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Export Orientation and Productivity in Sub-Saharan Africa

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Analysis of firm-level panel data from three Sub-Saharan African economies shows that export manufacturers have an average total factor productivity premium of 17 percent. In addition to the effect on productivity levels, exporters enjoy productivity growth that is 10 percent faster than do nonexporters. The data do not allow testing of whether these premiums are because more efficient producers go into exporting or because of a process of learning-by-exporting. In thinking about the mechanisms behind selectivity and learning, however, our finding of higher premiums for direct exporters, and for those who export to areas outside of Africa, could be interpreted as being consistent with learning-by-exporting effects. [JEL D21, D24, L60 O12]

A recent World Bank report argues that greater export orientation of manufacturing industries should be promoted as an important element of the growth strategy for Sub-Saharan Africa (World Bank, 2000). The argument is partly premised on the idea that exporting leads to productivity gains. However, there are also calls from others for public intervention to help raise the productivity of Africa's potential exporters to the entry thresholds of international markets, with investment programs and policy reforms aimed at reducing the transaction costs of foreign trade. Both of these approaches hinge on the relative productivity of exporters. Among African manufacturers, are exporters more productive than nonexporters? And if so, does this mean that there are productivity gains from exporting? Or, is the higher productivity of exporters a problem of lack of competitiveness

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by nonexporters that governments may be able to help solve? These are the issues that we address in this paper.

We analyze data on manufacturing firms from three African countries with the aim of estimating the productivity premium of exporters while controlling for the import-intensity of inputs and the incidence or strength of other forms of foreign links. The data are from the manufacturing sectors in Ethiopia, Ghana, and Kenya, and adequately capture the diversity of the region's economies in terms of the size and export orientation of the manufacturing sector. With as much as 25 percent of establishments engaged in the export business, Kenya has one of the strongest export-oriented manufacturing sectors in the region, while Ethiopia, with only 3.7 percent of its establishments producing for the export market, represents countries in the region where manufacturing is almost entirely confined to import substitution. Ghana represents countries in between these extremes, with about 10 percent of its manufacturing establishments producing for export.

All previous studies of developed and developing economies, alike, find a positive productivity premium for exporters.[1] One possible explanation of the premium is that it may reflect self-selection by more efficient producers into export markets. Although the mechanisms behind this selection hypothesis are often not specified, it may be that firms, in accessing export markets, face difficulties that do not arise when they supply domestic markets, which are typically protected from foreign competition by a combination of distance and trade policy.[2]

Recently there have been attempts at testing a second explanation for the premium, namely, that exporting itself leads to a productivity gain. The gain could be attributable to economies of scale, and possible only with a production scale that is larger than the small domestic market's (Pack, 1988). It could also be a result of "learning-by-exporting," that is, a relatively inexpensive process of technical information flowing to exporters from their developed-country clients, eventually translating into lower unit costs or improvements in product quality (Clerides and others, 1998; Pack and Saggi, 1999). The evidence on whether or not productivity grows as a result of involvement in export markets thus far has been mixed. Three studies—Clerides and others (1998) on data from three developing countries, Bernard and Jensen (1997) on data from the United States, and Liu and others (1999) on data from Taiwan—find no evidence that participation in export markets generates growth in productivity. However, Kraay (1998), using Chinese data, Bigsten and others (2002), using data pooled across four Sub-Saharan African countries, and Van Biesebroeck (2001), also using African data, detect post-entry productivity growth by exporters, which they interpret as evidence of "learning-by-exporting."

Regardless of whether and how the productivity premium of exporters is derived from learning and selection components, its measurement is a useful exercise because it provides an upper bound to either component. Still, the aim of this paper extends

[1]Examples of these include Aw and Hwang (1995) on Taiwan (Province of China), Tybout and Westbrook (1995) on Mexico, Bernard and Jensen (1997) on the United States, Clerides and others (1998) on three middle-income developing countries, Kraay (1998) on China, and Bigsten and others (2002) on four African economies.

[2]Bernard and others (2000) derive this in a static trade model of technically heterogeneous producers under a regime of monopolistic competition.

beyond estimating the premium. Unfortunately, because we do not have long enough time series, the data do not allow a formal causality test of whether the productivity premium of exporters is caused by self-selection or learning-by-exporting. Instead, we have chosen a different route: comparison of the total factor productivity of two particular subgroups of exporters with other exporters. The first of these consists of direct exporters, that is, exporters who are in direct contact with their foreign clients rather than supplying international markets through domestic intermediaries. The second subgroup consists of those who directly export to destinations outside of Africa, as opposed to those confined to markets within the region.

In Section III, the paper compares the productivity of direct and indirect exporters, and of exporters to outside of Africa and within the region. The idea is that looking at different types of exporters forces us to think more carefully about the mechanisms underlying the selection and learning-by-exporting hypotheses. By thinking about how selectivity and learning-by-exporting actually work, it may be that certain findings on the relative productivity of the subgroups can provide evidence supporting the existence of particular explanations for the premium.

The learning-by-exporting hypothesis naturally highlights the need for controlling for the effects of more traditionally recognized channels of international technology diffusion in measuring the productivity premium of exporters. These include direct foreign investment, international licensing of processes, international technical assistance arrangements, and the import of physical inputs in which new technical knowledge may be embodied. Although both exporting and nonexporting firms are involved in some or all of these in the data, it is clear that their average incidence or intensity is higher for exporters. Accurate measurement of productivity gains from exporting therefore requires controlling for differences in productivity changes that may arise from these other sources.

Having estimated an error-components production function with random firm effects, we find that for exporting manufacturers total factor productivity is 17 percent higher than for nonexporters using observations pooled across the three countries. We also find that the estimated average productivity premium for exporters as a whole clearly underestimates the average premium for direct exporters. Indeed, the estimated productivity premium for indirect exporters is not statistically significant. The premium for direct exporters is about 22 percent. Moreover, the average productivity premium of direct exporters itself underestimates the average for those exporting to destinations outside of Africa. For the entire sample, the productivity premium of direct exporters to outside of Africa is 42 percent, relative to nonexporters, which suggests a premium of 20 percent for exporting outside of the region relative to direct exporting to within the region.

We also estimate a specification for total factor productivity growth, controlling for lagged productivity levels, because this formulation is less likely to lead to estimates of exporter premiums that could merely reflect selection effects. We estimate a productivity growth premium of 10 percent for exporters relative to nonexporters. The productivity growth premium for direct exporters is 20 percent, while, again, the effect of indirect exporting on productivity is insignificant. Results are weaker for the comparison of direct exporters to outside and within Africa. While the former group has larger premiums, the estimates are not significant.

These estimates are all based on controls for degree of competition from imports, the import content of intermediate inputs, foreign equity participation, foreign licensing, and technical assistance arrangements with foreign partners. However, contrary to findings for other developing regions, none of these variables enters significantly in the estimated productivity equations. This seems attributable to the high collinearity of the variables with exporting status rather than because they do not influence productivity.

I. Model

The first step in thinking about how self-selection and learning-by-exporting can result in higher productivity for exporters is to consider a simple model, such as the one presented in Clerides and others (1998). They begin by assuming monopolistic competition, so that each firm faces a downward-sloping demand curve. If marginal costs c do not depend on output, gross operating profits can be written as $B(c,z)$, where the random variable z captures demand shifters such as foreign income level, exchange rates, and other goods prices. Next, they let M represent the per period fixed costs of being an exporter, that is, the costs of dealing with customs and other intermediaries. Then, firms would choose to export whenever $B(c,z) > M$, because they would earn positive net operating profits. This formulation indicates that all firms with marginal costs below some threshold value would self-select into exporting. Since lower marginal costs mean higher productivity, exporters will have higher productivity than nonexporters simply because the more efficient firms self-select into exporting. Note that how low marginal costs have to be (or how high productivity must be) for firms to self-select into export markets depends on the value of M, the per period fixed costs of being an exporter.

Next, the model considers sunk entry costs, because microeconomic evidence has suggested these costs are important for firms trying to break into the export market. If an entry cost F is incurred every time a firm enters or reenters the export market, then it may be optimal to continue exporting even when $B(c,z) < M$, because by remaining in the export market, while marginal costs are temporarily high or foreign demand conditions are temporarily bad, the firm avoids paying future reentry costs. Thus, producers face a dynamic optimization problem, and it is necessary to specify how z and c evolve. Clerides and others (1998) assume z follows a plant-specific serially correlated process, while $c = g\ (w_t, c_{t-1}, y_{t-1})$, where w_t is a vector of exogenous factors affecting costs, c_{t-1} is the vector of previous realizations of c, and y_{t-1} is the history of the binary variable indicating whether a firm was exporting or not.

