PhD Course: Development Economics (Micro)
Firms in International Trade

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1 Introduction

In this lecture I will discuss the extent to which, and how, firms in poor countries participate in international markets - basically the status of such firms in the global economy.

I will focus on exporting. The main reason is that this is an area where we've accumulated a lot of empirical evidence. But firms can participate in the global economy in other ways too, of course - notably by being part of global value chains (outsourcing) - but we know less about the impact of that on economic performance and development.

The basic motivation for looking at this from a development point of view is that growth in the private, non-farm sector is important for the economic development in poor countries. Why? A few examples:

- Generate more jobs
- Reduce vulnerability to weather shocks,
- Spur technological progress
- Ultimately, reduce poverty.

Since domestic markets for non-farm products and services are often small (applies for most African countries), growth in this sector requires participation of Africa's firms in the international market. Moreover, exporting generates foreign exchange and may even contribute to productivity gains.

The references for this lecture are the following:

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding and Peter K. Schott (2007). “Firms in International Trade,” Journal of Economic Perspectives 21(3), 105-130.

Blalock, G., and P. J. Gertlerb (2004), . “Learning from Exporting Revisited In a Less Developed Setting,” Journal of Development Economics 75 (2): 397—416.

Clerides S., Lach, S. and J. Tybout (1998), ”Is Learning by Exporting Important? Micro-Dynamic Evidence From Colombia, Mexico and Morocco ”, Quarterly Journal of Economics, 903-948.

Bigsten, A., Söderbom, M. et al (2004), “Do African Manufacturing Firms Learn from Exporting?”, Journal of Development Studies, 40(3): 115-71.

2 Setting the scene: Firms in international trade

Reference:

Bernard, A. et al. (2007). "Firms in international trade" JEP.

- Most mainstream economists would argue that free trade can be an important source of welfare gains.

- Those of us interested in development are often referred to the Asian miracle as evidence that manufactured exports is a key ingredient in the growth process.

- The private sector plays an important role in the current policy discussion. If you look at Africa, you see that domestic markets are small - significant growth in Africa's private sector will probably require a dramatic increase in the amount of exporting.

- In recent years, many people have argued there's a dark side to globalization - workers in poor countries get exploited, global capitalism impoverishes the poor etc.

- How can we understand patterns of international trade?

  – Traditional or "old" theories of international trade explain the flow of goods between countries in terms of **comparative advantage** (differences in opportunity costs of production). Comparative advantage can arise because of productivity differences ("Ricardian" comparative advantage) or because of a combination of cross-industry differences in factor intensity and cross-country differences in factor abundance ("Heckscher–Ohlin" comparative advantage). Key implication: **interindustry trade**.

– "New" trade models by Krugman, Helpman and others in the 1980s: a combination of economies of scale and consumer preferences for variety lead otherwise identical firms to "specialize" in distinct horizontal varieties. Results in two-way or "**intraindustry**" trade between countries. (Note: I'm told the course in "macro development economics", planned for next spring, will discuss these models in some detail.)

– **Current research** on trade relaxes the representative firm assumption, emphasizing the importance of a micro perspective. Look at a micro dataset of firms and you will probably find **large variation** in exporting, productivity, capital intensity and skill intensity across firms within narrowly defined industries. Could it be that by assuming, as both "old" and "new" trade models do, that there is a representative firm we are **missing out** on important aspects and mechanisms of international trade? Very much of the current research on trade revolves around **heterogeneous firms**.

- Exporters are different [Discuss Table 3 in Bernard et al., note US data]

Table 3

Exporter Premia in U.S. Manufacturing, 2002

	Exporter premia		
	(1)	*(2)*	*(3)*
Log employment	1.19	0.97	
Log shipments	1.48	1.08	0.08
Log value-added per worker	0.26	0.11	0.10
Log TFP	0.02	0.03	0.05
Log wage	0.17	0.06	0.06
Log capital per worker	0.32	0.12	0.04
Log skill per worker	0.19	0.11	0.19
Additional covariates	None	Industry fixed effects	Industry fixed effects, log employment

Sources: Data are for 2002 and are from the U.S. Census of Manufactures.

Notes: All results are from bivariate ordinary least squares regressions of the firm characteristic in the first column on a dummy variable indicating firm's export status. Regressions in column 2 include industry fixed effects. Regressions in column 3 include industry fixed effects and log firm employment as controls. Total factor productivity (TFP) is computed as in Caves, Christensen, and Diewert (1982). "Capital per worker" refers to capital stock per worker. "Skill per worker" is nonproduction workers per total employment. All results are significant at the 1 percent level.

3 Understanding Exporting: Causes and Consequences

- It is often argued that firms in developing countries lack the necessary skills to perform well: there are significant productivity differences between firms in developing and developed countries and/or significant cost differentials.

- How can this "gap" be reduced?

- Some economists believe that export-led development strategies improves efficiency, and in this section we discuss this idea more in detail.

- Growing literature on the link between exporting and firm-level efficiency in developing countries. Main question: Does exporting actually *cause* efficiency gains? Indeed, causality may run in the other direction: efficient firms may self-select into the export market.

- From a policy perspective, whether or not firms in developing countries learn from exporting is an important issue. As we have seen, the domestic markets for manufactures are typically very small in developing countries, so if developing countries are to industrialize it will have to be through exports. Under learning-by-exporting the competitiveness gap can be reduced **endogenously** through increased international trade.

- One of the first studies that analyzed the causal relationship between exporting and productivity at the firm-level was on the U.S. economy

(Bernard and Jensen, 1995, referenced in Bigsten et al., 2004). These authors find **little evidence** of any learning-by-exporting effect. There are now a number of studies examining the link between exporting and productivity on countries other than the USA, e.g. Mexico, Colombia, Morocco, the Republic of Korea, Taiwan and Ghana (see references in Bigsten et al.).

- On balance, there is little evidence in these studies that firms improve their efficiency as a result of a learning-by-exporting process. A common conclusion is that efficient firms self-select into the export market. Let's have a look at one such paper.

4 Learning by exporting? Evidence from Colombia, Mexico & Morocco

- The paper by Clerides, Lach and Tybout, published in the QJE in 1998, has been very influential in the discussion as to whether exporting leads to productivity gains.

- These authors study micro (plant-level) data from Colombia, Mexico and Morocco - i.e. semi-industrialized countries.

