme on Enterprise Development (RPED), collected three years of panel data. In the second half of the 1990s researchers at the Centre for the Study of African Economies (CSAE) at the University of Oxford revisited the firms originally covered by the RPED surveys. Firms were asked for past information in order to fill in the 'gaps' between the surveys. A panel data set was thus constructed with a maximum time dimension of 8 years for some firms.

The original samples in these countries were based on a stratified sampling methodology. Sector, location and size were the main characteristics used for stratification. Larger firms were over-sampled as these were found to be more heterogeneous than smaller firms. The repeat surveys attempted to revisit the original firms. If firms dropped out of the sample because they closed down, were unwilling to cooperate, moved or could not be located, they were replaced by firms of similar size, sector and location.

The Nigerian data comes from a survey that took place in 2001. This survey was organised by the United Nations' Industrial Development Organisation (UNIDO) and carried out jointly with the CSAE. Information on firm performance over the period 1998–2000 was gathered. The survey was designed so that the data is comparable with the RPED surveys. This meant that a similar questionnaire and sampling strategy were followed.[3]

[3] Teal (1998); Söderbom (2001); Söderbom and Teal (2002b); Harding, Kahyarara and Rankin (2002); Harding, Söderbom and Teal (2002) and Rankin, Söderbom and Teal (2002) all provide details on the Ghanaian, Kenyan, Nigerian and Tanzanian surveys and data.

The South African dataset is the only one of the five countries that is not nationally representative. The survey took place in 1999 and covered large firms (50+ employees) in the Greater Johannesburg Metropolitan Area (GJMA). The GJMA is the largest and most important industrial area in South Africa. This survey was undertaken by the World Bank in conjunction with the Greater Johannesburg Metropolitan Council (GJMC). The survey covered eight sectors: chemical products; electrical/electronic machinery; food processing and beverages; iron and steel; metal products; paper and furniture; textiles and vehicles and automotive components. Firms were selected according to a stratified sampling process. Although the sample is not representative of South African manufacturing as a whole (the textile sector and food processing sector are under represented) it does include firms in the most important manufacturing sectors. The questionnaire used for this survey was not directly comparable to that used in the other four countries. However, the variables of interest can be compared across countries. One year of recall data was asked for and thus the South African data covers the period 1997–1998.[4]

A dataset of 2,078 observations was created. This dataset only includes firms for which two or more consecutive years of data are available. The sample structure broken down by country, year and sector is presented in Table 1. The majority of observations in the sample (836) are from Ghana. The observations for Ghana cover the period 1992–1993 and 1996–1999.[5] Kenya and Tanzania have a similar number of observations (462 and 488 respectively) and together make up approximately 45% of the sample. Observations for Kenya stretch from 1993–1999 but there are very few observations for the mid-1990s. This is because no surveys were carried out then and the data for the mid-1990s is recall data asked for in a later round. The data for Tanzania is for 1993 and 1996–2000. The South African and Nigerian observations are similar in number and make up 15% of the

[4] Information about the South African survey, as well as the data and a report on the survey, can be found on the Trade and Industrial Policy Strategies (TIPS) website (www.tips.org.za).
[5] Ghanaian firms were surveyed in 1995 but no exporting related questions were asked about 1994.

sample. The Nigerian data covers two years – 1999–2000 – and the South African data one year only – 1998.[6]

Table 1 Sample structure

	Country					
Year	Ghana	Kenya	Tanzania	Nigeria	South Africa	Total
1992	123	0	0	0	0	123
1993	123	140	114	0	0	377
1994	0	134	0	0	0	134
1995	0	10	0	0	0	10
1996	144	8	20	0	0	172
1997	165	11	53	0	0	229
1998	140	16	95	0	147	398
1999	141	143	87	67	0	438
2000	0	0	119	78	0	197
Total	836	462	488	145	147	2,078

Sector	Ghana	Kenya	Tanzania	Nigeria	South Africa	Total
Wood processing	79	42	44	2	0	167
Furniture	168	77	103	12	19	379
Foods, beverages and bakeries	203	95	106	12	8	424
Metal products and machinery	196	122	143	48	112	621
Textiles (except SA)	26	35	46	36	0	143
Garments (except SA)	164	91	46	35	0	336
Textiles and garments (SA only)	0	0	0	0	8	8
Total	836	462	488	145	147	2,078

Firms were grouped into comparable sectors. This was straightforward for Ghana, Kenya, Tanzania and Nigeria as the surveys in these countries covered similar sectors. In order to compare South Africa with these countries the South African chemical products sector was dropped and a separate South African textiles and garments sector created. Most of the South African firms were allocated to the metal products and machinery sector. This sector has the most observations in the sample as a whole and in all countries

[6] Table 1 describes the sample once lagged values have been accounted for. If lagged values are not used the data covers the following periods: Ghana 1991–1993, 1995–1999; Kenya 1992–1999, Tanzania 1992–1993, 1995–2000, Nigeria 1998–2000, South Africa 1997–1998.

except Ghana. In Ghana the foods, beverages and bakeries sector has the highest number of observations. The foods, beverages and bakeries and the furniture sector have the next highest number of observations for the sample as a whole. The sector with the least number of observations is the South African textiles and garments sector. The wood processing and the textiles sectors are the next smallest sectors.

