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Does Freer Trade Really Lead to Productivity Growth?

Evidence from Africa

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ABSTRACT

Manufacturing is intensive in the use of reproducible factors and exhibits greater technological dynamism than primary production. As such, its growth is central to long-run development in low-income countries. African countries are latecomers to industrialization, and barriers to manufacturing growth, including those that limit trade, have been slow to come down. What factors contribute most to increases in output and productivity growth in African manufacturing? Recent trade–industrial organization theory suggests that trade liberalization should raise average total factor productivity (TFP) among manufacturing firms (Melitz 2003). However, these predictions are conditional on maintained assumptions about the nature of industries, factor markets, and trade patterns that may not be appropriate in a developing-country setting.

Manufacturing firms are heterogeneous, so the analysis demands disaggregated data. We use firm-level data from the World Bank’s Regional Program on Enterprise Development, covering Ghana, Kenya, Nigeria, and Tanzania for 1991–2003. Among other things, the data distinguish exports by destination (Africa and the rest of the world), which is important due to the spread of intra-African regional trade agreements (RTAs). Econometric results confirm well-known relationships, such as a positive association between export intensity and TFP, which implies that more productive firms are more likely to select in to exporting. However, we also find the destination of exports to be important. Many exporters have experienced declining TFP growth rates, which have occurred at different rates depending on the country and the export destination. The evidence for “learning by exporting” is thus mixed. These results add a new dimension to controversies over the development implications of trade liberalization and the promotion of intra-African RTAs.

Keywords: trade, Africa, firm productivity, manufacturing

JEL Codes: F14, O14, O33

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1. INTRODUCTION

Economic theory and empirics confirm the aggregate benefits of international trade to firms that participate in it. But with any competition, there are winners and losers, and trade is no exception. Changes at the extensive margin—that is, the appearance or disappearance of industries—are standard occurrences. At the intensive margin (that is, within an industry), recent research has shown that lowering trade barriers has differential effects on firm profitability and activity, depending on the distribution of firm-specific assets. A large literature, beginning with Melitz (2003), explores the idea that firms with differing levels of total factor productivity within an industry respond to a trade liberalization shock by specializing in exports, producing for domestic markets only, or exiting the industry (Chaney 2008; Eaton, Kortum, and Kramarz 2011).

Much of the economic research elaborating on these theories and empirical work on them has focused principally on developed countries. African countries present an important location to test these recent theories because of their relatively low levels of trade and integration with the global economy, especially in manufacturing exports. African countries have just started to join the global reduction in tariff and non-tariff barriers that has been in motion elsewhere in the world for multiple decades. Testing the recent trade literature in the context of African manufacturing productivity can expand our understanding of the applicability of these models. A further important development in Africa is that many, especially East African, countries are now actively implementing RTAs and customs unions. These measures might have implications for trade diversion, as is often postulated, but they may also have effects on firm and industry productivity growth.

In this paper, we consider the interactions of trade and productivity in some key West and East African economies, analyzing trade within RTAs and with the rest of the world. We find that the response of manufacturing firms to trade openings aligns broadly with standard theory, though it also diverges in some important and interesting ways. As expected, export status is positively and significantly correlated with firm productivity—that is, exporters are more productive than firms producing only for the domestic market. However, productivity trends among exporting firms are generally negative over time, a finding that contrasts with theories of *learning by exporting* and other less formal narratives of endogenous productivity growth associated with participation in trade.

The paper is structured as follows: In Section 2, we motivate the study and review relevant literature. In Section 3, we move to the data, highlighting special features of African economies that are likely to be relevant to empirical analysis. Here we also propose and apply an econometric model to test for links between trade orientation and firm productivity. The paper concludes in Section 4.

2. EXPORTS, TRADE SHOCKS, AND PRODUCTIVITY GROWTH

The economics literature shows strong evidence that export-oriented economic strategies have positive growth benefits (Krugman 1987; Rodrik 1988, 1991; Grossman and Helpman 1991). Exporting expands market access for domestic producers and can lead to productivity and knowledge spillovers from interaction with foreign markets. Many empirical studies demonstrate positive links between firm productivity and export status (Hallward-Driemeier, Iarossi, and Sokoloff 2002; Bernard and Jensen 2004; Álvarez and Lopez 2005). This empirical literature tends to support the notion of self-selection of more-efficient firms into the export market as being the cause for the productivity difference between exporting and nonexporting firms (Clerides, Lach, and Tybout 1998; Bernard and Jensen 1999; Granér 2002). The evidence on firm-level endogenous productivity growth caused by moving into the export market, or *learning by exporting*, is less clear. A smaller empirical literature addresses these questions specifically with Africa data, once again with mixed findings, with some finding productivity gains to exporting and others not (Biggs, Shah, and Srivastava 1995; Bigsten et al. 1999; Rankin 2001; Bigsten et al. 2004; Mengistae and Pattillo 2004; Granér and Isaksson 2009).

