Supplementary Web Appendix for:

"Firms' Exporting Behavior under Quality Constraints"

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1 Theory Appendices

1.A Factor input requirements of quality production

Production requires the use of labor, capital and intermediate inputs. There are H_L types of labor, indexed by $h = 1, ..., H$, which earn market-determined wages w_h^L. Additionally, there are H_I types of intermediate inputs, indexed by $h = 1, ..., H_I$, with market-determined prices w_h^I, and H_K types of capital, indexed by $h = 1, ..., H_K$, each with market-determined rental rate w_h^K.

Denote by L_h the units of labor of type h, by I_h the units of intermediate input of type h, by K_h the value of capital of type h hired by the firm, and define $L = \sum_h L_h$, $I = \sum_h I_h$ and $K = \sum_h K_h$. Then, the average wage the firm pays is $w_L = \frac{\sum_h w_h^L L_h}{L}$, the average price of intermediate inputs is $w_I = \frac{\sum_h w_h^I I_h}{I}$, and the average rental is $w_K = \frac{\sum_h w_h^K K_h}{K}$. Variation in wages, intermediate inputs prices, and rental rates across types of factor inputs can be thought to reflect differences in relative productivity in an unmodeled "numeraire" industry. In the case of labor, relative productivity is assumed to depend on skills.

To produce quality λ, a firm needs to pay average wage $w_L = \underline{w}_L \lambda^{b_L}$ and average intermediate input price $w_I = \underline{w}_I \lambda^{b_I}$, $b_L > 0$, $b_I > 0$, where $\underline{w}_L$ and $\underline{w}_I$ are the least expensive types of labor and intermediate inputs, respectively. Since capital is measured in monetary units, although rental rates could vary, for example, according to depreciation rates by type of capital, there is no reason to presume that they will vary according to output quality. Therefore, we simply assume that the rental rate w_K is constant across firms.

The quantity of output only depends on the quantity of inputs used in production, not on their type. Output is produced using a constant returns to scale Cobb-Douglas production function: $q = \varphi L_v^{\alpha_L} I_v^{\alpha_I} K_v^{\alpha_K}$, where $\alpha_L + \alpha_I + \alpha_K = 1$. Combining this production function with the requirements of input quality described above yields the unit (variable) cost function postulated in equation (4) in the text:

$$c(\lambda, \varphi) = \frac{A}{\varphi}(w_L)^{\alpha_L}(w_I)^{\alpha_I}(w_K)^{\alpha_K} = \frac{\kappa}{\varphi}\lambda^{\beta} \tag{1}$$

where $A = \frac{1}{\alpha_L^{\alpha_L}\alpha_K^{\alpha_K}\alpha_I^{\alpha_I}}$, $\kappa = A(\underline{w}_L)^{\alpha_L}(\underline{w}_I)^{\alpha_I}(w_K)^{\alpha_K}$, and $\beta = \alpha_L b_L + \alpha_I b_I$.

Analogously, we assume that the fixed cost part of quality production requires labor and capital combined in a Cobb-Douglas production function with the same exponents but allowing for non-constant returns to scale: $\lambda = \left(\xi L_f^{\alpha_L} I_f^{\alpha_I} K_f^{\alpha_K}\right)^{\frac{1}{\nu}}$.[1] In addition, the firm incurs other fixed costs F_0 unrelated to quality. We assume that these fixed costs arise from using L_0 units of the least expensive labor and K_0 units of capital:

$$F_0 = \underline{w}_L * L_0 + w_K * K_0 \tag{2}$$

To avoid dealing with composition effects between these fixed costs and those that depend on quality, we assume that the factor shares in their production are also α_L and α_K. This implies that

$$\frac{K_0}{L_0} = \frac{\alpha_K}{\alpha_L}\frac{\underline{w}_L}{w_K} \tag{3}$$

Accordingly, fixed costs, conditional on quality λ, are as in equation (5) in the text:

$$F(\lambda, \xi) = \frac{A}{\xi}(w_L)^{\alpha_L}(w_I)^{\alpha_I}(w_K)^{\alpha_K}\lambda^{\nu} + F_0 = \frac{f}{\xi}\lambda^{\alpha} + F_0 \tag{4}$$

where $f = A(\underline{w}_L)^{\alpha_L}(\underline{w}_I)^{\alpha_I}(w_K)^{\alpha_K}$ and $\alpha = \nu + \alpha_L b_L + \alpha_I b_I$.

This model is consistent with assumption $A.2$. Clearly, average wages and intermediate input prices increase with quality since $b_L > 0$ and $b_I > 0$. The assumption that $b_L > 0$ also implies that capital intensity increases with quality. In our data, we do not observe variable and fixed costs separately. Thus, we measure capital

[1] In this static framework, sunk and fixed costs are equivalent. In a dynamic setting, sunk costs could still be considered fixed costs if capital markets allow the firm to convert them into an equivalent stream of per-period fixed costs.

intensity as the ratio of total capital ($K = K_f + K_v + K_0$) to total labor ($L = L_f + L_v + L_0$). Since variable costs are Cobb-Douglas, cost shares are constant. Thus, $\frac{w_K K_v}{\alpha_K} = \frac{w_L L_v}{\alpha_L}$, which implies that:

$$\frac{K_v}{L_v} = \frac{\alpha_K}{\alpha_L}\frac{w_L}{w_K} = \frac{\alpha_K}{\alpha_L}\frac{\underline{w}_L}{w_K}\lambda^{b_L}. \tag{5}$$

Since fixed costs are also Cobb-Douglas, we obtain the same expression for the fixed costs capital-labor ratio. By assumption, the capital intensity used to produce F_0 coincides with the capital intensity used in variable and quality-related fixed costs for the lowest quality. Since the capital intensity of the production of both fixed costs and variable costs increase at the same rate with quality, the aggregate capital intensity of the plant is also increasing in quality.

The intuition here is that assumption $b_L > 0$ essentially implies that the relative cost of using labor goes up as quality goes up, which in turn means that firms substitute capital for labor at higher quality levels.

1.B Equilibrium existence in the closed and open economies

i. Existence in the closed economy. Let $\overline{\pi}(P) = \int_0^{\overline{\varphi}} \int_0^{\overline{\xi}} \pi(\varphi, \xi, P) v(\varphi, \xi) d\xi d\varphi$ be expected post-entry profits of firms before entering. Firms may enter the market by paying a cost f_e. Thus, in equilibrium:

$$\overline{\pi}(P) = f_e$$

Since $\pi(\varphi, \xi, P)$ and $\underline{\xi}(\varphi, P)$ are continuous and differentiable in P, $\overline{\pi}(P)$ is also continuous and differentiable in P. Because $\overline{\pi}(P)$ is continuous, to demonstrate existence we only need to show that it takes the value f_e at least once. Using the closed form solution for profits, it is easy to see that $\lim_{P\to 0}\overline{\pi}(P) = \infty$ and $\lim_{P\to\infty}\overline{\pi}(P) = 0$. This implies that there is at least one value of P such that $\overline{\pi}(P) = f_e$. □

ii. Existence in the open economy.

Ex-ante expected profits are given by:

$\overline{\pi}(P, P^*) = \int_0^{\overline{\varphi}} \int_0^{\overline{\xi}} \pi(\varphi, \xi, P, P^*) v(\varphi, \xi) d\xi d\varphi, \qquad P > 0, P^* > 0$

where:

$$\pi(\varphi, \xi, P, P^*) = \begin{cases} 0 \quad \text{if } \pi_d(\varphi, \xi) < 0 \\ \pi_d(\varphi, \xi, P, P^*) \ \text{ if } \pi_d(\varphi, \xi) \geq 0 \text{ and } \Delta\pi(\varphi, \xi) < 0 \\ \pi_x(\varphi, \xi, P, P^*) \ \text{ if } \pi_d(\varphi, \xi) \geq 0 \text{ and } \Delta\pi(\varphi, \xi) \geq 0 \end{cases}$$

At the borders between regions in Figure 4, firms are indifferent so $\pi(\varphi, \xi, P, P^*)$ does not jump. Since $\pi_d(\varphi, \xi, P, P^*)$ and $\pi_x(\varphi, \xi, P, P^*)$ are continuous, $\pi(\varphi, \xi, P, P^*)$ is also continuous in (φ, ξ), though not differentiable at the limits of integration - of measure 0 in $\mathbb{R}^2$. The functions $\pi_x(\varphi, \xi, P, P^*)$ and $\pi_d(\varphi, \xi, P, P^*)$ are also continuous and differentiable in P and P^*. Therefore, the continuity and differentiability of the function $\overline{\pi}(P, P^*)$ in P and P^* follows directly.

Since $\pi(\varphi, \xi, P, P^*)$ is continuous in (φ, ξ), by application of Leibnitz rule we can find the derivatives of $\overline{\pi}(P, P^*)$ with respect to P and P^*. Since $\forall(P, P^*, \varphi, \xi)$: $\frac{\partial \pi_i}{\partial P} < 0$, $i = d, x$, $\frac{\partial \pi_x}{\partial P^*} < 0$, $\frac{\partial \pi_d(\varphi, \xi, P, P^*)}{\partial P^*} = 0$, and the derivatives of the limits of integration cancel out, we can establish that $\forall(P, P^*)$: $\frac{\partial \overline{\pi}(P, P^*)}{\partial P} < 0$. Similarly, $\frac{\partial \overline{\pi}^*(P, P^*)}{\partial P^*} < 0$ in the foreign country.

