# Who's Afraid of a Globalized World? Foreign Direct Investments, Local Knowledge and Allocation of Talents

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**Abstract**

We study the distributional effects of globalization within a model of heterogeneous agents where both managerial talent and knowledge of the local economic environment are required in order to become a successful entrepreneur. Agents willing to set up a firm abroad incur a learning cost that depends on how different the foreign and domestic entrepreneurial environments are. In this context, we show that globalization fosters FDI and raises wages, output and productivity. However, not everybody wins. The steady state relationship between globalization and income is U-shaped: high- and low-income agents are better off in a globalized world, while middle-income agents (domestic entrepreneurs) are worse off. Thus, consistently with recent empirical evidence, the model predicts globalization to increase inequality at the top of the income distribution while decreasing it at the bottom.

**JEL Classification**: E61-F23-F41.
**Keywords**: Distributional Effects of Globalization, Heterogeneous Agents, Income Inequality, Endogenous TFP, Multinational Firms.

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# 1 Introduction

Who opposes globalization? Who favors it? It is well-known that in a Hecksher-Ohlin context the process of globalization produces winners and losers as a consequence of the changes in the relative abundance of factors. Despite its obvious relevance, this issue has been so far hardly analyzed in the context of intraindustry trade models *à la* Melitz (2003), where gains from trade do not arise from international differences in factor endowments, but from consumers' love for variety and from the ability of the entrepreneurs to overcome the barriers that distance generates. So far this literature has focused on models with "heterogeneous firms" and "homogeneous agents".

This paper is an attempt to analyze the distributional effects of globalization within a Melitz-type model with heterogeneous *agents*. Our main finding is that the effect of globalization on the individuals' well-being is non-monotonic. A higher degree of inter-connectedness among countries has a U-shaped effect on the income distribution, improving the position of both those at the top and the bottom of the distribution and harming those in the middle. This prediction is consistent with recent empirical evidence showing that since the 1990's both in the U.K. and the U.S. inequality went up in the upper tail of the distribution and decreased in the lower tail (Autor et al., 2005; Autor et al., 2006 and Machin and Van Reenen, 2007).

We obtain this result in a model of Foreign Direct Investments (FDI), one of the most prominent (and debated) features of globalization. FDI grew dramatically over the last decades far outpacing the growth of trade and income.[1] Another salient feature of FDI is that they take place mostly between developed countries, i.e. between countries that are similar in terms of natural endowments and relative supply of inputs.[2] We provide additional empirical evidence in line with this fact, documenting that bilateral FDI are also higher between countries that have more similar *entrepreneurial environments*.[3]

Consistently, we propose a model in which *both* managerial talent and *knowledge of the local entrepreneurial environment* are required in order to set up a firm and earn positive profits. The main trade-off that arises in the model depends on how individuals with different abilities are allocated to the different types of jobs available in the economy. To be more specific, a first key feature of the model is that agents with different levels of managerial ability are allowed to select their occupation and choose whether to become entrepreneurs or workers. Those who become entrepreneurs may engage in FDI and set up a firm abroad. However, in order to become a

[1] Whereas world-wide real GDP increased at a rate of 2.5 percent per year between 1985 and 1999 and world-wide exports by 5.6 percent, world-wide real inflows of FDI increased by 17.7 percent.

[2] For the period 1970-2000, Barba Navaretti and Venables (2004) report that more than 90% of outward flows of FDI originates from advanced countries. Over the same period, the share of the world FDI inflows directed to developed countries ranges between 58 and 78 percent.

[3] Broadly speaking, one may think of the entrepreneurial environment as representing the complex set of circumstances, generally different across countries, entrepreneurs need to deal with: identification of consumers' tastes, communication with costumers, relationship with the bureaucracy, comprehension of the legal environment, purchase of inputs, relationship with other firms, setup of the production process (hiring and firing procedures, salary structure, technology choices,...). This is very well explained in the statement that used to appear on Unilever's website (cite taken from Barba Navaretti and Venables, 2004):

> "Many of our brands have international appeal, while others are leaders in local markets. It is our *keen understanding of cultures and markets* that allows us to anticipate consumers' needs and to provide them with what they need, when they need it." (Unilever, emphasis added)

successful entrepreneur in a given country, managerial ability is not sufficient: some *knowledge* of the local economic environment is also required.