Another recent strand of the trade-development literature argues that productivity is also affected by the composition of exported goods and trading partners. In analyses of several countries, Hausmann, Hwang, and Rodrik found that “not all goods are alike in their consequences for economic performance” (2007, 2). In their analysis, the authors found that baskets of export goods with higher quality (based on the authors’ evaluation system) produce better economic performance. To date, few studies have explored these ideas with African data. Mengistae and Pattillo (2004), using a dataset that overlaps with ours, studied the productivity effects of exporting, as well as the effects of exporting outside Africa versus exporting within the region. They found not only that exporters have higher productivity, but also that African firms exporting to the rest of the world are significantly more productive than those exporting only within the continent. Granér and Isaksson (2009), using Kenyan data from the same source as our analysis but for a shorter time period, also found evidence that the destination of a country’s exports has positive productivity effects. Surprisingly, however, they found that it is the exports *within* Africa, rather than those to the rest of the world, that contribute the greatest share of “learning by exporting” productivity gains. They speculated that this may be because technologies in other African countries are better suited to production for intraregional trade than are those of other continents, notably industrialized countries.

Despite their reliance on subsets of a common database, the findings in these studies display wide variation. One reason for this variety is that some subsets are for specific countries, and those countries’ experiences may be idiosyncratic in some way. Another reason is that the 1990s were a period of rapid and sometimes far-reaching change in African trade policies and in global trade policies affecting Africa. These policies may have had different effects on exporting and thus on productivity. We explore these ideas in the following paragraphs.

In Melitz (2003), increasing exposure to trade raises average total factor productivity (TFP) in manufacturing through the exit of the least productive firms and the reallocation of labor to new, more productive firms. This within-industry restructuring comes about due to competition from imports (which drives out the least productive domestic firms) and opportunities for expansion among those firms that are competitive in the world market. In this theory, the resulting rise in average manufacturing-sector TFP is a source of welfare growth over and above the gains from specialization and trade identified in neoclassical trade theory.

Of course, the highly stylized Melitz model maintains an exclusive focus on manufacturing industries, which ensures that following a trade shock, resources freed up by the exit of the least productive firms will be reassigned under full employment to more-productive manufacturing firms. In reality, manufacturing in low-income economies, especially African ones, coexists with a large nonmanufacturing, primarily agricultural economy. Intersectoral mobility of labor and other factors makes it just as likely that resources given up by firms that exit from manufacturing will instead migrate

to nonmanufacturing employment, whether in agriculture and natural resource extraction or in nontraded industries (transportation, domestic trade and warehousing, construction, and so on) that service the other sectors. This likelihood is greater in countries whose comparative advantage lies in farming or mining, as is the case for most of countries in Africa south of the Sahara (SSA).

A second stylization in Melitz is that, by assumption, every firm produces only one good, which implies that changes in the product mix thus necessitate entry or exit by firms. The real world, however, is densely populated with multiproduct firms. In these cases, changes in relative prices—caused, for example, by a trade shock—may result in resource reallocation within firms rather than (or in addition to) among firms. In addition to the changes in extensive and intensive margins identified by the Melitz model, this is an additional margin at which adjustment may occur. It may also appear in the data as a lower rate of firm entry and exit than would be expected under the assumption of single-product firms.

Finally, Melitz's model assumes that firms sell to one of just two homogeneous markets—domestic or foreign. Yet, in Africa, a continent with high overall trade costs and many landlocked countries, there are (at least) three distinct market types: domestic, nondomestic intra-African, and rest of the world (ROW). The data also suggest that there are large fixed costs to “moving up” in terms of markets, whether from domestic to intra-African markets or from domestic markets to ROW. In our data, which span more than a decade, almost no firms are recorded as *entering* either of the two types of export market after initially selling only in the domestic market. However, the distribution of their sales among markets does change over time.¹

One possible reason for changes in the allocation of sales across markets is trade policy reform. During the 1990s, there were three broad types of policy-related changes in trade conditions for African economies. Each is likely to have had distinct *ceteris paribus* effects on average productivity and welfare.

1. *Lowering of own-country manufacturing tariffs.* This should have some Melitz-type effects: if import competition increases and the least productive domestic firms exit, then average productivity among the remaining firms should rise. However, it is not necessary that we would also see expansion or exporting by the most productive firms. Resources given up by manufacturing firms that exit can also be reassigned to other industries, specifically commercial agriculture, natural resource extraction, and the service industries that support them.
2. *Liberalization of foreign (especially ROW) export markets for manufactures.* Examples are multilateral trade liberalization in the Uruguay Round of the World Trade Organization, the U.S. African Growth and Opportunity Act, the European Union's Everything but Arms agreement, and their successors. These liberalization policies should be expected to lower the average productivity of exporting firms, because the marginal African firm able to break even by exporting after liberalisation has lower TFP than before. The downward shift in average TFP could be offset by endogenous productivity growth (“learning by exporting”), but as noted, the empirical evidence on this effect is mixed.
3. *Creation or expansion of African regional trade agreements (RTAs).* *Ceteris paribus*, RTAs have differential effects on their member economies, depending on the average productivity of the respective economies' manufacturing sectors. For countries with relatively low average productivity, the RTA has Melitz-type effects, as they face stronger competition from abroad (in this case, from an RTA partner). For more productive countries, however, the margin between producing for their own domestic market and producing for export within the RTA moves down, bringing lower-productivity firms into export markets (or, in a model with multiproduct firms, increasing the share of output exported by less productive firms). If the latter effect dominates, then average manufacturing-sector productivity may fall, with a more

¹ Unfortunately, the aggregation level of the data makes it impossible to know whether these are identical products going to different markets or differentiated products produced by multiproduct firms for different markets. This remains a subject for research with new data.

pronounced TFP decline observed among those firms exporting to less productive RTA partners.