Free-entry in each country implies the following system of equations:

$$\overline{\pi}(P, P^*) = f_e \tag{6}$$
$$\overline{\pi}^*(P, P^*) = f_e \tag{7}$$

We want to show that an equilibrium pair (P, P^*) exists and is unique. First we make the following assumption:

Assumption 1:

a) $\lim_{P\to\infty}\overline{\pi}(P, P^*) < \lim_{P\to\infty}\overline{\pi}^*(P, P^*)$

b) $\lim_{P^*\to\infty}\overline{\pi}(P, P^*) > \lim_{P^*\to\infty}\overline{\pi}^*(P, P^*)$

The two inequalities are analogous. When $P \to \infty$, there are no profits to be made in the Home market so firms only operate in the Foreign market. Then the first inequality simply states that Foreign firms' expected profits in the Foreign market - for any P^* - are higher than Home firms' expected profits in that market. Analogously, the second inequality states that Home firms' expected profits in the Home market are higher than Foreign firms' expected profits there.

Proposition A.1. Under Assumption 1, there is a pair (P, P^*) that solves the system of equations (6) and (7).

Proof. Since $\overline{\pi}(P, P^*)$ is strictly decreasing in P^*, for any given P the value of P^* that solves equation 6 is unique and implicitly defines a function $P^* = P^{*H}(P)$. Similarly, since $\overline{\pi}(P, P^*)$ is strictly decreasing in P, we can obtain the inverse function $P = P^H(P^*)$. Using the Implicit Function Theorem and previous results, we establish that this function is downward sloping: $\frac{dP^*}{dP}|_H = -\frac{\partial\overline{\pi}(P,P^*)/\partial P}{\partial\overline{\pi}(P,P^*)/\partial P^*} < 0$. Assumption 1.a. implies that:

$f_e = \lim_{P\to\infty} \overline{\pi}\left(P, P^{*H}(P)\right) < \lim_{P\to\infty} \overline{\pi}^*\left(P, P^{*H}(P)\right)$. Since $\overline{\pi}^*(P, P^*)$ is decreasing in P^*, this inequality also implies that:

$$\lim_{P\to\infty} P^{*H}(P) < \lim_{P\to\infty} P^{*F}(P) \tag{8}$$

Analogously, assumption 1.b implies that $f_e = \lim_{P^*\to\infty} \overline{\pi}^*\left(P^F(P^*), P^*\right) < \lim_{P^*\to\infty} \overline{\pi}\left(P^F(P^*), P^*\right)$. Since $\overline{\pi}(P, P^*)$ is decreasing in P, this inequality implies:

$$\lim_{P^*\to\infty} P^F(P^*) > \lim_{P^*\to\infty} P^H(P^*) \tag{9}$$

Since both $P^{*H}(P)$ and $P^{*F}(P)$ are decreasing, equations (8) and (9) imply that the two curves cross at least once. Thus, an equilibrium exists. □

1.C Graphical representation

In this appendix, we demonstrate the properties of the graphical representation in Figures 3, 4 and 5 in the text.

1.C.1 Isorevenue and isoprofit curves are continuous both in the domestic and in the exporting case

In the domestic case, continuity for both revenue and profits can be directly observed from their closed-form solutions (see Hallak and Sivadasan 2009). In the exporting case, however, establishing continuity is not as direct.

The first order condition with respect to quality, after solving for optimal prices is:

$$\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}(1-\beta)\frac{E}{P} + \left(\frac{\sigma}{\sigma-1}\right)^{\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}(1-\beta)(\sigma-1)\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*}$$
$$+\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\frac{E^*}{P^*}\tau(\lambda)^{1-\sigma}\left(\frac{-\tau'(\lambda)\lambda}{\tau(\lambda)}\right) - \frac{f}{\xi}\alpha\lambda^{\alpha'} = 0.$$

The LHS is differentiable and continuous in (λ, φ, ξ) for any $\lambda \neq 0$. Since the marginal benefits of increasing quality go to infinity when $\lambda \to 0$, $\lambda = 0$ is never optimal. This means that the LHS is continuous and differentiable at the optimal quality, $\lambda_x(\varphi, \xi)$. Hence, by the implicit function theorem, $\lambda_x(\varphi, \xi)$ is continuous and differentiable in (φ, ξ). Since revenue and profits are continuous functions of $\lambda_x(\varphi, \xi)$, then $r_x(\varphi, \xi)$ and $\pi_x(\varphi, \xi)$, they are also continuous and differentiable. Hence, so are isorevenue and isoprofit curves.

1.C.2 The exporting-case isoprofit curve is flatter than the domestic-case isoprofit curve (Figure 3)

To prove this statement, we will first compute the slope of both curves.

a. The slope in the domestic case is given by $\frac{d\xi}{d\varphi} = -\frac{\xi\alpha}{(1-\beta)\varphi}$

Proof. On a domestic isoprofit curve:

$$d\pi_d(\varphi,\xi) = \frac{\partial \pi_d}{\partial \varphi} d\varphi + \frac{\partial \pi_d}{\partial \xi} d\xi = 0 \tag{10}$$

Domestic profits are given by

$$\pi_d(\lambda;\varphi,\xi) = \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}{\lambda_d}^{(1-\beta)(\sigma-1)}\frac{E}{P} - \frac{f}{\xi}{\lambda_d}^{\alpha} - F_0 \tag{11}$$

Taking derivatives and substituting into (10) yields:

$$\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\varphi^{-1}\frac{E}{P}d\varphi + \frac{f}{\xi^2}{\lambda_d}^{\alpha'} d\xi = 0 \tag{12}$$

Using the first order condition of the domestic case and substituting into (12) yields:

$$\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\varphi^{-1}\frac{E}{P}d\varphi + \left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}(1-\beta)\frac{E}{P}\frac{d\xi}{\xi\alpha} = 0$$

Manipulating terms on this last equation provides the desired result.

b. The slope in the exporting case is given by
$\frac{d\xi}{d\varphi} = -\frac{\xi\alpha}{\varphi(1-\beta)}\frac{(\frac{E}{P}+\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*})}{\left((\frac{E}{P}+\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*})-\frac{1}{(1-\beta)}\frac{\tau'(\lambda)\lambda}{\tau(\lambda)}\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*}\right)}$
Proof. On an exporting isoprofit curve:

$$d\pi_x(\varphi,\xi) = \frac{\partial \pi_x}{\partial \varphi} d\varphi + \frac{\partial \pi_x}{\partial \xi} d\xi = 0 \tag{13}$$

Exporting profits are given by

$$\pi_x(\lambda;\varphi,\xi) = \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}{\lambda_x}^{(1-\beta)(\sigma-1)}(\frac{E}{P} + \tau(\lambda_x)^{1-\sigma}\frac{E^*}{P^*}) - \frac{f}{\xi}{\lambda_x}^{\alpha} - F_0 - f_x \tag{14}$$

Taking derivatives and substituting into (13) yields:

$$\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\varphi^{-1}(\frac{E}{P} + \tau(\lambda_x)^{1-\sigma}\frac{E^*}{P^*})d\varphi + \frac{f}{\xi^2}\lambda_x^{\alpha'} d\xi = 0 \tag{15}$$

Using the first order condition of the exporting case and substituting into (15) yields:

$$\begin{aligned} & \frac{d\varphi}{\varphi}\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}(\frac{E}{P} + \tau(\lambda_x)^{1-\sigma}\frac{E^*}{P^*}) \\ = & -\frac{d\xi}{\xi\alpha}\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\left((1-\beta)\left(\frac{E}{P} + \tau(\lambda_x)^{1-\sigma}\frac{E^*}{P^*}\right) - \frac{\tau'(\lambda_x)\lambda_x}{\tau(\lambda_x)}\tau(\lambda_x)^{1-\sigma}\frac{E^*}{P^*}\right) \end{aligned}$$

Manipulating terms on this last equation provides the desired result.

Given these results, it is easy to note that, for any firm (φ,ξ), the slopes of the domestic-case and exporting-case isoprofit curves differ only by the presence of the term $\frac{(\frac{E}{P}+\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*})}{\left((\frac{E}{P}+\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*})-\frac{1}{(1-\beta)}\frac{\tau'(\lambda)\lambda}{\tau(\lambda)}\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*}\right)}$. This term is smaller than 1 due to the fact that the term $-\frac{1}{(1-\beta)}\frac{\tau'(\lambda)\lambda}{\tau(\lambda)}\tau(\lambda)^{1-\sigma}\frac{E^*}{P^*}$ in the denominator is positive. This means that, in absolute value, the slope is smaller in the exporting case. Since both slopes are negative, in figure 3 we see that the exporting isoprofit curve is flatter at any (φ,ξ). Moreover, by continuity, this result also implies that both isoprofit curves cannot cross again.

1.C.3 The export cut-off curve $\underline{\xi}_x(\varphi)$ is continuous and decreasing in φ (Figure 4)

Since $\pi_x(\varphi,\xi)$ and $\pi_d(\varphi,\xi)$ are continuous and differentiable, $\Delta\pi(\varphi,\xi) \equiv \pi_x(\varphi,\xi) - \pi_d(\varphi,\xi)$ is continuous and differentiable. Hence, by the implicit function theorem $\underline{\xi}_x(\varphi)$ is continuous and differentiable.

