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Entrepreneurship and Occupational Choice in the Global Economy

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Abstract:
This paper studies the effects of trade barriers on entrepreneurship. We first reveal a previously unknown fact: the higher the trade costs, the smaller the fraction of entrepreneurs. This fact holds across countries and across industries within the United States. To analyze this fact, we develop a model of international trade with occupational choice, borrowing elements from Lucas (1978) and Melitz (2003). The model delivers three new predictions, refining the relationship between entrepreneurship and trade costs: (i) domestic entrepreneurship increases with the trade costs of exporting from a foreign country to the home country, (ii) domestic entrepreneurship increases with the trade costs of exporting to the foreign country, and (iii) higher levels of entrepreneurship are associated with a lower fraction of exporting firms. We confirm these predictions using cross-country, cross-industry, and individual-level data.

JEL Classifications: F12, F16, J23
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1 Overview

Entrepreneurship has long been recognized as an important engine of economic growth and wealth creation. The recent global financial crisis has further amplified the importance of this engine because, according to a *Wall Street Journal* report, the decline in U.S. entrepreneurship "may help explain the increasingly sluggish economic recoveries after the past three recessions."[1] Consistent with this argument, a poll by the Kauffman Foundation in 2009 reports that two thirds of survey respondents favor encouraging entrepreneurial activities over government stimulus as a solution to the global financial crisis (Kauffman Foundation 2009). Yet, despite the importance of entrepreneurship in the increasingly globalized economy, we lack a clear understanding of the link between international trade and entrepreneurship. Our paper aims to fill this gap in the literature.

We start by unveiling a previously unknown fact: the rate of entrepreneurship in an economy or sector decreases with openness, as measured by decreasing trade costs. Figure I illustrates this fact by showing the positive relationship between entrepreneurship and tariffs across countries. While this figure is quite suggestive, and we test the robustness of this relationship using several control variables in our empirical work, the result might be driven by country-specific factors, such as the level of development and industry composition, which these data cannot fully capture. To address this concern, Figure II plots entrepreneurship against trade costs for 3-digit NAICS manufacturing industries in the United States.[2] The clear positive relationship between entrepreneurship and trade costs across industries is consistent with our cross-country evidence.

We develop a theoretical model of international trade with heterogeneous agents to rationalize this relationship between entrepreneurship and trade costs. In the model, agents differ from one another in their ability to operate a firm. In the spirit of Lucas (1978), they decide to be either employees or entrepreneurs, conditional on their own ability. This selection process generates intra-industry firm heterogeneity as in Melitz (2003).[3] When the economy is open to international trade, entrepreneurs (firms) can chose to export to the foreign market, subject to fixed and variable costs, or they can choose to become employees—because of the fixed costs only the most productive firms will be exporters.

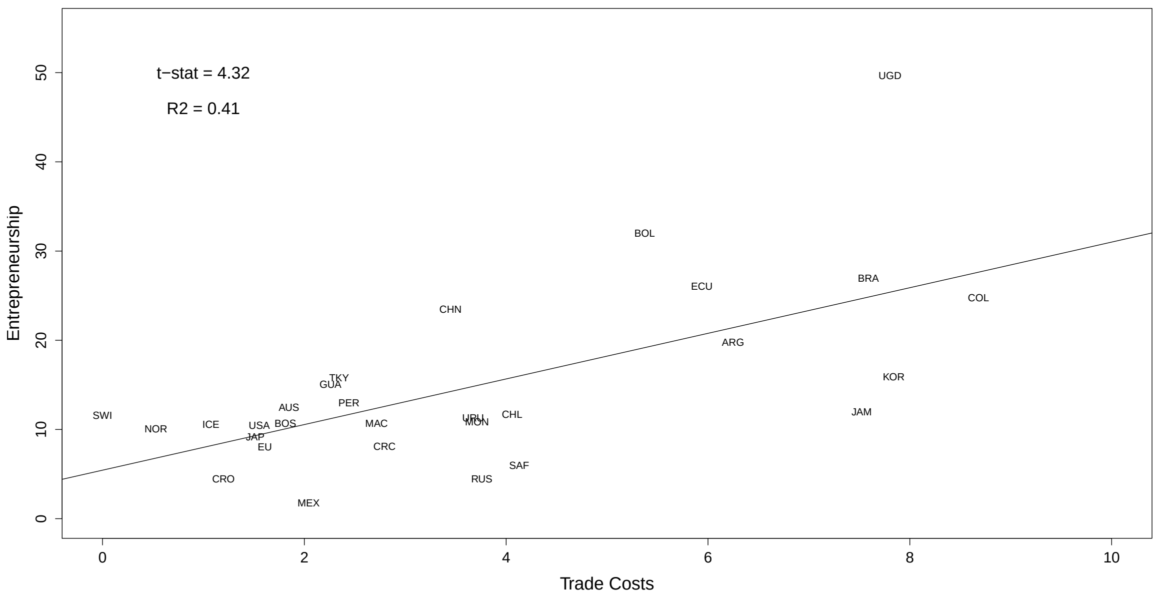
In this model, trade liberalization reduces entrepreneurship through two channels. First, as a result of foreign competition, goods become cheaper and domestic real wages go up,

[1]See Casselman (June 2, 2013) available at http://online.wsj.com.

[2]Our cross-industry measure of entrepreneurship is self-employment, a variable often used in the literature; see Parker (2009). The Bureau of Labor Statistics (BLS) defines a self-employed person as someone who does not work for someone else; therefore, it includes employers as well as own-account workers. Note that this definition is different from that of Garicano and Rossi-Hansberg (2006a, 2006b), where a self-employed person is someone who does not form part of any organization; that is, an own-account worker without partners.

[3]As an alternative to the Lucas (1978) setting we could have used the framework of managerial hierarchies in Antràs et al. (2006), Garicano and Rossi-Hansberg (2006a, 2006b), Caliendo and Rossi-Hansberg (2012) and Caliendo et al. (2012), merging their self-employed agents with their top-level managers (entrepreneurs). However, we find that embedding the Lucas (1978) choice model into the Melitz (2003) trade framework is a more straightforward exercise.

Figure I: Entrepreneurship and Trade Costs across Countries

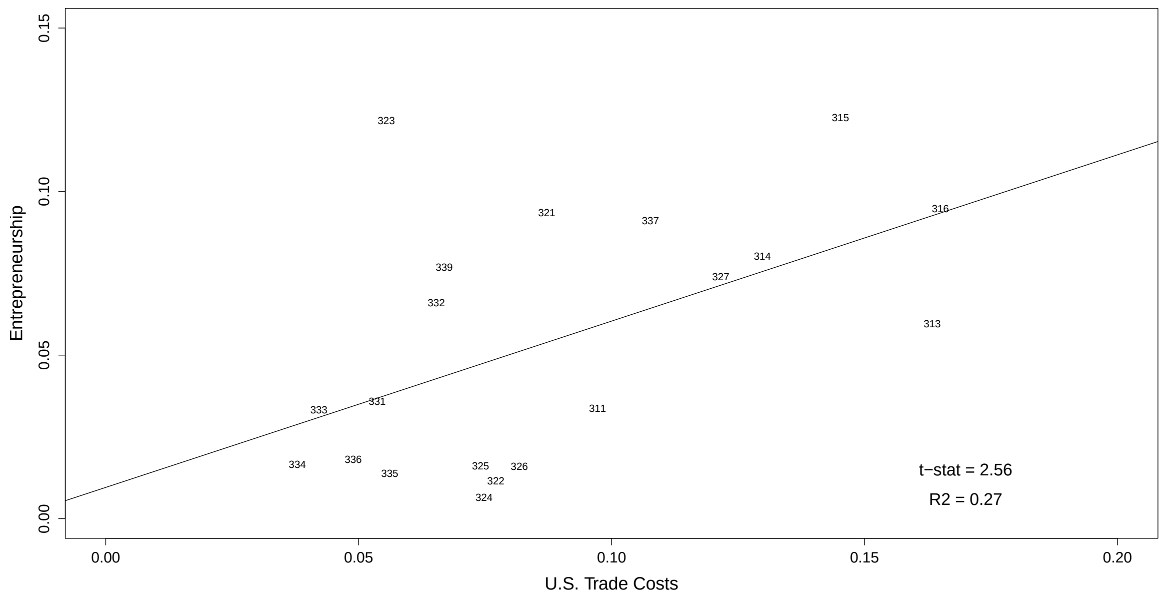


Source: Authors' calculations based on data from GEM (Global Entrepreneurship Monitor) and TRAINS (Trade Analysis and Information System).
Notes: "Entrepreneurship" is the percentage of 18–64 population who are currently owner-managers of a business. "Trade Costs" is the average tariff imposed by the country in percentage points. Data are for 2010. See Appendix D for country codes and further details.

increasing the opportunity cost of the marginal entrepreneurs, who now find it profitable to become employees (the Lucas channel). Second, at the same time, increased labor demand of domestic exporting firms leads to a further increase in real wages, making entrepreneurship less lucrative and re-allocating marginal entrepreneurs to the more productive firms as employees (the Melitz channel). These mechanisms provide the rationale for the stylized fact commented on above.

The model delivers three new predictions, *refining* the mechanism just described. First, domestic trade liberalization reduces the rate of domestic entrepreneurship and increases the share of domestic exporting firms. Intuitively, the foreign competition increases real wages (through lower aggregate prices) and this reduces entrepreneurship, as just described. At the same time, higher foreign income increases foreign demand for domestic varieties, inducing more domestic firms to become exporters. Second, perhaps less obviously, foreign trade liberalization has a qualitatively similar effect as the domestic liberalization: domestic entrepreneurship decreases and the share of domestic exporters increases. Intuitively, the improved access to foreign markets makes it profitable for more firms to export—the increased domestic labor demand increases the real wage and reduces the rate of entrepreneurship. Third, and as a

Figure II: Entrepreneurship and Trade Costs across U.S. Industries



Source: Authors' calculations based on data from the BLS (Bureau of Labor Statistics) and TRAINS.

Notes: We use the rate of self-employment as a measure of entrepreneurship across industries as is often done in the literature, see Parker (2009). "U.S. Trade Costs" include tariffs, freight, and insurance costs. Data are for 2010. See Appendix E for industry codes. Industry 312 (beverages and tobacco) is dropped as an outlier.

corollary of the previous two results, the model predicts that there is a negative relationship between the rate of entrepreneurship and the share of exporting firms.

We confirm these predictions empirically. First, we use cross-country data to show that entrepreneurship is positively linked to both domestic and foreign tariffs, even after adding controls for the level of economic development. Second, we show that the same relationship holds between entrepreneurship and tariffs using U.S. self-employment and tariff data aggregated at industry level. Finally, we also use a binary choice model using individual data on occupational choice from the United States and obtain similar results. We find that a 1 percentage point increase in domestic or foreign tariffs is associated with about 0.5 percentage point increase in entrepreneurship.