- The basic idea: If exporting generates efficiency gains, then firms that begin to export should **thereafter** exhibit a change in efficiency.

- Findings: relatively efficient firms become exporters; but efficiency is **not affected** by previous exporting activities.

- Conclusion: The positive correlation between exporting and efficiency is explained by **self-selection**, not learning.

- Before this paper was published, although a lot of evidence existed indicating a positive correlation between efficiency and exporting, there was almost no rigorous study looking into the causal mechanisms. Attempting to sort out causality is the main goal of the Clerides et al. paper, and indeed the main contribution.

4.1 A model of export participation with learning effects

- Clerides et al. begin their analysis by writing down a model of export participation. Their model draws heavily on developments made by Dixit and Krugman in the late 1980s.

- The **simplest form** of the model is based on the following assumptions:

1. There is monopolistic competition (so that each firm faces a downward sloping demand curve for its output):

2. Firms can sell their goods at home and abroad, and firms can price discriminate between domestic and foreign buyers;

3. There is a non-negative fixed cost M of being an exporter which is incurred in each period;

4. There are no entry costs to exporting;

5. Marginal costs, c, do not depend on output;

6. Firms maximize profits.

The firm's optimization problem is written

$$
\begin{aligned}
\max_{q^f, q^h} \Pi &= p^h\left(q^h\right) \cdot q^h + p^f\left(q^f\right) \cdot q^f \\
&\quad - c \cdot \left(q^h + q^f\right) - y\left(q^f\right) \cdot M,
\end{aligned}
$$

subject to inverse demand

$$
\begin{aligned}
p^h\left(q^h\right) &= \left(\frac{q^h}{z^h}\right)^{-\frac{1}{\sigma^h}}, \\
p^f\left(q^f\right) &= \left(\frac{q^f}{z^f}\right)^{-\frac{1}{\sigma^f}},
\end{aligned}
$$

where the superscripts f and h indicate foreign and home, respectively, and where p is output price, q is output, z denote demand shifters, σ is the price elasticity of demand and y is a dummy variable equal to one if $q^f > 0$ (i.e. there is some exports) and zero otherwise.

We can now **solve this optimization problem** to see if the firm should be doing any exporting, and if so, how much.

Begin by substituting the inverse demand functions back into the profit function:

$$\begin{aligned}\max_{q^f, q^h} \Pi &= \left(z^h\right)^{1/\sigma^h} \cdot \left(q^h\right)^{(\sigma^h-1)/\sigma^h} + \left(z^f\right)^{1/\sigma^f} \cdot \left(q^f\right)^{(\sigma^f-1)/\sigma^f} \\ &\quad -c \cdot \left(q^h + q^f\right) - y\left(q^f\right) \cdot M.\end{aligned}$$

Suppose $q^f > 0$ is optimal (we will determine if this is the case shortly). In this case we can derive optimal levels of q^h and q^f from the **first order conditions**. The latter are as follows:

$$\begin{aligned} q^h &: \frac{\sigma^h - 1}{\sigma^h}\left(z^h\right)^{1/\sigma^h}\left(q^h\right)^{-1/\sigma^h} = c, \\ q^f &: \frac{\sigma^f - 1}{\sigma^f}\left(z^f\right)^{1/\sigma^f}\left(q^f\right)^{-1/\sigma^f} = c. \end{aligned}$$

Solving for q^h and q^f yields

$$\begin{aligned} q^h &= \left(\frac{\sigma^h c}{\sigma^h - 1}\right)^{-\sigma^h} z^h, \\ q^f &= \left(\frac{\sigma^f c}{\sigma^f - 1}\right)^{-\sigma^f} z^f. \end{aligned}$$

Note: This assumes that $q^f > 0$ is optimal. To find out whether this is actually the case - perhaps zero exports is better - we need to compare profits under this policy to profits under $q^f = 0$ (and optimal q^h under this policy).

Under $q^f > 0$ profits at the optimum are:

$$\begin{aligned}
\Pi_{y=1} &= \left(z^h\right)^{1/\sigma^h} \cdot \left(\frac{\sigma^h c}{\sigma^h - 1}\right)^{-(\sigma^h - 1)} \left(z^h\right)^{(\sigma^h - 1)/\sigma^h} \\
&+ \left(z^f\right)^{1/\sigma^f} \cdot \left(\frac{\sigma^f c}{\sigma^f - 1}\right)^{-(\sigma^f - 1)} \left(z^f\right)^{(\sigma^f - 1)/\sigma^f} \\
&- c \cdot \left(\left(\frac{\sigma^h c}{\sigma^h - 1}\right)^{-\sigma^h} z^h + \left(\frac{\sigma^f c}{\sigma^f - 1}\right)^{-\sigma^f} z^f\right) \\
&- 1 \cdot M.
\end{aligned}$$

This can be simplified by factoring out several terms, so that

$$\begin{aligned}
\Pi_{y=1} &= c^{1-\sigma^h} z^h \left(\sigma^h - 1\right)^{\sigma^h - 1} \left(\sigma^h\right)^{-\sigma^h} \\
&+ c^{1-\sigma^f} z^f \left(\sigma^f - 1\right)^{\sigma^f - 1} \left(\sigma^f\right)^{-\sigma^f} - M.
\end{aligned}$$

If in fact $q^f = 0$ is optimal, so that $y = 0$, we have

$$\Pi_{y=0} = c^{1-\sigma^h} z^h \left(\sigma^h - 1\right)^{\sigma^h - 1} \left(\sigma^h\right)^{-\sigma^h}.$$

Hence, the firm will **decide to export** if $\Pi_{y=1} > \Pi_{y=0}$, i.e. if

$$c^{1-\sigma^f} z^f \left(\sigma^f - 1\right)^{\sigma^f - 1} \left(\sigma^f\right)^{-\sigma^f} > M.$$

- Accordingly: all firms with marginal costs **below** some threshold would choose to export, i.e. they would **self-select** into the export market.

- Note: There is **no learning-by exporting in this version of the model**, so the positive correlation between cost efficiency (we take low c to imply good cost efficiency) and exports is entirely driven by selection-into-exporting.

- Next we can **generalize** the export model in two ways, namely by allowing for **fixed entry costs**, denoted F, and for **learning-by-exporting,** in the sense that the marginal cost is a function of exporting.