Learning-by-exporting is built into the model here by assuming that marginal costs are a decreasing function of a firm's past participation in exporting activities. Being an exporter in previous periods lowers a firm's marginal costs and therefore increases productivity. The idea is that exporters learn from their contacts in the export market, for example, by benefiting from production or managerial advice involved in supplier specifications.

Because of the sunk entry costs, the decision of whether to enter the export market today is a forward-looking choice. The dynamic optimization problem implies firms export whenever

$$B(c, z) - M + \delta\{E_t(V_{t+1}|y_t = 1) - E_t(V_{t+1}|y_t = 0)\} > F(1 - y_{t-1}).$$

According to this condition, firms enter the export market when current net operating profits plus the expected future discounted payoff from exporting is greater than startup costs. It is important to note that expected future payoffs include both the value of avoiding start-up costs in the future, plus efficiency gains from learning by exporting.

This setup illustrates the mechanisms that generate exporter's efficiency premiums from both selection and learning effects. For the purpose of this paper though, all exporters are taken to be similar—that is, there is no difference between different types of exporters or exporting to alternative destinations.

However, it is straightforward to think about how the problem would be modified if we were to model the choice between being a direct exporter or an indirect exporter, and between exporting to destinations outside of Africa or within the region. First, we could imagine that the fixed costs per period (flow fixed costs) would be different, so that we could let M_D and M_I represent flow measures of fixed costs for direct and indirect exporters, and M_{OA} and M_A would stand for flow measures of fixed costs for exporters to outside and within Africa. We discuss below reasonable assumptions about the relative size of these costs. Second, regarding sunk entry costs, it again appears reasonable that these costs could be different for each subgroup of exporters. Third, it is likely that the learning-by-exporting effects (where past export participation implies lower marginal costs) would be stronger for certain subgroups of exporters.

Thus, if we were to find a larger productivity premium for direct exporters relative to indirect exporters and for exporters to outside Africa, compared with exporters to within the region, how could it be interpreted? First, this finding could be rationalized by arguing that if there are learning effects, they are likely to be greater for direct exporters and exporters to outside of Africa. The learning-by-exporting hypothesis assumes that purchasers are the ultimate source of the learned information, which translates into product improvements or lower costs. It could be argued that the quality or quantity of this information is likely to be higher when the exporters are in direct contact with the source—purchasers. It also appears reasonable that exporters are more likely to learn from clients if the latter are located in a more developed economy than their own, where technology and management techniques are more advanced. In the African context, the distinction between exporters to more developed economies and other exporters largely overlaps that between exporters to outside of Africa and those who export only to destinations within the region.

Second, what about selection effects? While we argue that learning-by-exporting is likely to be greater for direct exporters and exporters to outside of Africa, this may not be true for selection effects. Recall that in the Clerides and others (1998) model, the relationship of the productivity premium to the self-selection of more efficient producers into exporting arises because productivity has to be high enough to generate positive net operating profits, that is, gross profits greater than the per period fixed costs M. The higher the per period fixed costs, the higher will be the level of productivity needed to enter exporting and the larger the exporter's productivity premium from selection.

Are flow measures of fixed costs likely to be higher for direct exporters or exporters to outside of Africa? If these costs are thought of as including customs compliance, barriers to export markets, and other bureaucratic requirements, plus flow fixed costs of market research and modifying/maintaining distribution channels, then in the absence of empirical evidence, it is not clear what is sensible to assume regarding the relative sizes of M_D and M_I, and M_{OA} and M_A. That is, we may think that $M_D > M_I$ because direct exporters would have to incur these costs on their own. However, the relationship could be the other way around because the domestic intermediaries that facilitate indirect exporting may not be efficient and could charge firms more for these flow fixed cost items. Also, it could be that $M_{OA} > M_A$, because continuing market research and improving distribution are likely to be more costly for exporters to outside of Africa. However, again, it could be that the costs are greater for those exporting to within the region, where customs and bureaucratic requirements are often high.

Thus, considering this mechanism, it is hard to say for which subgroup we would expect selection effects to be stronger. Of course, there is another possible channel. Because competition is likely to be stronger in export markets than in the domestic market, only more efficient firms will be able to successfully compete and become exporters. It does not seem there would be any difference in this mechanism for direct or indirect exporters, to the extent that both are exporting to similar markets, because the domestic intermediary would also need to "select" the more efficient firms that are able to handle foreign competition. Comparing exporters to outside of Africa and to within the region, however, it seems more likely that there would be stronger selection effects for firms exporting to outside of Africa, where markets are more competitive.

Given the limitations of our data, it is not possible to prove that learning-by-exporting contributes to a higher productivity premium for direct exporters and exporters to outside of Africa. However, the arguments above suggest that such a finding would be consistent with some learning-by-exporting effects. Of course, the premium is likely to relate to selection effects also, but it is somewhat harder to be certain which subgroups we would expect to have larger selection effects.

One way of minimizing the likelihood that any estimates of the productivity premium are driven, in part, by selection effects is to model the relationship between current levels of productivity and exporting status in the past, rather than in the present. This is the estimation strategy we follow. Because the selection hypothesis suggests that only producers who have crossed a minimum threshold in the level of productivity participate in export markets, it implies a contemporaneous link between export market participation and the level of productivity. On the other hand, learning-by-exporting is a dynamic process, where the act of exporting ultimately leads to a growth in productivity. Testing for the correlation between productivity and past exporting status is an appropriate way of testing for learning effects. An even more attractive approach is to relate the growth rate of productivity to past participation in export markets while controlling for current levels of productivity, or the selection component of an exporter's possible advantage in productivity or cost levels. A positive coefficient on export status variables is thus more likely to reflect learning effects rather than selection effects.

II. Estimation and Data

Estimation

In estimating the productivity premium of exporters of various categories, we assume that the technology of each firm is given by the Cobb-Douglas production function:

$$Q_{it} = \alpha_{it} + \beta_K K_{it} + \beta_M M_{it} + \beta_L L_{it} + \varepsilon_{it}, \tag{1}$$

where Q_{it} is the log of the output of establishment i in year t; α_{it} is total factor productivity; K_{it}, M_{it}, and L_{it} are the logs of capital goods, intermediate inputs, and labor inputs, respectively; and ε_{it} is a zero mean, independently and identically distributed random error term uncorrelated with factor inputs. We assume also that α_{it} is not correlated with factor inputs and is composed of a firm-specific, time-invariant, unobservable, random component, α_i; observable firm characteristics, X_{hit}; an industry-specific but time-invariant component, α_S; and a purely temporal component, α_t; such that

$$\alpha_{it} = \alpha_i + \alpha_S + \alpha_t + \sum_j \alpha_j E_{jt-1} + \sum_{h=1} \alpha_h X_{hit}. \tag{2}$$

E_{jt-1} is a dichotomous variable indicating participation in export markets last year, with the subscript j indexing whether or not participation in export markets, in general, was direct or indirect or involved markets within Africa or outside of Africa. Estimation of the α_j values, while controlling for the other components of α_{it}, is the main objective in the data analysis. In order to address the problem of potential bias arising from firm heterogeneity, we use the panel method for estimating random-effects models using the GLS estimator (producing a matrix-weighted average of the between and within models). The results reported in the next section regarding the relative productivity of various categories of exporting firms are based on the GLS estimation of equation (1) subject to equation (2).[3]

[3] A better alternative would have been GMM estimation of a dynamic panel specification of the type used in, for example, Clerides and others (1998) and Kraay (1998). However, with two or three time observations per firm, our panel of observations is too short to use a dynamic panel data technique.

We supplement this by OLS estimation of the current growth rate of total factor productivity, while controlling for the initial level of total factor productivity, $\log(tfp)_{it-1}$, that is, by estimating

$$\Delta \log(tfp)_{it} = \beta_0 + \beta \log(tfp)_{it-1} + \sum_j \delta_j E_{ijt-1} + \sum \gamma_h X_{iht} + \mu_{it}, \tag{3}$$

where μ_{it} is a random error term assumed to be uncorrelated with any of the other right-hand-side variables.