These three trade liberalization measures have contradictory effects on domestic industry, which implies that their relative magnitudes will also matter. In general, African import tariffs have fallen less than ROW tariffs applied to African exporters, while progress on within-Africa RTAs has been slow and uneven. Among the effects of these three broad types of trade liberalization, if the ROW tariff effect is dominant, then average TFP among African exporters should decline. When economies also participate in an RTA, the least productive members of the RTA could see a significant loss of industrial manufacturing capacity, with only the most efficient and productive firms surviving. In the more productive RTA partners, the combination of lower ROW tariffs and lower tariffs within the RTA could cause average firm productivity to fall. In short, there can be no uniform prediction for trade–productivity interactions. Whether freer trade increases average TFP among manufacturing firms or reduces it is an empirical question.

3. DATA AND ANALYSIS

Data

We use a panel of firm-level data from the World Bank African Regional Program on Enterprise Development (RPED). RPED has up to 12 consecutive years of firm-level data from a random selection of privately held manufacturing firms. The industries covered are: food and bakery; furniture, machinery; chemicals and metals; textiles; garments; and wood products. Firms can be either formally registered or informal. The countries covered are Ghana, Kenya, Nigeria, and Tanzania (RPED also contains data from South Africa, but they are insufficient for panel data analysis).

The dataset has information on production, inputs, and sales, including whether sales are to the domestic market or, if exported, to markets within Africa or beyond. Characteristics of the firm—such as age, foreign ownership, output per worker, number of employees, and other features—are also included. There is also more specific information on resource use and outputs, such as profit-to-capital ratios, materials per worker, and average education and age of workers. Table 3.1 provides definitions of the most important variables.

Table 3.1—Definition of variables

Variables	Definition
Firm age	Age of firm
Any foreign ownership	Dummy variable if firm has any foreign ownership
% foreign ownership in industry	Percentage of firms in an industry that have any foreign ownership
Output	Production output of firm, measured in real USD
Capital	Capital of firm, measured in real USD
Material inputs	Material inputs used, measured in real USD
Other inputs	Other inputs used, measured in real USD
Workers	Number of employees
Export in Africa	Dummy variable if firm exports within Africa
Export ROW	Dummy variable if firm exports outside Africa (to Rest Of the World)
Real eff. exchange rate	Nominal exchange rate adjusted for CPI differentials using trade weights

Source: Authors' compilation.

Note: USD = U.S. dollars

Table 3.2 and Table 3.3 describe the main variables of interest. Note that in Table 3.3 the number of firms and observations for ownership and export status are not directly correlated; there are nearly one-third more foreign-owned nonexporting firms than exporters and 89 percent more domestically owned than foreign-owned exporting firms. The average number of employees is larger for foreign-owned firms than for domestically owned firms.

Table 3.2—Span and size of data

Observations	Ghana	Kenya	Nigeria	Tanzania
Number of firms	273	405	180	375
Years covered	1991–2002	1992–1999	1998–2003	1992–2000
Total observations	2,291	1,475	700	1,290
Any foreign ownership	427	242	131	182
Exporters	309	340	62	152
Exporters within Africa	218	85	34	40
Exporters outside Africa	160	261	51	65

Source: Authors' calculation.

Note: Last four rows reported are number of observations except for the Number of firms variable. Last two rows may add up to a figure larger than the exporters' figures as a firm may export both within and outside Africa.

Table 3.3—Sample size by ownership, firm size, and export status

		Nonexporter	Exporter
<i>Domestically owned</i>			
Number of observations		3,371	540
Number of firms		905	187
Number of employees	Avg.	35	199
	Min.	1	3
	Max.	2,103	2,598
<i>Any foreign ownership</i>			
Number of observations		515	319
Number of firms		146	99
Number of employees	Avg.	119	300
	Min.	1	5
	Max.	1,742	4,000

Source: Authors' calculation.

Note: Totals of number of observations and/or number of firms may differ from the analogous figures in Table 3.2 due to missing values for information about export status or country location.

Despite the number of firms and the length of the series, the data show almost no instances of firms making the transition from wholly domestic sales to exporting. Nor do they show corresponding transitions from exporting to wholly domestic sales. The kinds of firm-level responses to trade shocks predicted by the Melitz model are thus not visible in the African data. What we do see, however, are changes at the firm level in the mix of sales by market—a trend more consistent with the existence of multiproduct firms that change product mixes and the destination of products.

The data form an unbalanced panel and the countries are observed for different time periods. Some firms exit or enter during the observation period, and other firms cannot be traced in some years. Sometimes, previously interviewed firms decline to be interviewed again.

A typical pattern is for firms to report for a few years, fail to report for several years, resume reporting, and then fail to report again, depending on the duration of the data series.² Thus, it is unclear whether they have actually ceased operations or are simply failing to report. With regard to firm entry, the number of firms entering the dataset midstream is a negligible fraction of the total observations.