A second key feature of the model is that agents are assumed to know more about the domestic economic environment (e.g. domestic consumers' tastes) than about the foreign environment. Domestic agents have to *learn* how the foreign economic environment works in order to profitably set up a firm abroad. Thus, both managerial ability *and* nationality affect career choices. The idea is that a certain level of managerial talent, though allowing agents to profitably produce within the domestic economic environment, may be of little help when setting up a firm abroad: the more different the foreign and the domestic economic environments, the more difficult it is to succeed in the foreign market. This *distance* between entrepreneurial environments is the only explicit barrier to capital movements that matters in the model. It may be overcome only at the cost of learning how the foreign environment works. Of course, in equilibrium, only the most talented entrepreneurs, who run – in line with the empirical evidence – the largest and most productive firms, have incentives to pay the learning cost and produce abroad.

The model endogenously determines the allocation of talents between (domestic and international) entrepreneurial activity and salaried work. It follows that FDI, Total Factor Productivity (TFP), GDP and wages depend on how efficiently talents are allocated. Talent allocation, in turn, depends on how hard it is to learn about the foreign entrepreneurial environment. A lower distance between entrepreneurial environments reduces the learning cost and raises the inflow of foreign-owned firms into the domestic market. This increases the domestic wage and makes the entrepreneurial activity less profitable, driving a fraction of low-ability domestic entrepreneurs out of the market. This general equilibrium effect improves the allocation of talents and increases both TFP and GDP.[4] Conversely, a larger distance between entrepreneurial environments protects low-ability entrepreneurs from foreign competitors and reduces output, wages and TFP. Thus, globalization fosters *aggregate* efficiency.

Still, not everybody wins when the degree of globalization increases. The welfare of the individuals with the lowest and highest levels of entrepreneurial talent (who choose to become workers and multinational entrepreneurs, respectively) increases as learning costs go down and GDP, TFP and wages rise. Differently, the welfare of the individuals with an "intermediate" level of talent is decreasing in the degree of globalization. The reason is that, in a globalized world, domestic entrepreneurs pay the cost of tougher competition without enjoying the benefits of accessing to wider markets. In a non-globalized world they enjoy higher entrepreneurial profits as they are sheltered from foreign competition. Even in the absence of any pro-competitive effects of FDI working through lower prices,[5] the general equilibrium effect through wages is

[4]This is consistent with a growing body of empirical evidence pointing to the existence of a positive relationship between FDI and both wages and productivity. Baldwin, Braconier and Forslid (1999) show that FDI positively affects wages using industry-level data for seven OECD countries. Keller and Yeaple (2003) provide firm-level evidence from the US showing that FDI spillovers account for about 14% of productivity growth in U.S. firms between 1987 and 1996. Javorcik (2004) provides similar evidence for Lithuania. See Lipsey (2002) for a review of the micro evidence on the home and host country effects of FDI.

[5]The competition effect is present in almost all the standard IO-based FDI models, since Horstmann and Markusen (1992). In our model product market competition does *not* increase in the domestic country as a consequence of foreign competition. We rule this effect out by assuming monopolistic competition and Dixit-Stiglitz preferences. See Melitz and Ottaviano (2008) for a model of trade with firm heterogeneity and endogenous mark-ups.

sufficient to expel mediocre entrepreneurs from the market when the difference between economic environments becomes smaller. As a result, globalization increases inequality in the upper tail of the distribution and decreases it in the lower tail of the distribution.

As the model is based on the idea that globalization reduces the distance between economic environments and therefore leads to higher FDI, we test this relationship against the data. We proxy the distance between economic environments exploiting measures of Product Market Regulation and interpret the difference between languages as an additional *qualitative* proxy of the distance between economic environments. Our results indicate that, controlling for the *levels* of regulation, GDPs and populations in both countries, host and source countries fixed effects, time effects, and a set of geographical variables, a higher distance between economic environments negatively affects the size of bilateral FDI stocks.

This paper is obviously related to the recent trade literature that, since Melitz (2003), develops dynamic industry models with heterogeneous firms, in which only the most efficient firms engage in cross-border activities and where more openness forces the least productive firms out of the market. The key difference with Melitz (2003) is that in this paper firms' heterogeneity stems from the heterogeneity (in managerial talent) of the agents who are allowed to make career choices. This feature of the model allows us to emphasize the (endogenous) mechanism by which exposure to foreign competition improves the allocation of talents and, most importantly, to discuss the distributional implications of globalization.

Another strand of literature related to this paper is the one that analyzes the distributional effects of decreasing trading costs. While this issue has been widely studied in the context of models *à la* Hecksher-Ohlin, the literature on the distributional effects of globalization in the context of intraindustry trade models is much thinner. Closest to us is Helpman et al. (2010) that study the distributional consequences of international trade in a model with heterogeneous firms and workers in which labor markets are imperfect.[6] In their context, the distributional effects of globalization in developed economies are akin to those derivable in Hecksher-Ohlin models: the most efficient workers benefit from globalization because their firms (the most efficient ones) do, while the least skilled workers suffer because their firms (the least efficient ones) also suffer. One key difference between our approach and their model is that we allow for endogenous career choices and learning of the foreign environment. Thus, in our context the welfare effects of globalization are U-shaped. The individuals at the low-end of the income distribution improve their position because the demand for their labor services is larger when foreign firms have access to the local market.