Following from the Clerides and others (1998) model described above, and Roberts and Tybout (1997), we also present estimates (by maximum likelihood) of a reduced-form export market participation probit with random effects, and in which the X_{hit} values of equation (3) figure as right-hand-side variables. As will be reported later, this is a useful exercise because the coefficient estimates of certain variables, generally known to influence productivity in other studies, turn out to be not significant in equation (1). However, the same variables have large and statistically significant coefficients in the participation equation, suggesting that their statistical insignificance in equation (1) may be due to a multicollinearity problem arising from their inclusion alongside exporting status as right-hand-side variables.

Data and Variables

The Ghanaian and Kenyan firm data come from surveys of manufacturing establishments carried out under the Regional Program on Enterprise Development (RPED) of the World Bank. The data on Ethiopian firms is from a survey of manufacturers carried out with a comparable instrument and a very similar sampling design. Table 1 lists notations and definitions of the variables of interest; Table 2 shows the distribution of the observations by country, industry, and year of observation; and Tables 3 and 4 provide descriptive statistics.

All three surveys covered between 200 and 230 firms in different years. The first Ghanaian survey was carried out in 1992. It covered 200 establishments and was followed up in 1993 and 1994 by visits to the same firms.[4] The Kenyan survey took place during 1993 through 1995, beginning with about 223 firms; the Ethiopian survey collected data on 220 firms covering the years 1993–95. As seen in Table 2 the samples for the Ghanaian and Kenyan surveys were drawn exclusively from four industries: food and beverages, textiles and garments, woodwork, and metalwork. Although there were no sector restrictions in sampling for the Ethiopian survey, the same four sectors also accounted for about 46 percent of establishments in the sample.

The 1992–94 Ghanaian survey generated an unbalanced panel of 645 observations on 215 establishments. The Kenyan survey resulted in an unbalanced panel of 656 observations on 223 establishments. The Ethiopian dataset consists of an unbalanced panel of 688 observations on 251 establishments. After omitting 700 data-

[4]The original number of establishments was expanded to 215 in later years, when firms that were dropped were replaced in the sample by similar firms.

Table 1. Definition of Variables

Variable Notation	Definition
Trade variables	
EXPORTER	= 1 if the establishment is currently exporting.
DIRECT_EXPORTER	= 1 if the establishment is currently exporting directly.
DIRECT_AFRICA	= 1 if the establishment is currently directly exporting only to within Africa.
DIRECT_EXAFRICA	= 1 if the establishment is currently directly exporting to outside of Africa.
percent_EXPORTED	The value of annual exports as percentage of annual output.
percent_IMPORTED	The percentage share of imports in annual purchase of intermediate inputs.
Percent_FOREIGN	Percentage share of foreign owners in total equity.
IMPORT_COMPETITION	= 1 if imports have been a source of competition to the firm.
FOREIGN_LICENSE	= 1 if the firm holds a foreign license.
FTA_CONTRACT	= 1 if the firm has a technical assistance contract with a foreign partner.
LICENSE_FTA	= 1 if the firm holds a foreign license or has a foreign technical assistance contract.
FOREIGN	= 1 if *percent_FOREIGN* > 0.
Production variables	
LN(*OUTPUT*)	The log of constant U.S. dollar value of annual output.
LN(*INTERMEDIATE*)	The log of constant U.S. dollar value of annual consumption of intermediate inputs.
LN(*LABOR*)	The log of constant U.S. dollar annual labor cost.
LN(*CAPITAL*)	The log of constant U.S. dollar estimated market value of plant and equipment.
Other firm characteristics	
EMPLOYMENT	Number of employees at the end of the year.
AGE	Number of years since the establishment started to operate.
FOOD & BEVERAGES	= 1 if in the food and beverages industry.
TEXTILES	= 1 if in the textiles and garment industry.
WOODWORK	= 1 if manufacturing of wood products.
METALWORK	= 1 if manufacturing of fabricated metal products.

points, for which observations on one or more of the main variables of interest were missing, the effective sample was much smaller at a panel of 1,271 observations on 599 establishments for the three countries. Of these, 251 establishments are from Ethiopia, 142 from Ghana, and 206 from Kenya.

The dependent variable in the productivity equation (1) is *LN*(*OUTPUT*), defined as the logarithm of the value of annual gross output in 1993 U.S. dollars. The corresponding input variables are *LN*(*INTERMEDIATE*), defined as the log of the annual consumption of materials and utilities in 1993 U.S. dollars; *LN*(*LABOR*), which is the log of annual total labor cost in 1993 U.S. dollars; and *LN*(*CAPITAL*), defined as the log of the estimated market value of equipment in 1993 U.S. dollars. In all cases, national, rather than international or sector-specific deflators, along with

Table 2. Means of Dummy Variables for Exporting Status, Industry, and Year of Observation by Country

	Country			
Variable	Ethiopia	Ghana	Kenya	All
EXPORTER	0.04	0.10	0.25	0.13
Industries				
Food and beverages	0.14	0.26	0.21	0.19
Textiles	0.06	0.17	0.24	0.14
Woodwork	0.13	0.22	0.30	0.21
Metalwork	0.13	0.26	0.25	0.20
Years of observation				
1991	—	—	—	—
1992	—	0.48	—	0.09
1993	0.29	0.52	0.36	0.36
1994	0.36	—	0.34	0.28
1995	0.35	—	0.30	0.27
Number of observations	569	245	457	1271
Number of firms	251	142	206	599

national official exchange rates, were used to arrive at 1993 dollar figures. This is potentially a source of measurement error, but it should be minimized by the inclusion of dummy variables for industry, year, and country. The cost of this approach is that we are unable to interpret the coefficients of these dummy variables as industry and country effects.[5]

The constant-price wage bill is used as a measure of labor input. The wage bill is a better measure of labor input than the number of workers when there are large disparities in skills among workers that are reflected in wage differentials, as is the case in this sample.[6]

The firm's age, measured as the log of the number of years it has been in business, is included in all the estimated production equations in order to control for possible life-cycle effects. Including an establishment's age among the controls ensures that the estimated productivity premium of exporters is net of the produc-

[5]The use of constant-price valuations of output, intermediates, and capital input as an aggregating technique in the face of normally heterogeneous products and material equipment is a widely accepted practice in the estimation of aggregate as well as plant-level production functions, despite difficulties in getting the right price deflators. We use constant-price labor cost rather than man-years, man-hours, or number of employees as a measure of labor input, on the basis of a similar reasoning. Because it is likely that the workforces in our sample are highly heterogeneous in terms of skills or effort, using raw man-hours as a measure of labor input would involve serious measurement error. Ideally, the production function should be specified in terms of detailed skill and effort grades. Because this is rarely practical, however, a common practice is to use the constant-price wage bill as a measure of labor's input, which is defensible under the assumption that wage differentials essentially reflect differences in marginal productivity.

[6]Estimation of the basic productivity equation using employment (number of workers) rather than the wage bill as the labor input measure does not change the results concerning the exporting productivity premium. Results are available upon request.

tivity implications of the average exporter being longer established in business than the average nonexporter.

The key right-hand-side variable of the productivity equation is $EXPORTER_{it-1}$, which is equal to unity if establishment *i* is an exporter in year *t*–1 and is zero otherwise. The contemporaneous export status variable is used as the dependent variable in our estimation of the export market participation equation. In alternative specifications of the productivity equation, we replace $EXPORTER_{it-1}$ jointly by $DIRECT\_EXPORTER_{it-1}$ and $INDIRECT\_EXPORTER_{it-1}$, or jointly by $DIRECT\_AFRICA_{it-1}$ and $DIRECT\_EXAFRICA_{it-1}$. The variable, $DIRECT\_EXPORTER_{it-1}$, is unity if firm *i* is a direct exporter in year *t*–1 and is zero otherwise, where direct exporting means finding customers and shipping directly to them without the use of a domestic intermediary. The variables, $DIRECT\_AFRICA_{it-1}$ and $DIRECT\_EXAFRICA_{it-1}$, similarly distinguish between direct exporters confined to Africa and those who export to destinations outside of Africa as well.