To prove that $\underline{\xi}_x(\varphi)$ is decreasing in φ, we only need to show that $\Delta\pi(\varphi,\xi)$ is increasing in both φ and ξ. First, compute $\frac{\partial\pi_i(\varphi,\xi)}{\partial\xi}$ and $\frac{\partial\pi_i(\varphi,\xi)}{\partial\varphi}$, $i = d, x$. By the envelope theorem $\frac{\partial\pi_i(\varphi,\xi)}{\partial\xi} = \frac{\partial\pi_i(\lambda(\varphi,\xi);\varphi,\xi)}{\partial\lambda(\varphi,\xi)}\frac{\partial\lambda(\varphi,\xi)}{\partial\xi} + \frac{\partial\pi_i(\lambda(\varphi,\xi))}{\partial\xi} = \frac{\partial\pi_i(\lambda(\varphi,\xi))}{\partial\xi}$. Using this argument for every case, we obtain:

$\frac{\partial\pi_d(\varphi,\xi)}{\partial\varphi} = \left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\varphi^{-1}\lambda_d(\varphi,\xi)^{(1-\beta)(\sigma-1)}\frac{E}{P}$,

$\frac{\partial\pi_d(\varphi,\xi)}{\partial\xi} = \frac{f}{\xi^2}\lambda_d(\varphi,\xi)^{\alpha}$,

$\frac{\partial\pi_x(\varphi,\xi)}{\partial\varphi} = \left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}\left(\frac{\varphi}{\kappa}\right)^{\sigma-1}\varphi^{-1}\lambda_x(\varphi,\xi)^{(1-\beta)(\sigma-1)}\left(\frac{E}{P} + \tau(\lambda_x(\varphi,\xi))^{1-\sigma}\frac{E^*}{P^*}\right)$, and

$\frac{\partial\pi^x(\varphi,\xi)}{\partial\xi} = \frac{f}{\xi^2}\lambda_x(\varphi,\xi)^{\alpha}$.

As shown in Appendix 2, $\lambda_x(\varphi,\xi) > \lambda_d(\varphi,\xi)$. Thus, $\frac{\partial\pi_d(\varphi,\xi)}{\partial\varphi} < \frac{\partial\pi_x(\varphi,\xi)}{\partial\varphi}$ and $\frac{\partial\pi_d(\varphi,\xi)}{\partial\xi} < \frac{\partial\pi_x(\varphi,\xi)}{\partial\xi}$.

1.C.4 The export cut-off curve $\underline{\xi}_x(\varphi)$ is flatter than the domestic and exporting cases isoprofit curves (Figure 5)

Proof. Take a firm (φ,ξ) located on $\underline{\xi}_x(\varphi)$. Since the firm is indifferent between exporting and producing for the domestic market, this firm is located both on an exporting $(\xi_{\pi_x=k}(\varphi))$ and on a domestic $(\xi_{\pi_d=k}(\varphi))$ isoprofit curve of level k, for some $k > 0$. As shown in figure 3, $\xi_{\pi_x=k}(\varphi)$ is flatter than $\xi_{\pi_d=k}(\varphi)$ at (φ,ξ). Moreover, these two curves cross only once. Therefore, for $\varphi' > \varphi$, $\xi_{\pi_x=k}(\varphi') > \xi_{\pi_d=k}(\varphi')$, whereas for $\varphi' < \varphi$, $\xi_{\pi_x=k}(\varphi') < \xi_{\pi_d=k}(\varphi')$. Hence, firms with $\varphi' > \varphi$ located on $\xi_{\pi_x=k}(\varphi')$ prefer producing for the domestic market, while firms with $\varphi' < \varphi$ located on $\xi_{\pi_x=k}(\varphi')$ prefer exporting. This implies that the export cut-off curve must be flatter than both isoprofit curves. Moreover, by continuity, the export cut-off curve does not cross these isoprofit curves again. As a result, profits increase with φ on the export cut-off $\underline{\xi}_x(\varphi)$.

2 Implications for productivity estimation

This section investigates the implications of our model for productivity estimation. We will address two questions. First, we examine the performance of standard approaches to estimating productivity under the assumptions of our model. In particular, we discuss the regression-based approach and the Solow-residual approach. Then, we discuss how the parameters of our model, in particular φ and ξ could potentially be recovered if more detailed information on cost components were available.

2.A Set up

We follow the supply-side set up outlined in Appendix 1.A. However, for simplicity (and consistent with the approach in many papers of the micro-productivity literature) we assume a value-added production function with only labor and capital as inputs. In particular, we assume output is produced following a CRS Cobb-Douglas production function:

$$q = \varphi L_v^{\alpha_L} K_v^{\alpha_K}, \text{ where } \alpha_L + \alpha_K = 1$$

and quality is produced using a Cobb-Douglas production function:

$$\lambda = (\xi L_f^{\alpha_L} K_f^{\alpha_K})^{\frac{1}{\nu}}, \text{ where } \nu = \alpha - \beta.$$

We assume the same production function parameters (α_L and α_K) for output and quality for analytical tractability.

As in Appendix 1.A, the quality of labor inputs is related to output quality, so that:

$$w_L = \underline{w}_L \lambda^{b_L}, \quad b_L > 0$$

where $\underline{w}_L$ is the least expensive type of labor. As discussed in that appendix, we assume the rental rate w_K is constant across firms and F_0 is given by equation (2). Then, assuming firms minimize costs, we get the cost function:

$$C = w_L * (L_v + L_f) + w_K * (K_v + K_f) + (\underline{w}_L L_0 + w_K K_0) = \frac{\kappa}{\varphi}\lambda^\beta q + \frac{f}{\xi}\lambda^\alpha + F_0$$

$$\text{where: } A = \frac{1}{\alpha_L^{\alpha_L}\alpha_K^{\alpha_K}}; \quad \kappa = A\left(\underline{w}_L\right)^{\alpha_L}\left(w_K\right)^{\alpha_K}; \quad \beta = \alpha_L b_L; \text{ and } f = A\left(\underline{w}_L\right)^{\alpha_L}\left(w_K\right)^{\alpha_K}$$

Given the above assumptions, optimal variable input choice, L_v^* and K_v^*, conditional on output and quality is given by:

$$L_v^* = \frac{q}{\varphi}\left(\frac{w_K\alpha_L}{w_L\alpha_K}\right)^{\alpha_K} = \frac{q}{\varphi}\left(\frac{w_K\alpha_L}{\underline{w}_L\alpha_K}\right)^{\alpha_K}\lambda^{-\alpha_K b_L} \tag{16}$$

$$K_v^* = \frac{q}{\varphi}\left(\frac{w_L\alpha_K}{w_K\alpha_L}\right)^{\alpha_L} = \frac{q}{\varphi}\left(\frac{\underline{w}_L\alpha_K}{w_K\alpha_L}\right)^{\alpha_L}\lambda^{\alpha_L b_L} \tag{17}$$

Dividing equation (16) by equation (17) to eliminate q and φ, we obtain:

$$\frac{L_v^*}{K_v^*} = \left(\frac{w_K\alpha_L}{\underline{w}_L\alpha_K}\right)^{\alpha_K-\alpha_L}\lambda^{-b_L(\alpha_K+\alpha_L)} = \left(\frac{w_K\alpha_L}{\underline{w}_L\alpha_K}\right)^{\alpha_K-\alpha_L}\lambda^{-b_L}$$

$$\Rightarrow \ln\lambda = \frac{1}{-b_L}\left((\alpha_L-\alpha_K)\ln\left(\frac{w_K\alpha_L}{\underline{w}_L\alpha_K}\right) + \ln L_v^* - \ln K_v^*\right) \tag{18}$$

Cost minimizing input choice in quality production, L_f^* and K_f^*, conditional on quality, is given by:

$$L_f^* = \frac{\lambda^\nu}{\xi}\left(\frac{w_K\alpha_L}{w_L\alpha_K}\right)^{\alpha_K} = \frac{\lambda^\nu}{\xi}\left(\frac{w_K\alpha_L}{\underline{w}_L\alpha_K}\right)^{\alpha_K}\lambda^{-\alpha_K b_L} \tag{19}$$

$$K_f^* = \frac{\lambda^\nu}{\xi}\left(\frac{w_L\alpha_K}{w_K\alpha_L}\right)^{\alpha_L} = \frac{\lambda^\nu}{\xi}\left(\frac{\underline{w}_L\alpha_K}{w_K\alpha_L}\right)^{\alpha_L}\lambda^{\alpha_L b_L} \tag{20}$$

From equations (16), (17), (19) and (20), we obtain:

$$\frac{L_v^*}{L_f^*} = \frac{K_v^*}{K_f^*} = \frac{q}{\lambda^\nu}\frac{\xi}{\varphi}. \tag{21}$$

In the case of non-exporters, the solution for the optimal choice of quality λ has a closed form. Using this solution, the optimal price p, and the firm demand equation, we obtain:

$$\begin{aligned} \lambda^\nu &= A_1 \varphi^{\frac{\sigma-1}{\alpha'}(\alpha-\beta)} \xi^{\frac{\alpha-\beta}{\alpha'}} \\ q &= A_2 \varphi^{\left(\sigma + \left(\frac{\sigma-1}{\alpha'}\right)\{\sigma(1-\beta)-1\}\right)} \xi^{\frac{\sigma(1-\beta)-1}{\alpha'}} \\ \text{where:} \quad A_1 &= \left[\left(\frac{1-\beta}{\alpha}\right)\left(\frac{\kappa\sigma}{\sigma-1}\right)^{-\sigma}\frac{\kappa}{f}\frac{E}{P}\right]^{\frac{\alpha-\beta}{\alpha'}} \quad \text{and} \quad A_2 = \left(\frac{\kappa\sigma}{\sigma-1}\right)^{-\sigma}\frac{E}{P}A_1^{\frac{\sigma(1-\beta)-1}{\alpha-\beta}} \end{aligned}$$

These results, combined with equation (21), then yields for non-exporters:

$$\frac{L_v^*}{L_f^*} = \frac{K_v^*}{K_f^*} = \frac{q}{\lambda^\nu}\frac{\xi}{\varphi} = A_3 \equiv \left(\frac{\alpha}{1-\beta}\right)\frac{f}{\kappa} \tag{22}$$

Throughout the analysis, we assume that the fixed costs related to exporting (f_x) are incurred abroad or in ancillary establishments not included in the manufacturing survey datasets, and hence are excluded from the data. Also, without loss of generality (as these parameters simply scale the underlying productivity and caliber parameters), we will assume $\kappa = f = 1$.