- Clerides et al. assume that the cost function can be written

$$c_t = g\left(w_t, c_{t-1}, y_{t-1}\right),$$

where g is some function, w_t is a vector of exogenous cost shifters, and the rest of the notation has been introduced above.

- Notice that current marginal costs are taken to depend on the export status in the previous period (y_{t-1}). Of course, $y_{t-1} = 1$ if there was some exporting in the previous period and $y_{t-1} = 0$ if there was no exporting. If there is learning, then clearly $g\left(w_t, c_{t-1}, 1\right) < g\left(w_t, c_{t-1}, 0\right)$ - i.e. the cost is lower (higher efficiency).

While these additional assumptions make the model more realistic, the analytical framework unfortunately becomes much more complicated. Firms are now faced with a truly dynamic problem, in which they must take into account the consequences of the current export decision on future revenue streams.

- Formally, the dynamic optimization problem can be written as a **Bellman equation**:

$$
\begin{aligned}
V_t &= \max_{y_t} y_t \left(\pi^f \left(c_t, z_t^f\right) - M - (1 - y_{t-1}) F\right) \\
&\quad + \pi^h \left(c_t, z_t^h\right) + \delta E_t V_{t+1} (y_t),
\end{aligned}
$$

  where δ is the discount factor. Note the following:

  - If firms have been **non-exporters** in time $t-1$ then they will have to pay the entry cost F if they decide to do some exporting in time t.

– One 'reward' associated with exporting in time t is that the firm will **not** have to pay F in the next period should it decide to export then as well.

– If there is learning, then another 'reward' is that the firm will have **lower costs** in the next period. For these two reasons, V_{t+1} depends on y_t.

While we cannot derive analytical rules for exporting decisions (such solutions will have to be obtained by means of some numerical method) we can state the following:

- Firms will choose to export in time t if
  $\pi^f\left(c_t, z_t^f\right) - M - (1 - y_{t-1})\, F + \delta E_t V_{t+1}\,(y_t = 1) > \delta E_t V_{t+1}\,(y_t = 0)\,.$
  Interpret this condition.

- An **incumbent** exporter will export in time t if

$$\pi^f \left(c_t, z_t^f\right) - M + \delta E_t V_{t+1} \left(y_t = 1\right) > \delta E_t V_{t+1} \left(y_t = 0\right).$$

- A **non-exporter** in time $t-1$ will enter the export market in time t if

$$\pi^f \left(c_t, z_t^f\right) - M - F + \delta E_t V_{t+1} \left(y_t = 1\right) > \delta E_t V_{t+1} \left(y_t = 0\right).$$

Clearly the incumbent exporter is more likely to export than the potential entrant - if the entry cost is positive. Given this insight, what can we possibly learn about the significance of entry costs from analyzing exporting dynamics empirically?

Clerides et al. then proceed by showing numerical solutions to the dynamic problem with and without learning.

[Figures IIa and IIb in the paper].

Simulated average cost trajectories, with & without learning

Fig II(a): No learning

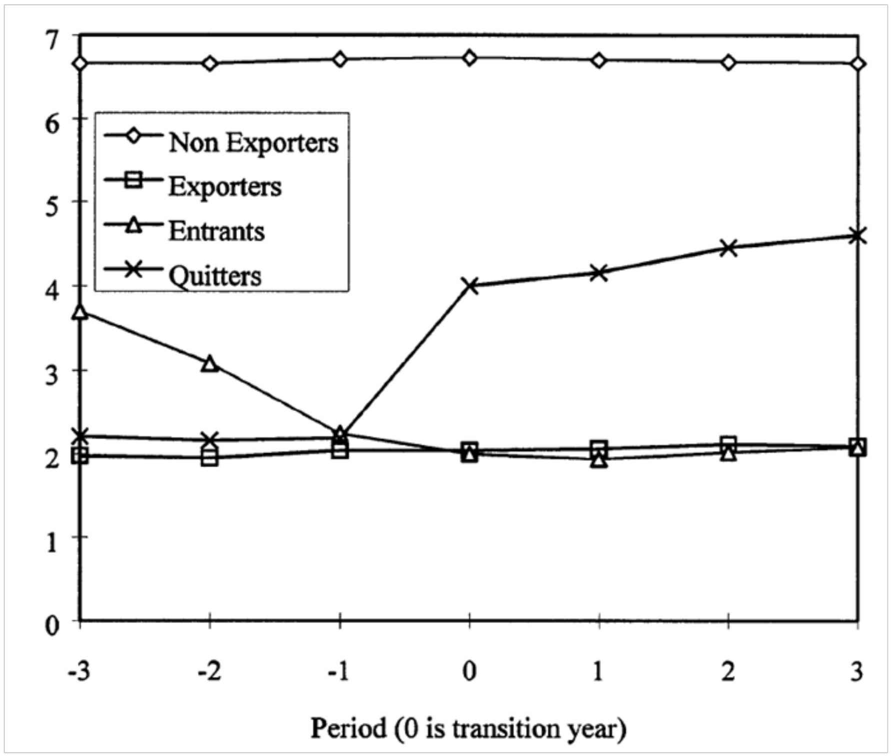
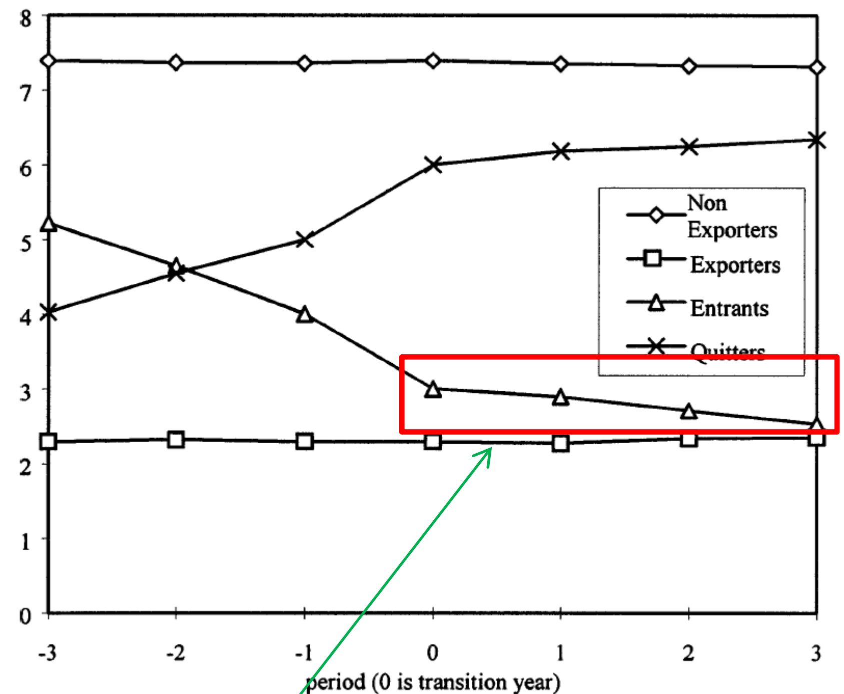


Fig II(b): With learning



Cost continues to fall after entry.