About 13 percent of the establishments in all three countries export part of their output (Table 2). This, however, is an average of extremes: less than 4 percent of manufacturers in the Ethiopian sample are exporters, compared with 25 percent of those in the Kenyan sample and 10 percent of those in the Ghanaian sample. There are similar variations among the three samples in terms of the proportion of output exported as well. The average percentage of annual output that is exported is about 5 percent for the sample, pooled across the three countries: about 1 percent for the Ethiopian sample, 3 percent for the Ghanaian sample, and 12 percent for the Kenyan sample. Although the figures for all three countries suggest manufacturing sectors with very low degrees of export orientation, the proportion of exports to total output is invariably large for establishments that do export, ranging from 34 percent for Ghana to 45 percent for Kenya.

About a third of exporters in the pooled sample export through domestic intermediaries. Again, there is substantial cross-country variation here, with the proportion of direct exporters ranging from 38 percent for the Ethiopian sample to 72 percent for the Kenyan sample. Most direct exports are to destinations within Africa; those who directly export to outside of Africa make up 25 percent of all direct exporters in the overall sample. Surprisingly, this proportion is lowest for Kenya at 18 percent, while about one-third of direct exporters in the Ghanaian sample export to destinations outside of Africa.[7]

Exporting firms are strikingly different from nonexporters with respect to certain variables found to be important covariates of productivity in the empirical literature. In particular, the average exporter is more than twice as large as the average nonexporter, when size is measured by the number of regular employees. Although the differences in size in terms of age is not as great, the average exporter also typically has been in business for a significantly longer period. More importantly, the two groups of firms sharply contrast in terms of "trade-related" variables (as identified in Table 1), a pattern that also emerges clearly in the analysis of data from Colombia, Mexico, and Morocco in Kraay, Soloaga, and Tybout (2002). First, the incidence of

[7]For Ethiopia, it should be kept in mind that these country-specific figures are less informative because they are based on such a small share of exporters in the sample.

foreign-held equity for exporters (20 percent) is more than four times that of nonexporters in the pooled sample. Second, exporters are almost three times more likely to have foreign links in the form of either operating with a foreign license or entering into a technical assistance arrangement with a foreign partner (Table 3). Indeed, 37 percent of exporters are linked to foreign agents through foreign ownership, licensing, or technical assistance as compared with less than 15 percent of nonexporters who have similar links. Third, the consumption of intermediate inputs is significantly more import-intensive for exporters (Table 4). The only dimension of external links where there does not seem to be significant difference between the two groups is competition from imports, with approximately a quarter of firms in each group identifying imports as a major source of competition for their products.

A variation on the theme of endogenous growth is knowledge embodied in capital and intermediate goods imported from more advanced economies is a source of productivity growth in a developing economy (Grossman and Helpman, 1991; Coe, Helpman, and Hoffmaister, 1995). This idea implies that domestic firms with higher import-intensive capital stocks or intermediate inputs should be more productive in economies where the capital goods industry is underdeveloped or the rate of investment on research and development is relatively low. If this were the case, we would find exporters in our data to be more productive than nonexporters, but this would stem from higher import intensity, not selection or learning effects. In order to control for this effect, the variable *percent_IMPORTS,* that is, the percentage of imports in annual intermediate inputs, is included as a control variable. It is also possible that exporters are more productive simply because they have been more successful in imitating product designs of imports or have survived stronger import competition.[8] The true productivity premium that can be attributed to exporting status should be net of such influence by imports as a source of competitive pressure or of opportunity for imitation. Whether or not an establishment considers imports a major source of competition, that is, the variable *IMPORT_COMPETITION* is the second control variable in the productivity equation.

The third control variable is *percent_FOREIGN,* the percentage share of foreign ownership. Foreign direct investment has long been considered a major source of productivity growth for developing economies because it is believed to be a vehicle for the international transfer of management skills, technical know-how, and market information that cannot be licensed out or transferred to clients via technical assistance arrangements.[9] If this is true, the average total productivity of exporters could be higher than that of nonexporters because of the higher incidence of foreign ownership among exporters.[10] About 20 percent of exporters in our Ghanaian sample and 38 percent in the Kenyan sample have foreign equity participation, compared with just 10 percent for all firms. Conversely, an equal

[8]MacDonald (1994) found that growth in competition from imports led to large increases in labor productivity in highly concentrated industries in the United States in the 1970s and the 1980s, although it did not have any observable impact on productivity in less concentrated industries.

[9]See, for example, Teece (1977), Mansfield and Romeo (1980), and Helleiner (1988).

[10]The greater focus in the empirical literature is on the spillover effects of FDI on industry productivity. However, the evidence is probably stronger for its direct effect on firm-level productivity. See, for example, Aitken and Harrison (1999) on Venezuela, Griffith (1999) on the United Kingdom, and Grether (1999) on Mexico.

Table 3. Means of Dummy Variables for Foreign-Trade-Related Variables

Variables	Ethiopia	Ghana	Kenya	All
All firms				
EXPORTERS	0.03	0.10	0.24	0.12
EXPORT OUT OF AFRICA	0.02	0.02	0.05	0.03
EXPORT TO AFRICA	0.01	0.07	0.17	0.08
DIRECT EXPORTERS	0.01	0.05	0.17	0.08
DIRECT_AFRICA	0.00	0.02	0.14	0.05
DIRECT_EXAFRICA	0.01	0.01	0.04	0.02
INDIRECT EXPORTER	0.02	0.02	0.07	0.04
INDIRECT_AFRICA	0.01	0.02	0.05	0.02
INDIRECT_EXAFRICA	0.01	0.01	0.02	0.01
IMPORT_COMPETITION	0.34	0.22	0.20	0.25
FOREIGN_LICENSE	0.06	0.06	0.05	0.06
FTA_CONTRACT	0.03	0.07	0.09	0.06
LICENSE_FTA	0.08	0.11	0.11	0.10
FOREIGN	0.01	0.17	0.06	0.08
Exporters				
EXPORT OUT OF AFRICA	0.70	0.23	0.23	0.28
EXPORT TO AFRICA	0.30	0.77	0.77	0.72
DIRECT EXPORTERS	0.43	0.65	0.70	0.66
DIRECT_AFRICA	0.09	0.28	0.56	0.44
DIRECT_EXAFRICA	0.35	0.14	0.14	0.16
INDIRECT EXPORTER	0.57	0.35	0.30	0.34
INDIRECT_AFRICA	0.22	0.24	0.21	0.22
INDIRECT_EXAFRICA	0.35	0.07	0.09	0.11
IMPORT_COMPETITION	0.35	0.33	0.20	0.25
FOREIGN_LICENSE	0.00	0.10	0.18	0.15
FTA_CONTRACT	0.00	0.23	0.32	0.27
LICENSE_FTA	0.00	0.26	0.36	0.31
FOREIGN	0.00	0.37	0.12	0.17
Foreign owned + A64				
EXPORTERS	0.00	0.21	0.49	0.27
EXPORT OUT OF AFRICA	0.00	0.37	0.11	0.05
EXPORT TO AFRICA	0.00	0.16	0.37	0.20
DIRECT EXPORTERS	0.00	0.10	0.34	0.16
DIRECT_AFRICA	0.00	0.06	0.29	0.11
DIRECT_EXAFRICA	0.00	0.02	0.06	0.03
INDIRECT EXPORTER	0.00	0.03	0.14	0.06
INDIRECT_AFRICA	0.00	0.02	0.09	0.04
INDIRECT_EXAFRICA	0.00	0.01	0.06	0.02
IMPORT_COMPETITION	1.00	0.40	0.11	0.36
FOREIGN_LICENSE	0.00	0.14	0.17	0.14
FTA_CONTRACT	0.00	0.16	0.34	0.20
LICENSE_FTA	0.00	0.25	0.37	0.27

Table 3. *(concluded)*

Variables	Ethiopia	Ghana	Kenya	All
Foreign owned exporters				
EXPORT OUT OF AFRICA		0.19	0.24	0.21
EXPORT TO AFRICA		0.81	0.76	0.79
DIRECT EXPORTERS		0.75	0.71	0.72
DIRECT_AFRICA		0.33	0.59	0.45
DIRECT_EXAFRICA		0.10	0.12	0.11
INDIRECT EXPORTER		0.25	0.29	0.28
INDIRECT_AFRICA		0.17	0.18	0.17
INDIRECT_EXAFRICA		0.05	0.12	0.08
IMPORT_COMPETITION		0.38	0.06	0.24
FOREIGN_LICENSE		0.19	0.35	0.27
FTA_CONTRACT		0.21	0.65	0.45
LICENSE_FTA		0.29	0.71	0.52

proportion of foreign-owned establishments export their products, with the proportion as high as 50 percent for the Kenyan sample.