Our paper is related to a recent line of research studying the effects of international trade on labor markets. Like our paper, Eeckhout and Jovanovic (2012) studies occupational choice but, unlike our paper, it focuses on international labor market integrations and finds that this integration increases output most in rich and poor countries and least in middle-income countries. Burstein and Monge-Naranjo (2009) combines the Lucas (1978) setting with a

Ricardian international trade model in which managers can produce abroad by hiring foreign workers, and compute significant welfare effects resulting from this type of offshoring. In terms of modeling, our paper is closely related to Monte (2011) that also combines elements from Lucas (1978) and Melitz (2003) but it focuses on the effects of trade on wage dispersion rather than on entrepreneurship.[4]

Earlier classical papers on the relationship between entrepreneurship and trade also include Grossman (1984) and Bond (1986). Grossman (1984) argues that establishing risk-sharing mechanisms to stimulate domestic entrepreneurship is a better solution than imposing welfare-reducing tariffs or other trade restrictions on foreign entrepreneurs. Bond (1986) considers a two-sector model where one sector has heterogeneous entrepreneurs as in Lucas (1978) and shows how differences in factor intensities may lead to conflicts among entrepreneurs over commercial policies. Our paper differs from these papers not only in its approach but also in its focus because we study how both domestic and foreign trade barriers affect domestic entrepreneurship and entrepreneurship across industries within a country.

The rest of the paper is organized as follows. Section 2 describes the basic setup of the model in the context of a closed economy, and then presents the open economy version of the model, studying the effects of trade costs on entrepreneurship and exporting status. In Section 3, we provide a two-sector version of the model and show that all of our qualitative results are preserved once we have more than one industry in the economy. In Section 4, we describe our different datasets on entrepreneurship. In Section 5 we take the model's predictions to the data and present our econometric results. Finally, Section 6 concludes.

2 Basic Model

In this section, we first present a closed economy, general equilibrium model of occupational choice. Then, we discuss the properties of this model in a two-country setting to study the effect of trade barriers on entrepreneurship.

2.1 Closed Economy

2.1.1 Basic Setup

Consider an economy populated by a mass L of consumers with the same Dixit-Stiglitz preferences over a set J of differentiated goods $y(j)$:

$$U = \left[\int_{j \in J} y(j)^{\frac{\sigma-1}{\sigma}} \, dj \right]^{\frac{\sigma}{\sigma-1}} \equiv Y, \tag{1}$$

[4]A parallel strand of literature in the intersection of international trade and labor economics focuses on issues outside of entrepreneurship and occupational choice, such as wage inequality (see Burstein and Vogel 2009; Costinot and Vogel 2010; and Ohnsorge and Trefler 2007); or unemployment (see Helpman, Itskhoki, and Redding 2010; and Helpman and Itskhoki 2010).

where $\sigma > 1$ is the elasticity of substitution between any two goods and Y represents aggregate consumption. As is well known, these preferences generate the following individual demand function $y(j)$ for each variety j:

$$y(j) = \left(\frac{p(j)}{P}\right)^{-\sigma} Y, \tag{2}$$

where $p(j)$ is variety j's price, and

$$P = \left[\int_{j \in J} p(j)^{1-\sigma}\, dj\right]^{\frac{1}{1-\sigma}} \tag{3}$$

stands for the aggregate price, and $R = PY$ represents total expenditure. Note that consumers' expenditure on a particular variety can be expressed as $R(j) = \left(\frac{p(j)}{P}\right)^{1-\sigma} R$.

Production is undertaken by entrepreneurs who own monopolistically competitive firms using labor as the only factor of production. Firms differ from one another in the particular variety j they produce and in their productivity level, φ. As in Melitz (2003), productivity reduces the marginal cost. Thus, the firm's problem can be written as

$$\max_{p(j)} \pi(j) = R(j) - \frac{wy(j)}{\varphi(j)}, \tag{4}$$

which leads to the following pricing equation:

$$\frac{p(j)}{P} = \frac{\sigma}{\sigma - 1} \frac{1}{\varphi(j)} \frac{w}{P}, \tag{5}$$

where w is the wage of production workers. Using this last expression, the profit maximizing function (per unit mass of consumers) can be written as

$$\pi(j) = \frac{1}{\sigma}\left(\frac{\sigma}{\sigma - 1}\right)^{1-\sigma}\left(\frac{\varphi(j)}{w/P}\right)^{\sigma-1} R. \tag{6}$$

2.1.2 Selection into Entrepreneurship

The labor force is composed of a mass L of workers (who are also the consumers). Workers choose whether to run a firm (and thus be entrepreneurs) and earn total profits of $L\pi$, or to become employees and earn a wage, w. In the spirit of Lucas (1978), workers are heterogeneous in their ability to run a firm, given by φ, which determines the firm's productivity if the worker chooses to be an entrepreneur.[5]

There is an ability/productivity cutoff φ_c, such that all agents with a productivity draw below φ_c will work as employees, whereas all agents with a draw greater than φ_c will be entrepreneurs. Formally, this cutoff is given by the following expression:

[5] Note that in this way, in the spirit of Lucas (1978), we associate a firm's productivity with its owner's ability to run a business.

$$\varphi_c \equiv \inf\left[\varphi : L\pi\left(\varphi, R, \frac{w}{P}\right) - w \geq 0\right]. \tag{7}$$

Let $G(\varphi)$ be the measure (mass) of agents with ability less than φ, so that $G(\infty) = L$. Then, $G(\varphi_c)$ is the measure of workers and $[L - G(\varphi_c)]$ is the mass of entrepreneurs (that is, employers).

We use "entrepreneurs" and "firms" as interchangeable terms in the model's description, although they are potentially different objects in the data. Clearly, one entrepreneur may own more than one firm, two or more entrepreneurs may own a given firm, or one firm may be a subsidiary of another firm (so the president of the first one is just an employee of the second one). We could extend our model to accommodate several of these different scenarios, but that would take us farther from the intuition we want to emphasize through the Lucas and Melitz channels.

2.1.3 Equilibrium

Using equations (6) and (7) we can express φ_c as

$$\varphi_c = \sigma^{\frac{1}{\sigma-1}} \frac{\sigma}{\sigma-1}\left(\frac{w}{P}\right)^{\frac{\sigma}{\sigma-1}}\left(\frac{RL}{P}\right)^{-\frac{1}{\sigma-1}}. \tag{8}$$

Labor market clearing requires the number (mass) of workers to be equal to the amount of labor demanded by good producers to satisfy their demand. That is,

$$\int_{\varphi_c}^{\infty} L\frac{y(\varphi)}{\varphi} dG(\varphi) = G(\varphi_c), \tag{9}$$

which, using expressions (2) and (5), can be re-written as

$$\left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \frac{RL}{P}\left(\frac{w}{P}\right)^{-\sigma} \int_{\varphi_c}^{\infty} \varphi^{\sigma-1} dG(\varphi) = G(\varphi_c). \tag{10}$$

Finally, from equations (3) and (5) we get the following expression that accounts for the goods market clearing condition

$$\int_{\varphi_c}^{\infty} \left(\frac{\sigma-1}{\sigma}\right)\left(\frac{\varphi}{w/P}\right)^{\sigma-1} dG(\varphi) = 1. \tag{11}$$

Therefore, the model is closed by the system of equations (8), (10), and (11) that determines the values of the productivity cutoff, φ_c, real revenues (spending), $\frac{R}{P}$, and real wage, $\frac{w}{P}$.

We assume that the productivity parameter φ is Pareto distributed. Then, $G(\varphi) = L\left[1 - \left(\frac{\varphi_0}{\varphi}\right)^{\alpha}\right]$, where φ_0 is the lower bound of the distribution and α is the shape parameter of the function, assumed to be large enough ($\alpha > 1$) so that the distribution has a finite mean.[6]

[6] The assumption that firm productivity is Pareto distributed is widely used in the literature on firm heterogeneity and trade (see Antràs and Helpman 2004 and Helpman, Melitz, and Yeaple 2004). Additionally, the Pareto distribution approximates reasonably well the observed distribution of firm sizes (see Axtell 2001). Since

We also assume that $\alpha > \sigma - 1$ for the convergence of the integral in the labor market clearing condition.

Under this assumption, it is straightforward to check that equations (8) and (10) imply the following:

$$\left[1 + (\sigma - 1)\frac{\alpha}{\alpha + 1 - \sigma}\right]\left(\frac{\varphi_0}{\varphi_c}\right)^{\alpha} = 1, \tag{12}$$

where $\left(\frac{\varphi_0}{\varphi_c}\right)^{\alpha}$ is the rate of entrepreneurship. Intuitively, this expression implies that if σ increases, so that there is greater substitutability between goods, then markups and profits decrease and, therefore, entrepreneurship becomes less attractive.

2.2 Open Economy

2.2.1 Basic Setup

Consider now a world with two countries, Home and Foreign, which trade with each other. Home is the country described above, while Foreign has the same preferences and production function as Home, and its variables are labeled by an asterisk $(*)$.

Similar to the demand function for the closed economy, Home's demands for domestic and foreign goods are

$$\begin{aligned} y_d(j) &= \left(\frac{p_d(j)}{P}\right)^{-\sigma}\frac{R}{P}, \\ y_x^*(j) &= \left(\frac{p_x^*(j)}{P}\right)^{-\sigma}\frac{R}{P}, \end{aligned} \tag{13}$$

respectively. In the expressions above, p_d (p_x^*) refers to the price paid by Home consumers for domestic (foreign) goods. Note that the aggregate price now includes the foreign varieties consumed in the Home market:[7]

$$P^{1-\sigma} = \int_{j \in Home} p_d(j)^{1-\sigma}\, dj + \int_{j \in Foreign} p_x^*(j)^{1-\sigma}\, dj. \tag{14}$$

The producer's problem in the Home market looks exactly as in the closed economy case, yielding the same pricing and profit functions:

$$\frac{p_d(j)}{P} = \frac{\sigma}{\sigma - 1}\frac{w/P}{\varphi(j)}; \qquad \pi_d(j) = \sigma^{-1}\left(\frac{\sigma}{\sigma - 1}\right)^{1-\sigma}\left(\frac{\varphi(j)}{w/P}\right)^{\sigma - 1} R. \tag{15}$$

Entry into foreign markets requires producers to first pay an entry cost, measured as f units of labor (f^* for foreign producers). Additionally, there is also a variable cost, such that $\tau^* > 1$ $(\tau > 1)$ units of good $y(j)$ must be shipped in order for one unit of $y(j)$ to be delivered to consumers in the Foreign (Home) market. Therefore, the producer's operating export profits

the distribution of firm productivity is just the truncated distribution of abilities, it is reasonable to conjecture that the ability parameter is also Pareto distributed (a truncated Pareto is also a Pareto).

[7]The expressions for demands and aggregate prices in Foreign are analogous to those of Home.