2.B Implications for productivity measures

This section investigates the implications of our model for standard productivity measures. There are two major approaches used to estimate total factor productivity (TFP) in the literature. One is a regression-based approach that regresses log of revenue (or output) on log of inputs (usually assuming a Cobb-Douglas production function). The other common approach is to define a solow TFP residual, measured as log of revenue less sum of cost-share weighted log of inputs. We investigate both approaches in turn.

Because most commonly used datasets have data only on total revenue and total inputs, we focus on implications for estimation using such data.

2.B.1 Regression-based approaches

The most simple regression-based approach is to use OLS to regress either revenue or physical output on log of inputs. It is well recognized that the OLS approach could suffer from endogeneity bias (as inputs could be correlated with the productivity residual). The most common approaches to deal with endogeneity bias in the recent literature are based on the methods of Olley and Pakes (1996) and Levinsohn and Petrin (2003). These approaches use lagged inputs as instruments for current inputs. Hence, to investigate the implications of using those estimation methods, we would need to specify a dynamic model, which is beyond the scope of this work.

Instead, in this section we will assess the extent and nature of the bias in the context of our two-factor, endogenous-quality model. In addition, we want to assess whether and how the estimated productivity residual correlates with the two underlying firm attributes in our model.

From equation (18), and given our demand side and output production assumptions, we have:[2]

$$\begin{aligned} \ln r &= \ln p + \ln q = \left(\ln\frac{\sigma}{\sigma-1} + \ln\kappa - \ln\varphi + \beta\ln\lambda\right) + (\ln\varphi + \alpha_L \ln L_v + \alpha_K \ln K_v) \\ &= a_0 + a_1 \ln L_v + a_2 \ln K_v \\ \text{where:} \quad a_0 &= \frac{\beta(\alpha_K - \alpha_L)}{b_L}\ln\left(\frac{w_K \alpha_L}{\underline{w}_L \alpha_K}\right) + \ln\frac{\kappa\sigma}{\sigma-1}; \quad a_1 = \frac{-\beta}{b_L} + \alpha_L; \quad a_2 = \frac{\beta}{b_L} + \alpha_K \end{aligned} \tag{23}$$

[2]Note that, for exporters, revenue can be expressed as the product of fob prices and total production (i.e. including that which melts in transportation).

We first consider a case with zero non-quality related fixed costs ($F_0 = 0$) as a benchmark. This case could be justified if non-quality related fixed costs (e.g. top management pay) are incurred at the firm's headquarters and not captured in establishment-based datasets. In this case, total inputs equal the sum of the inputs used in variable and quality production (i.e. $L = L_v + L_f + L_0 = L_v + L_f$, and $K = K_v + K_f + K_0 = K_v + K_f$),

For non-exporters, equation (22) implies that $\ln L_v = \ln(L_v + L_f) - \ln\left(1 + \frac{1}{A_3}\right)$. Then from equation (23) we get:

$$\begin{aligned}
\ln r &= a_0 + a_1 \ln L_v + a_2 \ln K_v = \left\{ a_0 - (a_1 + a_2)\ln\left(1 + \frac{1}{A_3}\right)\right\} + a_1 \ln(L_v + L_f) + a_2 \ln(K_v + K_f) \\
&= a_0' + a_1 \ln(L_v + L_f) + a_2 \ln(K_v + K_f) \quad ; \qquad a_0' \equiv a_0 - (a_1 + a_2)\ln\left(1 + \frac{1}{A_3}\right) \\
&= a_0' + a_1 \ln L + a_2 \ln K
\end{aligned}$$

When $F_0 = 0$, the relationships above hold exactly in the absence of measurement or optimization errors. Therefore, the regression has a perfect fit and no residuals can be recovered from the regression. If measurement or optimization errors were present, they would generally be uncorrelated with φ or ξ, so residuals from using this method would not meaningfully identify any relevant parameter of the model.[3]

In the case of exporters, quality does not have a closed form. Hence, equation (22) above does not exactly hold as variable inputs are not a constant proportion of fixed quality inputs across firms. To analyze this case we use simulated data from our full model.[4] In particular, we examine the extent to which residuals recovered from the OLS regressions are correlated with the underlying productivity parameters in our model. The results are presented in columns 2 and 3 of Table A.12 (in column 1 we present the results for non-exporters as a benchmark).[5] We find that for the exporter sample (column 2), the qualitative conclusions are very similar to that for the non-exporter sample. In particular, we find that the goodness of fit (R-squared) is close to perfect and the residuals have very little correlation with the underlying productivity parameters (η, φ, ξ) of the model (correlations are displayed in the bottom four rows of the table). Consequently, even in the regression in column 3 that pools exporters and non-exporters – as is typical in the literature – we find that the estimated production function residuals have almost no correlation with those productivity parameters.

To examine how F_0 affects the results, in columns 4 to 6 of Table A.12 we estimate the same regressions assuming a high F_0, set to 20.[6] In all of the cases, the goodness of fit is very high, and the residuals have almost no correlation with the underlying productivity parameters. Also, the direction of bias on the coefficients estimates is the same as in the case of $F_0 = 0$. We repeated this analysis (results available on request) for intermediate values of F_0 and found similar results.

The results in this section suggest that even when residuals are generated from measurement error introduced by having non-quality related fixed inputs included in measured labor and capital, these estimated residuals are not meaningfully related to underlying parameters of the model. We view our findings as an extension of the multi-collinearity problem documented by Bond and Söderbom (2006) and Ackerberg, Caves and Fraser (ACF) (2006). While they uncover this problem in the context of a single-productivity Cobb-Douglas perfect-competition case our result arises in the context of a two-productivity, monopolistic-competition, endogenous-quality case.[7] Multi-collinearity in our model arises because: (i) as prices are proportional to physical productivity φ, this parameter drops out of the revenue equation (23) once quality λ is controlled for; (ii) (log) λ is linear in (log) variable inputs for non-exporters (as shown in equation (18)) and almost linear for non-exporters (as shown by the simulations) . Hence, revenue becomes an almost linear function of those inputs as well.

[3]Incidentally, given assumption $b_L > 0$, the relations in (23) imply that the estimate of the labor coefficient α_L is biased downwards while the estimate of the capital coefficient α_K is biased upwards.

[4]Details on the simulation are discussed in Appendix 3 of the paper. Parameters specific to the supply-side set up in this section are chosen to match the calibrated parameters discussed in Table A.1. In particular, we set: $\underline{w}_L = \alpha_L$, and $w_K = \alpha_K$ so that $\kappa = f = 1$; $b_L = \frac{\beta}{\alpha_L}$ so that $\beta = \alpha_L b_L$ and $b_L > 0$; and $L_0 = \frac{0.5F_0}{\underline{w}_L}$ and $K_0 = 0.5 * \frac{F_0}{w_K}$ so that $F_0 = \underline{w}_L * L_0 + w_K * K_0$.

[5]The estimated coefficients on log labor and log capital for non-exporters are 0 and 1, respectively, due to our particular choice of parameter values, which given the biases imply that $a_1 = \frac{-\beta}{b_L} + \alpha_L = -0.7 + 0.7 = 0.0$ and $a_2 = \frac{\beta}{b_L} + \alpha_K = 0.7 + 0.3 = 1.0$.)

[6]This value for F_0 is high relative to the range of realized gross profits in the simulation, which take values between 23 and 65.

[7]The major contribution of ACF is related to this point as well, as they show that the non-parametric collinearity between inputs affects the viability of the first stage of the Olley and Pakes (1996) and Levinsohn and Petrin (2003) approaches.

2.B.2 The Solow-residual approach

The other common approach to measuring productivity is the Solow residual approach. A particularly useful benchmark is the approach in Foster, Haltiwanger and Syverson (2008) (FHS), who also posit two forms of heterogeneity – a supply side physical productivity parameter isomorphic to φ in our model and an exogenous "demand productivity" isomorphic to quality (λ) in our model. Crucially, "demand productivity" is exogenous in FHS, whereas in the models we consider (full and benchmark) quality is endogenous.[8]

Because the only available data on output in many datasets is revenue, the most commonly used Solow residual productivity measure is what FHS define as revenue TFP or TFPR:

$$TFPR \equiv \ln r - \hat{\alpha_L} \ln L - \hat{\alpha_K} \ \ln K$$

where $\hat{\alpha_L} = \frac{w_L.L}{w_L.L + w_K.K}$ and $\hat{\alpha_K} = \frac{w_K.K}{w_L.L + w_K.K}$ are labor share and capital share of total costs, respectively.