Foreign equity participation also happens to be highly correlated with the import-intensity of inputs and the occurrence of other mechanisms of direct technology transfer, the correlation being stronger for exporters among foreign-owned establishments. The other mechanisms of direct technology transfer for which there are data are foreign licensing and technical assistance contracts with foreign partners. Over the full sample, intermediate inputs are 1.5 times as import-intensive for foreign-owned firms (Table 4). A foreign-owned firm is also twice as likely to hold a foreign technical assistance contract, and three times more likely either to hold a foreign license or obtain technical assistance from a foreign partner (Table 3). The contrast between foreign-owned firms and others is not as great as when we restricts ourselves to looking at exporters only. However, there are significant differences between foreign-owned exporters and nonforeign-owned exporters too. Intermediate inputs of foreign-owned firms are significantly higher among exporters as is the probability of holding a foreign license or foreign technical assistance contract. Because foreign licenses or technical assistance contracts with foreign partners are expected to lead to a productivity gain on their own, we use the variable *LICENSE_FTA* as a fourth control variable.

III. Results

As noted in the introduction, given the data limitations, we cannot definitively prove whether an estimated productivity premium of exporters is caused by self-selection or learning-by-exporting. We have argued, that if the results indicate higher premiums for direct exporters and exporters to destinations outside of Africa, this could be interpreted as being consistent with learning-by-exporting effects, because

Table 4. Descriptive Statistics of Continuous Variables

	Country							
	Ethiopia		Ghana		Kenya		All	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All firms								
Percent_EXPORTED	1.22	9.84	3.47	16.10	11.79	28.93	5.46	20.44
Percent_IMPORTED	45.85	39.52	26.29	36.98	20.28	31.52	32.89	38.19
Percent_FOREIGN	1.85	12.35	9.11	21.21	9.86	26.38	6.13	20.48
EMPLOYMENT	117.70	427.00	49.26	76.31	78.90	200.65	90.56	312.78
AGE	17.54	13.29	15.20	11.83	17.73	13.36	17.16	13.07
LN(*OUTPUT*)	10.86	2.06	28.48	1.86	11.45	2.43	14.47	7.19
LN(*INTERMEDIATE*)	10.12	2.31	27.97	1.95	10.74	2.61	13.78	7.33
LN(*LABOR*)	8.79	2.07	26.29	2.03	9.22	2.21	12.32	7.15
LN(*CAPITAL*)	9.97	2.44	26.87	2.89	10.54	2.84	13.43	7.10
Exporters only								
Percent_EXPORTED	32.93	40.65	39.34	39.90	45.07	40.99	42.68	40.77
Percent_IMPORTED	36.97	33.10	25.64	34.76	40.54	37.06	37.76	36.40
Percent_FOREIGN	0.00	0.00	11.00	22.57	24.99	36.69	19.56	33.44
EMPLOYMENT	451.76	327.67	89.00	97.83	205.00	350.96	219.17	335.43
AGE	26.00	17.45	14.80	8.55	18.48	12.45	18.89	12.99
Foreign-owned:								
Percent_EXPORTED	0.00	0.00	1.14	4.29	18.47	33.64	7.55	22.32
Percent_IMPORTED	96.33	4.93	45.34	40.99	30.77	34.95	43.74	40.51
Percent_FOREIGN	100.00	0.00	48.50	22.04	90.00	30.51	67.45	32.77
EMPLOYMENT	75.17	28.23	112.17	138.62	105.33	103.32	106.96	120.99
AGE	33.50	6.02	19.33	13.15	28.70	13.54	23.79	13.82
Foreign owned exporter:								
Percent_EXPORTED			12.50	8.66	36.93	40.17	31.79	37.04
Percent_IMPORTED			44.00	43.36	43.87	31.09	43.90	33.28
Percent_FOREIGN			55.00	5.52	100.00	0.00	88.75	20.15
EMPLOYMENT			189.00	155.25	174.80	103.51	178.35	114.06
AGE			16.00	7.84	27.13	15.10	24.35	14.33

this hypothesis would predict higher productivity for these two subgroups, while one would expect the relative strength of selectivity effects to go either way.

At a theoretical level, learning-by-exporting is a dynamic process, and its effects on productivity would only be expected to emerge over time. On the other hand, the selectivity hypothesis implies that only producers who have crossed a minimum threshold in the level of productivity or competitiveness will participate in an export market. In other words, selection into or out of export markets is determined by the level of productivity rather than by its growth rate.

Our empirical strategy uses relatively simple estimation methods. Thinking about the likely timing of learning and selectivity effects underlies our choice of specifications. First, we estimate a set of models testing the correlation between

Table 5. Productivity Equation Using Contemporaneous Export Status Variable

(*Dependent variable = LN(OUTPUT)*)

	All Countries	Ghana and Kenya	Kenya	Ghana
LN(INTERMEDIATE)	0.561 (0.016)**	0.623 (0.025)**	0.569 (0.038)**	0.672 (0.024)**
LN(LABOR)	0.271 (0.019)**	0.193 (0.030)**	0.173 (0.044)**	0.252 (0.024)**
LN(CAPITAL)	0.069 (0.011)**	0.062 (0.017)**	0.110 (0.027)**	–0.012 (0.013)
EXPORTER	0.237 (0.068)**	0.293 (0.085)**	0.439 (0.124)**	0.124 (0.085)
percent_IMPORTED	0.001 (0.001)	0.000 (0.001)	0.001 (0.002)	–0.001 (0.001)
LICENSE_FTA	0.126 (0.074)	0.154 (0.106)	0.157 (0.157)	0.059 (0.108)
percent_FOREIGN	–0.001 (0.001)	0.000 (0.001)	–0.000 (0.002)	–0.001 (0.002)
IMPORT_COMPETITION	–0.047 (0.049)	–0.025 (0.073)	–0.002 (0.109)	0.010 (0.081)
Log (*AGE*)	–0.262 (0.094)**	–0.067 (0.128)	–0.118 (0.215)	0.004 (0.109)
[Log (*AGE*)]^2	0.057 (0.021)**	0.018 (0.028)	0.031 (0.045)	–0.004 (0.026)
Textiles	–0.173 (0.067)**	–0.226 (0.092)*	–0.289 (0.140)*	–0.247 (0.100)*
Woodwork	–0.191 (0.060)**	–0.239 (0.085)**	–0.260 (0.132)*	–0.307 (0.093)**
Metalwork	–0.143 (0.061)*	–0.164 (0.086)	–0.338 (0.139)*	–0.007 (0.084)
Ethiopia	–0.134 (0.057)*			
Ghana	1.528 (0.216)**	1.834 (0.318)**		
1992	0.043 (0.077)	0.035 (0.089)		–0.018 (0.033)
1994	–0.057 (0.046)	–0.206 (0.080)**	–0.148 (0.094)	
1995	–0.105 (0.046)*	–0.236 (0.082)**	–0.154 (0.098)	
Constant	2.568 (0.152)**	2.573 (0.208)**	2.853 (0.311)**	3.514 (0.507)**
R-squared	0.992	0.9931	0.8886	0.9627
Wald chi-square	131846	85508	2855	3956
rho	0.1957	0.1211	0.1534	0.1534
Chi-square for Breusch-Pagan test	7.59	0.01	0.02	16.94
Number of observations	1268	699	457	242
Number of firms	599	348	206	142

Note: Standard errors are in parentheses.
(*) significant at 5 percent level; (**) significant at 1 percent level.

current firm productivity levels and lagged export status, as a method appropriate for testing for learning effects.[11] Second, we test for a positive correlation directly between the growth rate of productivity and export market participation in the past, while controlling for the level of productivity through which self-selectivity operates. The advantages are that using productivity growth rates links most closely to the idea of learning effects, while the specification also controls for current productivity levels as a determinant of the selection component.[12]

Before proceeding to these results, we first present a specification relating productivity levels to contemporaneous export status variables. Of course, following the argument on the timing of learning and selection effects, contemporaneous correlation between export market participation and productivity levels is likely to confound the two effects. We would expect, therefore, estimates of exporters' productivity premiums to be larger than in a specification using lagged export status, because of the likely reverse causality from productivity to exporting status. In terms of a learning component of the premium, these estimates are upwardly biased, and would constitute an upper bound. An ancillary benefit of using this specification is that it allows separate regressions to be estimated for both the Kenyan and Ghanaian subsamples, providing some idea of the cross-country variation in the productivity premium of exporters among countries that are substantial exporters. (Given the extremely low proportion of exporters in the Ethiopian sample and moderate share in the Ghanaian sample, when using lagged export status, there are not enough observations to estimate separately for these countries.)