The key insights from this exposition are as follows:

1. With and without learning, the costs of exporters will be lower than the costs of non-exporters. This reflects self-selection into exporting.

2. With and without learning, firms **entering** at $t = 0$ experience cost declines *before* entering the export market (hinges on c_t being serially correlated).

3. With and without learning, firms **exiting** at $t = 0$ experience cost increases *before* exiting from the export market (hinges on c_t being serially correlated).

4. With learning, there is continuing cost reduction *after* entry into the export market as a result of exporting. This does **not** happen without learning.

5. With learning, firms are prepared to export at higher costs than if there is no learning.

4.2 Analysis of the data

- Plant-level data.

- Colombia: Virtually all plants with ≥ 10 workers, 1981-1991.

- Mexico: 2,800 large firms, 1986-1990

- Morocco: Virtually all plants with ≥ 10 workers, 1984-1991.

- Construct **balanced panels** (suspect this is because it was easier to deal with balanced than unbalanced panels, in those days...). Delete industries that are not export oriented.

[Table I: some transitions into and out of exporting, though most firms tend to stay in or out of the export market]

TABLE I

ENTRY, EXIT, NUMBER OF PLANTS, AND EXPORT INTENSITY BY COUNTRY (EXPORT-ORIENTED INDUSTRIES)

	Average annual entry rate	Average annual exit rate	Average number of plants	Average export intensity
Colombia 1981–1991	.027	.017	1354	.095
Morocco 1984–1991	.049	.037	938	.360
Mexico 1986–1990	.048	.015	1327	.230

4.2.1 Preliminary evidence: Comparing productivity trajectories

Two variables measuring efficiency: average variable cost (AVC) and labor productivity (LAB):

$$AVC = \frac{\text{labor \& intermediate costs}}{\text{output}},$$

$$LAB = \frac{\text{output}}{\text{number of workers}}.$$

These are purged of industrywide time effects and some plant-specific characteristics, so as to be comparable across different types of firms in different industries (check paper for details). Graphical analysis in figures IIIa-c, IVa-c. Have a look. The findings can be summarized as follows:

- Entrants generally do better than nonexporters and exiting plants: higher labor productivity (due to more skilled labor) & lower average variable costs.

- Little evidence of productivity gains following entry into foreign markets. You find improved labor productivity for Colombian plants but not much else.

4.2.2 An econometric test of learning effects

- Basic idea is to estimate the cost function:

$$c_t = g\left(w_t, c_{t-1}, y_{t-1}\right),$$

  where the main interest is to determine whether past exporting status y_{t-1} impacts current costs c_t.

- The empirical specification adopted by Clerides et al. is of the following form (I have simplified the algebra a little to highlight the main idea rather than the details):

$$
\begin{aligned}
c_{it} &= \beta_1 c_{i,t-1} + \beta_2 y_{i,t-1} + \boldsymbol{z}_{it}\boldsymbol{\beta}_3 + \alpha_{1i} + \epsilon_{1it}, & (1) \\
\Pr\left(y_{it} = 1\right) &= \Phi\left(\gamma_1 c_{i,t-1} + \gamma_2 y_{i,t-1} + \boldsymbol{z}_{it}\boldsymbol{\gamma}_3 + \alpha_{2i} + \epsilon_{2it}\right), & (2)
\end{aligned}
$$

  where the first equation is a linear cost regression and the second equation is a probit model of the decision to export. The key coefficient here (in order to test if there is learning) is β_2. If $\beta_2 < 0$ then this is evidence for learning. Clerides et al. using several lags of c and y but the intuition is unchanged.

- The terms α_{1i} and α_{2i} are time invariant unobserved terms that need to be dealt with econometrically. Had they **not** been there, we would just estimate (1) and (2) using OLS and probit, respectively (ϵ_{2it} is assumed normally distributed).

- Basically, if we are using standard panel data techniques for nonlinear models (cf. Traditional Random Effects; see my Applied Econometrics Lecture 15), there is an endogeneity problem known as the "initial conditions problem". To deal with this, the authors adopt a method proposed by Heckman in the early 1980s. No reason to get bogged down in the details - if you are interested, check the material covered during the last hour of my Applied Econometrics "revision class").

- [Table IIIa-b: Results for Colombia & Morocco (Mexico dropped due to lack of data)]