In order to compare firm performance across countries and over time, variables were converted to 1991 US$ prices. For Ghana, values for output and inputs were deflated using a firm-specific price deflator. For Kenya and Tanzania sector-specific deflators were used. These were then converted to US$. In the case of Nigeria and South Africa, values were first converted to US$ and then deflated using the US GDP deflator.

The employment data combines full- and part-time employees. Part-time employees are counted as one half of a full-time worker. The capital stock is calculated using a perpetual investment method. Thus the capital stock in the current period is calculated as the capital stock in the previous period minus depreciation, plus investment. A low depreciation rate was used. This is because in most cases the capital stock is very old. This low depreciation rate, together with very little investment by many of the firms in the sample, means that there is little change in the capital stock for many of the firms. It also means that any observed large change in the capital stock is a result of investment (or disinvestment).

Export participation is represented by a dummy variable. This is created from a question that asks whether a firm exported during the period or not. This may undercount exporters if the firm did not export themselves but their products were exported through other firms or middle-men. Table 2 presents export propensity by country and sector. South African firms are the most likely to export followed by Kenyan firms. Nigerian firms are the least likely to participate in the export market. Firms in the wood and

textiles sectors are the most likely to participate in the export market[7], those in the furniture and garments sector are the least likely.

Table 2 Export propensity: by country and sector

	Ghana	Kenya	Tanzania	Nigeria	South Africa	Total
Wood						
Mean	0.80	0.14	0.18	0.00		0.46
n	79	42	44	2	0	167
Furniture						
Mean	0.11	0.27	0.02	0.00	0.63	0.14
n	168	77	103	12	19	379
Foods						
Mean	0.09	0.43	0.34	0.17	0.63	0.24
n	203	95	106	12	8	424
Metal & machinery						
Mean	0.14	0.47	0.10	0.02	0.72	0.29
n	196	122	143	48	112	621
Textiles (except SA)						
Mean	0.42	0.83	0.28	0.11		0.40
n	26	35	46	36	0	143
Garments (except SA)						
Mean	0.06	0.14	0.15	0.17		0.11
n	164	91	46	35	0	336
Textiles & Garments (SA)						
Mean					0.75	0.75
n	0	0	0	0	8	8
Total						
Mean	0.18	0.36	0.17	0.09	0.71	0.25
n	836	462	488	145	147	2,078

Notes: Observations are for firms over time and thus firms may be counted more than once.

4. Results

4.1 Are exporters different from non-exporters?

Investigation of export behaviour at the firm-level across a number of countries (for example Bernard and Jensen, 1995, 1999a, Clerides, Lach and Tybout, 1998, Aw, Chen and Roberts, 2001, Bigsten *et al*, 2002) reveals striking consistencies in export behaviour and the relative performance of firms. Exporting firms are generally a minority of the sample; they tend to be larger and more productive; and most export only a small

[7] This excludes South African firms in the textiles and garments sector as the sample size in this category is too small to say anything meaningful.

proportion of total output. Furthermore, these results do not seem to depend on the sector of the firm.

Table 3 presents mean values for a number of variables broken down by country and export participation to investigate whether the characteristics of exporters in African countries are similar to those in other countries. Across all countries the results show clear similarities: exporters have higher levels of labour productivity, are larger, more capital intensive, tend to be older[8] and are more likely to be foreign owned.

Table 3 The characteristics of non-exporting and exporting firms

	Output per employee		Value added per employee		Employment		Capital per employee		Age		Foreign ownership	
	Non exporter	Exporter	Non exporter	Exporter	Non exporter	Exporter	Non exporter	Exporter	Non exporter	Exporter	Non exporter	Exporter
Ghana												
Mean	7.99	8.69	6.90	7.59	2.90	4.76	6.79	8.62	17.77	20.58	0.15	0.47
Std Dev.	1.28	0.99	1.35	1.20	1.27	1.23	1.96	1.42	12.01	12.25		
N	688	148	636	141	688	148	688	148	688	148	688	148
Kenya												
Mean	8.57	9.55	7.41	8.35	2.76	4.72	8.13	9.67	21.37	21.32	0.11	0.35
Std Dev.	1.21	1.19	1.35	1.21	1.39	1.20	1.61	1.07	14.65	10.96		
N	295	167	269	160	295	167	295	167	295	167	295	167
Tanzania												
Mean	7.98	9.13	6.81	7.88	2.81	4.45	7.45	9.00	16.54	21.05	0.16	0.36
Std Dev.	1.30	1.27	1.22	1.25	1.31	1.42	1.74	1.67	11.88	15.70		
N	407	81	403	81	407	81	407	81	407	81	407	81
Nigeria												
Mean	8.53	9.36	7.02	8.02	3.57	4.87	8.50	8.68	20.21	25.46	0.27	0.38
Std Dev.	1.47	1.03	1.33	0.88	1.82	2.52	2.06	1.72	9.80	13.49		
N	132	13	130	13	132	13	132	13	132	13	132	13
South Africa												
Mean	10.28	10.70	9.44	9.76	4.51	5.05	9.57	9.75	17.35	22.78	0.14	0.29
Std Dev.	0.56	0.65	0.69	0.79	0.75	0.85	1.16	1.22	16.13	17.61		
N	43	104	42	102	43	104	43	104	43	104	43	104
Total												
Mean	8.20	9.46	7.05	8.34	2.95	4.76	7.43	9.25	18.32	21.46	0.16	0.37
Std Dev.	1.34	1.27	1.38	1.37	1.39	1.24	1.96	1.41	12.58	13.72		
N	1565	513	1480	497	1565	513	1565	513	1565	513	1565	513