We finally relate to the extensive (theoretical and empirical) literature that studies the driving factors of FDI.[7]

The rest of the paper is organized as follows. Section 2 presents new empirical evidence on the effects of the distance between economic environments on FDI. Section 3 describes the model. Section 4 solves for the closed economy while section 5 discusses the open economy framework. Section 6 analyzes the distributional effects of globalization and section 7 concludes.

[6]Related papers are also Coşar, Guner, Tybout (2010), Egger and Kreickemeier (2009), Epifani and Gancia (2008), Felbermayr, Prat, and Schmerer (2008), Davis and Harrigan, (2007), and Manasse and Turrini (2001).

[7]See, among many others, Horst (1972), Deardorff, (1998), Ekholm (1998), Lipsey (2001), Razin et al. (2003), Shatz (2003), and Fumagalli (2003).

## 2 Differences between Economic Environments and FDI

This sections provides empirical support to the idea that a lower distance between economic environments leads to higher bilateral FDI. We use two proxies for the "distance between entrepreneurial environments". The first is the difference between languages. Countries sharing the same language are likely to be more homogeneous than countries with different languages. The cultural environment is arguably more similar and both mutual understanding and exchange of ideas are easier when the same language is spoken. The interplay between those factors very likely contributes to enhance the homogeneity of the economic environments. Even though this factor has already been considered in previous empirical work, it is interesting to check whether the positive *ceteris paribus* impact of common language on FDI survives after controlling for the levels of regulation in each country and for the distance between regulations.

In fact, our second proxy for the distance between entrepreneurial environments is the cross-country distance between regulations. National regulations contribute to shape the economic environment because they typically impose compliance with particular procedures (e.g. business start-up procedures, safety and health regulations, food regulations). The more the institutional settings are different, the more costly the adaptation process to the new environment and the smaller the incentives to run businesses abroad. Thus, rough as it may be, this easily observable measure captures, at least partly, the difference between entrepreneurial environments.[8]

The empirical analysis relies on data on bilateral FDI, on nationwide regulation indexes and on country characteristics described in the next section.

### 2.1 Data Description

FDI figures are drawn from the *OECD International Direct Investment Statistics* that provide annual data on international direct investment stocks for a number of OECD countries by geographical distribution, i.e. to and from partner countries and regions from 1981 to 2002 in current dollars. Table 1 presents descriptive statistics and shows that the data contain 5371 non-missing observations on bilateral FDI stocks, 127 of which are negative (and have been therefore dropped) and 246 are zero. A notorious problem in the literature that estimates traditional log-linear gravity models is that the log eliminates all zeros. For this reason, we show results both from the traditional log-linear specification and, in a separate appendix, from the Poisson Pseudo-Maximum-Likelihood (PPML) model that allows to easily incorporate zero stocks (Santos Silva and Tenreyro, 2006 and Head and Ries, 2008).

Data on GDP per capita and population are taken from the Penn World Tables version 6.2 (Heston, Summers and Aten, 2006). Geographical variables are drawn from Frankel, Stein and Wei (1995) and Frankel and Wei (1998).

Variables measuring the level of regulation are from the OECD and the World Bank. The OECD dataset (Nicoletti et al., 2000) consists of indexes measuring the extent of Product and Labor Market Regulation in a number of OECD countries during the 90's. The OECD provides both an overall index and a set of sub-indexes measuring the extent of Product Market Regulation along specific dimensions. Of particular interest for our purposes are those cap-

[8] For an analysis of institutional differences as a source of comparative advantage see Levchenko (2007).

turing administrative burdens and red tape costs (*Administrative regulations* and *Barriers to entrepreneurship*). The Labor Market Regulation index measures the strictness of Employment Protection Legislation (EPL).

The World Bank database, called *Doing Business*, collects information on business regulations and their enforcement for 145 countries. The dataset we exploit refers to January 2004. The indicators cover seven areas, namely Starting a Business, Hiring and Firing, Registering Property, Getting Credit, Protecting Investors, Enforcing Contracts, and Closing a Business. For each of them different indexes are provided. Some indicators (like *Number of procedures to register a business* or *Index of employment law rigidity*) aim at measuring the effect of *actual* regulation on businesses, while others (such as *Time and cost to register a business, enforce a contract, or go through bankruptcy*) are measures of regulatory outcomes.