TABLE IIIa
FIML ESTIMATES OF EQUATIONS (10) AND (11)
COLOMBIA 1983–1991

	Chemicals	Textiles	Apparel
Participation equation			
Intercept	−15.06 (5.87)*	−4.34 (1.33)*	−5.20 (1.58)*
ln (e_t)	.462 (2.27)	3.93 (1.14)*	3.60 (0.94)*
ln (K_{it-1})	3.73 (0.72)*	1.71 (0.34)*	2.03 (0.37)*
ln (A_{it})	5.94 (3.87)	−0.12 (0.85)	0.64 (1.07)
ln $(A_{it})^2$	−0.88 (0.58)	0.09 (0.14)	−0.01 (0.18)
B_{it}	−0.00 (0.28)	0.23 (0.15)	0.28 (0.14)*
ln (AVC_{it-1})	−0.14 (0.28)	−0.18 (0.18)	−0.05 (0.11)
ln (AVC_{it-2})	0.06 (0.29)	−0.16 (0.18)	−0.10 (0.13)
$\hat{y}_{it-1}$	1.86 (0.41)*	2.04 (0.27)*	1.03 (0.25)*
$\hat{y}_{it-2}$	0.18 (0.40)	0.25 (0.29)	−0.10 (0.25)
$\hat{y}_{it-3}$	0.26 (0.40)	−0.57 (0.46)	−0.20 (0.25)
Cost function			
Intercept	−0.16 (0.13)	−0.33 (0.06)*	−0.36 (0.06)*
ln (K_{it})	−0.17 (0.11)	0.05 (0.04)	0.09 (0.06)
ln (AVC_{it-1})	0.36 (0.05)*	0.65 (0.02)*	0.74 (0.02)*
ln (AVC_{it-1})	0.45 (0.05)*	0.16 (0.03)*	0.12 (0.03)*
y_{it-1}	0.09 (0.05)	0.01 (0.03)	0.08 (0.03)*
y_{it-2}	0.22 (0.09)*	0.04 (0.06)	0.01 (0.08)
y_{it-3}	0.11 (0.10)	0.06 (0.07)	0.01 (0.08)
Variance-covariance matrix for disturbances			
var (α_1)	0.298	0.167	0.574
var (α_2)	0.005	0.0001	0.001
corr (α_1,α_2)	−0.106	−0.147	−0.082
var (ϵ_1)	0.702	0.823	0.426
var (ϵ_2)	0.995	0.106	0.163
corr (ϵ_1,ϵ_2)	0.180	−0.110	−0.026
No. observations	567	1,854	2,547
Log-likelihood	−309.61	−938.45	−1,679.24

Standard errors are in parentheses. An asterisk indicates that the estimate is significant at a 95 percent significance level.

TABLE IIIb

FIML Estimates of Equations (10) and (11)

Morocco 1984–1990

	Chemicals	Food	Textiles
	Participation equation		
Intercept	17.66 (18.18)	16.35 (15.04)	16.49 (10.05)
ln (e_t)	5.69 (3.90)	3.58 (3.22)	3.50 (2.13)
ln (K_{it-1})	2.64 (0.67)*	1.03 (0.46)*	2.45 (0.43)*
ln (A_{it})	2.45 (3.23)	−1.56 (1.73)	−2.09 (1.47)
ln $(A_{it})^2$	−0.39 (0.48)	0.28 (0.26)	0.35 (0.24)
B_{it}	0.81 (0.70)	0.26 (0.15)	0.07 (0.16)
ln (AVC_{it-1})	−1.16 (0.60)	−0.18 (0.42)	0.06 (0.18)
ln (AVC_{it-2})	−1.05 (0.89)	0.92 (0.47)	−0.24 (0.30)
$\hat{y}_{it-1}$	1.14 (0.45)*	1.25 (0.54)*	0.91 (0.36)*
$\hat{y}_{it-2}$	0.09 (0.05)	1.25 (0.51)*	0.50 (0.28)
$\hat{y}_{it-3}$	0.28 (0.35)	0.67 (0.47)	0.02 (0.28)
	Cost function		
Intercept	0.05 (0.03)	−0.07 (0.03)*	−0.12 (0.03)*
ln (K_{it})	−0.06 (0.04)	−0.16 (0.04)*	−0.07 (0.04)
ln (AVC_{it-1})	0.39 (0.05)*	0.20 (0.05)*	0.15 (0.04)*
ln (AVC_{it-1})	0.40 (0.07)*	0.25 (0.05)*	0.07 (0.05)
y_{it-1}	−0.02 (0.03)	0.12 (0.02)*	−0.02 (0.02)
y_{it-2}	0.03 (0.05)	0.02 (0.04)	0.00 (0.05)
y_{it-3}	0.02 (0.04)	0.01 (0.10)	−0.12 (0.06)
var (α_1)	0.546	0.724	0.677
var (α_2)	0.0001	0.003	0.001
corr (α_1,α_2)	0.046	−0.559	−0.590
var (ϵ_1)	0.454	0.276	0.323
var (ϵ_2)	0.024	0.022	0.057
corr (ϵ_1,ϵ_2)	−0.019	−0.040	−0.057
No. observations	637	1,169	1,722
Log-likelihood	69.13	117.79	−517.87

Standard errors are in parentheses. An asterisk indicates that the estimate is significant at a 95 percent significance level.

Summary of results:

- Determinants of exporting:
  - Plants with large capital stocks are more likely to be exporters - perhaps because large firms can accommodate high fixed costs of exporting.
  - Plants that have lower marginal costs are more likely to be exporters (though not obviously statistically significant - because of collinearity, apparently). Coefficients on lags usually sum to a negative number.
  - Previous export experience has a large positive effect on current exporting. Suggests high entry costs - why?
- Determinants of efficiency (cost):

- Plants with larger capital stocks tend to have lower marginal costs, suggesting increasing returns.
- Little evidence that exporting history contributes matters for marginal costs - goes **against** the idea that there's learning by exporting.

5 Learning from exporting in less developed countries

Bigsten et al. (2004)

Blalock and Gertler (2004)

Whereas most papers in this area seem to conclude that the positive association between exports and efficiency is due to self-selection rather than learning, there is now some evidence that there is learning in less developed economies.

the paper by Bigsten et al. (2004) is one exception in this respect. This paper provides cross-country evidence on the link between exports and efficiency for sub-Saharan Africa (Cameroon, Ghana, Kenya and Zimbabwe). These countries have had high trade restrictions in the past and are widely regarded as technologically backward. In such economies the potential gains from exporting are large. Exporting offers the maximum scope for the increased discipline of competition and contact with foreign customers provides the maximum scope for learning opportunities. Arguably, if exporting induces efficiency in any environment, it should do so in these economies.

Bigsten et al. find that, consistent with the learning-by-exporting hypothesis, exporting impacts positively on productivity. Notice that this is not the typical result in the literature. There is also some evidence for self-selection into the export market, thus suggesting that causality runs both from exporting to efficiency and from efficiency to exporting.

5.1 Blalock and Gertler (2004): Indonesia

- estimating production functions using a panel dataset of Indonesian manufacturing establishments from 1990 to 1996
- find that firms experience a jump in productivity of about 2% to 5% following the initiation of exporting
- Main hypothesis: The hypothesis is that exporting increases firm productivity through learning, defined broadly to include knowledge, technology, and operational efficiencies gained from participation in international markets
- Exporting & productivity are positively correlated - but what about causation?

- Recall the mechanism generating self-selection: firms incur a large fixed cost to enter export markets, and therefore, only the more productive firms are profitably able to export.

- Blalock and Gertler find that productivity gains follow the initiation of exports rather than precede it.