(before paying the entry cost f) can be written as

$$\max_{p_x(j)} \pi_x(j) = p_x(j)\, y_x(j) - w\tau^* \frac{y_x(j)}{\varphi(j)}, \tag{16}$$

yielding the following pricing and profit functions (per unit mass of consumers):

$$\frac{p_x(j)}{P^*} = \frac{\sigma}{\sigma-1}\tau^* \frac{w/P^*}{\varphi(j)}; \qquad \pi_x(j) = \sigma^{-1}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} (\tau^*)^{1-\sigma} \left(\frac{\varphi(j)}{w/P^*}\right)^{\sigma-1} R^*. \tag{17}$$

Note that this implies that prices charged in the Home market and in the Foreign market are closely related: $p_x(j) = \tau^* p_d(j)$.

2.2.2 Selection into Entrepreneurship

As in the closed economy case, each agent selects himself into being either an entrepreneur or an employee. However, in the open economy, those who are entrepreneurs (those agents who own a firm) must also decide whether they are going to export. Therefore, there are now two cutoffs. The first cutoff, φ_d, determines which agents will be entrepreneurs ($\varphi > \varphi_d$) and which ones will be employees ($\varphi < \varphi_d$); thus, φ_d is essentially the open-economy version of φ_c. The second cutoff, φ_x, determines which agents/firms are exporters ($\varphi > \varphi_x$) and which ones sell only in the domestic market ($\varphi < \varphi_x$). Formally,[8]

$$\begin{aligned} \varphi_d &= \inf\left[\varphi : L\pi\left(\varphi, R, \frac{w}{P}\right) - w \geq 0\right] \\ \varphi_x &= \max\left\{\varphi_d, \inf\left[\varphi : L^*\pi\left(\varphi, R^*, \frac{w}{P^*}, \tau^*\right) - fw \geq 0\right]\right\}. \end{aligned} \tag{18}$$

Note that it is not possible for an entrepreneur to export without selling in the Home market: by exporting the agent already gives up wage income, and there is no entry cost into the domestic market. Agents in Foreign face an analogous situation. Thus, there are two other cutoffs for Foreign, φ_d^* and φ_x^*, defined symmetrically.

After some simple algebra we can rewrite the cutoffs as follows:

$$\begin{aligned} \varphi_x &= \tau^* f^{\frac{1}{\sigma-1}} \left(\frac{w}{w^*}\right)^{\frac{\sigma}{\sigma-1}} \varphi_d^* \\ \varphi_x^* &= \tau (f^*)^{\frac{1}{\sigma-1}} \left(\frac{w^*}{w}\right)^{\frac{\sigma}{\sigma-1}} \varphi_d. \end{aligned} \tag{19}$$

This relationship between the cutoffs is going to prove useful when solving for the equilibrium of the model—we do that next.

[8] We assume that the parameters are such that $\varphi_x > \varphi_d$, so not every firm is an exporter, in accordance with the data. If the countries are symmetric, then a sufficient condition is $\tau^* f^{\frac{1}{\sigma-1}} > 1$.

2.2.3 Equilibrium

In order to solve the model we use the expressions for the cutoffs from the previous section, along with some conditions to ensure that trade is balanced and that labor markets clear.

First, the trade balance condition simply states that Home exports should be equal to Home imports:

$$L^* \int_{j \in Home} p_x(j)\, y_x(j)\, dj = L \int_{j \in Foreign} p_x^*(j)\, y_x^*(j)\, dj. \tag{20}$$

Using expressions (13)–(18), and assuming that both φ and φ^* are Pareto distributed, we can re-write the trade balance condition in the following way:

$$f \frac{w}{L^*} \frac{\alpha}{\alpha + 1 - \sigma} \left(\frac{\varphi_0}{\varphi_x} \right)^{\alpha} = f^* \frac{w^*}{L} \frac{\alpha^*}{\alpha^* + 1 - \sigma} \left(\frac{\varphi_0^*}{\varphi_x^*} \right)^{\alpha^*}. \tag{21}$$

We then combine equation (21) with each of the expressions in (19) relating the different cutoffs; after some algebra we obtain the following two equations:

$$f \frac{L}{L^*} \frac{\alpha}{\alpha + 1 - \sigma} \Psi_x \Psi_d^{-\frac{\sigma-1}{\sigma\alpha}} = \left(\frac{f^*}{\tau} \right)^{\frac{\sigma-1}{\sigma}} \frac{\alpha^*}{\alpha^* + 1 - \sigma} \left(\frac{\varphi_0^*}{\varphi_0^*} \right)^{\frac{\sigma-1}{\sigma}} (\Psi_x^*)^{1 - \frac{\sigma-1}{\sigma\alpha^*}} \tag{22}$$

$$f^* \frac{L^*}{L} \frac{\alpha^*}{\alpha^* + 1 - \sigma} \Psi_x^* (\Psi_d^*)^{-\frac{\sigma-1}{\sigma\alpha}} = \left(\frac{f}{\tau^*} \right)^{\frac{\sigma-1}{\sigma}} \frac{\alpha}{\alpha + 1 - \sigma} \left(\frac{\varphi_0}{\varphi_0^*} \right)^{\frac{\sigma-1}{\sigma}} \Psi_x^{1 - \frac{\sigma-1}{\sigma\alpha}}, \tag{23}$$

where $\Psi_d \equiv \left(\frac{\varphi_0}{\varphi_d} \right)^{\alpha}$, $\Psi_x \equiv \left(\frac{\varphi_0}{\varphi_x} \right)^{\alpha}$, $\Psi_d^* \equiv \left(\frac{\varphi_0^*}{\varphi_d^*} \right)^{\alpha^*}$ and $\Psi_x^* \equiv \left(\frac{\varphi_0^*}{\varphi_x^*} \right)^{\alpha^*}$. Note that Ψ_d (Ψ_d^*) is the measure of entrepreneurs (and of firms) in Home (Foreign). Likewise, Ψ_x (Ψ_x^*) is the measure of exporting firms.

Second, the condition for labor market clearing can be written as follows

$$L \int_{j \in Dom} \frac{y_d(j)}{\varphi(j)} dj + \int_{j \in Export} \left(L^* \frac{\tau^* y_x(j)}{\varphi(j)} + f \right) dj = G(\varphi_d). \tag{24}$$

Next, using the definitions of the cutoffs on this last expression we obtain

$$1 = A \left[\Psi_d + f \Psi_x \right]. \tag{25}$$

A similar expression can be found for Foreign:

$$1 = B \left[\Psi_d^* + f^* \Psi_x^* \right], \tag{26}$$

where $\Psi_d, \Psi_x, \Psi_d^*, \Psi_x^*$ are defined as above and $A \equiv \left(1 + (\sigma - 1) \frac{\alpha}{\alpha + 1 - \sigma} \right)$, and $B \equiv \left(1 + (\sigma - 1) \frac{\alpha^*}{\alpha^* + 1 - \sigma} \right)$. We emphasize this expression as a remark because in later sections, we show that a similar equation holds for the two-industry-two-country model. We also provide empirical evidence supporting this remark.

Remark 1. *Equations (25) and (26) imply that, in each country, the mass of entrepreneurs* (Ψ_d, Ψ_d^*) *and the mass of exporting firms* (Ψ_x, Ψ_x^*) *must move in opposite directions.*

Finally, we have a system of four equations (22)–(26) in four unknowns: Ψ_d, Ψ_x, Ψ_d^*, and Ψ_x^*. We are interested in the effects that changes in trade costs (τ^* and τ) have on the resulting levels of entrepreneurship and exporting status. Formally, after taking logarithms, we totally differentiate the system with respect to the trade costs of exporting to the Home market (τ) and obtain the following objects, as shown in Appendix A:

$$\begin{aligned} \varepsilon_d &\equiv \frac{d\log\Psi_d}{d\log\tau} > 0 \quad \varepsilon_d^* \equiv \frac{d\log\Psi_d^*}{d\log\tau} > 0 \\ \varepsilon_x &\equiv \frac{d\log\Psi_x}{d\log\tau} < 0 \quad \varepsilon_x^* \equiv \frac{d\log\Psi_x^*}{d\log\tau} < 0. \end{aligned} \tag{27}$$

Likewise, we differentiate with respect to the trade costs of exporting to the Foreign market and find the following:

$$\begin{aligned} \eta_d &\equiv \frac{d\log\Psi_d}{d\log\tau^*} > 0 \quad \eta_d^* \equiv \frac{d\log\Psi_d^*}{d\log\tau^*} > 0 \\ \eta_x &\equiv \frac{d\log\Psi_x}{d\log\tau^*} < 0 \quad \eta_x^* \equiv \frac{d\log\Psi_x^*}{d\log\tau^*} < 0. \end{aligned} \tag{28}$$

The interpretation of these results is fairly simple. Higher (lower) trade costs will increase (decrease) the mass of entrepreneurs and reduce (increase) that of exporting firms. It is interesting to note that this holds true regardless of whether we consider τ^* or τ.

Consider first a decrease in τ^*, so that it is cheaper to export goods from Home to Foreign. This increases the mass of domestic firms that find it profitable to export (and makes it even more profitable for those that were already exporting). In turn, this results in an increase in the demand for labor from the more productive firms, raising the domestic real wage and decreasing the mass of agents who choose to be an entrepreneur.[9]

Next, consider a decrease in τ, so that it is cheaper to export goods from Foreign to Home. The presence of (efficiently produced) Foreign goods in the Home market increases the domestic real wage, making some marginal entrepreneurs become employees. In Foreign, increased exports and the reallocation of resources towards more productive firms, increases the real wage. This, in turn, increases Foreign's demand for Home goods, where the mass of exporters increases, employing former entrepreneurs. An analogous argument applies for the entrepreneurship and exporting status in Foreign. We summarize these results in the following two propositions.

Proposition 1. *An increase in Home's trading cost,* τ*, will have the following effects:*

1. *The mass of entrepreneurs in Home will increase.*

[9] In Appendix A we show that φ_d can be expressed as the product of a constant times the real wage w/P.

2. *The mass of exporting firms in Home will decrease.*

3. *These effects are the qualitatively the same for Foreign's variables.*

Proposition 2. *An increase in Foreign's trading cost, τ^*, will have the following effects:*

1. *The mass of entrepreneurs agents in Home will increase.*

2. *The mass of exporting firms in Home will decrease.*

3. *These effects are qualitatively the same for Foreign's variables.*

As we have argued in the introduction the positive relationship between entrepreneurship and trade costs also holds across industries, which we focus on in the next section.

3 Two-Sector Model

In this section, we present a two-sector version of the model developed in the previous section and show that our results are qualitatively preserved. Because our empirical work focuses on industries at a highly aggregated level, we assume that both labor and managerial skills are sector-specific. Nevertheless, our basic results still hold in a setting where there are two sectors and employees are able to move freely between sectors.[10]

3.1 Closed Economy

Consider a similar model to the one presented in the previous section, but where Home has two industries, labeled A and B.

In this setting, the consumer's problem can be written as,

$$\begin{aligned} \max Y &\equiv \left(Y_A^\mu + Y_B^\mu\right)^{1/\mu} \\ s.t. & \\ R &= R_A + R_B, \end{aligned} \tag{29}$$

where $Y_k = \left[\int_{j\in J_k} y_k(j)^{\frac{\sigma-1}{\sigma}} dj\right]^{\frac{\sigma}{\sigma-1}}$ is the aggregate consumption of goods from industry k, $R_k = \int_{j\in J_k} p_k(j)\, y_k(j)\, dj$ is the expenditure on industry k, and $p_k(j)$ and $y_k(j)$ are the price and quantity of firm j within industry k, where $k \in \{A, B\}$. We assume that $\sigma > 1$ and $\frac{\sigma-1}{\sigma} > \mu > 0$, implying that the degree of substitution between varieties within an industry is greater than the degree of substitution across industries (Antràs and Helpman 2004).