Table 5 indicates that when using contemporaneous exporting status, the productivity premium of the average exporter for all the three countries is 23.7 percent higher than that of the average nonexporter. The exporter's premium rises to 29.3 percent when Ethiopian firms are excluded from the sample. This figure is an average of the much larger premium for Kenyan exporters (43.9 percent) and the lower figure for exporters in Ghana (12.4 percent).

Are Exporters More Productive Than Nonexporters?

Table 6 reports the results of the GLS estimation of equation (1), using the variable $EXPORTER_{it-1}$ as the indicator of exporting status.[13] Estimates reported in the first column of the table are based on the data pooled across all the three countries and should give an idea of the average relationship between exporting status and productivity for the region as a whole. The results show that total factor productivity of the average exporter is 17.4 percent higher than that of the average

[11] However, positive correlation between exporting activities in the past and current productivity does not necessarily imply productivity gains through learning if high-productivity firms also exhibit high growth rates in productivity due to inherent unobservable factors affecting the level as well as growth of productivity.

[12] This argument is implied in many previous papers aimed at testing the learning-by-exporting hypothesis, most directly communicated in Bernard and Jensen (1999).

[13] The tables report a Wald χ^2 statistic for overall significance of the regressors. *Rho* is the fraction of the variance due to the time-invariant, firm-specific effects. A χ^2 statistic is reported for the Breusch-Pagan test of the null hypothesis that the firm-specific variance is zero.

Table 6. Productivity of Direct Exporters and Exporters to Outside of Africa

(*Dependent variable* = *LN*(*OUTPUT*))	All countries			Kenya		
	(1)	(2)	(3)	(4)	(5)	(6)
LN(*INTERMEDIATE*)	0.700 (0.016)***	0.699 (0.016)***	0.700 (0.016)***	0.744 (0.033)***	0.744 (0.033)***	0.748 (0.033)***
LN(*LABOR*)	0.255 (0.019)***	0.256 (0.019)***	0.256 (0.019)***	0.252 (0.041)***	0.253 (0.041)***	0.250 (0.041)***
LN(*CAPITAL*)	0.027 (0.011)**	0.027 (0.011)**	0.026 (0.011)**	0.007 (0.021)	0.006 (0.021)	0.004 (0.021)
EXPORTER_1	0.174 (0.062)***			0.186 (0.101)*		
DIRECT_EXAFRICA_1			0.419 (0.212)**			0.458 (0.269)*
DIRECT_ AFRICA_1			0.207 (0.073)***			0.181 (0.113)
INDIRECT_EXPORTER_1		0.091 (0.090)	0.091 (0.090)		0.141 (0.144)	0.141 (0.144)
DIRECT_EXPORTER_1		0.219 (0.072)***			0.205 (0.111)*	
percent_FOREIGN	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	–0.000 (0.002)	–0.000 (0.002)	–0.000 (0.002)
LICENSE_FTA	0.093 (0.064)	0.088 (0.064)	0.093 (0.064)	0.103 (0.129)	0.097 (0.130)	0.114 (0.131)
percent IMPORTED	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
IMPORT COMPETITION	–0.060 (0.044)	–0.062 (0.044)	–0.061 (0.044)	–0.022 (0.095)	–0.025 (0.095)	–0.022 (0.095)
Log (*AGE*)	0.084 (0.096)	0.082 (0.096)	0.083 (0.096)	0.197 (0.178)	0.202 (0.178)	0.203 (0.178)
$[\text{Log}(AGE)]^2$	–0.014 (0.021)	–0.013 (0.021)	–0.013 (0.021)	–0.022 (0.038)	–0.023 (0.038)	–0.022 (0.038)
Textiles	–0.094 (0.059)	–0.092 (0.059)	–0.093 (0.059)	–0.180 (0.119)	–0.178 (0.120)	–0.179 (0.120)
Woodwork	–0.036 (0.051)	–0.037 (0.051)	–0.037 (0.051)	–0.043 (0.106)	–0.046 (0.106)	–0.043 (0.106)
Metalwork	–0.095 (0.054)*	–0.098 (0.054)*	–0.096 (0.054)*	–0.117 (0.115)	–0.120 (0.115)	–0.114 (0.115)
Ethiopia	0.224 (0.051)***	0.225 (0.051)***	0.226 (0.051)***	0.000 (0.000)		
Ghana	0.354 (0.209)*	0.373 (0.209)*	0.378 (0.209)*	0.000 (0.000)		
1995	–0.051 (0.027)*	–0.049 (0.027)*	–0.052 (0.027)*	0.066 (0.051)	–0.062 (0.051)	–0.072 (0.052)
Constant	0.926 (0.148)***	0.934 (0.148)***	0.935 (0.148)***	0.403 (0.278)	0.467 (0.276)*	0.471 (0.277)*
Number of firms	470	470	470	167	167	167
Observations	693	693	693	264	264	264
R-squared	0.77	0.77	0.77	0.81	0.81	0.82
Wald chi-square	176036	176669	176308	4825	4831	4815
rho	0.52	0.51	0.52	0.51	0.5	0.51

Note: Standard errors are in parentheses.
(*) significant at 10 percent; (**) significant at 5 percent; (***) significant at 1 percent.

nonexporter. The productivity premium is higher for Kenya, a country where the share of manufacturing exporters is large, at 18.6 percent (Table 6, column 4).

Because a wider range of possible influences on productivity are controlled for, these estimates are not strictly comparable to those of previous studies. However, the estimates are surprisingly close to those reported for the United States and some East Asian economies. For U.S. manufacturing industries, Bernard and Jensen (1997) report figures ranging between 13 and 16 percent; Kraay's (1998) estimate for his sample of Chinese firms is in the range of 23–29 percent; Aw, Chung, and Roberts (1998) estimate a premium of 15–20 percent for the sample of Taiwanese firms and a premium of 5–23 percent for exporters in Korean industries; and Sjoholm (1999) reports a 31 percent premium for exporters in Indonesia.

Note that, as expected, the productivity premiums in the estimates using contemporaneous exporting status are higher than those in the estimates using lagged export status. This is consistent with learning effects taking time to materialize while selection effects do not. To the extent that more productive firms self-select into export markets, the relationship between productivity and exporting is contemporaneous rather than lagged.

Productivity Premiums of Exporters and Other Forms of External Links

In estimating the productivity premium, we argued that it was important to control for the import-intensity of inputs, competition from imports, foreign direct investment, foreign licensing, and technical assistance from foreign partners. Surprisingly, and contrary to findings of other studies, none of these external link variables were found to be statistically significant. However, there are a number of reasons that lead us to think that this is the result of the same variables being strongly collinear with exporting status rather than evidence that the variables do not influence productivity.

First, as discussed above (Table 4), the incidence of these external links is much higher among exporters than nonexporters. Second, many of the same variables are significant in the export market participation equation reported in Table 7. Here we estimate a random-effects probit model using GLS, again on the assumption that firm-specific effects are random rather than fixed.[14] The idea is not to imply that causation flows from the variables to exporting status, but rather that there is a high degree of correlation between the two groups of variables. Next to country of residence and sector of activity, foreign equity participation, the holding of foreign licenses, and access to foreign technical assistance are the most important features distinguishing exporters from nonexporters in all three countries, as can be seen in the first column of Table 7. In the sample without Ethiopian firms (column two) exporters also experience stronger competition from imports. In addition, the amount by which the import-intensity of

[14]The reported *rho* in this model is the proportion of the total variance contributed by the panel-level variance component. We report a likelihood ratio test of *rho* = 0, that is, the panel-level variance component is unimportant and the panel estimator is not different from the pooled estimator.