As in section 2.B.1 above, we start with the benchmark case of $F_0 = 0$. Then, following from equation (22), for non-exporters: $L = L_v + L_f = L_v \left(1 + \frac{1}{A_3}\right)$. This implies for $\hat{\alpha_L} = \alpha_L = \frac{w_L.L_v}{w_L.L_v + w_K.K_v}$ and similarly $\hat{\alpha_K} = \alpha_K$. In this case, TFPR is perfectly correlated with λ, as:

$$\begin{aligned}
\text{TFPR} &\equiv \ln p + \ln q - \hat{\alpha_L} \ln L - \hat{\alpha_K} \ln K \\
&= (\ln p) + (\ln q - \hat{\alpha_L} \ln L_v - \hat{\alpha_K} \ln K_v) - \ln\left(1 + \frac{1}{A_3}\right) \\
&= \left(\ln \frac{\sigma}{\sigma - 1} + \ln \kappa - \ln \varphi + \beta \ln \lambda\right) + (\ln \varphi) - \ln\left(1 + \frac{1}{A_3}\right) \\
&= \ln \frac{\kappa\sigma}{\sigma - 1} - \ln\left(1 + \frac{1}{A_3}\right) + \beta \ln \lambda \qquad (24)
\end{aligned}$$

The intuition for this result is as follows: in our model, price varies directly with quality (λ) and inversely with physical productivity (φ), while quantity (q) varies directly with φ. Then in $TFPR$, which combines price and quantity, the terms that include physical productivity offset each other leaving only the linear dependence on $\ln\lambda$.

As discussed above, since equation (22) does not hold strictly for exporters, we analyze this case with simulated data. We find that TFPR is almost perfectly correlated with log quality, so that this is also true when we pool exporters and non-exporters (correlation > 0.999).

We then check results using simulated data for $F_0 = 20$. We find that, both for non-exporters and exporters, the correlation between TFPR and log quality remains very strong. Specifically, this correlation is 0.989 for non-exporters, 0.977 for exporters, and 0.992 for the data pooling exporters and non-exporters.

The correlation of TFPR with φ, ξ, and η closely track the dependence of quality on these parameters. In particular, with $F_0 = 0$, TFPR's correlation with log of φ, ξ and η are respectively for non-exporters (exporters): -0.83 (-0.86), 0.98 (0.98), and -0.63 (-0.75). With $F_0 = 20$, TFPR's correlation with log of φ, ξ and η are respectively for non-exporters (exporters): -0.74 (-0.74), 0.95 (0.92) and -0.51 (-0.60).

We conclude that under our model, TFPR is most closely correlated with log quality, with perfect correlation in the case of $F_0 = 0$. Because quality is a (positive) function of both productivity (φ) and caliber (ξ), TFPR conflates both productivity parameters.

2.C Recovering φ, ξ, and other model parameters

We finally investigate how our model parameters, in particular φ and ξ, could potentially be recovered if data availability were improved in two ways. First, we assume that, as in Foster, et. al (2008), we have data on both quantity and revenue. Second, we assume that we have information on variable and fixed costs. In that case, we could observe the different inputs (L_v, L_f and L_0, K_v, K_f and K_0), as well as total costs (C), variable costs (cq), quality related fixed costs ($F - F_0$), and other fixed costs (F_0). While this separation is unavailable in currently available manufacturing census datasets (such as the ones we use), separate tracking of fixed and

[8] Even in the exogenous quality model of Section 3, to fit CEP 3-5 we need to assume dependence of observed marginal costs on λ, which is not considered in FHS.

variable costs is often done by firms internally for managerial decision-making purposes as discussed in standard accounting textbooks (e.g. see Garrison et al 2009, chapter 5). Thus, the data availability assumptions we make are not unfeasible, so that if such data become available in the future, the approach laid out below could be implemented.

(i). Recovering φ: FHS also use a Solow residual based on physical output, denoted TFPQ, as a measure of physical productivity. In our model, it directly follows from the output production function that process productivity (φ) is identical to TFPQ_v, defined based on variable costs:

$$\text{TFPQ}_v \equiv \ln q - \alpha\hat{_{L_v}} \ln L_v - \alpha\hat{_{K_v}} \ln K_v = \ln\varphi \tag{25}$$

Thus, under our assumptions, φ can be directly recovered from TFPQ_v.

(ii). Recovering σ and β: We can recover these parameters from a regression of quantity sold in the domestic market, (q^{dom}) on price and TFPR_v, as we have:

$$q_j^{dom} = -\sigma p_j + (\sigma - 1)\ln\lambda_j + \ln\left(\frac{E}{P}\right) = -\sigma p_j + \frac{\sigma - 1}{\beta}\text{TFPR}_{vj} + \left(\ln\frac{E}{P} - \frac{\sigma - 1}{\beta}\ln\frac{\kappa\sigma}{\sigma - 1}\right)$$

Thus we get estimates for σ and β as:

$$\hat{\sigma} = -(\text{Coefficient on price}); \quad \hat{\beta} = \frac{\hat{\sigma} - 1}{\text{Coefficient on TFPR}_v}$$

(iii). Recovering α: With an estimate of β, and using equation (22), we can recover α as:

$$\hat{\alpha} = (1 - \hat{\beta})\frac{L_v^*}{L_f^*}$$

(iv). Recovering λ: Having estimates of σ and β enables us to recover λ from TFPR using equation (24).

(v). Recovering ξ: Having estimates of α and λ finally allows us to recover ξ from information on quality-related fixed costs:

$$\widehat{\xi} = \hat{\alpha}\ln\hat{\lambda} - \ln\ (F(\lambda) - F_0)$$

where the second term in the parenthesis is obtained directly from data.

3 Data Appendix

3.A Manufacturing Data for India, U.S., Chile and Colombia

The Indian Manufacturing Survey dataset (ASI 1997-1998) covers all registered industrial establishments (formal sector) employing more than 20 persons, divided into a "census" sector and a "sample" sector.[9] All factories in the census sector (employing more than 100 workers or located in designated backward areas) are surveyed. Factories in the sample sector are stratified and randomly sampled. Throughout our analysis, we appropriately adjust for sampling weights (called "multipliers"). The ASI uses the National Industrial Classification (NIC) 1987 revision. Each establishment is classified under a 4-digit NIC code. Thus, establishment-level information, e.g. export status, wagebill, employment, and capital, is provided at this level of aggregation. Product-level information for deriving unit values (shipment value and quantity) is provided at the (5-digit) "item code" level. Unfortunately, item codes do not aggregate up consistently to the 4-digit NIC classification. We define "industries" at the 4-digit level and "products" at the 5-digit item code level. After data cleaning – explained below – we are left with 323 4-digit NIC codes and 976 item codes. In the U.S. Census of Manufactures database (CMF 1997), establishments are classified under the 4-digit Standard Industrial Classification 1987-revision (SIC 87). Product information is provided at the 7-digit SIC level. We define "industries" and "products" at the 4-digit and 7-digit SIC levels, respectively. After data cleaning, there are 467 4-digit SIC codes and 2,069 7-digit SIC codes.[10] Finally, both the Chilean Manufacturing Census (1991-1996) and the Colombian Manufacturing Census (1981-1996) use the 4-digit ISIC industry classification. After data cleaning, we are left with 77 industries in Chile and 88 in Colombia.

As part of our data cleaning process, we drop observations with missing data for our size proxies (revenue and employment) or for variables required to form our dependent variables (capital intensity and average wages). When focusing on price information, we also drop products with missing revenue or quantity information. Also, because we control for size using industry-specific or product-specific polynomials of order 3, we exclude industries or products with less than 5 observations from our sample as well as those reporting no exporters. Further, to avoid the influence of outliers, we winsorize all variables by 1% on both tails of the distribution (within each industry). For India, we also drop codes for aggregate or miscellaneous categories (99920, 99930, and 99999) and products measured in unspecified units (unit code 999). As discussed in the text, all our analysis using the Indian dataset adjusts appropriately for sampling probabilities.

For India, price is defined as the "ex-factory value" of goods manufactured divided by the quantity manufactured. The "ex-factory value" excludes all distribution and transportation costs associated with the sale of the manufactured products.[11] For the U.S., product value of shipments is defined as "net selling value, f.o.b. plant, of shipments, after discounts and allowances and exclusive of freight charges and excise taxes".

For various tests we perform, we need to concord our India and U.S. product-level data with the 4-digit SITC classification. For India, we construct a manual concordance between 5-digit item codes and 4-digit SITC Rev.3 categories. For the U.S., we construct a manual concordance between 5-digit SIC Rev.1987 codes and 4-digit SITC Rev.2 categories. We also construct a mapping from 4-digit SITC Rev.3 codes to 4-digit SITC Rev.2 codes (Rev.3 $\rightarrow$ Rev.2) using the concordances between 10-digit Harmonized System (HS) codes and those two classifications available at the the Center for International Data (CID) website.[12] Specifically, to map a given Rev.3 category into a Rev.2 category, we first identify all the 10-digit HS codes included in the first category. Then, we select the Rev.2 category into which most 10-digit HS codes are mapped. Thus, U.S. product codes are also mapped to the Rev.2 classification.

We also combine our data with other industry classifications as follows:

- *Rauch's classification (RC)*: Rauch (1999) proposed a classification of 4-digit SITC Rev.2 categories into three classes: "homogenous", "reference-priced" and "differentiated" goods. We use his "liberal" version. For products, we apply RC directly to our earlier mapping of product codes into SITC Rev.2 categories. For the India dataset, we first manually concord 3-digit NIC codes to the 3-digit ISIC classification. Then,

[9]The limit is lower (10 employees) for plants that use electric power for production.

[10]While there is a total of about 13,000 distinct 7-digit product codes, quantity information is not available for product lines that "are not meaningful" (Monahan, 1992).

[11]In the 1997-98 survey, data on transportation and other distribution costs was collected at the plant level and then imputed to individual products in proportion to the gross sales value data collected for each product.