Notes: The values for gross output per employee, value added per employee, employment and capital per employee are given in natural logarithms; firm age is in years and foreign ownership is the proportion of observations of firms that have some foreign ownership.
There is a smaller number of observations for value added per employee because taking the natural logarithm eliminates observations with negative value added.

Although these results indicate that, in terms of labour productivity, exporters are more productive than non-exporters, they do not control for factor inputs, nor other characteristics of the firms. To ascertain whether exporters have higher levels of total

[8] The firms in this sample are on average 19 years old. There has been very little recent entry of new firms into the manufacturing sector in many of these countries.

factor productivity than non-exporters we need to estimate a production function to control for inputs and other firm characteristics.

4.2 Exporting and productivity levels.

Table 4 presents the results of the production function estimates. We use four techniques: ordinary least squares (OLS); instrumental variables (IV); fixed effects; and the Griliches and Hausman technique. For each technique we initially allow for economies of scale (first column) but also restrict the specification to constant returns to scale (second column). We control for observed firm characteristics including age and ownership, as well as include sector, country and time controls.

Table 4. Gross output production function estimates: summary

	OLS		IV (exports endogenous)		Fixed effects		Griliches and Hausman (combined)	
							exports exogenous	exports endogenous
$(Labour)_{it}$	0.017		0.009		-0.079			
	(2.1)**		(0.66)		(-1.57)			
(Capital/ $labour)_{it}$	0.04	0.043	0.028	0.029	0.052	0.105	0.012	-0.058
	(4.26)***	(4.75)***	(2.44)**	(2.56)**	(1.2)	(3.98)***	(0.05)	(-0.75)
(Materials/ $labour)_{it}$	0.646	0.647	0.711	0.712	0.608	0.609	0.916	0.723
	(29.21)***	(29.24)***	(40.55)***	(40.58)***	(44.69)***	(44.82)***	(14.54)***	(8.22)***
(Other costs/ $labour)_{it}$	0.187	0.189	0.173	0.176	0.125	0.126	0.121	0.173
	(10.77)***	(10.89)***	(8.65)***	(8.94)***	(7.93)***	(8.03)***	(1.44)	(1.80)*
$(Exports)_{it-1}$	0.059	0.075	0.058	0.073	0.073	0.069	0.084†	0.086†
	(2.3)**	(2.98)***	(1.06)	(1.45)	(1.66)*	(1.57)	(1.56)	(1.79)*
R-squared	0.92	0.92	0.907	0.907	0.901	0.910		
N	2,078	2,078	960	960	2,078	2,078	1,504	1,504

Notes: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
Values in parenthesis are t-statistics.
Inputs and output are expressed in natural logarithms.
Lagged values of the endogenous variables and the set of exogenous variables are used as instruments in the IV estimation.
† Current exporting status is used in the Griliches and Hausman technique.
Values one period prior to the earlier period differenced are used as instruments for the Griliches and Hausman estimate.
The combined Griliches and Hausman column is the 2-step GMM coefficient estimates and the 1-step GMM standard errors.

The point estimates on the export variable are very similar across specifications. After controlling for measurement error, firm heterogeneity and endogeneity the coefficient on exporting remains significant at the 10 percent level. These results suggest that firms that exported in the previous period have a current level of productivity between 5.8 and 8.6 percent higher than previous period non-exporters.

4.3 Exporting and productivity growth.

The results above indicate that previous period exporters have higher productivity levels than previous period non-exporters. This is interpreted as evidence of learning-by-exporting. To investigate the nature of this learning process we examine whether the productivity growth rates between continuous exporters, continuous non-exporters, entrants and exits differ. Firms are classified into one of these groups depending on their export status at *t* and *t-d*.[9] Results for different lengths of *d* are presented in Table 5. These results indicate that there is very little robust evidence that firms in the different classifications have different growth rates. There is no evidence that exporters have higher growth rates than non-exporters. The point estimates on the entrants dummy are positive for shorter lengths of difference but not significant. This may suggest that entrants experience higher growth rates of productivity immediately prior and during entry. However, our data does not allow us to investigate this further.