Table 7. Estimated Export Market Participation Equation

(*Dependent variable* = *EXPORTER*)

	All three countries	Ghana and Kenya	Kenya	Ghana	Ghana
percent_IMPORTED	0.002 (0.005)	0.013 (0.008)	0.008 (0.007)	0.020 (0.020)	0.015 (0.016)
LICENSE_FTA	1.164 (0.570)*	1.644 (0.705)*	2.317 (0.779)**	7.097 (3.149)*	–1.476 (2.015)
percent_FOREIGN	0.035 (0.007)**	0.065 (0.014)**	0.027 (0.007)**	0.024 (0.037)	–0.273 (0.028)
IMPORT_COMPETITION	0.472 (0.453)	2.365 (0.772)**	–0.592 (0.704)	2.326 (1.573)	0.876 (1.093)
LN (*EMPLOYMENT*)	2.573 (0.639)**	2.398 (1.037)*	2.765 (0.948)**	6.526 (3.764)	1.850 —
[*LN* (*EMPLOYMENT*)]^2	–0.078 (0.067)	0.013 (0.148)	0.006 (0.121)	–0.450 (0.408)	0.073 (0.100)
LN (*AGE*)	1.597 (1.083)	4.264 (1.458)**	1.469 (2.130)	–2.869 (2.377)	–2.374 (2.803)
[*LN* (*AGE*)]^2	–0.527 (0.251)*	–1.284 (0.381)**	–0.563 (0.451)	0.212 (0.535)	0.376 (0.543)
Textiles	–1.516 (0.619)*	–1.028 (0.733)	–1.311 (0.910)	3.432 (2.004)	
Woodwork	–1.288 (0.682)	–0.015 (0.716)	–0.133 (0.880)	0.925 (2.155)	
Metalwork	0.338 (0.596)	0.062 (0.710)	1.439 (0.924)	–9.740 (4.329)*	
Ethiopia	–5.727 (1.022)**				
Ghana	–2.275 (0.726)**	–2.476 (0.791)**			
1992	–1.188 (0.655)	–0.739 (0.639)		–1.036 (0.758)	
1994	0.120 (0.375)	0.087 (0.482)	–0.290 (0.483)		
1995	0.478 (0.366)	0.349 (0.492)	0.009 (0.473)		
Constant	–11.606 (2.242)**	–17.355 (3.694)**	–13.896 (3.391)**	–24.361 (11.079)*	–12.974
Log likelihood	–224.01	–173.73	–106.38	–55.07	–59.17
Wald chi-square (df)	54.17 (16)	33.85 (15)	35.29 (13)	7.21 (12)	—
rho	0.9512	0.9777	0.9595	0.9891	0.9794
chi-square (1) for LR-test of rho = 0	163.91	118.53	82.32	27.17	28.76
Number of observations	1268	699	457	242	242
Number of firms	599	348	206	142	142

Note: Standard errors are in parentheses.
(*) Significant at 5 percent level; (**) significant at 1 percent level.

exporters exceeds that of nonexporters becomes statistically significant in the Kenyan subsample.[15]

Productivity Premiums of Direct Exporters and Exporters to Outside of Africa

Next we compare the productivity of particular subgroups of exporters, namely, direct versus indirect exporters, and exporters to destinations outside of Africa compared with exporters to within the region. The learning-by-exporting hypothesis would predict higher productivity for direct exporters, because they are in direct contact with purchasers, and for exporters to outside of Africa because clients in more industrially developed economies are likely to have more technical and managerial information to share. Of course, part of each subgroup's premium is also due to selection effects. We argued above, however, that it is somewhat more difficult to be certain that selection effects would necessarily be stronger for direct exporters and exporters to outside of Africa. Columns 2 (full sample) and 5 (Kenya) of Table 6 re-estimate the productivity equation by replacing the variable $EXPORTER_{it-1}$ jointly by the variables $DIRECT\_EXPORTER_{it-1}$ and $INDIRECT\_EXPORTER_{it-1}$; and columns 3 and 6 use $DIRECT\_AFRICA_{it-1}$ and $DIRECT\_EXAFRICA_{it-1}$ as the export status variables.

Comparing direct and indirect exporters

The second column of Table 6 indicates that the 17.4 percent premium estimated for exporters as a whole is composed of a higher figure for direct exporters (22 percent) and a smaller figure for indirect exporters (9 percent and not statistically significant). The story is similar for Kenya, where the 21 percent premium for direct exporters is higher than for Kenyan exporters overall, and higher than the insignificant premium for Kenyan indirect exporters.

The finding of higher productivity premiums for direct exporters is consistent with learning effects. Two additional pieces of information also support this interpretation. First, a larger share of direct exporters export to destinations within Africa (44 percent) than outside of Africa (16 percent) (see Table 3). Considering only the mechanism of selection relating to competitive forces, this would suggest that selection effects are probably weaker for the direct exporters compared with indirect exporters, because competitive pressures are greater in intercontinental markets. If selection effects are weaker overall for direct exporters, then it is more likely that their higher productivity premiums can be attributed to learning-by-exporting.

Second, recall that in the Clerides and others (1998) model, higher productivity premiums from selection effects are associated with higher fixed costs, because productivity has to be high enough to generate gross profits greater than per period fixed

[15]In an earlier version of this paper (Mengistae and Pattillo, 2002), we presented estimates of equation (1) using a sample that excludes exporters with foreign ownership or those holding a foreign license or technical assistance contract. The exporting premium was much smaller and insignificant, which can be attributed to the correlation between foreign links and productivity.

Table 8. OLS Regression of TFP Growth on Exporting Status

(*Dependent variable = growth rate of TFP*)

	All countries			Kenya		
	(1)	(2)	(3)	(4)	(5)	(6)
Log *TFP_1*	–0.914 (0.024)***	–0.925 (0.025)***	–0.924 (0.025)***	–0.991 (0.037)***	–0.993 (0.038)***	–0.991 (0.038)***
EXPORTER_1	0.100 (0.058)*			0.156 (0.097)		
DIRECT_EXAFRICA_1			0.315 (0.215)			0.350 (0.270)
DIRECT_ AFRICA_1			0.178 (0.074)**			0.156 (0.112)
INDIRECT_EXPORTER_1		0.079 (0.102)	0.079 (0.102)		0.081 (0.161)	0.082 (0.161)
DIRECT_EXPORTER_1		0.191 (0.071)***			0.181 (0.106)*	
percent_FOREIGN	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)
LICENSE_FTA	0.013 (0.058)	0.014 (0.059)	0.018 (0.059)	0.074 (0.118)	0.065 (0.120)	0.081 (0.122)
percent_IMPORTED	0.001 (0.001)	0.001 (0.001)*	0.001 (0.001)	0.003 (0.001)**	0.003 (0.001)**	0.003 (0.001)**
IMPORT_COMPETITION	–0.053 (0.041)	–0.075 (0.043)*	–0.074 (0.044)*	–0.033 (0.090)	–0.037 (0.090)	–0.033 (0.090)
Log(*AGE*)	0.050 (0.089)	0.061 (0.098)	0.064 (0.098)	0.213 (0.174)	0.219 (0.175)	0.224 (0.175)
[Log(*AGE*)]^2	–0.009 (0.019)	–0.010 (0.021)	–0.010 (0.021)	–0.022 (0.037)	–0.024 (0.037)	–0.024 (0.037)
Textiles	–0.107 (0.054)**	–0.117 (0.058)**	–0.117 (0.058)**	–0.264 (0.107)**	–0.257 (0.108)**	–0.254 (0.108)**
Woodwork	–0.089 (0.045)**	–0.074 (0.048)	–0.073 (0.048)	–0.130 (0.098)	–0.133 (0.098)	–0.127 (0.098)
Metalwork	–0.083 (0.048)*	–0.114 (0.051)**	–0.112 (0.051)**	–0.192 (0.104)*	–0.196 (0.105)*	–0.187 (0.106)*
Ethiopia	0.149 (0.046)***	0.157 (0.047)***	0.157 (0.047)***			
Ghana	0.154 (0.045)***	0.120 (0.054)**	0.121 (0.054)**			
Constant	0.841 (0.112)***	0.820 (0.121)***	0.814 (0.122)***	0.640 (0.222)***	0.640 (0.222)***	0.621 (0.224)***
Observations	611	611	611	230	230	230
R-squared	0.71	0.73	0.73	0.79	0.79	0.79

Note: Standard errors are in parentheses.
(*) significant at 10 percent; (**) significant at 5 percent; (***) significant at 1 percent.

costs (see Section I). Looking at our data, if gross export revenues are smaller for direct exporters, this may imply lower fixed costs, because export revenues must be at least large enough to cover fixed costs. For the pooled sample, it is the case that the share of export revenue in total revenue is lower for direct exporters (mean, 42 percent; median, 20 percent) than for indirect exporters (mean, 47 percent; median, 30 percent). This may also suggest that selection effects are weaker for direct exporters, and support the learning interpretation of the higher premiums.