[12]http://cid.econ.ucdavis.edu/data/sasstata/usxss.html

using a concordance between the 3-digit ISIC classification and the more disaggregate 4-digit SITC Rev.2 classification,[13] we define as "differentiated" any 3-digit ISIC code where more than half of 4-digit SITC Rev.2 codes that match it are differentiated according to RC. For industries in the U.S. dataset, 4-digit SIC codes are defined as differentiated if more than half of 5-digit SIC codes within a 4-digit SIC category are differentiated according to RC. For Chile and Colombia, "differentiated" 3-digit ISIC categories are identified as done for India.

- *Measure of external financial dependence*: The Rajan-Zingales measure of dependence on external finance is available for 2-digit SIC 1987 categories. For India, we use the CID concordance to map those categories into the 4-digit SITC Rev.3 classification. The modal 2-digit SIC category is chosen as the unique match to any 4-digit SITC Rev.3 code. For the U.S., 7-digit SIC product categories are directly mapped to their classification.
- *Measure of dependence on the government*: The Bureau of Economic Analysis of the U.S. provides Input-Output (I-O) matrices for 1997 based on a 5-digit IO classification code.[14] For India, we combine BEA's IO-HS (10-digit) concordance with a HS-SITC (Rev.3) 4-digit concordance from the CID website to obtain a 4-digit SITC Rev.3 I-O matrix. For the U.S. we follow analogous procedure except for the use of a HS-SITC (Rev.2) 4-digit concordance to obtain a 4-digit SITC Rev.2 I-O matrix. We form a measure of dependence on the government as the ratio of total output consumed by the government to total output. For a handful of product codes with missing data, we imputed the fraction of output used by government for the corresponding 4-digit I-O codes.

3.B Shipment Data for India and the United States

India Shipments data

We purchased export shipments level data for India for 2004-05 covering the period April 2004 to March 2005 from a private data vendor (ACE Infobanc Private Limited); shipment data for year 1997-98 (year used for other analysis) was not available. The key variables used include firm name (used to construct firm level aggregates and averages), 8-digit ITC HS code, a destination string, value of shipment (free on board), quantity, units for quantity, and shipping mode. We undertook steps to clean the data before analysis. First, we created a destination country identifier using the destination string information. This involved manually going through a number of different destinations strings in the data and identifying the destination country through online searches of destination information. (E.g. "Port Khalid" was identified as United Arab Emirates (ARE), and "Port Said" was identified as Egypt (EGY). We coded several hundred such destinations to countries individually.) Second, we standardized the names of exporter firms (e.g. by trimming spaces and standardizing expressions such as "COMPANY" to "CO").

The Indian Manufacturing sector data (based on the Annual Survey of Industries) does not contain firm names or identifiers that can be linked to the shipments data. Hence the analysis is undertaken using the export shipment data alone.

We found heterogeneity in units within HS code (more than half of the HS codes in our differentiated products sample had multiple units). Because prices are not comparable across different units of measurement, we use product-unit fixed effects in all our analysis.

We also undertook two sets of robustness checks (unreported in the text). One, we used a set of sub-strings (e.g. "Trading", "TRADER", "EXIM") to identify companies that are likely to be trading companies and performed analysis separately on non-trading companies alone. This did not significantly affect the baseline estimates. Two, because the full exporter name string may have some noise in it, we used an alternative exporter id based on just the first 10 characters of the exporter name. Again, the baseline results were quite robust to this check.

[13] From http://www.macalester.edu/research/economics/page/haveman/Trade.Resources/.
[14] http://www.bea.gov/industry/io_benchmark.htm

U.S. Shipments data

U.S. shipments data was accessed through the U.S. Census Research Data Center at the University of Michigan.[15] This dataset was first collated and analyzed by Bernard, Jensen and Schott (2009). We use data for year 1997 (corresponding to the 1997 CMF data used in the rest of the analysis), and use the same set of variables as for the Indian shipping data, including: firm identifier, exporter name, 10-digit ITC HS code, a destination string, value of shipment (free on board), quantity, units for quantity, and shipping mode. Note two differences in these variables with the Indian data: (i) There is a firm identifier available in the U.S. data that is also available in the CMF, so that shipment data can be linked to the manufacturing plant-level data; (ii) data are classified at 10-digit HS code as opposed to the 8-digit HS code for India.

Using additional available information, we also undertook two extra steps in cleaning the data. Specifically, we: (i) restrict data to "U.S. origin" exports (eliminating trans-shipments and origin shipments outside the U.S. which constituted 11.3% of the transactions, and (ii) drop related party transactions (about 29% of U.S. origin export transactions as our theory relates to arms-length transactions).

Linking the shipment data to the CMF required two steps (as described in the Data Appendix of Bernard, Jensen and Schott 2009): (i) For destinations other than Canada, a 9-digit employer identification number (EIN) was available, which was used to link the shipment data to the business register (SSEL) and then another firm identifier from the SSEL was used to link those data to the CMF.[16] (ii) EIN is not available for Canada. We wrote a program to match the name string available in the shipments data to the name string available in the business register.[17] We were able to match the names for about 70% of the transactions. Note that while the name matching may inevitably contain some errors, these errors are very likely to be random and hence unlikely to systematically bias our results.

Again we found significant heterogeneity in units within HS codes (more than half of the HS codes in our differentiated products sample had multiple units). Because prices are not comparable across different units of measurement, we use product-unit fixed effects in all our analysis. We also undertook two sets of robustness checks (unreported in the text). One, because information on units for quantity was missing for a large proportion (48%) of our sample, these were dropped in our baseline analysis. As a robustness check, we classified all missing units in one common "other units" category and redid the baseline analysis finding the results to be robust. Two, we used an alternative measures of firm size – employment from the LBD where there is employment data available also for non-manufacturing subsidiaries of firms – and found the baseline results to be robust as well.

For both India and the U.S., we use Rauch classification to select only differentiated products. Also, we merge information on destination countries obtained from the website of the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) [18], and from the World Bank's World Development Indicators data[19]. The two key variables are distance and destination GDP per capita. The distance measure we use is the Log bilateral population weighted distance (in km), obtained from CEPII. The per capita GDP measure is obtained from the World Bank's World Development Indicators.

[15] We thank Jim Levinsohn and William Lincoln for facilitating access to the data.

[16] Here we found a non-trivial number of cases where the EIN in the shipment data had errors such as leading or trailing blanks that needed to be cleaned.

[17] To write this code, we did a number of manual checks of failed matches and cleaned the name strings by standardizing certain terms (e.g. CORPORATION and CORP) as well as fixing a number of common spelling errors (e.g. "SYTEMES" for "SYSTEMS").

[18] http://www.cepii.fr/anglaisgraph/bdd/distances.htm

[19] http://data.worldbank.org/

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Figure A.1: Goodness of fit to Figure 1 in full model simulation