Table 5 Productivity growth, gross output specification, OLS

Order of difference (*d*):	1	2	3	4	5	6	7
Δ^d(capital/labour)$_{it}$	0.103	0.076	0.059	0.089	0.039	0.013	0.058
	(3.76)***	(2.69)***	(1.72)*	(3.06)***	(1.24)	(0.4)	(1.61)
Δ^d(materials/labour)$_{it}$	0.631	0.658	0.662	0.664	0.705	0.727	0.686
	(39.05)***	(39.54)***	(38.77)***	(32.45)***	(30.65)***	(28.72)***	(20.96)***
Δ^d(other costs/labour)$_{it}$	0.124	0.125	0.158	0.125	0.122	0.113	0.148
	(9.24)***	(9.04)***	(9.65)***	(7.35)***	(6.59)***	(5.11)***	(5.69)***
Age$_i$	0.001	0.001	0.002	0.000	-0.001	0.001	0.002
	(1.19)	(0.83)	(1.17)	(-0.1)	(-0.6)	(0.7)	(0.81)
Foreign ownership$_i$	-0.003	-0.037	-0.023	-0.015	0.055	0.066	0.038
	(-0.18)	(-1.15)	(-0.54)	(-0.29)	(0.95)	(0.94)	(0.43)
Average employment^d_i	0.005	-0.001	-0.015	-0.041	-0.042	-0.006	-0.019
	(0.75)	(-0.13)	(-0.99)	(-2.3)**	(-1.99)**	(-0.25)	(-0.61)
Continuous exporters$^d_{it}$	-0.033	-0.038	-0.014	-0.003	-0.052	-0.169	-0.179
	(-1.61)	(-1)	(-0.28)	(-0.06)	(-0.74)	(-2.11)**	(-1.67)*
Entrants$^d_{it}$	0.021	0.066	0.047	0.168	0.079	-0.202	-0.061
	(0.39)	(1.22)	(0.62)	(1.73)*	(0.88)	(-2.03)**	(-0.51)
Exits$^d_{it}$	0.136	-0.074	0.003	0.145	-0.032	-0.210	-0.239
	(2.47)**	(-1.47)	(0.04)	(1.94)*	(-0.37)	(-2.05)**	(-1.95)*
Country controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls?	No	No	No	No	No	No	No
Time trends?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.760	0.784	0.818	0.791	0.791	0.803	0.792
N	1,589	1,128	751	654	555	472	309

Notes: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
Values in parenthesis are t-statistics. Inputs and output are expressed in natural logarithms
Stata 8.0 SE command *hadimvo* used to eliminate outliers.
A p-value of 0.2 used.

[9] *d* is the length of difference between the two observed years.

4.4 Exporting and output and inputs growth.

Although we have found little evidence of differences in productivity growth between exporters and non-exporters this does not necessarily mean that the rates of growth of output, value-added, employment, the capital stock or raw materials are the same between exporters and non-exporters. In fact, the results presented in Table 6 indicate that there are significant differences across categories.

These results suggest that firms that enter exporting increase their output but firms that exit exporting experience a contraction in output over longer time periods. The contraction in output over the five to seven years during which a firm exits exporting averages between 5 and 11.6 percent a year. This contraction is large in magnitude and means that a firm reduces its output by over half in a six year period.

There is robust evidence that entrants into the export market increase employment dramatically. In the seven year period during which a firm enters exporting employment increases on average by 56 percent. This is an 8 percent increase per annum. There is no significant evidence that the contraction in output experienced by firms that exit is accompanied by a contraction in employment.