We know of only one other study using the full dataset applied in this paper. Rankin, Söderbom, and Teal (2006) investigated what they described as the poor export performance of SSA firms. They found only weak evidence for self-selection into exporting based on efficiency and firm size, and they concluded that firm-specific factors, such as skills and foreign ownership, are predominant. As previously noted, earlier versions of this dataset with fewer observations have been used in several studies (Granér and Isaksson 2009; Van Biesebroeck 2005; Bigsten et al. 2004; Söderbom and Teal 2003; Waldkirk and Ofusu 2010). Methodologically our work is closest to Waldkirk and Ofusu's (2010) analysis on foreign ownership and productivity using the Ghana portion of these data, although they did not analyze the effects of exporting.

² Very frequently, firms absent from the data for a few years then reappear. For example, a firm might enter the dataset at age 25, report for an additional year, and then stop reporting for the remainder of the dataset. There are also cases in which well-established firms (older than 40 years) report for only one year, and others in which relatively new firms (younger than 10 years) enter and report for the remainder of the series. When any of this happens, variables describing the firm are typically consistent and similar to the values in their previous reporting session. Nevertheless, unexplained exit or entry has the potential to cause selection bias if, for example, firms that exit have characteristics different from those that survive.

Empirical Analysis

In this section, we examine relationships among firm characteristics, such as ownership, trade orientation, and total factor productivity (TFP) growth. Our starting point is a basic production function from which we recover estimates of TFP levels and changes over time for the dataset as a whole and for a variety of relevant subsets. For any firm, we denote output per worker Y as a function of inputs of capital, material inputs, and other inputs per worker, all measured in constant U.S. dollars and denoted by K , M , and O , respectively. Suppressing subscripts, we have

$$Y = A f(K, M, O), \quad (1)$$

where A is a measure of TFP.

We are interested in differential productivity and productivity growth across firms, industries, and countries, as well as among firms with different characteristics, including foreign ownership, which is represented by a binomial variable F , and destination of exports X . We hypothesize that each of these, along with time T , could affect overall productivity levels, implying that in equation (1), $A = A(X, F, T)$. We assume Cobb-Douglas technology, which gives the function

$$Y = A^{a+(1+rT)(1+gF+hX)} K^{b_1} M^{b_2} O^{b_3}. \quad (2)$$

In this expression, unconditional initial TFP is equal to $A^{1+\alpha}$. TFP evolves in a linear fashion with time at rate ρ . The influence of foreign ownership and export status on TFP are captured by γ and η , respectively; these influences may also evolve over time at rates $\rho\gamma$ and $\rho\eta$, respectively. Effects on output per worker of increases in capital K , material M , and other inputs O are given by the respective β terms. Under constant returns, the marginal product of labor is equal to $(1 - \beta_1 - \beta_2 - \beta_3)$.

Taking the logarithm of equation (2) and choosing productivity units such that $\ln A = 1$, indexing firms by i and time by t , and writing this in the form of an empirical model, the resulting basic equation is

$$\ln Y = a + rT_t + (1 + rT_t) * (gF_{it} + hX_{it}) + \sum_k b_k \ln Z_{it}^k + \delta' \mathbf{D} + \mu_i + e_{it}, \quad (3)$$

in which $Z = (K, M, O)$; $\delta' \mathbf{D}$ is the product of a vector of industry and country dummy variables $\mathbf{D}$ and their associated coefficient vector δ ; μ_i is a random effect at the firm level; and e_{it} is an independently and identically distributed error term.

Although equation (3) represents a standard Solow-type TFP estimation, improvements in TFP are likely to be known and anticipated by firm managers, which would potentially make observations of inputs (for example, capital investments) endogenous to changes in TFP known by firm managers but unobserved by econometricians. Olley and Pakes (1996) proposed using capital investment as a proxy for increases in TFP; however, their method relies on observing firm exit and nonzero investments, which does not conform to our data. Levinsohn and Petrin (2003) proposed a more tractable method using intermediate inputs as a proxy for capital investments. In their approach, demand for intermediate inputs by firm i in period t is a function of both capital K_{it} and of TFP, ω_{it} , such that $M_{it} = M_{it}(K_{it}, \omega_{it})$. As long as this function exhibits monotonicity, we can invert it to obtain $\omega_{it} = g^{-1}(K_{it}, M_{it})$. We estimate this from our data using Levinsohn and Petrin's revenue-based generalized method of moments estimator, as described by Petrin, Poi, and Levinsohn (2004):

$$\begin{aligned} Y_{it} &= \alpha + \beta_O O_{it} + \beta_K K_{it} + \beta_M M_{it} + \omega_{it} + e_{it} \\ &= \beta_O O_{it} + \varphi_{it}(K_{it}, M_{it}) + e_{it} \end{aligned} \quad (4)$$

where $\varphi_{it}(K_{it}, M_{it}) = \beta_0 + \beta_K K_{it} + \beta_M M_{it} + g^{-1}(K_{it}, M_{it})$. This equation is estimated using ordinary least squares, with a third-order polynomial approximation in K_{it} and M_{it} taking the place of $\varphi_{it}(K_{it}, M_{it})$. The

estimation procedure then makes use of moment conditions on the relationship between the previous period's error terms, as described by Petrin, Poi, and Levinsohn (2004), and uses bootstrapped standard errors. The estimates of TFP ω_{it} are calculated from equation (4) as follows:

$$\omega_{it} = \exp(y_{it} - \beta_o O_{it} - \beta_k K_{it} - \beta_m M_{it}). \quad (5)$$