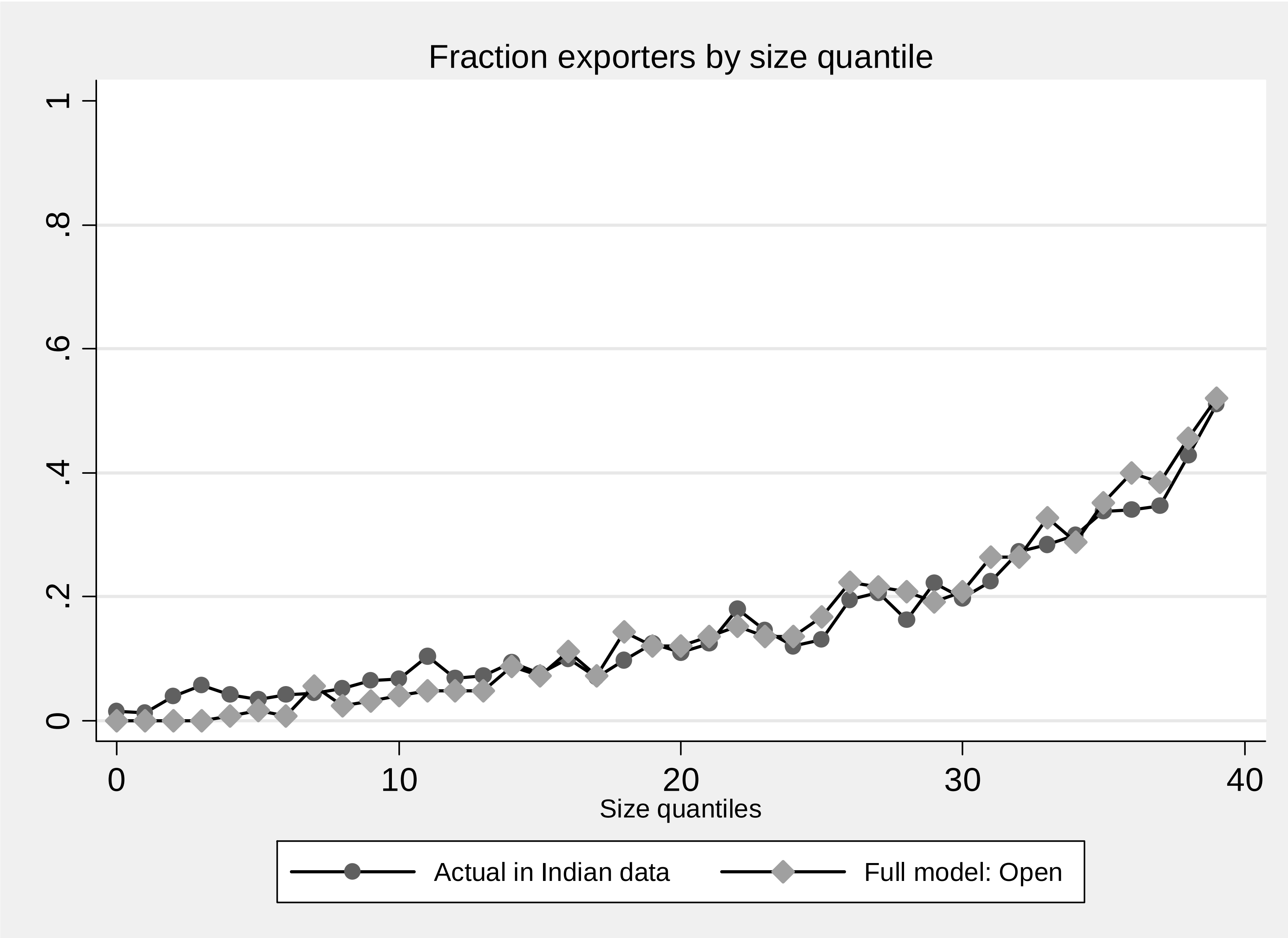

Table A.1: Model parameters used in simulations

Parameters	Full Model	Benchmark Model	Comments
Panel 1: Parameters set based on literature or without loss of generality (WLOG)			
κ	1	1	φ scales with κ, set to 1 (WLOG)
f	1	1	ξ scales with f, set to 1 (WLOG)
σ	4	4	Middle of range reported in Ruhl (2008)
β	0.9	0.9	Less than 1 by assumption; set close to 1 to emphasize effect of quality on marginal costs
F_0	0.25	0.25	Chosen low enough so firm survival rate is ensured (given other parameters)
E	50	50	E and P scale together, E set to 50 (WLOG)
P	50	50	The price in baseline case is set to equate $E/P = 1$.
E^*	50	50	Set equal to E (as we consider symmetric countries)
P^*	50	50	Set equal to P (as we consider symmetric countries)
γ	0.7	0.7	Set to yield a moderately strong effect of quality on iceberg costs (τ)
α	2.5	2.5	Assumption A.3 implies $\alpha > (1 - \beta + \gamma)(\sigma - 1) = (0.8)3 = 2.4$.
N	5000	5000	Number of firms simulated is 5000
Panel 2: Parameters jointly calibrated to fit Figure 1 and overall fraction of exporters for India			
τ_0	1	2.22	For the Full Model, τ_0 is set to 1; For the Benchmark Model, τ_0 is calibrated to fit the overall fraction of exporters (0.153) in Indian sample
τ_1	3.02	0	For the Benchmark Model, τ_1 is set to 0; For the Full Model, τ_1 is jointly estimated with f_x and distribution function parameters to maximize fit of simulated data to overall fraction of exporters and fraction of exporters by size quantile (Figure 1) for India
f_x	4.81	4.81	For the Full Model these parameters (of the bivariate log normal distribution) are jointly estimated with τ_1 to maximize fit of simulated data to overall fraction of exporters and fraction of exporters by size quantile (Figure 1) for India. Same parameters are used for the Benchmark Model
Mean(μ_φ)	1.92	1.92	
Mean(μ_ξ)	0.93	0.93	
SD(σ_φ)	0.07	0.07	
SD(σ_ξ)	0.80	0.80	
Corr($\rho_{\varphi,\xi}$)	-0.905	-0.905	
F_e	40.31	40.24	F_e is implied by the choice of P, and is equal to the ex-ante expected profit. The implied F_e is slightly different for Benchmark Model (based on equating all other parameters and calibrating τ_0 to match fraction of exporters as described above).
Mass of firms	0.26	0.27	Implied equilibrium mass of firms (=E/mean revenue of survivors)

Table A.2: Output price CEP: Results for differentiated and homogenous goods sectors

All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. Price is defined as a unit value (product revenue/quantity). Standardized (log) price is (log) price demeaned by the product-specific mean and divided by the product-specific standard deviation. Homogenous products include Rauch's (1999) "homogeneous" and "reference-price" sectors (liberal version). Size is defined as log total sales of the establishment. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	India (1997-98)				**USA (1997)**			
	Differentiated products		**Non-differentiated products**		**Differentiated products**		**Non-differentiated products**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dependent variable: Log output price (standardized)	0.177***	0.169**	-0.0305	-0.0158	0.136***	0.135***	0.100***	0.100***
	[0.063]	[0.073]	[0.0361]	[0.0549]	[0.019]	[0.020]	[0.018]	[0.020]
Number of observations (plant-product)	6,494	6,494	18,541	18,541	49,203	49,203	49,499	49,499
Product fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Product-specific size polynomial (order 3)	Yes	No	Yes	No	Yes	No	Yes	No
Product-specific size-decile fixed effects	No	Yes	No	Yes	No	Yes	No	Yes

Table A.3: Output price CEP: Robustness to using single product plants and a plant price index

All reported figures are coefficients on an exporter dummy. The exporter dummy equals 1 if the establishment reports positive exports. Price is defined as a unit value (value/quantity). All results use standardized (log) price, which is (log) price demeaned by the product-specific mean and divided by the product-specific standard deviation. The value weighted price index is constructed as the sales value weighted average of the standardized price. Only differentiated sectors are included. Standard errors clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	India (1997-98)		USA (1997)	
	(1)	(2)	(3)	(4)
Base case: Coefficient on exporter dummy (from Table 3)	0.177***	0.169**	0.136***	0.135***
	[0.063]	[0.073]	[0.019]	[0.020]
Sample restricted to single product establishments	0.231*	0.183	0.109***	0.115*
	[0.136]	[0.194]	[0.037]	[0.063]
Using a value-weighted price index	0.177**	0.163	0.137***	0.136***
	[0.0820]	[0.135]	[0.019]	[0.022]
Product fixed effects	Yes	No	Yes	No
Product-specific size polynomial (order 3)	Yes	No	Yes	No
Product-specific size-decile fixed effects	No	Yes	No	Yes

Table A.4: Output and input price CEP: Robustness to export intensity and main product

All reported figures are coefficients on an exporter dummy. The exporter dummy equals 1 if the establishment reports positive exports, except for row 2 where it equals 1 if the establishment exports more than 2% of their total sales. Price is defined as a unit value (value/quantity). Standardized (log) price is (log) price demeaned by the product-specific mean and divided by the product-specific standard deviation. Only differentiated sectors are included. Standard errors clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	Log output price (standardized)		Log input price (standardized)	
	(1)	(2)	(3)	(4)
Panel 1: India (1997-98)				
Base case: Coefficient on exporter dummy (from Tables 3 and 4)	0.177***	0.169**	0.120***	0.121*
	[0.063]	[0.073]	[0.0464]	[0.0682]
Coefficient on dummy for export share >2%	0.161**	0.142*	0.110**	0.123*
	[0.068]	[0.079]	[0.0489]	[0.0714]
Coefficient on exporter dummy, main output/input product only	0.179**	0.126	0.139*	0.252**
	[0.091]	[0.11]	[0.0732]	[0.110]
Panel 2: USA (1997)				
Base case: Coefficient on exporter dummy from Panel 2 of Table 2	0.136***	0.135***	0.149***	0.182***
	[0.019]	[0.020]	[0.028]	[0.030]
Coefficient on dummy for export share >2%	0.136***	0.130***	0.187***	0.211***
	[0.022]	[0.024]	[0.032]	[0.035]
Coefficient on exporter dummy, main output/input product line only	0.122***	0.121***	0.181***	0.221***
	[0.021]	[0.025]	[0.032]	[0.037]
Product fixed effects	Yes	No	Yes	No
Product-specific size polynomial (order 3)	Yes	No	Yes	No
Product-specific size-decile fixed effects	No	Yes	No	Yes

Table A.5: Average wage CEP: Robustness to alternate skill-intensity measures

All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. The skilled share of the wage bill is the ratio of non-production worker wages to total wages. Skilled share of employment is the share of non-production workers in total employment. Both variables are standardized by using 4-digit industry-specific means and standard deviations. Only differentiated sectors are included. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	India (1997-98)		**USA (1997)**		**Chile (1991-96)**		**Colombia (1981-91)**	
Skilled share of the wage bill (standardized)	0.0166	-0.0147	0.244***	0.239***	0.110***	0.151***	0.121***	0.154***
	[0.039]	[0.041]	[0.016]	[0.016]	[0.036]	[0.036]	[0.034]	[0.032]
Skilled share of employment (standardized)	0.0096	-0.0149	0.192***	0.197***	-0.0228	0.0071	0.0678*	0.0929**
	[0.0403]	[0.0464]	[0.016]	[0.017]	[0.0391]	[0.0420]	[0.0351]	[0.0365]
Number of observations (plants)	11,226	11,226	123,079	123,079	17,053	17,053	39,990	39,990
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year specific size polynomial (order 3)	Yes	No	Yes	No	Yes	No	Yes	No
Industry-year size-decile fixed effects	No	Yes	No	Yes	No	Yes	No	Yes

Table A.6: Robustness to using U.S. CMF 1992

All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. The data covers the differentiated products/industries (defined per the Rauch 1999 classification) of the manufacturing sector for the US in 1992. For standardized log price, "product/industry" in the last four rows refers to 7-digit product codes; for other variables "product/industry" refers to 4-digit SIC (1987) code. Size is defined as log total sales of the establishment. Only differentiated sectors are included. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

Dependent variable	**(1)**	**(2)**	**(3)**	**(4)**
Log output price (standardized)	0.147***	0.117***	0.121***	0.131***
	[0.015]	[0.015]	[0.015]	[0.015]
Log input price (standardized)	0.214***	0.194***	0.198***	0.209***
	[0.024]	[0.024]	[0.024]	[0.026]
Log average wage (standardized)	0.313***	0.100***	0.101***	0.112***
	[0.015]	[0.017]	[0.017]	[0.018]
Capital intensity (standardized)	0.233***	-0.001	-0.002	0.006
	[0.018]	[0.014]	[0.014]	[0.014]
Product/industry fixed effects	Yes	Yes	Yes	No
Product/industry-specific size polynomial (order 2)	No	Yes	No	No
Product/industry-specific size polynomial (order 3)	No	No	Yes	No
Product/industry size-decile fixed effects	No	No	No	Yes