In the empirical exercise we will interpret the common language dummy, that captures cultural proximity and ease of communications, as a qualitative measure of similarity between economic environments, and the absolute value of the difference between regulation indexes as a measure of proximity more strictly related to the entrepreneurial environment. Of course, these measures are far from perfect. Ideally, one would like to have (time-varying) information on whether regulations are *qualitatively* different rather than just *quantitatively* different as, for example, two countries that require the same number of procedures to start up a business may demand to comply with very different tasks. However, since qualitative differences in regulations plausibly generate quantitative differences as well, these data should allow to capture, at least partially, the distance between entrepreneurial environments. One may still worry that biases arise if the distance between regulations proxies for factors that are not linked to the economic environment. For example, Latin countries may all tend to be more regulated than Anglo-Saxon countries for historical reasons. To deal with this, we add in the regression a set of area dummies, such as a "Latin country" dummy, a European Union dummy, a North American dummy and an Asian dummy.

We conduct the analysis on a final set of 24 OECD countries, listed in Table 1, for which we have data both on FDI stocks and regulation indexes. Table 2 shows the closest and farthest country pairs, by listing the top and bottom deciles of the average proximity distribution. Among the closest country pairs one finds not only the low-regulation Anglo-saxon countries, but also pairs of fairly regulated countries such as Portugal-Spain or Sweden-Germany. The farthest country pairs include, not surprisingly, the U.S. on the one side and the most regulated European countries, such as Italy, Greece, Portugal, Turkey and Poland, on the other side.

## 2.2 Empirical Model and Results

We estimate the following standard log-linear gravity model:

$$\ln F_{ijt} = \alpha_i + \eta_j + \tau_t + X_{ijt}\beta + \delta lang_{ij} + \gamma|reg_i - reg_j| + \ln \varepsilon_{ijt} \tag{1}$$

where $\ln F_{ijt}$ is the (log of) the stock of FDI in year $t$ from country $j$ (the source) to country $i$ (the host); $\alpha_i$ and $\eta_j$ are host and source countries fixed effects; $\tau_t$ is a year effect; the matrix $X_{ijt}$ includes variables, such as the (log of) the source and host countries GDPs per capita (in

US dollars); the (log of the) source and host countries populations; the (log of the) distance between the main cities of the two countries; dummies for country $i$ and $j$ sharing common land borders, for both countries belonging to the European Union; for both countries being located in North America; for both countries being located in Asia; for both countries being "Latin". These geographical variables capture the proximity-concentration trade-off (Brainard, 1997). The matrix $X_{ijt}$ also includes time-varying Product Market Regulation indexes (Conway et al., 2005) to control for the *levels* of regulation in both the host and the source country.

Thus, all specifications include (source and host country) fixed effects and control for the levels of regulation, GDPs per capita and populations in both countries. This makes us confident that we are correctly partialling out the effect of the regulation *levels* in both countries. Therefore, the coefficient $\gamma$ exclusively captures the effect on FDI of regulation proximity, as measured by the absolute value of the difference between regulation indexes, while the coefficient $\delta$ measures the impact of *cultural* proximity, as proxied by the dummy variable $lang_{ij}$ that takes the value of one if countries $i$ and $j$ share the same language.

Yet, the log-linear specification outlined in equation (1) may provide biased estimates if the variance of the *level* error term $\varepsilon_{ijt}$ is a function of the covariates (such as for example the distance between countries), because the expected value of the logarithm of a random variable depends both on the mean and on higher moments of the distribution. Additionally, the above log-linear specification forces us to drop all country pairs with zero bilateral FDI. To address these problems we generate additional results from the PPML model (available on-line in a separate appendix) that allows one to get consistent estimates in the presence of heteroskedasticity and provides a very natural way to deal with zeros of the dependent variable.

Before turning to the estimates, we provide a visual summary of the relationship between the distance in entrepreneurial environments and the stock of FDI. The top left panel in Figure 1 displays the difference between country $i$ and country $j$ indexes of *Product Market Regulation* on the horizontal axis and a non-parametric prediction of the mean stock of FDI from country $j$ to country $i$ on the vertical axis. The graph shows that a smaller difference between regulations is associated with larger bilateral FDI. The top right panel in Figure 1 displays the extent of *State Control over Business Enterprises* on the horizontal axis and, as before, the average stock of FDI on the vertical axis. Again, a smaller difference between regulations tends to be associated with larger bilateral FDI. Also the bottom panels in Figure 1 considering *Barriers to entrepreneurship* and *Barriers to Trade and Investment* provide strong visual evidence of an inverse U-shaped relationship between FDI and the distance between regulations.