We then conduct a second-stage estimation of how TFP, measured as $\ln(\omega_{it})$, changes with the variables of interest related to firm export status and ownership. This represents a similar random effects model to equation (3), but we now have TFP as our dependent variable and have already controlled for inputs, so they no longer appear. The estimating equation is as follows:

$$\ln \omega_{it} = \alpha + \rho T_t + (1 + \rho T_t) * (\gamma F_{it} + \eta^r \mathbf{X}_{itr}) + \delta \mathbf{D} + \mu_i + \varepsilon_{it}, \quad (6)$$

where we have allowed for separate productivity effects from exports to more than one destination r , each denoted by an element of the vector $\mathbf{X}_{itr}$ with marginal productivity effect η^r , as well as a vector of control variables in $\mathbf{D}$. The control variable vector includes industry dummy variables, as well as a measure of the real effective exchange rate (REER) for each country and year. The REER captures macroeconomic forces that are expected to have an effect on tradable sector profitability. A high value of REER indicates an overvalued nominal exchange rate, which is typically (though not always) the result of inflation at a rate persistently higher than that of a country's trading partners. It also indicates diminished international competitiveness of domestic production.³

Null hypotheses based on this model are as follows:

- (a) $\rho = 0$: secular TFP growth is zero;
- (b) $\gamma = 0$: foreign ownership has no effect on TFP levels;
- (c) $\rho\gamma = 0$: foreign ownership has no effect on TFP trends;
- (d) $\eta^r = 0$: firms that export to destination r have no difference in TFP levels; and
- (e) $\rho\eta^r = 0$: firms that export to destination r have no difference in TFP trends.

Note that acceptance of hypothesis (d) is evidence against the idea that more-productive firms select into exporting, whereas acceptance of hypothesis (e) is evidence that there are no "learning by exporting" productivity effects. These are the main foci of our estimation work.

Results

Summary statistics of key variables used in regressions are shown in Table 3.4. The Levinson-Petrin production function estimates are in Table 3.5. These tables display expected signs and magnitudes (see Yasar and Morrison-Paul 2007) and have strong statistical significance. For comparison, the appendix tables show the results of ordinary least squares estimates of Cobb-Douglas production functions (under the assumption of exogenous capital), with controls for firm type, export orientation, and industry. Finally we fit the TFP model of equation (6) with a random effects specification. The results are shown in Table 3.5, which reports estimates for all countries pooled, as well as for individual countries.

³ REER data were obtained from <http://www.bruegel.org/publications/publication-detail/publication/716-real-effective-exchange-rates-for-178-countries-a-new-database/>, accessed May 24, 2012.

Table 3.4—Summary statistics of regression variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Real output per worker, USD (log)	4,502	8.436	1.374	2.6744	13.708
Real other inputs per worker, USD (log)	4,502	5.969	1.668	−0.4656	11.319
Real capital per worker, USD (log)	4,502	7.627	2.092	0.5184	13.134
Real material inputs per worker, USD (log)	4,502	7.672	1.571	−0.5591	13.640
Any foreign ownership	4,482	0.1796	0.383	0	1
Export to ROW	3,478	0.1003	0.3005	0	1
Export to Africa	3,478	0.1394	0.3464	0	1
Real Effective Exchange Rate				52.036	301.055
Textiles	4,502	0.0680	0.2517	0	1
Garments	4,502	0.1813	0.3852	0	1
Wood products	4,502	0.0772	0.2670	0	1
Furniture	4,502	0.1755	0.3853	0	1
Processed foods	4,502	0.2061	0.4045	0	1
Metals and machinery	4,502	0.2918	0.4547	0	1

Source: Authors' calculation.

Notes: USD = US dollars; ROW = rest of the world.

Table 3.5—Levinson-Petrin production function estimates

Dependent var. (ln real output/worker)	
Variables	All Countries ⁺
ln real USD other inputs per worker	0.156*** (0.00969)
ln real USD <i>K:L</i> ratio	0.178*** (0.0608)
ln real USD materials per worker	0.367** (0.164)
Observations	4502

Source: Authors' calculation.

Notes: USD = U.S. dollars; Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The results contain several interesting features. First, the secular trend of TFP is significantly negative in Kenya and Ghana, but it is positive (and large) in Tanzania, whereas in Nigeria there is no trend. This is consistent with evidence in the literature of flat or stagnating overall productivity growth in African countries over this period. Second, firms that export have generally higher TFP levels than those that do not; however, the difference is significant only in the case of Ghanaian and Nigerian exports to the rest of the world and of Kenyan exports to Africa. In these cases alone can we claim, through rejection of hypothesis (d), that there is any support for the claim that more-productive firms self-select into exporting. Third, despite higher TFP levels, firms that export show no evidence of “learning by exporting” (the only exception of a positive effect is for Ghanaian exporters to non-African destinations). In fact, West African exporters to non-African destinations show *negative* TFP growth rates of −3 percent (Ghana, $p < 0.05$) and −6 percent (Nigeria, $p < 0.15$). Similarly, Kenyan firms exporting to *African* destinations have negative TFP growth rates of −5 percent ($p < 0.05$). Fourth, after controlling for other sources of variation, foreign ownership appears to be significantly associated with TFP growth in only one country—Tanzania.