Comparing exporters to destinations within and outside africa

Table 6, columns 3 and 6, show how the premium of direct exporters breaks down into components corresponding to those directly exporting to destinations outside of Africa and those directly exporting to within Africa. In the pooled sample, the productivity premium of direct exporters to outside of Africa is 41.9 percent. This should be compared with a premium of 21 percent for direct exporters to within Africa, 17.4 percent for exporters as a whole and a statistically insignificant 9 percent for indirect exporters to destinations within Africa. In the Kenyan sample alone, the premium for direct exporters to outside of Africa is quite large (46 percent), and, again, larger than that for direct exporters to within Africa (insignificant). Thus, while it is not possible to formally test for learning-by-exporting, we interpret the findings in Table 6 as being consistent with the learning-by-exporting hypothesis.[16]

Total Factor Productivity Growth Regressions

In this section we estimate a specification using total factor productivity growth as the dependent variable, while also controlling for lagged productivity levels. While learning-by-exporting could explain higher productivity growth, it is less likely that a finding of a significant effect of exporting on productivity growth would reflect selection effects.

Table 8 presents results where the growth rate of total factor productivity is regressed on lagged export status variables (and similar controls as in earlier specifications), while also controlling for lagged productivity levels. In all the regressions, the lagged productivity level is strongly significant, statistically and economically. The negative coefficient is consistent with a process of "catching up" or convergence that can be explained in terms of gradual diffusion of technology from more innovative producers to the technological laggards.[17]

[16]Results using the contemporaneous export status variable (not shown) indicate that in all samples, the direct exporters' premiums are higher than those of indirect exporters, and premiums for direct exporters to outside of Africa are higher than those of direct exporters to within Africa. As noted above, for comparable samples, all productivity premiums estimated using contemporaneous export status are higher than those estimated using lagged export status. Comparing Ghana and Kenya, the premiums are highest for the Kenyan sample, the country with the most developed manufacturing export sector.

[17]See Barro and Sala-i-Martin (1995, pp. 274–81) for a model of productivity convergence driven by lower unit costs of imitation relative to innovation. See also Dowrick and Nguyen (1989), Bernard and Jones (1996a, 1996b) and Miller and Upadhyay (2002) for empirical evidence of cross-country convergence in aggregate TFP among OECD countries. The latter estimates the convergence parameter to range from –0.062 to –0.057, which is reasonably close to what we report in this paper. The firm-level estimation results of Kraay (1998) and Bernard and Jensen (1997) are also consistent with the growth rate of productivity decreasing in initial productivity levels.

The effects of exporting on productivity growth are quite sizable, and strengthen the results discussed above for productivity levels. Column 1 of Table 8 indicates that total factor productivity growth of the average exporter for the three countries is 10 percent higher than that of the average nonexporter. The productivity growth premium is 16 percent for Kenyan exporters, although it is only significant at the 11 percent level.

Next, we focus on comparing productivity growth for the subgroups of exporters. The higher average productivity growth premium for all exporters breaks down into a much higher premium for direct exporters (19 percent) than for indirect exporters (8 percent and not significant). Similar results are obtained with the Kenyan subsample.

Combined with the results in the previous section, this strongly suggests that the higher productivity premiums for direct exporters are consistent with learning-by-exporting effects. In specifications explaining current firm productivity as a function of lagged export status, direct exporters are two and one-half times more productive than indirect exporters. Secondary evidence on differences in the destination of exports and export revenues of the two subgroups (leading to inferences about fixed costs) suggests that selection effects may be weaker for direct exporters, supporting the inference that the higher premiums reflect learning. In the specification least likely to reflect selection effects, estimating the effect of lagged export status on productivity growth, indicates that productivity growth of direct exporters is more than twice as high as that of indirect exporters.

Columns 3 and 6 of Table 8 compare the productivity growth premiums of firms directly exporting to destinations outside of and within Africa. The relative sizes of the coefficients are similar to those obtained with the productivity level regressions; productivity growth premiums of direct exporters to outside of Africa (32 percent) are larger than those for direct exporters to inside Africa (18 percent). However, the premiums for firms exporting outside of Africa are not significant in either the pooled sample or the Kenyan sample. As noted, for an approach to detecting learning effects, this is the most demanding specification because past export status variables now also compete with a lagged productivity-level variable representing a determinant of the selection component. Consequently, exporters' premiums are very unlikely to reflect a correlation between lagged exporting and productivity growth because of the reverse causality of selection effects where more productive firms become exporters. The coefficient of lagged productivity is very significant economically and statistically, which in turn signals a process of technological diffusion or TFP convergence through which laggards "catch up" with the more advanced among firms. The weaker results obtained comparing exporters by destination may indicate that in addition to learning-by-exporting, selection effects—through the greater productivity needed to survive stronger competition in exporting to outside of Africa—are also present.[18]

[18]Note that for a sample of Kenyan firms, Granér and Isaksson (2002) do not find evidence that export destination affects technical efficiency.

IV. Conclusion

Many firm-level studies in developed and developing economies alike have reported a positive productivity premium for exporters. The premium is a useful economic indicator because it shows the upper limit to possible contributions of exporting activities to productivity growth or to the size of the international competitiveness gap faced by nonexporters (at current world prices and trade/exchange policy regimes). This paper has analyzed data on a sample of manufacturing firms drawn from three Sub-Saharan African countries, with two objectives in mind. First, to measure the productivity premium of exporters as accurately as possible, that is, while controlling for the productivity effects of other possible channels for the international diffusion of technology. Second, to compare the estimated productivity premium of certain subgroups of exporters: direct versus indirect exporters and exporters to outside of Africa relative to those exporting to within the region.

The sample is drawn from firms in Ethiopia, Ghana, and Kenya, which, among them, seem to capture the diversity of the region in terms of the development and export orientation of manufacturing industries. Our findings suggest that it is difficult to disentangle the influence of exporting activity on productivity from that of other international technology diffusion mechanisms.[19] Because the incidence of these foreign links (imported inputs, foreign direct investment, and foreign licensing) is much higher among exporters, multicollinearity makes it difficult to establish a relationship between foreign links and productivity.

We find that the average productivity premium of exporters for the three countries is about 17 percent. In addition to the effect on productivity levels, the estimates indicate that exporters enjoy productivity growth that is 10 percent faster than nonexporters. We also find that, among exporters, direct exporters are around two and a half times more productive than indirect exporters. Moreover, those firms exporting to destinations outside of Africa are significantly more productive than those exporting to within the region.

Given the short time series of the data, it is impossible to test to what extent these premiums are caused by selection of more efficient producers into exporting, or by learning-by-exporting. We argue, however, that by thinking about the mechanisms behind selectivity and learning, our finding of higher premiums for direct exporters and exporters to outside of Africa could be interpreted as being consistent with learning-by-exporting effects. This follows because the learning-by-exporting hypothesis would predict higher productivity for these two subgroups, while one could expect the relative strength of selectivity effects to go either way. We have quite strong evidence for this interpretation in the case of direct exporters. The slightly weaker evidence for exporters to outside of Africa may indicate that selectivity effects are also present through the channel of reaching greater productivity necessary to survive stronger competitive pressures in export markets outside of Africa.

[19] Kraay, Soloaga, and Tybout (2002), isolate the correlation of exporting activity with plant performance from the correlation of the latter with FDI and imports of inputs, but with a much longer panel dataset than the one used in this paper.

Although it is difficult to draw policy conclusions, given that causality between exporting and productivity can not be definitely established, one general policy implication is that the results support the case for open trade and the desirability of an environment conducive to exports.

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