[10]The results for this setting are omitted for brevity of exposition, but they are available upon request.

From the first-order conditions, we obtain the following expressions for the demand, optimal pricing, and profit functions (per unit mass of consumer):

$$\begin{aligned} y_k(j) &= \left(\frac{p_k(j)}{P_k}\right)^{-\sigma} \frac{R_k}{P_k}, \\ \frac{p_k(j)}{P_k} &= \frac{\sigma}{\sigma-1} \frac{1}{\varphi_k(j)} \frac{w_k}{P_k}, \\ \pi_k(j) &= \frac{1}{\sigma} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \left(\frac{\varphi_k(j)}{w_k/P_k}\right)^{\sigma-1} R_k, \end{aligned} \tag{30}$$

where P_k is the price index for sector $k \in \{A, B\}$. The first-order conditions also imply the following relationship between consumption and expenditure across the two industries:

$$\frac{R_A}{Y_A^{\mu}} = \frac{R_B}{Y_B^{\mu}}. \tag{31}$$

The agents within sector k select themselves into being either entrepreneurs or production workers, just as in the one-sector model. Specifically, we assume that agents within sector k are heterogeneous in regard to their ability, φ, to run a firm. Thus, there is a sector-specific cutoff, $\varphi_{c,k}$, such that all agents with ability $\varphi < \varphi_{c,k}$ chose to be production workers, and all agents above this threshold chose to be entrepreneurs. Formally, the cutoff for sector $k \in \{A, B\}$ is defined as follows:

$$\varphi_{c,k} \equiv \inf \left[\varphi : L\pi_k \left(\varphi, R_k, \frac{w_k}{P_k}\right) - w_k \geq 0\right]. \tag{32}$$

In order to close the model, we look at the labor market clearing condition (one for each sector $k \in \{A, B\}$). Just as in the one-sector model, we can write the condition as follows:

$$\int_{\varphi_{c,k}}^{\infty} L \frac{y_k(j)}{\varphi} dG_k(\varphi) = G_k(\varphi_{c,k}). \tag{33}$$

Under the assumption that φ is Pareto distributed in each sector, so that $G_k(\varphi) = L_k \left[1 - \left(\frac{\varphi_{0,k}}{\varphi}\right)^{\alpha_k}\right]$, the last expression yields the following equilibrium condition:

$$\left(1 + (\sigma - 1) \frac{\alpha_k}{\alpha_k + 1 - \sigma}\right) \left(\frac{\varphi_{0,k}}{\varphi_{c,k}}\right)^{\alpha} = 1. \tag{34}$$

where L_k is the labor force in sector k and $\left(\frac{\varphi_{0,k}}{\varphi_{c,k}}\right)^{\alpha}$ is k's rate of entrepreneurship. Equation (34) is very similar to equation (12), the analogous condition for the one-sector model. Intuitively, this expression implies that if σ increases, so that there is greater substitutability between goods within industry k, then markups and profits decrease and, therefore, entrepreneurship becomes less attractive in sector k.

3.2 Open Economy

The open economy for the two-sector model is analogous to the open economy model with one sector. There are two countries, Home and Foreign, with populations L and L^*. Consumers in both countries share the same preferences over the goods produced by the two industries A and B, as represented by (29).

Firms in each country and sector can access the foreign market through exports, but in order to do so, they must pay a sector- and country-specific fixed cost (f_k and f_k^*) as well as variable trade costs (τ_k^* and τ_k).

The open economy two-sector model requires 20 variables to be determined: eight cutoffs ($\varphi_{d,A}$, $\varphi_{x,A}$, $\varphi_{d,B}$, $\varphi_{x,B}$, $\varphi_{d,A}^*$, $\varphi_{x,A}^*$, $\varphi_{d,B}^*$, $\varphi_{x,B}^*$), four wages (w_A, w_B, w_A^*, w_B^*), four aggregate revenues (R_A, R_B, R_A^*, R_B^*), and four aggregate prices (P_A, P_B, P_A^*, P_B^*); so we can set $P_B^* = 1$. To close the model we use the equations for labor market clearing, aggregate prices, trade balance, inter-industry substitution, and the cutoffs. We present the summary of the main results in this section and refer the reader to the Appendix B for details of solution of the model.

First, the labor market clearing condition simplifies to:

$$\left(1 + (\sigma - 1)\frac{\alpha_k}{\alpha_k + 1 - \sigma}\right)\left[\left(\frac{\varphi_{0,k}}{\varphi_{d,k}}\right)^{\alpha_k} + f_k\left(\frac{\varphi_{0,k}}{\varphi_{x,k}}\right)^{\alpha_k}\right] = 1. \tag{35}$$

This expression implies that there is a negative relationship between the mass of entrepreneurs and the mass of exporters, similar to the relationship discussed in Remark 1. Also, note that there are four expressions like this, one for each country and each sector k.

Second, we can write the price aggregator for sector k as

$$w_k L_k \frac{\alpha_k}{\alpha_k + 1 - \sigma}\left(\frac{\varphi_{0,k}}{\varphi_{d,k}}\right)^{\alpha_k} + f_k^* w_k^* L_k^* \frac{\alpha_k^*}{\alpha_k^* + 1 - \sigma}\left(\frac{\varphi_{0,k}^*}{\varphi_{x,k}^*}\right)^{\alpha_k^*} = \frac{R_k L}{\sigma}. \tag{36}$$

Once again, there are four expressions like this, one for each country and each sector k.

Third, we can express inter-industry substitution in the following way:

$$\frac{R_A}{R_B} = \left(\frac{P_A}{P_B}\right)^{\frac{-\mu}{1-\mu}}. \tag{37}$$

This expression relates aggregate revenues and prices across the two sectors. Note that there is an analogous expression for Foreign.

Fourth, the trade balance condition between Home and Foreign simplifies to

$$\begin{aligned} & f_A w_A L_A \frac{\alpha_A}{\alpha_A + 1 - \sigma}\left(\frac{\varphi_{0,A}}{\varphi_{x,A}}\right)^{\alpha_A} + f_B w_B L_B \frac{\alpha_B}{\alpha_B + 1 - \sigma}\left(\frac{\varphi_{0,B}}{\varphi_{x,B}}\right)^{\alpha_B} \\ = \; & f_A^* w_A^* L_A^* \frac{\alpha_A^*}{\alpha_A^* + 1 - \sigma}\left(\frac{\varphi_{0,A}^*}{\varphi_{x,A}^*}\right)^{\alpha_A^*} + f_B^* w_B^* L_B^* \frac{\alpha_B^*}{\alpha_B^* + 1 - \sigma}\left(\frac{\varphi_{0,B}^*}{\varphi_{x,B}^*}\right)^{\alpha_B^*}. \end{aligned} \tag{38}$$

Finally, using these equations and the cutoffs' definitions, we calculate the elasticities at the symmetric equilibrium under the assumption that the structural parameters are the same in Home and Foreign.

From the system of equations we obtain the following:

$$\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\frac{\tau_A}{\tau_B}} > 0. \tag{39}$$

We focus on relative effects because the trade cost in one sector affects not only entrepreneurship in the same sector but also entrepreneurship in the other sector. Therefore, equation (39) is our actual object of interest, as it implies that if trade costs for sector A increase relative to those for sector B, then we should observe that entrepreneurship in industry A should increase relative to sector B, which is consistent with our empirical results.

Similarly, we can study the effects of changes in trade costs at Home on Foreign entrepreneurship. In particular, we get

$$\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\frac{\tau_A^*}{\tau_B^*}} > 0. \tag{40}$$

This equation implies that if trade costs for Foreign's sector A increase relative to those of Foreign's sector B, then we should observe that entrepreneurship in Home's sector A should increase relative to Home's sector B, which is also consistent with our empirical results.

We summarize this section's results in the following proposition:

Proposition 3. *In the context of the two-sector model, relative changes in trade costs will have the following effects:*

1. *Entrepreneurship in Home's sector A relative to Home's sector B increases with Home's sector A trade costs relative to Home's sector B trade costs.*

2. *Entrepreneurship in Home's sector A relative to Home's sector B increases with Foreign's sector A trade costs relative to Foreign's sector B trade costs*

Analogous results hold for entrepreneurship in Foreign.

Intuitively, a higher domestic trade cost in sector A (τ_A) increases the price of imported sector A goods relative to domestic sector A goods. Therefore, imported varieties are substituted with domestic varieties in sector A, which increases the demand for domestic varieties and causes the workers with highest ability to become entrepreneurs in sector A. Moreover, the higher trade cost in sector A makes sector B goods relatively cheaper, so sector A varieties are substituted with sector B varieties. This increased demand for B varieties, in turn, causes the workers with highest ability to become entrepreneurs in sector B. However, the effect on sector A dominates the effect on sector B because the inter-sector elasticity of substitution, μ, is lower than the intra-sector elasticity of substitution, $\frac{\sigma-1}{\sigma}$. A symmetric argument holds for an tariff increase in sector B. As a result, we have

$$\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\tau_A} > 0, \qquad \frac{d\log\left(\frac{\Psi_{d,B}}{\Psi_{d,A}}\right)}{d\log\tau_B} > 0,$$

which leads to inequality (39).

Similarly, a higher Foreign trade cost in sector A (τ_A^*) increases the price of the Home's exported sector A goods relative to Foreign's sector A goods in the Foreign market. Therefore, Foreign's demand for Home's sector A exports decreases, leading to a lower labor demand from the most productive firms in Home's sector A. This reduces real wages in Home's sector A and makes the marginal workers become entrepreneurs. Moreover, the higher Foreign trade cost in sector A increases the relative price of sector A goods in the Foreign market. Therefore, consumers in Foreign substitute sector A varieties with sector B varieties, which increases the demand for Home's sector B exports, increasing the demand for sector B workers and, hence, reducing entrepreneurship in Home's sector B. Since the effect of the higher tariff in Foreign's sector A increases the entrepreneurship in Home's sector A and decreases the entrepreneurship in Home's sector B, the relative entrepreneurship in Home's Sector A increases. A symmetric argument holds for a tariff increase in Foreign's sector B. As a result, we have

$$\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\tau_A^*} > 0, \qquad \frac{d\log\left(\frac{\Psi_{d,B}}{\Psi_{d,A}}\right)}{d\log\tau_B^*} > 0,$$

which leads to inequality (40).

4 Data Sources and Description

In our empirical work, we make use of two datasets on entrepreneurship levels. The first dataset contains information of entrepreneurship across countries, allowing us to perform international comparisons. The second dataset has information on entrepreneurship across different U.S. industries, allowing us to conduct cross-industry analysis within the United States. We describe both datasets next.