The graphs in Figure 1 show that FDI does not flow from more regulated countries – where one would tend to think that the rewards from capital are low[9]– to less regulated economies, where one would tend to think that the rewards from capital are high. One explanation is that similarities between entrepreneurial environments foster FDI. An alternative explanation is that FDI takes place mostly among (rich) non-regulated countries and regulation proximity is simply capturing the effect of the *level* of regulation. To discern between these two explanations, we estimate equation (1) controlling for both the source and host country regulation *levels*. The

[9]Unless, of course, these are poor countries with high marginal productivity of capital. In this case we expect them to enjoy net FDI inflows. Our point is that, *in addition to this effect*, the flows seem to depend negatively on the regulatory *distance*.

formal analysis allows us to rule out the alternative explanation and largely bears out the impression given by the figures: more similar regulations foster FDI.

Table 3 presents the results from the estimation of equation (1) obtained exploiting the OECD regulation variables. Columns 1–9 report the results of nine alternative specifications that differ only in the measure of regulation proximity included on the right hand side. In column 1 we use the overall index of Product Market Regulation and, from column 2 to column 9, the sub-indexes that focus on particular dimensions of product market regulation. As our regulation variables are, in many cases, indexes with no natural scale, the magnitude of the coefficients would not be *per se* informative of the potential impact of regulation proximity on FDI. Therefore, the tables report "beta" coefficients, i.e. regression coefficients converted into units of sample standard deviations. This is equivalent to regressions where all variables are previously divided by their standard deviations.

The first row of table 3 reports the coefficients of the linguistic tie dummy. They are, as expected, positive and significant in all specifications and their magnitude is around 0.1. This means that, even after conditioning for all the relevant geographical and regulation variables, the stock of FDI from country $i$ to country $j$ is 10% larger if the two countries share the same language. The remaining rows of table 3 show the coefficients of the different indexes that measure the cross-country distances between regulations. Out of nine variables, seven turn out to be negative and significant at the conventional significance levels. The magnitude of the coefficients reported in table 3 suggests that regulation proximity has a non negligible impact on bilateral FDI stocks. For instance, a one standard deviation decline in the distance between *State Control*, i.e. a decline of 0.779, raises the stock of FDI by 0.048. In other words, if the distance between *State Control* regulations in France and Italy moved from the actual value of 1.3 to 0.5 (which is the actual distance between France and Austria), the stock of French FDI in Italy would increase on average by 4.8%

Tables 4-6 report the results from the estimation of equation (1) using the World Bank dataset. Again, the coefficient of the linguistic tie dummy is always positive and significant in all specifications, its value lying around 0.1. The coefficients of the regulation proximity indexes are all negative (except one) and typically significantly different from zero. In particular, Table 4 shows that the coefficients of the variables *Starting a Business* and *Hiring and Firing* are always negative and significant. Table 5 shows that a higher similarity in the regulations concerning *Property Registration* has a positive and significant effect on FDI. Consistently, the coefficients of the variables measuring the difference between credit systems are all negative and significant, except the *Cost to create collateral* which, though negative, is not significant. Finally, Table 6 shows that, while larger differences in the index of *Investor Protection* do not seem to matter, a larger distance in the procedures related to *Contract Enforcement* and to *Bankruptcy* procedures typically reduces FDI.

Results from the PPML model, available on-line in a separate appendix, confirm the existence of a negative relationship between the indexes of regulation proximity and FDI. Thus, the overall evidence suggests that, even after controlling for the levels of regulation in both countries, the distance between entrepreneurial environments has a negative bearing on FDI. In particular, sharing the same language and proximity in regulations concerning *Product Markets*, *Labor*

*Markets*, *Credit markets* and *Contract Enforcement* contribute to shape bilateral FDI. Notice that these regulations have to do with the way entrepreneurs have to set up firms.

The next section presents a simple general equilibrium model, consistent with the above empirical evidence, that allows us to study the distributional effects of globalization.

# 3 The Model

## 3.1 Demand and Production

There are two political entities (countries). In each of them agents have Dixit-Stiglitz preferences on the mass of products sold in their country. The demand for good $j$ is $x_j = Yp_j^{-\theta}$, where $Y$ stands for aggregate demand in the country, $\theta$ is the constant demand elasticity and $p_j$ is the price of the good. We normalize the price of the "aggregate" good in each country to 1. All goods are consumed in the country where they are produced.[10]