These results are robust to specification tests, including the effects of behind-the-border transport and marketing margins represented by dummy variables for industry location by city and by dummies for location in the capital city or the main port. The results are unaffected by inclusion or exclusion of the REER (which has the expected negative sign in most cases, but significantly so in Ghana alone). They are also unaffected by division of the sample between small and large firms (the dividing point being 10 employees), though the results for small firms are much weaker due to smaller sample sizes and (plausibly) higher degrees of measurement error.⁴ The results of the TFP estimates are also found in estimates of the Cobb-Douglas production functions (see Appendix).

Discussion

In our earlier discussion, we concluded that in the presence of multiple-product firms, nonmanufacturing sectors, and multiple-export destinations, and with more than one possible source of a trade liberalization shock, firm-level trade–TFP relationships might vary by country. Unfortunately we lack the data required for precise and direct tests of the influences of trade and trade policy shocks on firm-level productivity. Thus, the inferences we draw are necessarily speculative. Nevertheless, our results are sufficiently different from many previous findings and are sufficiently robust with respect to model specification that some discussion is warranted.

In our dataset, the two West African countries—Ghana and Nigeria—are engaged in trade with both ROW and their African neighbors. Both are partners in Economic Community of West African States (ECOWAS), a West African RTA. However, ECOWAS, though large, has essentially failed to produce measurable changes in intra-RTA trade policies. For these countries, then, most trade liberalization has been in the form of reduced foreign tariffs applied to their exports, with smaller reductions in their own import tariffs. From 1997 to 2004, the simple average Most Favored Nation (MFN) tariffs of SSA countries fell by one-fifth, from 21.6 percent to 17.2 percent. Tariffs in ECOWAS countries, which include Ghana and Nigeria, fell by less than that—by about one-sixth. Over the same period, tariffs imposed by industrial countries fell by more than one-third, from 8.7 percent to 5.7 percent (Yang and Gupta 2005, Table 2). From Section 2, we can predict that when foreign tariff reductions are the dominant form of trade liberalization, the margin of productivity at which exports are profitable moves down, with the result that average TFP among exporters to ROW should decline. We observe this in the cases of Ghana and Nigeria.

In the two West African countries, initial TFP is much higher among firms that export outside Africa—by 29 percent in Ghana and 9.6 percent in Nigeria—than among firms that do not. The rate of TFP growth among firms selling into domestic or African markets is zero, whereas that for exporters to ROW is significantly negative, at –2.5 percent per year in Ghana and a massive –8.1 percent in Nigeria. These estimates are strongly consistent with the prediction that when foreign tariff reductions dominate trade liberalization, average productivity among exporters will fall as the lower productivity margin compatible with profitability in exporting to ROW declines. The data do not show evidence of entry into exporting by new firms, however. Rather, the result presumably comes from the diversion of sales from domestic or African markets to ROW by existing exporters. Within these firms, it is likely that lower-technology products (simpler types of garments or furniture, perhaps) can now be profitably exported to ROW, whereas in the past, these products had been sold only within the domestic and African markets. To check on this trend, however, requires a finer level of product disaggregation than is available in the RPED dataset.

In East Africa, by contrast, the 1990s saw significant steps toward revitalization of a regional economic grouping, which by 1999 had evolved into the East African Community (EAC). The original members of this grouping were Kenya, Tanzania, and Uganda. All three share a common history of British colonialism and had constituted a common economic area during the colonial period.⁵ On average,

⁴ Complete tables of robustness checks are available from the authors.

⁵ The three countries were previously linked through several agreements, including the East African Community (1967–77). East African Cooperation was agreed on in 1993 and launched in 1996. Continuing negotiations led to the formation of the East

14.2 percent of Kenya's exports went to other African countries (almost all to its two EAC neighbors) from 1970 to 1997. Intra-EAC trade grew sharply through the 1990s, however, resulting in regional trade intensities much higher than in any other developing-country trading bloc (Kirkpatrick and Watanabe 2005, Table 3 and Figure 1). By 2004, 10 percent of Kenyan exports went to Uganda, and another 6.9 percent to Tanzania. In contrast, in the same year, only 7 percent of Tanzania's exports and 14 percent of Uganda's exports went to their EAC partners (Kirkpatrick and Watanabe 2005). Meanwhile, the EAC as a whole moved toward formation of a customs union. Kenyan and Tanzanian import tariffs were reduced somewhat, though (as in West Africa) by proportionally less than the reductions in ROW tariffs applied to their exports outside Africa. During the 1990s, therefore, intra-EAC liberalization was arguably the most important source of trade shocks for Kenya and Tanzania.

In Section 2, we argued that the *ceteris paribus* effects of an RTA would depend on where each country lay in relation to productivity among its RTA partners. Countries with lower average productivity should see intensified competition from outside, leading to exit of their least productive firms and a rise in average TFP. In contrast, in the more productive economies, lower tariffs within the RTA are equivalent to lower tariffs from any external source; firms that were formerly unable to make a profit exporting will now be able to do so (at least to their neighbors). At the margin between selling to domestic markets and selling to African markets, less productive firms will shift into exports (or, in multiproduct firms, less productive lines produced within diversified firms will now be exported). These are exactly the results shown in Table 3.6. In Tanzania, average productivity is initially somewhat lower than in Kenya. During the period covered by the data, average manufacturing-sector TFP in Tanzania rises by more than 8 percent per year. There is no difference in TFP growth rates between exporters and nonexporters, which is consistent with the prediction of a general decline in Tanzanian manufacturing activity, led by the least productive firms, with resources so released migrating out of the sector and into agriculture or services.