4.1 Cross-Country Data

In order to compare entrepreneurship rates across countries we use data from the Global Entrepreneurship Monitor (GEM) project. GEM conducts an annual assessment of the entrepreneurial activity, aspirations and attitudes of individuals from over 80 countries. Our data span from 2001 to 2011. The data we use are collected through a survey (Adult Population

Survey), which is administered to a minimum of 2000 adults in each GEM country. Crucially, all national surveys are collected in the same way and at the same time of year, allowing for reliable cross-country comparisons.

Our measure of entrepreneurship is the "percentage of 18–64 population who are currently owner-managers of an established business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments to the owners."[11]

In order to measure trade costs, we use tariff data from the United Nations' TRAINS database. For each country, we compute the domestic trade cost as the average effectively applied tariff that country imposes on the rest of the world. Similarly, we compute the foreign trade cost as the average tariff imposed on the country by the rest of the world.

Table I provides some basic statistics of our estimating sample. As can be seen, the average entrepreneurship rate is almost 13 percent, with a slightly lower median. The standard deviation is rather high, reflecting the great heterogeneity across the countries in our sample. Table VIII presents the average (across years) entrepreneurship rate for each country. As expected, there is a lot of disparity, with some developing countries (especially Africans) showing very large numbers. This is not at all surprising given the relative importance of agricultural activities and necessity-driven entrepreneurs (such as people who work on their own because of the lack of better alternatives). For these reasons, in our regression analysis we control for several developmental indicators taken from the World Bank's World Development Indicators database.

Table I: Cross-Country Summary Statistics

Variable	**Mean**	**Std. Dev.**	**Median**
Entrepreneurship	12.88	8.19	10.70
$\tau^{Domestic}$	4.00	3.61	3.01
$\tau^{Foreign}$	2.38	1.78	2.03
Observations	247	247	247

4.2 Cross-Industry Data

4.2.1 Aggregate Data

Next, we look at entrepreneurship across different industries within the United States. In this case, our measure of entrepreneurship is the self-employment rate across the 3-digit NAICS manufacturing sectors. As mentioned in the introduction, self-employment is a commonly used measure for entrepreneurship (Parker 2009) and is defined as the fraction of people who do

[11] More specifically, our measure adds up GEM's Established Business Ownership Rate (Estbbuyy) and New Business Ownership Rate (Babybuyy). The data are available at http://www.gemconsortium.org/.

not work *for* anybody else. The source for these data is the Bureau of Labor Statistics.[12] Our sample period is 2000–2010.

There are two advantages of performing this analysis. First, by focusing on intra-country variations we abstract from development-related reasons for cross-country differences in entrepreneurship. Second, by looking at manufacturing industries we eliminate sectors where the entrepreneurship (self-employment) rate is inherently high, such as farming and construction.

To measure trade costs we use again tariff data from the United Nations' TRAINS database. For each HS 6-digit industry, we observe the U.S. tariff and the foreign tariff (defined as the average tariff of the rest of the world), which we then map into 3-digit NAICS industries. For the United States, we also are able to construct a measure of transport costs (that is, the cost of shipping to the U.S.). We compute the transport cost as the ratio of import charges (insurance, freight, and all other charges excluding import duties) to import values, using data from the United States International Trade Commission. We add these transport cost values to the tariffs and obtain the domestic trade cost measure.[13]

Table II provides summary statistics of our second dataset. The average entrepreneurship (self-employment) rate is almost 5 percent. There is a lot of variation across sectors, with industries like paper manufacturing (NAICS 322) or chemical manufacturing (NAICS 324) having values close to zero, whereas sectors like apparel manufacturing (NAICS 315) and printing (NAICS 323) have rates above 10 percent.

Table II: Cross-Industry Summary Statistics

Variable	**Mean**	**Std. Dev.**	**Median**
Entrepreneurship	4.96	3.60	3.71
$\tau^{Domestic}$	9.24	3.97	8.23
$\tau^{Foreign}$	9.58	3.43	9.17
Observations	220	220	220

Notes: Domestic costs are computed as U.S. ad-valorem tariffs plus transportation costs. Their mean values are 2.9 and 6.3 percent, respectively. Industry 312 is dropped from our regressions as an outlier: its average U.S. and foreign trade costs are over 3 standard deviations above the mean values.

[12] See Appendix F for an explanation of how this variable is measured.

[13] We compute transport costs for the United States only, due to the unavailability of the necessary industry-level data for other countries.

4.2.2 Individual-Level Data

We also use individual-level data of the Current Population Survey (CPS). We obtain these data from King et al. (2010) as part of the IPUMS-CPS project.[14]

The CPS collects data on demographic characteristics and employment status, among other things. Specifically, since we look at the individual responses, we are able to observe personal characteristics like age, gender, marital status, and education level. We also observe the occupation of each individual and the industry where he/she works. On top of this, we observe whether the individual is self-employed or works for a wage/salary in the private sector (we drop those individuals who are working for the government or the armed forces). The data are collected annually (in March) and our sample period goes from 2003 to 2010. For our estimations, we combine these data with the trade costs data discussed above.

5 Econometric Evidence

5.1 Cross-Country Results

We begin by looking at the cross-country evidence. Our theory suggests that countries that impose lower trade costs and those that face lower trade barriers should have relatively lower entrepreneurship rates. In particular, we look at the following econometric specification:

$$entrepreneurship_{c,t} = \beta_0 + \beta_1 \tau_{c,t}^{Domestic} + \beta_2 \tau_{c,t}^{Foreign} + Controls + \epsilon_{c,t}, \tag{41}$$

where c is the country subindex and t is the time (year) subindex. We expect to find $\beta_1 > 0$ and $\beta_2 > 0$.

Table III presents our cross-country results. In Column 1, we run a simple regression of entrepreneurship on the domestic and foreign trade costs and find that, indeed, those countries facing higher trade costs are associated with higher entrepreneurship rates. For instance, we find that a 1 percentage point increase in domestic trade costs are associated with a 0.662 percentage point increase in entrepreneurship. Likewise, a 1 percentage point increase in foreign trade costs are associated with a 0.539 percentage point increase in entrepreneurship

However, as already mentioned, we have a very heterogeneous group of countries in our sample—it is quite likely that other factors related to development affect the observed entrepreneurship rate. For this reason, in the next columns of Table III we add several controls. In Column 2, we control for the fraction of urban population in the country: as expected we find that a lower fraction of farmers is associated with lower entrepreneurship rates. In Column 3, we incorporate unemployment as an additional regressor and we find some support for the 'recession-push' hypothesis, which holds that scenarios where unemployment is high and it is hard to get good paid employment *push* people into entrepreneurship.[15] Finally,

[14]The Integrated Public Use Microdata Series (IPUMS) website is hosted by the University of Minnesota. The data are available at https://cps.ipums.org/cps/.

[15]Additionally, during bad economic times firms close down, reducing the cost of second-hand physical capital

in Column 4 we add GDP per capita as an additional control since there is evidence that richer countries tend to have lower entrepreneurship rates (OECD 2000). However, we find that once we control for urban population and unemployment, GDP per capita is statistically insignificant. The bottom line is that in all the cases considered we find strong support for our predictions: our trade costs coefficients are estimated to be positive and significant in all columns.[16]

Table III: Cross-Country Entrepreneurship

	-1-	-2-	-3-	-4-
$\tau^{Domestic}$	0.622***	0.485**	0.817***	0.658**
	(0.154)	(0.233)	(0.255)	(0.258)
$\tau^{Foreign}$	0.539*	0.824*	0.825*	0.801*
	(0.288)	(0.433)	(0.421)	(0.422)
Urban Population		-0.134*	-0.169***	-0.151***
		(0.075)	(0.052)	(0.053)
Unemployment			-0.484***	-0.529***
			(0.150)	(0.161)
GDP per Capita				-0.053
				(0.037)
Observations	247	247	230	230
R^2	0.113	0.192	0.306	0.316

Notes: '***', '**' and '*' refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are adjusted for heteroscedasticity in column 1, and clustered by country in columns 2–4. Regressions include year fixed effects.

Therefore, the cross-country evidence on entrepreneurship seems to support our theory's predictions. Next, we turn to the cross-industry analysis.

and the barriers to entry into entrepreneurship. The literature, however, is not conclusive regarding the effects of unemployment on entrepreneurship. An alternative is the 'prosperity-pull' hypothesis, which holds that high unemployment reduces demand and the income of entrepreneurs, 'pulling' individuals out of entrepreneurship. Parker (2009) reports that there is evidence for both hypotheses.

[16]While our dataset is a panel, there is little time variation since most countries did not change their tariffs significantly over the 2000s. As a result, most of the variation in tariffs comes from the cross-section dimension of the panel. In particular, the cross-country coefficient of variation in tariffs is much bigger than the cross-year coefficient of variation, 0.88 vs. 0.30. For this reason, we do not include country fixed effects in our regressions as they would absorb most of the data variation. Instead, we include the country controls discussed above. An analogous situation occurs with the cross-industry panel, where the cross-industry coefficient of variation (0.87) is much greater than the cross-year coefficient of variation (0.07).

5.2 Cross-Industry Results

5.2.1 Aggregate Data

In this subsection, we present our cross-industry results. From our theory, we expect entrepreneurship to be positively affected by both the domestic and foreign trade costs of the particular industry. That is, we pose the following econometric model

$$entrepreneurship_{i,t} = \beta_0 + \beta_1 \tau_{i,t}^{Domestic} + \beta_2 \tau_{i,t}^{Foreign} + Controls + \nu_{i,t}, \tag{42}$$

where i indexes a 3-digit NAICS industry, t indexes time (year), and we expect $\beta_1 > 0$ and $\beta_2 > 0$. We try several specifications using different controls.[17] The idea underlying our first set of control variables is that one possible impediment to entrepreneurship is the lack of capital, consistent with prior evidence that entrepreneurs face liquidity constraints (see Evans and Leighton 1989; and Evans and Jovanovic 1989). In this spirit, we use two different measures for the importance of capital in a given sector. First, we use the ratio of total capital expenditures to the value of shipments ($k/ship$); second, we use the ratio of capital expenditures and material purchases to the value of shipments ($exp/ship$).[18] We also control for a number of demographic characteristics at the industry level, including race and gender, which seem to be related to entrepreneurial activity (see Hipple 2010; and Blanchflower 2000).

The results are shown in Table IV.[19] In Column 1, we run a simple regression of entrepreneurship on trade costs, with no controls (other than year fixed effects). From Column 2 onwards, we use the different controls described above. Note the positive and significant effects that both measures of trade costs have across all specifications. For example, under the specification of Column 6, a 1 percentage point increase in U.S. trade costs increases the entrepreneurship rate by almost 0.3 percentage points; likewise, a 1 percentage point increase in the foreign tariff increases the rate of entrepreneurship by 0.133 percentage points. Overall, the data seem to strongly support the model's predictions.