Table 6 Growth results

Length of difference (*d*)	1	2	3	4	5	6	7
Productivity (gross output, CRTS production function)							
Continuous exporters$^{d}_{it}$	-0.033	-0.038	-0.014	-0.003	-0.052	-0.169	-0.179
	(-1.61)	(-1)	(-0.28)	(-0.06)	(-0.74)	(-2.11)**	(-1.67)*
Entrants$^{d}_{it}$	0.021	0.066	0.047	0.168	0.079	-0.202	-0.061
	(0.39)	(1.22)	(0.62)	(1.73)*	(0.88)	(-2.03)**	(-0.51)
Exits$^{d}_{it}$	0.136	-0.074	0.003	0.145	-0.032	-0.210	-0.239
	(2.47)**	(-1.47)	(0.04)	(1.94)*	(-0.37)	(-2.05)**	(-1.95)*
R-squared	0.760	0.784	0.818	0.791	0.791	0.803	0.792
N	1589	1128	751	654	555	472	309
Output							
Continuous exporters$^{d}_{it}$	0.004	0.027	-0.009	-0.031	-0.023	-0.141	-0.008
	(0.11)	(0.4)	(-0.1)	(-0.32)	(-0.18)	(-0.85)	(-0.03)
Entrants$^{d}_{it}$	0.047	0.251	0.292	0.301	0.359	0.063	0.368
	(0.56)	(2.61)***	(1.92)*	(1.87)*	(2.04)**	(0.31)	(1.3)
Exits$^{d}_{it}$	0.082	0.069	-0.024	-0.043	-0.378	-0.698	-0.352
	(0.84)	(0.63)	(-0.22)	(-0.3)	(-2.65)***	(-4.04)***	(-1.26)
R-squared	0.016	0.037	0.051	0.091	0.097	0.096	0.095
N	1589	1128	751	654	555	472	309
Value-added							
Continuous exporters$^{d}_{it}$	-0.076	-0.104	-0.095	-0.141	-0.339	-0.617	-0.427
	(-1.2)	(-1.07)	(-0.75)	(-1.08)	(-2.01)**	(-2.84)***	(-1.44)
Entrants$^{d}_{it}$	0.030	0.057	0.424	0.235	0.223	-0.339	0.010
	(0.23)	(0.5)	(2.25)**	(0.87)	(0.84)	(-1.24)	(0.02)
Exits$^{d}_{it}$	0.103	0.031	0.142	0.056	-0.308	-0.733	-0.356
	(0.78)	(0.22)	(0.91)	(0.33)	(-1.54)	(-2.94)***	(-1.01)
R-squared	0.030	0.054	0.083	0.105	0.105	0.130	0.138
N	1487	1053	698	606	504	422	277
Employment							
Continuous exporters$^{d}_{it}$	0.052	0.076	0.077	0.095	0.141	0.152	0.179
	(2.13)**	(1.88)*	(1.32)	(1.44)	(1.74)*	(1.58)	(1.18)
Entrants$^{d}_{it}$	0.068	0.211	0.174	0.253	0.246	0.397	0.560
	(1.44)	(3.26)***	(2.2)**	(3.03)***	(2.71)***	(3.46)***	(3.62)***
Exits$^{d}_{it}$	-0.025	0.021	-0.052	0.018	-0.053	-0.166	-0.237
	(-0.48)	(0.34)	(-0.72)	(0.21)	(-0.57)	(-1.5)	(-1.57)
R-squared	0.034	0.055	0.050	0.088	0.073	0.093	0.103
N	1589	1128	751	654	555	472	309
Capital Stock							
Continuous exporters$^{d}_{it}$	0.003	0.009	0.064	-0.024	-0.049	0.064	0.207
	(0.83)	(0.55)	(2.56)**	(-0.41)	(-0.61)	(0.67)	(1.65)*
Entrants$^{d}_{it}$	0.009	0.010	0.067	-0.035	0.081	0.118	0.247
	(1.32)	(0.6)	(1.92)*	(-0.68)	(1.15)	(1.32)	(1.99)**
Exits$^{d}_{it}$	0.000	-0.006	0.000	-0.111	-0.099	-0.057	-0.289
	(0.05)	(-0.4)	(0.01)	(-1.74)*	(-0.96)	(-0.44)	(-1.51)
R-squared	0.075	0.048	0.081	0.063	0.073	0.066	0.102
N	1589	1128	751	654	555	472	309
Raw materials							
Continuous exporters$^{d}_{it}$	0.044	0.092	0.035	-0.041	0.008	0.019	0.156
	(0.91)	(1.1)	(0.3)	(-0.31)	(0.06)	(0.11)	(0.62)
Entrants$^{d}_{it}$	0.006	0.185	0.201	0.115	0.263	0.240	0.444
	(0.06)	(1.67)*	(1.29)	(0.84)	(1.48)	(1.17)	(1.5)
Exits$^{d}_{it}$	-0.075	0.206	-0.031	-0.291	-0.464	-0.624	-0.098
	(-0.6)	(1.51)	(-0.22)	(-1.71)*	(-2.49)**	(-2.94)***	(-0.32)
R-squared	0.014	0.026	0.039	0.079	0.114	0.130	0.147
N	1589	1128	751	654	555	472	309

Notes: OLS results, observed firm characteristics, sector and country controlled for.
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
Values in parenthesis are t-statistics.
Inputs and output are expressed in natural logarithms.
STATA 8.0 SE command *hadimvo* used to eliminate outliers.
A p-value of 0.2 used.

4.5 Entry and exit.

The determinants of entry and exit also provide insight to productivity-exporting relationship and whether it is characterised by self-selection and/or learning-by-exporting. Prior to presenting the results for the estimations of the entry and exit equations we present some descriptive statistics on entry and exit.