In Kenya, unlike in Tanzania, firms that export to Africa are significantly more productive (by 44 percent) than other firms. However, whereas average TFP growth among *all* Kenyan firms is zero, growth among Kenya's exporters to Africa declined by almost 4 percent per year. Again, this finding is consistent with the predictions from a model in which lower barriers to intra-RTA trade dominate the effects of other forms of trade liberalization, permitting less productive firms to remain competitive in export markets from which they would otherwise be excluded. Unlike the other economies in our sample, the share of Kenya's manufacturing output exported within Africa increased substantially during the 1990s, from 4 percent to more than 7.5 percent. Among Kenyan exporting firms, total output on average did not grow in real terms through the 1990s. However, that of Kenya's exporters to other African countries did grow by a statistically significant margin over other firms.

To reiterate, limitations in the dataset mean that we lack direct evidence of changes in firm behavior. We can say only that the estimation results are consistent with our *ex ante* postulates. It is also worth reiterating that our findings for Kenya contradict those of Granér and Isaksson (2009), who found that "learning by exporting" effects among Kenyan manufacturing firms are strongest from trade within Africa, where they (presumably) have a comparative advantage in skills and capital, rather than from exports to the rest of the world, where Kenya's comparative advantage is in low-skill products. A strict comparison of these two sets of results is part of an agenda for ongoing research.

African Community in 1999 (<http://www.eac.int/about-eac/eac-history.html>, accessed January 4, 2012). Kenya, Tanzania, and Uganda are also members of the Common Market for Eastern and Southern Africa, established in 1993.

Table 3.6—Total factor productivity regressions

Dependent var = ln(TFP) Variables	(1) All Countries	(2) Kenya	(3) Tanzania	(4) Ghana	(5) Nigeria
Time trend	−0.0132*** (0.00323)	−0.0360** (0.0152)	0.0857*** (0.0131)	−0.0235*** (0.00413)	−0.0126 (0.0103)
Trend * exports outside Africa	−0.0276*** (0.01000)	−0.0268 (0.0298)	−0.0213 (0.0485)	−0.0308** (0.0123)	−0.0653 (0.0451)
Trend * exports within Africa	−0.0102 (0.00909)	−0.0485** (0.0200)	−0.0139 (0.0377)	0.0234* (0.0139)	0.00336 (0.0377)
Any foreign ownership = 1	0.110** (0.0459)	0.0927 (0.0952)	0.185** (0.0761)	0.00934 (0.0846)	0.0172 (0.0913)
Exports within Africa = 1	0.116 (0.0741)	0.445*** (0.143)	0.240 (0.320)	−0.171 (0.111)	0.0886 (0.416)
Exports outside Africa = 1	0.249*** (0.0816)	0.220 (0.207)	0.0756 (0.416)	0.260*** (0.0982)	0.986** (0.494)
Real eff. exchange rate	−0.000330* (0.000173)	0.00329 (0.00317)	−0.00399 (0.00260)	−0.00203*** (0.000607)	−0.000107 (0.000188)
Constant	3.481*** (0.0478)	3.184*** (0.176)	3.054*** (0.376)	3.871*** (0.105)	3.667*** (0.137)
Observations	3,459	753	547	1,477	682
Number of firms	944	339	216	214	175

Source: Authors' calculation.

Notes: Industry controls are included but not reported. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

4. CONCLUSIONS

The economies of SSA have historically grown slowly, despite constant attention from international financial institutions and the donor community. It is well known that manufacturing-sector growth is a key to sustained economic growth in the aggregate and, moreover, that productivity growth is the key to long-run growth in manufacturing industries. In the African context, structural constraints to manufacturing-sector productivity growth are acknowledged to be important elements in the overall growth experience.

Using data on four African countries, we tested for relationships between manufacturing productivity growth and trade at the firm level. As expected, firms that export are (in most cases) significantly more productive, by a TFP measure, than firms selling only into domestic markets. However, secular TFP growth rates are found to be zero in one country (Nigeria) and negative in two others (Ghana and Kenya). Moreover, TFP growth rates among some types of exporters in some countries are found to be significantly negative. We argue that the observed pattern of TFP levels and growth rates is consistent with predictions about trade policy shocks experienced by these countries. The key to the observed patterns appears to lie in a model allowing for multiple export destinations, differential types and rates of trade policy liberalization, multiproduct firms, and the existence of a sizable nonmanufacturing component to employment of domestic factors of production. All of these phenomena are well-documented characteristics of African firms and economies.

The results yield some interesting thoughts on prospects for the growth of African manufacturing. In the past, foreign ownership may have been a significant source of productivity growth, though the direction of causation between foreign ownership and higher TFP at the firm or industry level remains unproven. More can be said from our data about the influence of trade. In Africa, postindependence import-substitution policies have been slow to break down. At the same time, domestic markets have remained small, limiting the scope for the kinds of endogenous productivity gains (whether within or between firms) that are associated elsewhere with expanded manufacturing-sector activity. Although Africa's export markets have become more open, this by itself has not helped to increase TFP in African manufacturing. In fact, as we see, it has contributed to a lowering of TFP growth as the margin of profitable exporting moves down. Similarly, the expansion of intra-African RTAs seems to have had mixed effects. For firms in the least-productive economies, RTAs mean intensified competition from within-RTA imports. Average TFP in manufacturing has risen due to the exit of less-productive firms. However, more productive firms have not necessarily appeared, because of competition in factor markets from agriculture and services. Meanwhile, the more productive RTA members have also experienced declining average productivity as the effective size of the "domestic" (that is, intra-RTA) market grows.