- Overall policy conclusion: "firms in the poorest countries may have much more to gain from exposure to international export markets" (p.398).

5.1.1 Why learning?

Two reasons why exporting may lead to an increase in firm productivity:

- Exporting firms may receive **technical assistance** from overseas buyers. Overseas buyers may share knowledge of the latest design specifications and production techniques that might otherwise be unobtainable. Might be particularly important if the transaction involves some degree of customization (e.g. conforming to IKEA's specifications)

- Exporting firms must **innovate** rapidly to remain viable in competitive international markets.

5.1.2 Indonesian manufacturing and export policy

- Indonesia shifted from a policy of import substitution to one of export promotion in the mid-1980s. Substantially reduced import tariffs, reformed customs administration, and introduced a more generous duty drawback scheme (allowed exporters to reclaim duties paid on inputs used to fabricate exported goods).

- Dramatic increase in exports beginning in 1989.

- Data used in the present paper: 1990-1996.

- [Table 1: Rapid increase in the number of exporters (note: headings "exporting" & "not exporting" probably swapped round)]

Headings mixed up, surely (see Table 2)

Table 1
Number of establishments exporting and not exporting, by year

Year	Number of establishments	
	Exporting	Not exporting
1990	13,967	1,646
1991	13,504	2,069
1992	13,869	2,595
1993	14,202	2,692
1994	14,835	2,798
1995	17,020	2,999
1996	17,843	3,502

- Main dataset: Annual manufacturing survey conducted by the Central Bureau of Statistics in Indonesia. Designed to be a complete annual enumeration of all manufacturing establishments with 20 or more employees from 1975 onwards (i.e. a census, for this sub-population).

- Includes data on industrial classification (5-digit ISIC), ownership (public, private, foreign), exports, status of incorporation, assets, asset changes, electricity, fuels, income, output, expenses, investment, labor (head count, education, wages), raw material use, machinery, and other specialized questions.

- Data not perfect of course. Missing values; obvious errors; misreporting for tax type reasons, etc. A fact of life when doing this kind of research. How might it affect the results?

- Output, materials, and capital are **deflated** in order to express values in real terms. Important!

- Sample is limited to wholly Indonesian-owned firms (foreign-owned firms more outward oriented and probably more productive - so delete them).

- [Descriptive statistics in Table 2]

- 24% of the firms are exporters.
- Exporters are larger than non-exporters.

Table 2
Descriptive statistics for establishments that exported (1 year or more) and never-exporting establishments

	Exporting establishments			Nonexporting establishments		
	No. obs.	Mean	Std. dev.	No. obs.	Mean	Std. dev.
log(output)	3877	13.33	1.91	16,141	11.71	1.51
No. employees	3877	251.95	545.35	16,141	65.03	159.81
log(capital)	3877	12.46	2.08	16,141	10.89	1.76
log(materials)	3877	12.59	2.11	16,141	10.89	1.80
Share output exported	3877	0.44	0.43	16,141	0	0

All monetary values are displayed in 000s of 1983 rupiah. Year and region–year dummies are included in all regressions but are not reported.
Statistics are for the first year the establishment entered the panel during 1990–1996.

Identification and Estimation

- Goal: To identify and estimate the effect of exporting on productivity.
- Estimate an establishment-level translog production function, which is flexible (in what sense?).
- In effect: Ask whether the "residual" in the production function is correlated with exporting, controlling for the inputs used in production.

Type of specification:

Most important coefficient

$$\begin{aligned}\ln Y_{it} = {} & \beta_0 \text{Exported}_{it} + \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \beta_3 \ln M_{it} + \beta_4 \ln^2 K_{it} + \beta_5 \ln^2 L_{it} \\ & + \beta_6 \ln^2 M_{it} + \beta_7 \ln K_{it} \ln L_{it} + \beta_8 \ln K_{it} \ln M_{it} + \beta_9 \ln L_{it} \ln M_{it} + \alpha_i + \gamma_t \\ & + v_{rt} + \omega_{it} + \varepsilon_{it} \end{aligned} \tag{1}$$

Managers observe **this** (unobserved to econometrician)…. But not **this** term….
So we have the usual **endogeneity** problem (inputs chosen in view of ω(it))

Three ways of addressing the endogeneity problem:

- Adding **fixed effects** in the usual manner.

- Controlling for idiosyncratic time-varying shocks with **proxy** estimators. Olley-Pakes (OP) type approach: Under certain assumption (see my lecture on trade liberalization), and increase in **investment** indicates a positive idiosyncratic shock (it "tells" you what the unobservable term ω_{it} must be). Authors modify the OP approach in three ways - I think what they are doing is not strictly correct from a theoretical point of view - e.g. as far as I understand you can't include fixed effects, which they do - but in practice it may not matter very much. Check details on p.404 if you are interested

- Testing the ordinal **sequence** of productivity increases and exports.
  - Suppose self-selection, rather than learning, is the key mechanism driving the correlation between exporting and productivity. The theoretical mechanism underlying self-selection is that there is a **fixed cost** associated with exporting.
  - Hence if there is self-selection you'd expect that firms will enter the exports market (i.e. incur the fixed cost) only **after** productivity rises sufficiently for exporting profits to justify the expense.
  - Thus, if productivity gains **precede** exporting you might conclude that exporting is the **result of,** rather than the cause, of efficiency.
  - Also, if there really is learning, then we would expect it to be permanent and to not disappear if the firm stops exporting. Therefore: examine whether productivity **drops** after firms **stop** exporting.

5.1.3 Results

- Pooled OLS; Fixed Effects; Proxy Variable (OP; Levinsohn-Petrin) methods: exporting increases productivity by about 2% to 5%.

[Table 3]

- Investigate the evidence for the alternative story (self-selection). Check:
  - Is productivity higher in the year before firms initiated exporting (if yes, then suggests selection - why?)
  - Do productivity gains persist even after exporting stopped (if yes, then suggests learning - why?)