The table below illustrates that, for the pooled sample of Ghana, Kenya and Tanzania, there are only 58 observations of firm entry. This is only 3.2% of the total sample or 4.2% of those firms not exporting in the previous period. Observations of exit are a similar small number – 53 observations or 3% of the total sample. This is 13.6% of the firms that exported in the previous period. These numbers indicate that a similar proportion of the sample have entered or exited the export market over the period, but the probability of entry, conditional on not participating in the export market in the previous period, is smaller than the probability of exit, conditional on participating in the export market in the previous period.

Table 7 Entry into and exit from the export market: pooled sample (excluding Nigeria and South Africa), number of observations

	X_t		
X_{t-1}	0	1	Total
0	1337	58	1395
1	53	338	391
Total	1390	396	1786

Table 8 presents the breakdown of entrants, exits and continuous exporters in the sample over various lengths of time. Between any two contiguous years approximately 6% of the sample change export status, either entering or exiting exporting. This is dramatically lower than the 22% of the sample that remain exporters. The number of firms switching status increases for differences longer than one year but remains between 10 and 13.5% of the sample for longer differences. Over longer time periods the number of continuous exporters falls. Switchers (those firms either entering or exiting) out-number continuous exporters only for differences of 7 years. These results suggest that persistence in export participation is present in the sample and is more common than entry and exit, especially over shorter differences. However over longer periods the percentage of firms entering

and exiting is similar to the percentage of continuous exporters. Given that the percentage of continuous exporters is over-estimated (because we do not know export status between the first and last periods) this indicates that although there is persistence among exporters there is also significant entry and exit over longer periods. Table 8 also indicates that over all periods of difference the percentage of continuous non-exporters is very similar. Although this is likely to over-estimate the true percentage for longer periods, it does suggest that there is a constant proportion of the firms in the sample that do not participate in the export market.

Table 8 Entrants, exits and continuous exporters

Length of difference:	1	2	3	4	5	6	7
Entry							
Entry (%) conditional on being a non-exporter	4.0	7.7	7.2	6.6	8.3	8.8	9.6
Entrants as % of total sample	3.0	6.0	5.7	5.4	6.8	7.3	8.0
N (entrants)	63	58	31	25	32	30	23
Exit							
Exit (%) conditional on being an exporter	11.1	24.2	29.9	26.1	27.1	28.2	30.6
Exits as % of total sample	2.7	5.2	6.4	4.9	4.9	4.9	5.2
N (exits)	56	50	35	23	23	20	15
Switchers (Entrants + Exits)							
Switchers as % of total sample	5.7	11.3	12.1	10.3	11.7	12.2	13.2
N (switchers)	119	108	66	48	55	50	38
Continuous exporters							
Continuous exporters as % of total sample	21.7	16.4	15.0	14.0	13.2	12.4	11.8
N (continuous exporters)	450	157	82	65	62	51	34
Continuous non-exporters							
Continuous non-exporters as % of total sample	72.6	72.4	72.9	75.8	75.1	75.4	75.1
N (continuous non-exporters)	1,509	695	398	353	353	310	217
Total (N)	2,078	960	546	466	470	411	289

Notes: Sample is based on that for the pooled regression.
The observations for all the differences are based on a firm being in this original sample.
The length of difference is the number of years between the first and last period.
The first row under entry is the percentage of non-exporters in the first period that became exporters in the last period. The second column is this number as a percentage of the whole sample.
This layout is similar for non-exporters.
Switchers are those firms that are either entrants or exits.
Continuous exporters are firms that participated in the export market both at the beginning and the end of the period (as defined by the length of difference).
Continuous non-exporters did not participate in the export market in either the first or last period (as defined by the length of difference).

Table 9 presents the results from the separate entry and non-exit[10] equations. In the more general specification efficiency is not a significant determinant of entry. Rather, size, the capital-labour ratio and the ratio of raw materials to labour matter. Age, foreign ownership and the sector- and country-specific dummies do not influence the probability of entry. There is a large degree of colinearility between output per unit labour and raw materials per unit labour. In order to deal with this potential problem, we restrict the coefficients on raw material per unit labour and other costs per unit labour to equal 0. If we impose this restriction efficiency becomes significant for entry at the 10% level. However, the magnitude of this effect is very small. A one unit change in efficiency for the typical non-exporting firm only changes the probability of entry by 0.6 percentage points.

Table 9 Parameter estimates of entry and exit: probit, pooled sample (excludes Nigeria and South Africa)