The results of our analysis are robust; however, additional data could help strengthen and generalize the results. A longer, richer dataset could also help answer more questions. With the current dataset, we can only examine the changes in productivity among exporting and nonexporting firms. More detailed information on firm entry and exit would allow us to provide more definitive results.

APPENDIX: SUPPLEMENTARY TABLES

Table A.1—Production function estimates from the full dataset

Dependent: ln output/worker	(1)	(2)	(3)	(4)
	All Countries	Exporters	Export Destination	Foreign Ownership
ln <i>K</i> (ln capital/worker)	0.0547*** (0.00621)	0.0552*** (0.00620)	0.0588*** (0.00724)	0.0552*** (0.00620)
ln <i>M</i> (ln mat. inputs/worker)	0.638*** (0.00653)	0.637*** (0.00653)	0.656*** (0.00731)	0.637*** (0.00653)
ln <i>O</i> (ln other inputs/worker)	0.142*** (0.00696)	0.143*** (0.00695)	0.119*** (0.00773)	0.143*** (0.00696)
<i>F</i> (any foreign ownership = 1)	0.0798*** (0.0309)	0.0793*** (0.0308)	0.0858*** (0.0357)	0.0794*** (0.0483)
<i>X</i> (exporter = 1)	0.0637*** (0.0223)	0.178*** (0.0404)		0.178*** (0.0413)
<i>T</i> (time)	−0.00175 (0.00207)	0.00122 (0.00225)	−0.00145 (0.00281)	0.00123 (0.00234)
<i>T</i> × <i>X</i>		−0.0179*** (0.00528)		−0.0179*** (0.00544)
<i>T</i> × <i>F</i>				−6.01e−06 (0.00551)
Export to Africa = 1			0.132** (0.0610)	
Export to ROW =1			0.267*** (0.0674)	
<i>T</i> × Export to Africa			−0.0146 (0.00748)	
<i>T</i> × Export to ROW			−0.0256*** (0.00828)	
Kenya	−0.164*** (0.0367)	−0.157*** (0.0367)	−0.191*** (0.0406)	−0.157*** (0.0367)
Ghana	−0.110*** (0.0386)	−0.101*** (0.0387)	−0.126*** (0.0430)	−0.101*** (0.0387)
Tanzania	−0.265*** (0.0370)	−0.259*** (0.0370)	−0.234*** (0.0431)	−0.259*** (0.0370)
Constant	2.389*** (0.0712)	2.357*** (0.0717)	2.371*** (0.0825)	2.357*** (0.0719)
Observations	4,280	4,280	3,459	4,280
Number of firms	1,139	1,139	944	1,139

Source: Authors' calculation.

Notes: Dependent variable is log of real output per worker. Industry controls included but not reported. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A.2—Production function estimates by country

Dependent variable: ln real output/worker	(1) Kenya	(2) Tanzania	(3) Ghana	(4) Nigeria
ln <i>K</i> (ln capital/worker)	0.0908 ^{***} (0.0181)	0.0247 ^{**} (0.00990)	0.0501 ^{**} (0.0111)	0.0720 ^{**} (0.0168)
ln <i>M</i> (ln material inputs/worker)	0.649 ^{***} (0.0203)	0.678 ^{***} (0.0135)	0.667 ^{***} (0.0100)	0.642 ^{***} (0.0163)
ln <i>O</i> (ln other inputs/worker)	0.0820 ^{***} (0.0262)	0.160 ^{***} (0.0163)	0.146 ^{***} (0.0105)	0.0892 ^{***} (0.0137)
<i>F</i> (any foreign ownership=1)	0.102 (0.0771)	0.0211 (0.0466)	0.130 ^{**} (0.0576)	−0.0208 (0.0773)
<i>T</i>	−0.00780 (0.00951)	0.0406 ^{***} (0.00809)	−0.00227 (0.00335)	−0.00749 (0.00738)
Export to Africa = 1	0.319 ^{**} (0.131)	0.125 (0.219)	−0.116 (0.0882)	−0.183 (0.348)
Export to ROW =1	0.265 (0.186)	0.305 (0.284)	0.289 ^{***} (0.0775)	0.960 ^{**} (0.424)
<i>T</i> × Export to Africa	−0.0394 ^{**} (0.0184)	−0.0104 (0.0257)	0.0144 (0.0110)	0.0206 (0.0316)
<i>T</i> × Export to ROW	−0.0300 (0.0273)	−0.0376 (0.0330)	−0.0249 ^{**} (0.00974)	−0.0806 ^{**} (0.0387)
Constant	2.217 ^{***} (0.194)	1.637 ^{***} (0.108)	2.131 ^{***} (0.105)	2.615 ^{***} (0.190)
Observations	753	547	1,477	682
Number of firms	339	216	214	175

Source: Authors' calculation.

Notes: ROW = rest of the world; Dependent variable is log of real output per worker. Industry controls are included but not reported. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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