Agents choose to be either entrepreneurs or workers. Workers receive the current wage of their country. Entrepreneurs set up firms and face monopolistic competition. All firms produce with constant returns to scale using only labor according to the production function $x_j = 4\rho L$. The parameter $\rho$ is stochastic, and agents are heterogeneous because the stochastic distribution of $\rho$ is different across agents. Agents choose to be workers or entrepreneurs based on their knowledge of their distribution of $\rho$ and, if entrepreneurs, they maximize their expected profits based upon this knowledge. Assuming for the sake of simplicity that $\theta = 2$, the expected profits of entrepreneur $i$ can be written as: $E(\pi) = 2E^i\left(\rho^{\frac{1}{2}}\right)Y^{\frac{1}{2}}(L^i)^{\frac{1}{2}} - wL^i$. Optimally choosing the labor input $L^i$, the labor demand and profits of a single firm are $L^i = \left[E^i\left(\rho^{\frac{1}{2}}\right)\right]^2\frac{Y}{w^2}$ and $E^i[\pi] = \left[E^i\left(\rho^{\frac{1}{2}}\right)\right]^2\frac{Y}{w}$. Thus, on average, agents with higher expected $\rho$ set up more productive firms, hire more labor and earn higher profits.

## 3.2 Heterogeneity

We posit that agents are heterogeneous and differ in their ability to run businesses. Each agent faces a career choice. Agents choosing to become entrepreneurs set up a firm and produce a good that enters symmetrically in the utility function of consumers, generating the demand presented above. We assume that the "entrepreneurial ability" – the source of heterogeneity that determines career choices – affects the productivity parameter $\rho$.

The idea is that in the day-by-day running of the firm, entrepreneurs face options and have to take decisions. In order to take the right decision two types of abilities are required. The first is managerial talent: more talented entrepreneurs are better able to solve problems and therefore make larger profits. The second type of ability is related to the entrepreneurial environment. Given a certain level of managerial talent, entrepreneurs with a deeper knowledge of the entrepreneurial environment are able to take better decisions.

We model these two types of entrepreneurial abilities (talent and local knowledge) by as-

[10] See the working paper version (Pica and Rodríguez Mora, 2007) for an extension to a two-sector model, in a very similar setting, where a tradable good is produced by perfectly competitive firms. This allows multinational entrepreneurs to move foreign profits between countries.

suming that, in each period $t$, agents need to take two actions, $v_1$ and $v_2$. In each case the "right action" is a number in the real line: $r_t \in \mathbb{R}$ and $\mu_t \in \mathbb{R}$. Both $r_t$ and $\mu_t$ are random variables. Managerial talent produces more accurate guesses on $r_t$, while knowledge of the local environment improves predictions on $\mu_t$. We assume that the two decisions are independent (i.e, $r_t$ and $\mu_t$ are independently distributed) and that each requires a different type of ability, which is a useful analytical simplification.

Entrepreneurs do not know the precise value of $r_t$ and $\mu_t$ and take decisions based on their available information. The further away their action from the "right action", the lower the productivity of workers. That is, we take the productivity parameter $\rho$ to be: $\rho = e^{-(r_t - v_1)^2} e^{-(\mu_t - v_2)^2}$ and therefore $E\left(\rho^{\frac{1}{2}}\right) = E\left(e^{-\frac{1}{2}(r_t - v_1)^2}\right) \times E\left(e^{-\frac{1}{2}(\mu_t - v_2)^2}\right)$. We now specify the information set available to producers.

**Information on $r_t$.** We assume that all producers know that $r_t$ is a normally distributed random variable, with independent draws over time, that has a certain known mean (whose value is irrelevant) and variance $V_r$. In each period, before taking decisions, each entrepreneur receives an unbiased signal on $r_t$. The precision of the signal determines the ability of the entrepreneur.

If the precision of the signal received by the entrepreneur is $\tau$, the variance of the posterior is $\frac{1}{\frac{1}{V_r}+\tau}$ and the precision is $P_{v_1} = \frac{1}{V_r} + \tau$. Given that the optimal action is to choose $v_1$ equal to the expectation of $r_t$, it is clear that: $E\left(e^{-\frac{1}{2}(r_t - v_1)^2}\right) = \sqrt{\frac{P_{v_1}}{1+P_{v_1}}}$. The first type of heterogeneity derives from the fact that agents receive signals on $r_t$ with different levels of precision. More talented entrepreneurs receive signals with larger precision (lower variance) and they expect to take, on average, more correct decisions on $r_t$. Consequently, they expect to have on average more productive workers.

**Information on $\mu_t$.** Agents do not receive signals on the value of $\mu_t$. Rather, they know that it evolves according to the process: $\mu_t = \mu + u_t$, where $\mu$ is a *country-specific* constant and $u_t$ is an individual-specific white noise disturbance with zero mean and variance equal to $\sigma_u^2$. Agents take decisions before the realization of the shock $u_t$.