Table 3
Estimation of a translog production function on a sample of wholly Indonesian-owned factories from 1990 to 1996

Dependent var.: log(output)	OLS	F.E.	Olley–Pakes				Levinsohn–Petrin			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exported current year	0.028	0.049	0.016	0.025	0.045	0.049	0.019	0.018	0.051	0.050
(0=N, 1=Y)	(5.23)	(7.98)	(1.89)	(4.69)	(4.14)	(7.90)	(3.85)	(3.54)	(8.51)	(8.31)
log(labor)	0.822	0.701	0.743	0.774	0.649	0.685	0.865	0.863	0.694	0.690
	(51.74)	(25.91)	(26.32)	(46.23)	(12.60)	(24.85)	(53.32)	(53.34)	(25.80)	(25.66)
log(capital)	0.310	0.147	−0.694	0.005	−0.847	−0.021	−0.029	0.098	0.163	0.193
	(42.38)	(12.27)	(3.12)	(0.04)	(2.92)	(0.16)	(0.31)	(1.05)	(1.34)	(1.60)
log(materials)	0.040	0.306	0.017	0.041	0.355	0.307	−0.051	−0.050	0.257	0.264
	(5.28)	(26.08)	(1.39)	(5.34)	(15.44)	(26.06)	(6.64)	(6.54)	(21.23)	(21.85)
log(K)*log(K)	0.014	0.007								
	(28.94)	(11.22)								
log(L)*log(L)	0.013	0.038	0.006	0.012	0.037	0.037	0.013	0.013	0.036	0.038
	(5.54)	(10.86)	(1.50)	(4.98)	(5.36)	(10.63)	(5.59)	(5.74)	(10.69)	(11.14)
log(M)*log(M)	0.073	0.048	0.079	0.072	0.053	0.048	0.069	0.069	0.048	0.048
	(142.64)	(71.15)	(89.25)	(142.17)	(37.01)	(71.00)	(141.72)	(141.66)	(72.02)	(71.78)
log(K)*log(M)	−0.059	−0.033								
	(70.13)	(29.80)								
log(K)*log(L)	0.043	0.034								
	(24.62)	(14.07)								
log(L)*log(M)	−0.096	−0.094	−0.102	−0.096	−0.110	−0.094	−0.097	−0.098	−0.093	−0.094
	(53.82)	(40.51)	(33.74)	(53.55)	(22.18)	(40.38)	(56.14)	(56.83)	(41.18)	(41.69)
Constant	3.463	3.321	6.736	5.161	6.384	3.889	4.948	4.195	3.235	2.671
	(45.66)	(34.81)	(9.76)	(13.65)	(6.99)	(9.19)	(17.19)	(13.82)	(8.69)	(7.00)
Observations	73,635	73,635	23,440	73,635	23,440	73,635	73,396	73,635	73,396	73,635
R-squared	0.95	0.78	0.96	0.95	0.79	0.78	0.95	0.95	0.79	0.79
No. of factories	20,446	20,446	10,863	20,446	10,863	20,446	20,414	20,446	20,414	20,446

All monetary values are displayed in 000s of 1983 rupiah. Year and region–year dummies are included in all regressions but are not reported.

Absolute value of t statistics in parentheses.

(1) OLS estimation, (2) factory fixed-effect estimation, (3) Olley–Pakes estimation on observations reporting positive investment, (4) Olley–Pakes estimation on all observations with indicator variable for nonpositive investment observations, (5) Olley–Pakes estimation with fixed effects on observations reporting positive investment, (6) Olley–Pakes estimation with fixed effects on all observations and an indicator variable for nonpositive investment observations, (7)–(10) estimation of (3)–(6) using Levinsohn–Petrin estimator and substituting electricity for investment. “No. of factories” indicates the number of unique establishments in the fixed-effect estimations.Year and year–region indicator variables are included but not reported.

Previous model

Add dummy: prior to exporting

What matters is whether you've **ever** exported (persistence = learning)

Table 4
Fixed-effect estimation using differing definitions of exporting behavior

Dependent var.: log(output)	(1)	(2)	(3)	(4)	(5)	(6)
Exported current year (0=N, 1=Y)	0.054 (9.62)	0.057 (9.06)	0.054 (8.01)		0.049 (5.69)	0.054 (8.77)
Year prior to exporting		0.007 (0.87)				
Exported in prior years but not this year (0=N, 1=Y)			−0.002 (0.23)			
Exported this year or in the past (0=N, 1=Y)				0.041 (6.29)		
Share of output exported					0.009 (0.78)	
Number of years exported						0.001 (0.43)
log(labor)	0.636 (27.61)	0.636 (27.60)	0.635 (27.59)	0.636 (27.61)	0.635 (27.60)	0.636 (27.59)
log(capital)	0.155 (14.26)	0.155 (14.26)	0.155 (14.25)	0.155 (14.22)	0.155 (14.26)	0.155 (14.26)
log(materials)	0.257 (24.00)	0.257 (23.99)	0.257 (23.99)	0.256 (23.90)	0.257 (23.99)	0.257 (24.00)
log(K)*log(K)	0.005 (8.75)	0.005 (8.74)	0.005 (8.75)	0.005 (8.72)	0.005 (8.75)	0.005 (8.75)
log(L)*log(L)	0.013 (4.66)	0.013 (4.65)	0.013 (4.65)	0.013 (4.64)	0.013 (4.65)	0.013 (4.65)
log(M)*log(M)	0.048 (75.93)	0.048 (75.93)	0.048 (75.93)	0.048 (75.99)	0.048 (75.94)	0.048 (75.93)
log(K)*log(M)	−0.031 (31.92)	−0.031 (31.91)	−0.031 (31.92)	−0.031 (31.87)	−0.031 (31.92)	−0.031 (31.92)
log(K)*log(L)	0.039 (19.33)	0.039 (19.33)	0.039 (19.33)	0.039 (19.35)	0.039 (19.33)	0.039 (19.31)
log(L)*log(M)	−0.078 (38.01)	−0.078 (38.00)	−0.078 (37.99)	−0.078 (38.01)	−0.078 (38.01)	−0.078 (38.01)
Constant	3.690 (43.10)	3.690 (43.10)	3.690 (43.08)	3.693 (43.10)	3.690 (43.11)	3.687 (42.95)
Observations	87,587	87,587	87,587	87,587	87,587	87,587
No. of factories	23,201	23,201	23,201	23,201	23,201	23,201
R-squared	0.79	0.79	0.79	0.79	0.79	0.79

All monetary values are displayed in 000s of 1983 rupiah. Year and region–year dummies are included in all regressions but are not reported.
Absolute value of *t* statistics in parentheses.
Year and year–region indicator variables are included but not reported.