Table A.7: Robustness to using employment and domestic sales as alternate size controls

All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. Establishment size is defined as log employment in panel 1 and log domestic sales in panel 2. Only differentiated sectors are included. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	India (1997-98)		USA (1997)		Chile (1991-96)		Colombia (1981-91)	
Dependent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Panel 1: Conditioning on employment								
Log output price (standardized)	0.137**	0.170**	0.139***	0.133***				
	[0.0558]	[0.0694]	[0.019]	[0.020]				
Log input price (standardized)	0.169***	0.190***	0.132***	0.145***				
	[0.0456]	[0.0654]	[0.028]	[0.030]				
ISO 9000 dummy	0.098***	0.106***						
	[0.009]	[0.009]						
Log average wage (standardized)	0.432***	0.435***	0.223***	0.234***	0.394***	0.395***	0.325***	0.360***
	[0.0347]	[0.0356]	[0.014]	[0.014]	[0.0324]	[0.0317]	[0.0315]	[0.0315]
Log capital intensity (standardized)	0.483***	0.507***	-0.090***	-0.084***	0.488***	0.492***	0.388***	0.387***
	[0.0362]	[0.0365]	[0.016]	[0.016]	[0.0370]	[0.0360]	[0.0322]	[0.0319]
Panel 2: Conditioning on domestic sales								
Log output price (standardized)	0.202***	0.245***	0.138***	0.134***				
	[0.0589]	[0.0788]	[0.019]	[0.020]				
Log input price (standardized)	0.159***	0.169**	0.162***	0.189***				
	[0.0517]	[0.0740]	[0.028]	[0.030]				
ISO 9000 dummy	0.093***	0.101***						
	[0.008]	[0.009]						
Log average wage (standardized)	0.349***	0.363***	0.133***	0.140***	0.224***	0.244***	0.209***	0.254***
	[0.0318]	[0.0332]	[0.012]	[0.013]	[0.0264]	[0.0269]	[0.0256]	[0.0268]
Log capital intensity (standardized)	0.323***	0.348***	-0.152***	-0.140***	0.301***	0.324***	0.197***	0.211***
	[0.0348]	[0.0357]	[0.014]	[0.014]	[0.0348]	[0.0345]	[0.0299]	[0.0295]
Product or industry-year fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Product or industry-year specific size polynomial (order 3)	Yes	No	Yes	No	Yes	No	Yes	No
Product or industry-year size-decile fixed effects	No	Yes	No	Yes	No	Yes	No	Yes

Table A.8: Robustness to aggregating at the firm level and to using single-establishment firms (U.S. 1997)

All reported figures are coefficients on an exporter dummy which equals one for firms where at least one establishment exports. The data covers the differentiated products/industries (defined per the Rauch 1999 classification) for the U.S. manufacturing sector in 1997. For price, "product/industry" in the last 4 rows refers to 7-digit product codes; for other variables "product/industry" refers to 4-digit SIC (1987) code. In all cases, size is defined as the log firm sales. Average wage and capital intensity are defined using firm level aggregates. (Firm and establishment variables are the same for single-establishment firms in panel 2.) Only differentiated sectors are included. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

Dependent variable	(1)	(2)	(3)	(4)
Panel 1: All variables defined at the firm level				
Log output price (standardized)	0.082***	0.108***	0.121***	0.118***
	[0.018]	[0.020]	[0.021]	[0.023]
Log input price (standardized)	0.159***	0.189***	0.185***	0.207***
	[0.028]	[0.028]	[0.028]	[0.030]
Log average wage (standardized)	0.321***	0.065***	0.074***	0.080***
	[0.016]	[0.016]	[0.015]	[0.018]
Capital intensity (standardized)	-0.014	-0.216***	-0.219***	-0.210***
	[0.018]	[0.016]	[0.017]	[0.016]
Panel 2: Sample restricted to single-establishment firms only				
Log output price (standardized)	0.113***	0.149***	0.151***	0.168***
	[0.027]	[0.028]	[0.028]	[0.031]
Log input price (standardized)	0.262***	0.239***	0.256***	0.315***
	[0.048]	[0.047]	[0.047]	[0.055]
Log average wage (standardized)	0.331***	0.068***	0.074***	0.090***
	[0.016]	[0.016]	[0.017]	[0.017]
Capital intensity (standardized)	-0.128***	-0.266***	-0.262***	-0.252***
	[0.023]	[0.019]	[0.019]	[0.019]
Product/industry fixed effects	Yes	Yes	Yes	No
Product/industry-specific size polynomial (order 2)	No	Yes	No	No
Product/industry-specific size polynomial (order 3)	No	No	Yes	No
Product/industry size-decile fixed effects	No	No	No	Yes

Table A.9: Robustness to using four-year means of variables

All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. All variables are the 4 year mean values by establishment. Establishments that switched exporter status during the 4 year period, or have fewer than 3 observations in the four year period are excluded. Only differentiated sectors are included. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	Chile (1993-1996 mean)		**Colombia (1988-1991 mean)**	
	(1)	**(2)**	**(3)**	**(4)**
Dependent variable: Standardized average wage	0.180***	0.219***	0.124**	0.234***
	[0.0498]	[0.0531]	[0.0540]	[0.0604]
Dependent variable: Standardized capital intensity	0.311***	0.353***	0.164***	0.166***
	[0.0618]	[0.0671]	[0.0627]	[0.0633]
Number of observations (plants)	1,978	1,978	3,103	3,103
Industry-year fixed effects	Yes	Yes	Yes	No
Industry-year specific size polynomial (order 2)	No	Yes	No	No
Industry-year specific size polynomial (order 3)	No	No	Yes	No
Industry-year size-decile fixed effects	No	No	No	Yes

Table A.10: Output price CEP: Robustness to excluding new plants and new exporters (U.S.)

Sample from CMF 1997 excluding plants not existing in 1992 and excluding exporters not exporting in 1992. All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. Output price is defined as a unit value (product revenue/quantity). Standardized log output price is log output price demeaned by the product-specific mean and divided by the product-specific standard deviation of log output price. Size is defined as log total sales of the establishment. Standard errors are clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	(1)	(2)	(3)	(4)
Dependent variable: Log output price (standardized)	0.138***	0.176***	0.177***	0.175***
	[0.029]	[0.029]	[0.029]	[0.035]
Dependent variable: Log output price	0.065***	0.092***	0.095***	0.097***
	[0.018]	[0.019]	[0.019]	[0.023]
Number of observations (plant-product)	25,487	25,487	25,487	25,487
Product fixed effects	Yes	Yes	Yes	No
Product-specific size polynomial (order 2)	No	Yes	No	No
Product-specific size polynomial (order 3)	No	No	Yes	No
Product-specific size-decile fixed effects	No	No	No	Yes

Table A.11: Output price CEP: Robustness to excluding sectors dependent on external finance and government purchases

All reported figures are coefficients on an exporter dummy which equals 1 if the establishment reports positive exports. The dependent variable is standardized log per unit price, i.e. demeaned by the product specific mean and divided by the product specific standard deviation. Only differentiated sectors are included. Standard errors clustered at plant level; * significant at 10%; ** significant at 5%, *** significant at 1%.

	India		**USA**	
	(1)	**(2)**	**(3)**	**(4)**
Panel 1: Excluding products with above median dependence on Rajan-Zingales (2006) external finance measure				
Dependent variable: Standardized price	0.217**	0.263**	0.086***	0.083***
	[0.0874]	[0.121]	[0.030]	[0.033]
Panel 2: Excluding products with above median dependence on government purchases (based on US I-O table)				
Dependent variable: Standardized price	0.390***	0.424***	0.169***	0.174***
	[0.0983]	[0.148]	[0.033]	[0.036]
Product/industry fixed effects	Yes	Yes	Yes	No
Product/industry-specific size polynomial (order 2)	No	Yes	No	No
Product/industry-specific size polynomial (order 3)	No	No	Yes	No
Product/industry size-decile fixed effects	No	No	No	Yes

Table A.12: Production function regressions using variable and total inputs in simulated Full Model data

	F_0=0			F_0=20		
	Non-exporters	Exporters	Overall	Non-exporters	Exporters	Overall
	(1)	(2)	(3)	(4)	(5)	(6)
Log (labor)	0.0000	0.0000	0.0000	-0.00085***	0.00961***	0.0152***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (capital)	1.000***	0.995***	0.971***	1.236***	1.193***	1.191***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Constant	0.248***	0.243***	0.351***	-1.178***	-1.006***	-1.014***
	(0.000)	(0.000)	(0.001)	(0.002)	(0.004)	(0.003)
Observations	4239	761	5000	4,239	761	5,000
R-squared	1.0000	1.0000	1.0000	1.0000	1.0000	0.9990
Variation in residual explained by: [1]						
Log (eta)	0.0000	0.0001	0.0755	0.0003	0.0011	0.0567
Log (phi)	0.0000	0.0001	0.0166	0.0011	0.0023	0.0197
Log (xi)	0.0000	0.0000	0.0050	0.0026	0.0053	0.0000
Log (lambda)	0.0000	0.0000	0.0000	0.0030	0.0064	0.0026

Notes: 1. The reported figures are the regression R-squared of the residuals from the production function regression in that column on the listed variables.