We assume that domestic and foreign producers differ in their knowledge on $\mu$ and, thus, in their ability to guess any specific $\mu_t$. Local producers *know* $\mu$, and therefore they are only left with the residual uncertainty implied by the presence of the shock $u_t$. Foreigners, instead, do not know the exact value of $\mu$ and have to learn it by observing its realizations over time. The first time they produce in the foreign country they have a prior on the value of $\mu$ with a certain precision $\frac{P_0}{\sigma_u^2}$. We assume that whenever they have a positive level of production they observe an additional realization of $\mu_t$, thus acquiring further information on the value of $\mu$. It follows that the precision of the conditional distribution of $\mu$ grows linearly with the stretch of time the foreign entrepreneur has been exposed to the domestic environment.[11] The precision of the prior on $\mu$ after having observed $t-1$ realizations of $\mu_t$ is $P_t = \frac{P_0}{\sigma_u^2} + \frac{t-1}{\sigma_u^2} = \frac{P_0+t-1}{\sigma_u^2}$, and the variance

[11] We assume that talent does not affect either the initial knowledge or the speed of learning. Allowing for such interactions would complicate the algebra without adding further insights, as all is needed is that heterogeneity has two dimensions: talent and location.

of the beliefs of such a foreign producer on $\mu_t$ is therefore $\frac{1}{P_t} + \sigma_u^2 = \sigma_u^2 \times \left(\frac{1}{P_0+t-1} + 1\right)$. Thus a foreign entrepreneur faces a more difficult problem than a domestic one. The variance that she faces is equal to the variance that a local entrepreneur faces ($\sigma_u^2$) times a term $\left(\frac{1}{P_0+t-1} + 1\right)$ which depends on the initial precision and on the length of the time period the entrepreneur has been operating abroad.[12]

The precision of the initial prior $P_0$ reflects the difference between entrepreneurial environments across the two countries. If there is no difference its value is infinite, and there is no difference between domestic and local entrepreneurs. The larger the difference, the less foreign entrepreneurs know about local conditions, and the smaller the precision of the prior of foreigners. Independently of the distance between entrepreneurial environments, the precision of foreign entrepreneurs on $\mu$ grows unboundedly as they keep spending time in the local market. Eventually, they learn everything and the difference with local entrepreneurs becomes trivial.[13] It is now useful to introduce the following definitions:

**Definition 1** *The "managerial talent" of an agent is defined as* $a = \frac{P_{v1}}{1+P_{v1}} \in [0,1]$. *The distribution of a across agents is determined by an exogenous CDF* $F(a)$.

**Definition 2** *The disadvantage of a foreign entrepreneur producing for the* $t^{th}$ *time in a foreign country is defined as* $b(t) = \frac{1+\sigma_u^2}{1+\sigma_u^2\left(1+\frac{1}{P_0+t-1}\right)} \in [0,1]$. *Notice that* $\lim_{t\to\infty} b(t) = 1$ *and* $\forall t$ $\lim_{P_0\to\infty} b(t) = 1$.

The expected productivities of local and foreign entrepreneurs with talent $a$ (the latter investing abroad for the $t^{th}$ time) are $\sqrt{a/(1+\sigma_u^2)}$ and $\sqrt{(ab(t))/(1+\sigma_u^2)}$. Assuming without loss of generality that $\sigma_u^2$ is equal to one, we now state the following result:

**Result 1** *An individual with talent a who sets up a firm in her country has expected profits and labor demand equal to* $E[\Pi(a)] = \frac{a}{2}\frac{Y}{w}$ *and* $L(a) = \frac{a}{2}\frac{Y}{w^2}$.

A corollary of Result 1 is that more productive firms earn higher profits and are larger than less productive ones. We will discuss the expected profits of foreign entrepreneurs in section 5. In order to have a suitable benchmark when we allow for cross-border activity, we now solve for the closed economy equilibrium.

# 4 Closed Economy Equilibrium

At the aggregate level the only relevant price is the wage rate. Given a certain wage, agents choose to become entrepreneurs if and only if:[14]

$$w \leq E[\pi(a)] \quad \Leftrightarrow \quad a \geq 2\frac{w^2}{Y} \equiv x \tag{2}$$

[12] To be precise, the initial precision is $\frac{P_0}{\sigma_u^2}$, but we parametrize it by $P_0$ only as we later set $\sigma_u^2$ equal to 1.

[13] Notice that there are no incentives either to enter into a market only to learn, or to produce a lot in order to learn faster. Learning is a byproduct of *being* in the market. It is not increasing with production, thus leaving no room to active learning strategies.

[14] We assume the existence of perfect capital markets, so that only expected profits are relevant.

where $x$ is defined as the threshold level of talent that induces an agent to become entrepreneur. It increases with the wage rate and decreases with aggregate income as $(i)$ higher wages make the option of being a worker more appealing and $(ii)$ higher wages and lower GDP make the option of being an entrepreneur less appealing.