Moreover, our two-sector model has implications regarding the relationship between relative entrepreneurship and relative trade costs across industries. Indeed, equations (39–40) suggest that a sector facing low trade costs relative to the other sectors should have a relatively low entrepreneurship rate as well. Therefore, in Appendix C we perform an exercise analogous to the one shown in Table IV, but using as our dependent (independent) variable(s) a sector's entrepreneurship (trade costs) relative to the average entrepreneurship (trade costs) across all

[17] The data source for these controls is the Annual Survey of Manufacturers. This is not available for some years, so the number of observations decreases when we use these controls.

[18] We also tried alternatives, including the ratio of capital expenditures to payroll, and the ratio of capital expenditures to the number of employees. The resulting estimates were very similar to those in Table IV.

[19] All regressions in Table IV are estimated using OLS. In contrast to the cross-country analysis, we do not cluster the standard errors because the number of clusters would be too small (namely, the 20 3-digit NAICS industries). Indeed, Wooldridge (2001, pp. 331, 409, 486) mentions that the methods for clustering the standard errors are known to have good properties *only* when the number of clusters is large relative to the number of units within a cluster.

Table IV: Cross-Industry Entrepreneurship

	-1-	-2-	-3-	-4-	-5-	-6-
$\tau^{Domestic}$	0.232***	0.235***	0.347***	0.171***	0.188***	0.293***
	(0.059)	(0.061)	(0.057)	(0.060)	(0.060)	(0.060)
$\tau^{Foreign}$	0.395***	0.398***	0.200***	0.195***	0.213***	0.133**
	(0.066)	(0.078)	(0.071)	(0.061)	(0.067)	(0.062)
$k/ship$		0.067			0.349**	
		(0.192)			(0.173)	
$exp/ship$			-0.149***			-0.098***
			(0.019)			(0.017)
$male$				-0.001***	-0.002***	-0.001***
				(0.000)	(0.000)	(0.000)
$white$				0.004***	0.004***	0.004***
				(0.000)	(0.000)	(0.000)
Observations	220	200	200	220	200	200
R^2	0.319	0.313	0.451	0.526	0.533	0.574

Notes: '***', '**' and '*' refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are adjusted for heteroscedasticity. Regressions include year fixed effects.

other sectors. As we discuss in Appendix C, the data support these predictions as well.

5.2.2 Individual Responses

In this subsection, we look at the individual-level data from the Current Population Survey. We use a logit model in order to study how trade costs affect the decision of an individual to become an entrepreneur. Once again, we expect positive coefficients for both domestic and foreign trade costs, implying that higher trade costs are associated with a higher probability of an individual choosing to be an entrepreneur.

Table V presents our results. In Column 1, we simply regress the entrepreneur dummy variable on both trade costs, whereas in Column 2, we include the individual's race, marital status, sex, and education level as control variables. These are all factors known to potentially affect the individual's occupational choice. The results in both columns indicate that the data support our predictions: those individuals working in industries with higher trade costs are more likely to be entrepreneurs.

A potential concern is that some individuals who report themselves as self-employed may not be business owners running firms in the *spirit* modeled in our theory, but, rather, own-account workers; that is, they are the only worker of their firm. We do not believe this should be a major concern in our case, because we only look at manufacturing industries. Nevertheless, we address this concern in columns 3 and 4, where we repeat the analysis restricting our sample to only those individuals whose occupation is part of the so-called 'Managerial and Professional' occupations—that is, we restrict our sample to those individuals more likely to be running sizable businesses. Moreover, this subsample allows us to focus on individuals who have the necessary skills and background to run an organization, and hence may choose to become entrepreneurs mainly because of the business environment, which is captured by our regressors, and individuals' aspirations, which are captured by the error term. As can be seen in columns 3 and 4, the data strongly support our predictions: trade costs increase the probability of someone selecting himself/herself into entrepreneurship, even after controlling for several demographic factors and focusing on this special subsample of individuals.

Table V: Cross-Industry Entrepreneurship (Individual Data)

	-1-	-2-	-3-	-4-
$\tau^{Domestic}$	6.460***	8.829***	12.053***	11.343***
	(0.586)	(0.592)	(0.767)	(0.830)
$\tau^{Foreign}$	4.549***	6.889***	6.958***	5.698***
	(0.615)	(0.627)	(0.849)	(0.915)
Observations	89,549	89,526	20,670	20,663
Pseudo R^2	0.012	0.058	0.038	0.084
Controls?	No	Yes	No	Yes

Notes: '***', '**' and '*' refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are adjusted for heteroscedasticity. Regressions include year fixed effects. *Controls* refer to dummy variables for race, marital status, sex, and education level. Columns 1 and 2 include the full sample, whereas columns 3 and 4 include those with 'Managerial and Professional' occupations.

Moreover, in Appendix C we perform an exercise analogous to the one shown in Table V using an industry's relative trade costs as regressors, along the lines mentioned in the previous subsection. As shown in Appendix C, these predictions also are supported by the data.

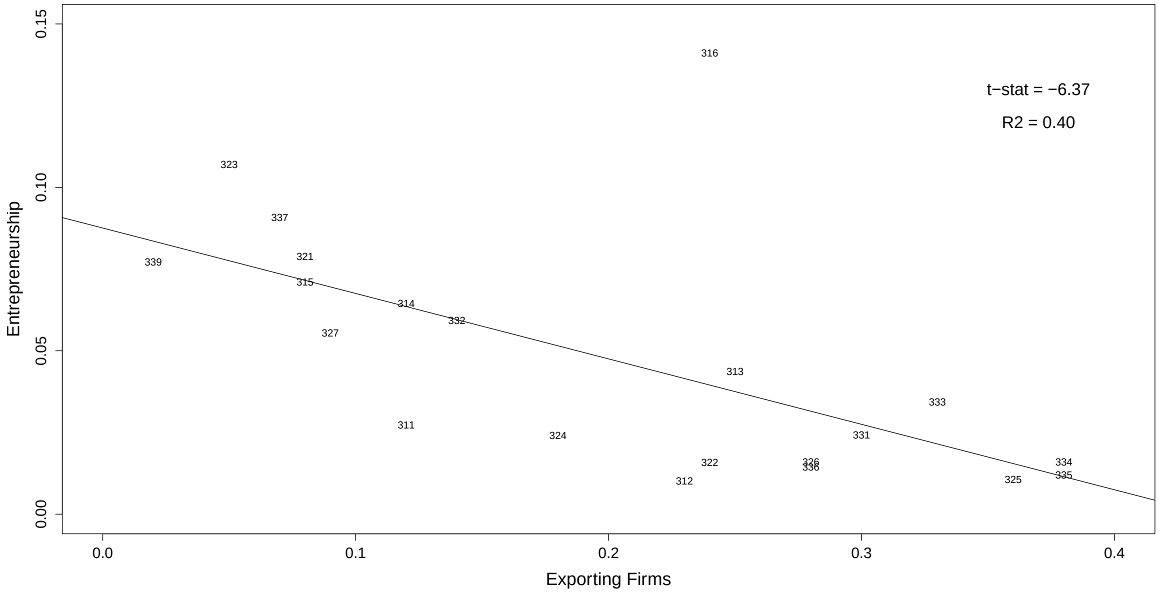
5.2.3 Evidence on Remark 1

Finally, our theory provides one last prediction. Recall that Remark 1 implies that industries with a higher fraction of exporting firms will have lower rates of entrepreneurship. In this subsection, we look for evidence on this relationship.

The data limitations are quite severe, and we can get only 3-digit industry data on the percentage of firms that are exporters in 2002 from Table 2 in Bernard et al. (2007). Because of these limitations, we provide a regression only for year 2002, combining our 3-digit industry-level data on self-employment with the data from Bernard et al. (2007).

Figure III suggests that this prediction is indeed supported by the data. That is, consistent with the theory, the data show that there is a negative and statistically significant relationship between entrepreneurship rates and the share of exporters.

Figure III: Entrepreneurship and Share of Exporters



Source: Authors' calculations based on data from the BLS and Bernard et al. (2007).
Notes: "Entrepreneurship" is the ratio of self-employed workers to total employment in the industry in 2002. "Exporting Firms" is the share of firms within an industry that were exporters in 2002. See the Appendix E for industry codes.

Moreover, note that equation (25) implies a structural negative linear relationship between the fraction of entrepreneurs and the fraction of exporting firms. When we impose this linear structure to the data, we find that

$$\begin{aligned} entrepreneurship_i = \quad & 0.088^{***} - 0.200^{***} \cdot exporters_i. \\ & (0.008) \quad\ (0.031) \end{aligned}$$

Thus, consistent with the theory, the data suggest that a 1 percentage point increase of the share of exporting firms is associated with a 0.2 percentage point decrease in the entrepreneurship rate.

6 Conclusion

In this paper, we unveil a previously unknown fact: the greater the exposure to international trade, the lower the entrepreneurship rate. This pattern holds across different countries and across industries within the United States.

We develop a simple model that rationalizes this behavior. In the model, heterogeneous agents choose whether to be employees or entrepreneurs. Entrepreneurial agents (firms) can also choose to export goods. The model delivers three main predictions that we test in the data:

1. Higher Home trade costs (overall costs of exporting to Home) result in lower entrepreneurship.

2. Higher Foreign trade costs also result in lower entrepreneurship.

3. The rates of entrepreneurship and of exporting firms are negatively related.

We test our predictions using different datasets. First, we use cross-country data; second, we use data on U.S. manufacturing industries (at the 3-digit level of aggregation); finally, we use individual-level data from the CPS. In all cases, we find support for our predictions across different econometric specifications.

As a final note, we would like to compare the message of this paper with Lucas' (1978) final remarks. Lucas' ultimate message is that, under Gibrat's law and with an elasticity of technical substitution less than unity, the managerial ability cutoff increases with the capital-labor ratio of the economy. Since capital per capita indeed increases through time, one would expect the share of entrepreneurs to decrease over time. In comparison, if we think that the world is becoming increasingly interconnected through international trade, then our model also predicts that the rate of entrepreneurship will decrease over time. Thus, our model delivers exactly the same prediction as Lucas (1978), but for a very different reason.

Appendix

A Basic Model

In this appendix we detail the solution to the model presented in the main text of the paper.