	[1]					[2]				
Dependent variable:	Entry		Non-exit		Coeffs equal.†	Entry		Non-exit		Coeffs equal.†
	Coef. Est z	dF/dx x-bar	Coef. Est z	dF/dx x-bar	z-value	Coef. Est z	dF/dx x-bar	Coef. Est z	dF/dx x-bar	z-value
Ln (Output/ labour)$_{t-1}$	-0.120 (-0.73)	-0.005 8.119	0.839 (2.91)***	0.117 9.114	2.87***	0.138 (1.73)*	0.006 8.119	0.253 (2.11)**	0.038 9.114	0.90
Ln (Labour)$_{t-1}$	0.316 (4.84)***	0.014 2.919	0.214 (1.93)*	0.030 4.675	-1.11	0.304 (4.66)***	0.014 2.919	0.210 (1.99)**	0.032 4.675	-1.01
Ln (Capital/ labour)$_{t-1}$	0.159 (2.86)***	0.007 7.251	0.064 (0.62)	0.009 9.063	-0.85	0.135 (2.61)***	0.006 7.251	0.061 (0.62)	0.009 9.063	-0.70
Ln (Materials/ labour)$_{t-1}$	0.282 (2.2)**	0.013 7.393	-0.417 (-1.8)*	-0.058 8.308	-2.55**					
Ln (Other costs/ labour)$_{t-1}$	-0.064 (-0.9)	-0.003 5.473	-0.198 (-1.53)	-0.027 6.856	-0.83					
Age	-0.022 (-1.45)	-0.001 18.478	0.033 (1.28)	0.005 21.383	1.90*	-0.019 (-1.28)	-0.001 18.478	0.029 (1.18)	0.004 21.383	1.73*
Age^2	0.000 (1.15)	0.000 504.158	-0.001 (-1.83)*	0.000 616.698	-2.36**	0.000 (0.84)	0.000 504.158	-0.001 (-1.67)*	0.000 616.698	-2.06**
Foreign ownership	0.525 (1.5)	0.035 0.152	0.024 (0.07)	0.003 0.377	-1.02	0.474 (1.36)	0.031 0.152	-0.004 (-0.01)	-0.001 0.377	-0.96
Foreign ownership x Ghana	-0.429 (-1.03)	-0.014 0.095	0.305 (0.57)	0.036 0.151	1.12	-0.469 (-1.14)	-0.015 0.095	0.258 (0.49)	0.034 0.151	1.11
Foreign ownership x Tanzania	-0.616 (-1.04)	-0.015 0.028	0.530 (0.93)	0.052 0.056	1.41	-0.603 (-1.03)	-0.016 0.028	0.528 (0.97)	0.057 0.056	1.41
N	1170		324			1170		324		
Log likelihood	-170.46		-104.93			-172.29		-107.05		
R-squared	0.26		0.27			0.25		0.26		
Obs P		0.05		0.84			0.05		0.84	
Predicted P		0.02		0.93			0.02		0.92	

Notes:
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
Values in parenthesis are z-statistics. Inputs and output are expressed in natural logarithms.
Observations are clustered for individual firms.
Sector, country and time dummies are included.
The impact of a variable on exit is simply $-\beta_{non\text{-}exit}$.
† Test of the null hypothesis that coefficients for entry and non-exit are equal.

[10] These are non-exit because of the way the LHS variable is specified. The results for exit are simply the negative of the coefficients.

The estimation results for the non-exit equation suggest that the determinants of entry and exit differ. Efficiency is significant even without restricting the coefficients on raw materials and other costs per unit labour to be equal to 0. In fact, imposing this restriction weakens the effect. Size also has a positive effect on the probability of non-exit, although this effect is smaller in magnitude at the mean than the effect of efficiency. There is no evidence that the capital-labour ratio influences a firm to remain in the export market.
In order to control for firm heterogeneity in entry and exit we estimate the entry and non-exit specifications using a random-effects probit. We do not use a fixed-effects probit because our specification implicitly contains a lagged dependent variable. The results from the random-effects estimation are presented in Table 10.

Table 10 Parameter estimates of entry and exit: random-effects probit, pooled sample (excludes Nigeria and South Africa)

	[1]		[2]	
Dependent variable:	Entry	Non-exit	Entry	Non-exit
Ln (Output/ labour)$_{t-1}$	-0.120	1.157	0.138	0.377
	(-0.63)	(2.37)**	(1.68)*	(2.2)**
Ln (Labour)$_{t-1}$	0.316	0.321	0.304	0.314
	(4.61)***	(2.15)**	(4.49)***	(2.17)**
Ln (Capital/ labour)$_{t-1}$	0.159	0.041	0.135	0.045
	(2.68)***	(0.33)	(2.4)**	(0.37)
Ln (Materials/ labour)$_{t-1}$	0.282	-0.574		
	(1.72)*	(-1.6)		
Ln (Other costs/ labour)$_{t-1}$	-0.064	-0.238		
	(-0.75)	(-1.36)		
Age	-0.022	0.030	-0.019	0.025
	(-1.23)	(0.97)	(-1.09)	(0.8)
Age^2	0.000	-0.001	0.000	-0.001
	(0.92)	(-1.52)	(0.68)	(-1.3)
Foreign ownership	0.525	0.050	0.474	0.005
	(1.39)	(0.09)	(1.28)	(0.01)
Foreign ownership x Ghana	-0.429	0.374	-0.469	0.318
	(-0.94)	(0.51)	(-1.06)	(0.45)
Foreign ownership x Tanzania	-0.616	0.580	-0.603	0.572
	(-1.07)	(0.68)	(-1.06)	(0.7)
N	1395	391	1395	391
N(firms)	572	189	572	189
Log likelihood	-170.46	-103.53	-172.29	-105.75
Likelihood-ratio test - pooled vs panel	1	0.047	1	0.053

Notes: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
Values in parenthesis are z-statistics. Inputs and output are expressed in natural logarithms.
Sector, country and time dummies are included.
The impact of a variable on exit is simply $-\beta_{non\text{-}exit}$.