[Table 4]

- Industry analysis shown in Table 6. 10 different sectors. The effect of exporting is positive & significant in 7/10 cases.

- Comparison of the characteristics of treatment factories prior to exporting (those that got "treated" by exporting) and "control" factories (non-exporters). Recall the logic: if treatment is randomized (clearly not the case here) then there should be no systematic difference between those that were actually treated and those that were not.

- Results indicate one should not reject the hypothesis that the treatment factories prior to exporting were equal in performance to the control factories.

5.1.4 Conclusions

- Evidence that Indonesian firms experience a jump in productivity by 2% to 5% upon entering export markets

- Interpretable as a learning effect.

- This conclusion is different from those in the majority of earlier studies that found evidence of selection of better firms into export markets but no evidence of learning.

- Explanation: Indonesia's relatively low level of development in comparison to the more technologically advanced economies examined in earlier work.

- Similar to what has been found for Sub-Saharan Africa.

- Suggests that firms in poor countries have much to learn from their trading partners. Policies encouraging firms to export may lead to productivity gains from learning.

5.2 Bigsten, Söderbom and others (2004): Sub-Saharan Africa

- Modifying the econometric framework proposed by Clerides et al. (1998), Bigsten and et al. (2004) estimate the effect of exporting on productivity using a production function approach and survey data (RPED) for Cameroon, Ghana, Kenya, and Zimbabwe.

- Production function:

$$\begin{aligned} y_{it} &= \lambda y_{i,t-1} + (1-\lambda)\left[\beta_n n_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_e e_{it} +\right] \\ &\quad + \delta \text{exports}_{i,t-1} + controls + \mu_i + \eta_{it}, \end{aligned}$$

  where i and t are firm and time indices, respectively, y_{it} is log output, n_{it} is log employment, k_{it} is log capital stock, m_{it} is log raw material, e_{it} is log indirect costs (for instance electricity, water, transport etc.), $\text{exports}_{i,t-1}$ is a dummy variable equal to one if the firm exported in the previous period and zero otherwise, $controls$ is a vector of control variables (dummy variables for country, industry, time and ownership), μ_i is an unobserved firm specific effect and η_{it} is a residual. Given this specification, δ is the effect of exporting on productivity - i.e. the "learning" effect.

- Following Clerides et al., we also model export participation as a function of past productivity and past exporting.

- [Summary statistics and results in Bigsten et al: Tables 2 & 4]

The usual pattern: exporters are larger, more productive,…..

TABLE 1
SUMMARY STATISTICS, BY INITIAL EXPORT STATUS

	Initial Exports = 0 (Number of firms: 204)			Initial Exports = 1 (Number of firms: 85)		
	Mean	p50	Std. dev.	Mean	p50	Std. dev.
VARIABLE IN $T = 1,2$						
Exports	0.08			0.85		
Employment	51.44	20.00	104.54	342.07	171.00	492.19
Ln Employment	3.04	3.00	1.29	5.12	5.14	1.25
Ln Value-Added/Employee	8.16	8.32	1.34	9.37	9.35	0.99
Ln Output/Employee	9.31	9.50	1.23	10.37	10.22	0.85
Ln Physical Capital/Employee	7.93	8.21	1.84	9.42	9.43	1.13
Cameroon	0.19			0.14		
Ghana	0.35			0.08		
Kenya	0.26			0.16		
Zimbabwe	0.20			0.61		
Food	0.26			0.19		
Textile	0.26			0.26		
Metal	0.23			0.28		
Wood	0.25			0.27		
Any foreign ownership	0.18			0.40		
Any state ownership	0.03			0.08		

Note: Variables for which p50 and Std. dev. are not reported are dummy variables.

TABLE 2
SELECTED MAXIMUM LIKELIHOOD ESTIMATES: COBB-DOUGLAS OUTPUT PRODUCTION FUNCTION AND EXPORT PROBIT

	[1] No firm effects	[2] Bivariate normal firm effects (CLT)	[3] Non-parametric bivariate firm effects (NPML)
The Production Function			
y_{t-1}	0.155	0.098	0.118
	(8.398)**	(5.166)**	(6.396)**
$export_{t-1}$	0.069	-0.001	0.067
	(2.111)*	(0.126)	(2.147)*
k_t	0.023	0.027	0.034
	(2.300)*	(2.521)*	(3.474)**
n_t	0.103	0.142	0.112
	(5.518)**	(6.626)**	(6.013)**
m_t	0.632	0.667	0.668
	(37.763)**	(41.311)**	(40.631)**
e_t	0.093	0.089	0.083
	(6.535)**	(6.235)**	(6.100)**
The Export Equation			
$(y_{t-1} - n_{t-1})$	0.061	0.086	0.270
	(0.205)	(0.177)	(0.766)
$export_{t-1}$	2.022	-0.354	1.081
	(10.758)**	(0.908)	(3.046)**
$(k_{t-1} - n_{t-1})$	0.065	-0.053	0.039
	(0.868)	(0.436)	(0.446)
$(m_{t-1} - n_{t-1})$	0.203	0.641	0.061
	(0.849)	(1.713)+	(0.225)
$(e_{t-1} - n_{t-1})$	-0.111	-0.411	-0.142
	(1.062)	(2.122)*	(1.138)
n_{t-1}	0.273	2.096	0.593
	(3.418)**	(5.752)**	(3.284)**
σ_η	0.270	0.223	0.242
σ_μ		0.160	0.126
σ_ψ		2.804	0.803
$\rho_{\eta\omega}$ 0.076		-0.226	0.038
$\rho_{\mu\omega}$		0.330	-0.018
Log likelihood value	-390.93	-353.57	-332.37
Number of firms	289	289	289

Note: The dependent variable in the production function is the log of gross output. The dependent variable in the export equation is a dummy variable equal to one if the firm exports and zero otherwise. All regressions include dummy variables for country, industry, ownership and time. The numbers in ( ) are *t*-statistics based on asymptotic standard errors. Significance at the 1 per cent, 5 per cent and 10 per cent level is indicated by *, ** and + respectively.

- Bottom line: The quantitative effect of exporting appears to be large: exporting is associated with a short-term productivity gain of 7–8 percent in an output production function, which corresponds to productivity gains in terms of value added of 20–25 percent in the short run and up to 50 percent in the long run.

- Van Biesebroeck (2005) reports similar results using a larger dataset.