A.1 Elasticities

If we take logs and differentiate the system of four equations (22)–(26) with respect to τ, we obtain the following:

$$\begin{bmatrix} \phi & f & 0 & 0 \\ 0 & 0 & \phi^* & f^* \\ -\frac{\sigma-1}{\alpha\sigma} & 1 & 0 & -\left(1-\frac{\sigma-1}{\alpha^*\sigma}\right) \\ 0 & -\left(1-\frac{\sigma-1}{\alpha\sigma}\right) & -\frac{\sigma-1}{\alpha^*\sigma} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_d \\ \varepsilon_x \\ \varepsilon_d^* \\ \varepsilon_x^* \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -\frac{\sigma-1}{\sigma} \\ 0 \end{bmatrix},$$

where $\phi \equiv \Psi_d/\Psi_x$. The solution to this system is as follows:

$$\begin{aligned} \varepsilon_d &= \alpha f \frac{f^*(\sigma-1)+\phi^*\alpha^*\sigma}{f\left(f^*(\sigma-1)+\phi^*\alpha^*\sigma\right)+\phi\left(f^*\alpha\sigma+\phi^*\left(1+(\alpha+\alpha^*-1)\sigma\right)\right)} > 0, \\ \varepsilon_x &= -\varepsilon_d\frac{\phi^*}{f} < 0, \\ \varepsilon_d^* &= f^*\alpha^*\phi\frac{1+(\alpha-1)\sigma}{f\left(f^*(\sigma-1)+\phi^*\alpha^*\sigma\right)+\phi\left(f^*\alpha\sigma+\phi^*\left(1+(\alpha+\alpha^*-1)\sigma\right)\right)} > 0, \\ \varepsilon_x^* &= -\varepsilon_d^*\frac{\phi^*}{f^*} < 0. \end{aligned}$$

If, instead, we differentiate with respect to the cost of trading with Foreign, τ^*, we obtain the ηs mentioned in the main text. The expressions are entirely analogous to the ones above, with f, ϕ, and α, respectively, replaced with f^*, ϕ^*, and α^*, and vice versa.

A.2 Cutoffs and Real Wages

It is interesting to note that the cutoffs can be expressed as the product of a constant term and real wages. Specifically, note that the constant markup of the monopolistically competitive producers implies that the total income (revenue) of Home producers should be equal to the mark-up times the total wages earned by production workers; that is,

$$\begin{aligned} L\int R_d(j)\,dj + L^*\int R_x(j)\,dj &= \frac{\sigma}{\sigma-1}wL\left(\int\frac{y_d(j)}{\varphi(j)}dj+\int\frac{y_x(j)}{\varphi(j)}dj\right) \\ &= \frac{\sigma}{\sigma-1}wL\left(\int l_d(j)\,dj+\int l_x(j)\,dj\right), \end{aligned}$$

where l_d and l_x are the labor used for producing the output sold in the domestic and export markets (per unit mass of consumer), respectively. Next, given that the total revenue is equal to the total spending of Home consumers, we can rewrite the above expression as follows:

$$R = \frac{\sigma}{\sigma-1}w\left[1-\left(\frac{\varphi_0}{\varphi_d}\right)^\alpha - f\left(\frac{\varphi_0}{\varphi_x}\right)^\alpha\right].$$

Combining this last expression with equation (25), we can re-write R as

$$R = \frac{\sigma}{\sigma-1} w \left[1 - \frac{1}{1 + (\sigma - 1) \frac{\alpha}{\alpha+1-\sigma}} \right] \equiv Mw.$$

Finally, plugging in this expression for R in the definition of the cutoff φ_d from equation (18) we obtain the following:

$$\varphi_d = \sigma^{\frac{1}{\sigma-1}} \frac{\sigma}{\sigma-1} (ML)^{\frac{-1}{\sigma-1}} \frac{w}{P}.$$

Thus, when real wages increase, so does φ_d—which implies that self-employment decreases.

B Two-Sector Model

In this appendix we provide a detailed explanation of the open economy in the case of the two-sector model.

Similar to our earlier models, it is straightforward to check that the demand function of the Home consumer for goods of industry $k \in \{A, B\}$ is the following:

$$\begin{aligned} y_{d,k}(j) &= \left(\frac{p_{d,k}(j)}{P_k} \right)^{-\sigma} \frac{R_k}{P_k}, \\ y^*_{x,k}(j) &= \left(\frac{p^*_{x,k}(j)}{P_k} \right)^{-\sigma} \frac{R_k}{P_k}, \end{aligned}$$

where the first expression corresponds to the demand for domestically produced goods, while the second expression is the demand for goods produced abroad (that is, exports from Foreign, sector k, producers).

Proceeding in an analogous way as before, we obtain the following expressions for the optimal pricing, output, and profits of the firm that sells domestically (per unit mass of Home consumers):

$$\begin{aligned} \frac{p_{d,k}(j)}{P_k} &= \frac{\sigma}{\sigma-1} \frac{1}{\varphi_k(j)} \frac{w_k}{P_k}, \\ y_{d,k}(j) &= \left(\frac{\sigma-1}{\sigma} \right)^{\sigma} \left(\frac{\varphi_k(j)}{w_k/P_k} \right)^{\sigma} \frac{R_k}{P_k}, \\ \pi_{d,k}(j) &= \frac{1}{\sigma} \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} \left(\frac{\varphi_k(j)}{w_k/P_k} \right)^{\sigma-1} R_k. \end{aligned} \quad \text{(B-1)}$$

Likewise, the expressions for the exporting firm are the following (per unit mass of Foreign consumers):

$$\begin{aligned} \frac{p_{x,k}(j)}{P^*_k} &= \frac{\sigma}{\sigma-1} \frac{w_k/P^*_k}{\varphi_k(j)} \tau^*_k, \\ y_{x,k}(j) &= \left(\frac{\sigma-1}{\sigma} \right)^{\sigma} \left(\frac{\varphi_k(j)}{w_k/P^*_k} \right)^{\sigma} \frac{R^*_k}{P^*_k} (\tau^*_k)^{-\sigma}, \\ \pi_{x,k}(j) &= \frac{1}{\sigma} \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} \left(\frac{\varphi_k(j)}{w_k/P^*_k} \right)^{\sigma-1} R^*_k (\tau^*_k)^{1-\sigma}. \end{aligned} \quad \text{(B-2)}$$

Based on the value of φ, agents in both sectors (and countries) choose whether to be an entrepreneur or a production worker. Conditional on being an entrepreneur, and therefore running a firm, some will also choose to become exporters. Formally, for each sector $k \in \{A, B\}$, and country, we have two cutoffs:

$$\begin{aligned}\varphi_{d,k} &= \sigma^{\frac{1}{\sigma-1}} \frac{\sigma}{\sigma-1} \left(\frac{w_k}{P_k}\right)^{\frac{\sigma}{\sigma-1}} \left(\frac{R_k L}{P_k}\right)^{\frac{-1}{\sigma-1}}, \\ \varphi_{x,k} &= \sigma^{\frac{1}{\sigma-1}} \frac{\sigma}{\sigma-1} \tau_k^* \left(f_k\right)^{\frac{1}{\sigma-1}} \left(\frac{w_k^*}{P_k^*}\right)^{\frac{\sigma}{\sigma-1}} \left(\frac{R_k^* L^*}{P_k^*}\right)^{\frac{-1}{\sigma-1}}.\end{aligned} \tag{B-3}$$

The first one ($\varphi_{d,k}$) determines the employment decision, while the second one ($\varphi_{x,k}$) pins down the exporting decision.

B.1 Closing the Model

Therefore, there are 20 variables to be determined: eight cutoffs ($\varphi_{d,A}$, $\varphi_{x,A}$, $\varphi_{d,B}$, $\varphi_{x,B}$, $\varphi_{d,A}^*$, $\varphi_{x,A}^*$, $\varphi_{d,B}^*$, $\varphi_{x,B}^*$), four wages (w_A, w_B, w_A^*, w_B^*), four aggregate revenues (R_A, R_B, R_A^*, R_B^*), and four aggregate prices (P_A, P_B, P_A^*, P_B^*)—so we can set $P_B^* = 1$. To close the model we use the equations for labor market clearing, aggregate prices, trade balance, inter-industry substitution, and the cutoffs.

First, the labor market clearing condition is now the following:

$$\int_{\varphi_{d,k}}^{\infty} L \frac{y_{d,k}(\varphi)}{\varphi} dG_k(\varphi) + \int_{\varphi_{x,k}}^{\infty} L^* \tau_k^* \frac{y_{x,k}(\varphi)}{\varphi} dG_k(\varphi) + f\left(L_k - G_k\left(\varphi_{x,k}\right)\right) = G_k\left(\varphi_{d,k}\right).$$

On the left-hand side, the first term is the labor employed in production for the domestic market, the second term is the labor employed in the production for export, and the third term is the labor used for the fixed cost of exporting. In turn, the right-hand side is the total amount of production workers in sector k. If we assume the Pareto distribution and we use the expressions for y from (B-1) and (B-2) along with equation (B-3), we can rewrite the last expression as follows:

$$\left(1 + (\sigma - 1)\frac{\alpha_k}{\alpha_k + 1 - \sigma}\right)\left[\left(\frac{\varphi_{0,k}}{\varphi_{d,k}}\right)^{\alpha_k} + f_k \left(\frac{\varphi_{0,k}}{\varphi_{x,k}}\right)^{\alpha_k}\right] = 1.$$

This expression implies that there is a negative relation between the mass of entrepreneurs and the mass of exporters which is similar to the relationship discussed in remark 1. Also, note that there are four expressions like this, one for each country and each sector k.

Second, we can write the price aggregator for sector k,

$$1 = \int_{j \in J_k} \left(\frac{p_{d,k}(j)}{P_k}\right)^{1-\sigma} dj + \int_{j \in J_k^*} \left(\frac{p_{x,k}^*(j)}{P_k}\right)^{1-\sigma} dj.$$

If we plug the expressions for optimal pricing from (B-1) and (B-2) into this equation, we obtain the following:

$$w_k L_k \frac{\alpha_k}{\alpha_k + 1 - \sigma}\left(\frac{\varphi_{0,k}}{\varphi_{d,k}}\right)^{\alpha_k} + f_k^* w_k^* L_k^* \frac{\alpha_k^*}{\alpha_k^* + 1 - \sigma}\left(\frac{\varphi_{0,k}^*}{\varphi_{x,k}^*}\right)^{\alpha_k^*} = \frac{R_k L}{\sigma}.$$

Once again, there are four expressions like this, one for each country and each sector k.

Third, from expression (31) and using $R_k = P_k Y_k$, we can express inter-industry substitution in the following way:

$$\frac{R_A}{R_B} = \left(\frac{P_A}{P_B}\right)^{\frac{-\mu}{1-\mu}}.$$

This expression relates aggregate revenues and prices across the two sectors. Note that there is an analogous expression for Foreign.

Fourth, we impose trade balance between Home and Foreign. Therefore, the following condition needs to hold:

$$L^*\left[\int p_{x,A}(j)\, y_{x,A}(j)\, dj + \int p_{x,B}(j)\, y_{x,B}(j)\, dj\right] = L\left[\int p^*_{x,A}(j)\, y^*_{x,A}(j)\, dj + \int p^*_{x,B}(j)\, y^*_{x,B}(j)\, dj\right].$$

After plugging in the expressions for prices and quantities, we can rewrite the trade balance condition as follows:

$$\begin{aligned} & f_A w_A L_A \frac{\alpha_A}{\alpha_A + 1 - \sigma}\left(\frac{\varphi_{0,A}}{\varphi_{x,A}}\right)^{\alpha_A} + f_B w_B L_B \frac{\alpha_B}{\alpha_B + 1 - \sigma}\left(\frac{\varphi_{0,B}}{\varphi_{x,B}}\right)^{\alpha_B} \\ = \; & f^*_A w^*_A L^*_A \frac{\alpha^*_A}{\alpha^*_A + 1 - \sigma}\left(\frac{\varphi^*_{0,A}}{\varphi^*_{x,A}}\right)^{\alpha^*_A} + f^*_B w^*_B L^*_B \frac{\alpha^*_B}{\alpha^*_B + 1 - \sigma}\left(\frac{\varphi^*_{0,B}}{\varphi^*_{x,B}}\right)^{\alpha^*_B}. \end{aligned}$$

Finally, using these equations and the cutoffs' definition (B-3), we calculate the elasticities at the symmetric equilibrium under the assumption that the structural parameters are the same in Home and Foreign.