These results confirm the findings from the ordinary probit: Efficiency is only significant for entry if we impose restrictions on some of the coefficients; size and capital-intensity

are important determinants of entry; efficiency is a robust determinant of non-exit but size also plays a role.

There is no difference between the pooled and panel estimators for entry. This suggests that firm heterogeneity is not a significant determinant of entry into the export market. However, there is evidence that firm heterogeneity matters for non-exit. The likelihood ratio test suggests that the panel and pooled estimators of non-exit are significantly different at the 5% level.[11]

5. Conclusions

This paper has investigated the nature of the productivity-exporting relationship among African manufacturing firms. We have found that exporters are more productive than non-exporters even after controlling for the possibility of measurement error, endogeneity and firm heterogeneity. However, exporters do not have higher rates of productivity growth. Rather it seems that the difference in productivity between exporters and non-exporters may be explained by higher growth rates of productivity associated with entry into the export market. These results are weak and require a larger sample of firms and a better specification of entry for further investigation.

There is also evidence that productivity does not matter for entry into the export market but does matter for exit. We find that once a firm participates in the export market productivity matters for continued participation – more productive firms are less likely to exit the export market. This is what we would anticipate if learning-by-exporting were important. Factors other than efficiency may determine entry, but firms become more productive through participation in the export market. Those firms that became more

[11] The random-effects estimations, although it allows for firm heterogeneity, does not attempt to model the initial state of export behaviour. We have attempted to control for this by using a Heckman dynamic probit model. However, regardless of the specification used, the Heckman dynamic probit fails to converge. This can be explained in light of the random effects results. Using this estimator we found that firm heterogeneity was not significant for export participation, and for entry into the export market. Thus when we try to model the initial conditions jointly with the entry/exit equation, the maximum-likelihood estimator finds it difficult to link the two equations though the residuals. This makes convergence difficult. However, these earlier results also suggest that there is little to be gained by attempting to model the initial conditions.

productive would then remain in the export market, whereas those that were unable to become more productive would drop out. However, these results are also consistent with an argument that participation in exporting sorts firms by productivity, but does not change it. Again factors other than efficiency determine entry, which allows for less efficient firms to enter the export market. However, it would be those firms that were more efficient prior to entry that continued exporting.

Our random-effects estimation results indicate that unobserved firm-specific factors influence entry and exit in different ways. There is no evidence that firm heterogeneity matters for entry but firm heterogeneity is important for exit. These results suggest that factors such as size and capital-intensity are more important than unobserved firm characteristics for entry into the export market. However, once firms participate in the export market size, productivity and unobserved firm characteristics are important for continued participation. They also suggest that the factors influencing entry into and exit from the export market differ, and that policy changes may have asymmetric effects on entry and exit.

We have shown that entry and exit are uncommon in our sample. For the sample as a whole about 6% of observations are of entry or exit between any two years. The proportion of firms switching into and out of exporting increases to 13% of the sample for observations 7 years apart. This is slightly larger than the proportion of firms that were continuous exporters over that period. We also found that there was a consistent proportion of the sample that did not participate in the export market. This suggests that there may be a pool of firms that cannot enter the export market because they are too small or not capital-intensive enough. Larger more capital-intensive firms can enter exporting but continued exporting participation would then depend on productivity and unobserved firm characteristics. Firms that continued to export may have higher productivity levels prior to entry or they may learn-by-exporting and be able to increase productivity to a higher level. Those firms that had low initial productivity levels, were able to enter the export market but failed to increase productivity would exit from exporting. This would lead to 2 types of exporting firms: continuous exporters with

higher productivity levels and sporadic exporters – large firms with lower productivity levels. Again, more research is required to investigate whether this is the case.

Our results have also shown a robust relationship between firm growth and entry into the export market, suggesting that firms are rapidly able to expand once they begin exporting. This also indicates that firm size is limited by the size of the domestic market. The increase in employment associated with entry is large – over seven years entrants increase employment by 56 percent. Although we do not know the type of employment created nor where these new employees are drawn from, these results suggest that exporting firms may provide a mechanism to rapidly increase employment within the economy as a whole.

The results in this paper suggest that if African governments want to promote exporting they must focus on growing large firms. However, this is not enough. For firms to be continuous rather than sporadic exporters they must be more productive prior to exporting or they must be able to increase productivity whilst participating in the export market. Thus, government policy must also focus on increasing productivity if firms are to remain successful exporters.

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