From the system of equations we obtain the following:

$$\begin{aligned} \varepsilon_{d,A} - \varepsilon_{d,B} &= \frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\tau_A} \\ &= \frac{f\alpha}{(f+\phi)} \frac{f\sigma\left(\frac{\sigma-1}{\sigma}\right)\left(f(\sigma-1) + \phi + (2\alpha-1)\sigma\phi\right)}{(\sigma-1)^2(\phi-f)^2 + 2fd\left[(\alpha+\mu)\sigma - \alpha\sigma\mu\frac{\sigma}{\sigma-1}\right]} > 0, \end{aligned}$$

where $\phi = \tau^{\alpha} f^{\alpha/(\sigma-1)} > f$.

Intuitively, the object $\varepsilon_{d,A} - \varepsilon_{d,B}$ captures the effect that a change in Home's sector A trade costs has on domestic entrepreneurship in sector A relative to the effect it has on domestic entrepreneurship in sector B. It is straightforward to check that if we differentiate with respect to the trade costs of sector B, we obtain an analogous expression:

$$\frac{d\log\Psi_{d,B}/\Psi_{d,A}}{d\log\tau_B} > 0.$$

Both results combined imply the following:

$$\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\frac{\tau_A}{\tau_B}} > 0. \tag{B-4}$$

Similarly, we can study the effects of changes in trade costs in Home on Foreign entrepreneurship:

$$\varepsilon_{d,A}^{*}-\varepsilon_{d,B}^{*}=\frac{d\log\left(\frac{\Psi_{d,A}^{*}}{\Psi_{d,B}^{*}}\right)}{d\log\tau_{A}}=\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\tau_{A}^{*}}=\eta_{d,A}-\eta_{d,B}=$$

$$=\frac{f\alpha}{(f+\phi)}\frac{(\sigma-1)^{2}(\phi-f)^{2}+f(\phi-f)(\sigma-1)^{2}+\mu\sigma(\sigma-1)f^{2}+f\phi\sigma\left(3\mu(\sigma-1)-2\alpha\sigma\left(\mu-\frac{\sigma-1}{\sigma}\right)\right)}{(\sigma-1)^{2}(\phi-f)^{2}+2fd\left[(\alpha+\mu)\sigma-\alpha\sigma\mu\frac{\sigma}{\sigma-1}\right]}>0.$$

Note that since we evaluate around the symmetric equilibrium, this is the same as the effect of a change in Foreign trade costs on Home entrepreneurship. By an analogous argument to the case just described, it follows that:

$$\frac{d\log\left(\frac{\Psi_{d,A}}{\Psi_{d,B}}\right)}{d\log\frac{\tau_{A}^{*}}{\tau_{B}^{*}}}>0. \qquad \text{(B-5)}$$

Equation (B-5) implies that if trade costs for Foreign's sector A increase relative to those of Foreign's sector B, then we should observe that entrepreneurship in Home's sector A should increase relative to Home's sector B, which is also consistent with our empirical results.

C Additional Cross-Industry Evidence

In Table VI we present some additional results. From Section 3 we expect that the rate of entrepreneurship in one sector relative to another sector depends on their relative tariffs. Accordingly, we conduct a exercise similar to the one presented in Table IV. The difference is that we replace the entrepreneurship rate in sector i with the ratio of the entrepreneurship rate in sector i to the average entrepreneurship rate in all other sectors, and likewise we replace sectoral trade costs with the ratio of sectoral trade costs to average trade costs of all other sectors. The results are presented in Table VI, and the data support these theoretical predictions as well: a relative increase in the trade costs of a sector increases that sector's entrepreneurship relative to the other sectors in the economy.

Similarly, Table VII re-estimates Table V, but using the relative trade costs just mentioned. Once again, the data support the basic message of the theory: the more open a sector is, the less likely an individual working in that sector will choose to become an entrepreneur. This fact is supported in all four specifications, even when we control for individual characteristics affecting selection into entrepreneurship and when we restrict the sample to individuals in managerial and professional occupations.

Table VI: Relative Entrepreneurship Regressions

	-1-	-2-	-3-	-4-	-5-	-6-
$\tau^{Domestic}/\tau^{D}_{mean}$	0.516***	0.522***	0.776***	0.370**	0.414***	0.658***
	(0.140)	(0.144)	(0.135)	(0.147)	(0.150)	(0.148)
$\tau^{Foreign}/\tau^{F}_{mean}$	0.893***	0.959***	0.509***	0.472***	0.552***	0.369***
	(0.140)	(0.178)	(0.161)	(0.134)	(0.151)	(0.140)
$k/ship$		1.779			7.977**	
		(4.379)			(3.997)	
$exp/ship$			-3.254***			-2.144***
			(0.449)			(0.386)
$male$				-0.031***	-0.034***	-0.021***
				(0.006)	(0.006)	(0.006)
$white$				0.096***	0.100***	0.081***
				(0.011)	(0.011)	(0.011)
Observations	220	200	200	220	200	200
R^2	0.296	0.292	0.428	0.513	0.522	0.561

Notes: '***', '**' and '*' refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are adjusted for heteroscedasticity. Regressions include year fixed effects.

Table VII: Entrepreneurship and Relative Trade Costs (Individual Data)

	-1-	-2	-3-	-4-
$\tau^{Domestic}/\tau^{D}_{mean}$	0.694***	0.946***	1.276***	1.201***
	(0.063)	(0.063)	(0.082)	(0.089)
$\tau^{Foreign}/\tau^{F}_{mean}$	0.429***	0.654***	0.673***	0.557***
	(0.059)	(0.060)	(0.082)	(0.088)
Observations	89,549	89,526	20,670	20,663
Pseudo R^2	0.012	0.058	0.038	0.084
Controls?	No	Yes	No	Yes

Notes: '***', '**' and '*' refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are adjusted for heteroscedasticity. Regressions include year fixed effects.

D Country Codes for Figure I

Code	Country
ARG	Argentina
AUS	Australia
BOL	Bolivia
BOS	Bosnia and Herzegovina
BRA	Brazil
CHL	Chile
CHN	China
COL	Colombia
CRC	Costa Rica
CRO	Croatia
ECU	Ecuador
EU	European Union
GUA	Guatemala
ICE	Iceland
JAM	Jamaica
JAP	Japan
KOR	Korea, Rep.
MAC	Macedonia, FYR
MEX	Mexico
MON	Montenegro
NOR	Norway
PER	Peru
RUS	Russian Federation
SAF	South Africa
SWI	Switzerland
TKY	Turkey
UGD	Uganda
USA	United States
URU	Uruguay

E Industry Codes for Figures II–III

NAICS	Industry
311	Food Manufacturing
312	Beverage and Tobacco Product Manufacturing
313	Textile Mills
314	Textile Product Mills
315	Apparel Manufacturing
316	Leather and Allied Product Manufacturing
321	Wood Product Manufacturing
322	Paper Manufacturing
323	Printing and Related Support Activities
324	Petroleum and Coal Products Manufacturing
325	Chemical Manufacturing
326	Plastics and Rubber Products Manufacturing
327	Nonmetallic Mineral Product Manufacturing
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
333	Machinery Manufacturing
334	Computer and Electronic Product Manufacturing
335	Electrical Equipment, Appliances, and Components
336	Transportation Equipment Manufacturing
337	Furniture and Related Product Manufacturing
339	Miscellaneous Manufacturing

F Measurement of Self-Employment

In the United States, the Bureau of Labor Statistics (BLS) is the agency that collects data on self-employment. It does so through the Current Population Survey (CPS).

> Since January 1994, employed respondents in the monthly CPS have been asked the question: "Last week, were you employed by government, by a private company, a nonprofit organization, or were you self-employed?" Respondents who say that they were employed by government, a private company, or a nonprofit organization are classified as wage and salary workers. Individuals who say that that they are self-employed are asked, "Is this business incorporated?" Respondents who say yes are the incorporated self-employed and are classified as wage and salary workers; respondents who say no are classified as unincorporated self-employed, the measure that typically appears in BLS publications. (Hipple 2010, page 18).

However, in our dataset we also include the incorporated self-employed—since in the theory we model the self-employed as agents who run/own firms, we think it is appropriate to include these individuals in our sample.

G Cross-Country Entrepreneurship Data

In Table VIII we present the average (across available years) rate of entrepreneurship for each of the countries in our sample.

Table VIII: Cross-Country Data

Country	*Entrepreneurship*
Algeria	9.33
Angola	20.40
Argentina	16.01
Australia	18.94
Bangladesh	18.70
Barbados	5.10
Bolivia	32.70
Bosnia and Herzegovina	8.88
Botswana	18.50
Brazil	19.79
Canada	9.32
Chile	13.02
China	22.77
Colombia	21.29
Costa Rica	8.35
Croatia	5.36
Czech Republic	7.65
Dominican Republic	17.80
Ecuador	24.94
Egypt, Arab Rep.	10.63
El Salvador	17.20
Estonia	12.30
European Union	7.23
Ghana	60.20
Guatemala	13.13
Hong Kong SAR, China	5.68
Hungary	7.66
Iceland	12.21
India	14.46
Indonesia	29.10
Iran, Islamic Rep.	14.36
Israel	6.69
Jamaica	16.82
Japan	8.08
Jordan	20.20
Kazakhstan	11.10
Korea, Rep.	16.90
Latvia	9.68
Lebanon	24.80
Lithuania	11.55
Macedonia, FYR	13.10
Malawi	31.20
Malaysia	10.18
Mexico	6.49
Montenegro	10.90

Table VIII: (continued)

Country	*Entrepreneurship*
Morocco	24.60
Namibia	10.20
New Zealand	18.20
Nigeria	29.90
Norway	10.22
Pakistan	6.80
Panama	9.13
Peru	18.17
Philippines	35.30
Poland	8.38
Romania	5.53
Russian Federation	3.70
Saudi Arabia	6.55
Serbia	11.70
Singapore	6.35
Slovak Republic	12.60
Slovenia	7.06
South Africa	3.98
Sweden	8.04
Switzerland	11.49
Syrian Arab Republic	11.80
Thailand	33.52
Tonga	13.40
Trinidad and Tobago	14.90
Tunisia	12.57
Turkey	12.72
Uganda	43.30
United Arab Emirates	7.38
United States	10.52
Uruguay	11.20
Vanuatu	50.30
Venezuela, RB	12.80
Yemen, Rep.	4.10
Zambia	22.50

Source: Authors' calculations based on data from GEM.

Notes: "Entrepreneurship" is the percentage of the 18–64 population who are currently owner-managers of a business. Data are averaged over 2001–2011.

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