Notice from Result 1 that labor demand depends only on $x$ (and on the entrepreneurial talent, of course). By definition labor supply is also determined by $x$. This is very convenient as it allows us to express the labor market equilibrium as a function of $x$, and not of $Y$ and $w$ separately. Effectively $x$ is akin to a price that reflects how hard it is to be an entrepreneur, as a higher level of $x$ means that the labor input becomes more expensive (relative to GDP). Thus, $x$ clears the labor market and determines the agents' career paths. Assuming a continuum of agents of mass one, and given a value of $x$, labor supply and demand are respectively:

$$L_S(x) = F(x) \tag{3}$$

$$L_D(x) = \int_x^1 \frac{a}{x} dF(a) \tag{4}$$

Labor supply is monotonically increasing in $x$; it equals 0 at $x = 0$ (labor being so cheap that everybody would rather be an entrepreneur) and approaches one as $x \to \infty$ (labor being so expensive that even the smartest agent prefers to be a worker). Labor demand is decreasing in $x$, equals zero if $x = 1$ (labor being so expensive that nobody wants to be an entrepreneur) and approaches $\infty$ as $x \to 0$.

Equilibrium in the economy is attained when $(i)$ career choices are optimally taken; $(ii)$ the labor market clears; and $(iii)$ aggregate demand equals aggregate income in the economy.

**Result 2** *Let $X^A$ be the unique solution of $L_S(x) = L_D(x)$. $X^A$ completely characterizes the closed economy equilibrium as the equilibrium aggregate income and wage are respectively:*

$$Y = 2 \int_{X^A}^1 \frac{a}{X^A} w dF(a) \tag{5}$$

*and*

$$w = \int_{X^A}^1 a dF(a) = \left[1 - F(X^A)\right] E\left(a \mid X^A < a\right) \tag{6}$$

The proof is straightforward, as the shapes of labor supply and demand described above guarantee that there exists a unique value $X^A$ that clears the labor market. In equilibrium, aggregate demand $Y$ equals total output, given by the sum of profits plus the wage bill. Taking into account the labor market clearing condition, this delivers equation (5). Finally, equation (6) is derived from equation (5) and the definition of $x$.

# 5 Open Economy

We now turn to a world where entrepreneurs are allowed to set up firms abroad.[15] We focus on "horizontal" FDI, i.e. on investments aiming at establishing production facilities in a foreign country in order to serve the local market by making use of the local workforce. In other words,

[15] We rule out trade. For a model where FDI and trade are substitutes see Helpman, Melitz and Yeaple (2003).

we restrict to goods that need to be produced in the same geographic location where they are consumed.[16]

In our setting, entrepreneurial ability is country-specific and, as we saw in section 3.2, foreign profits are a function of the amount of time spent abroad. Thus, the model acquires a truly dynamic structure. In order to obtain a non-degenerate steady state distribution of firms we assign to each individual an exogenous i.i.d. probability of dying equal to $(1-\beta)$ and assume the same birth rate in order to keep a constant population. Thus, in each period a proportion $(1-\beta)$ of the population randomly dies and is replaced by the same number of individuals. Each agent is born with a certain level of talent independently drawn from a certain distribution $F(a)$. As in Melitz (2003), we assume no time discounting beyond the probability of death. Thus, the discount factor equals the probability of survival $\beta$.

In addition, we assume that each foreign entrepreneur needs to hire one local manager. The local manager does not contribute to the local knowledge of the foreign-owned firm, but is nevertheless necessary for production.[17] It can be thought of as representing the need to overcome moral hazard and operational control issues that arise from physical distance. This assumption is needed to make the production technologies of the domestic and foreign production facilities symmetric, with one manager in each plant. This ensures that there are no increasing returns to scale generated by FDI. The expected profits and labor demand of the foreign firms are described next.

**Result 3** *Suppose that an individual with talent $a$ has been running a firm abroad for $t-1$ periods. The expected profits and labor demand of the foreign subsidiary at time $t$ are respectively:*

$$E[\Pi_f(ab(t))] = \frac{a}{2}b(t)\frac{Y}{w} - w = \left(\frac{ab(t)}{x} - 1\right)w \tag{7}$$

$$L_f(ab(t)) = \frac{a}{2}b(t)\frac{Y}{w^2} + 1 = \frac{ab(t)}{x} + 1 \tag{8}$$

In the following, we consider symmetric steady state equilibria in two countries that are identical in all respects except their entrepreneurial environments. They differ, but in no respect one is worse than the other; they are just different. As the difference between entrepreneurial environments is also symmetric, in steady state both countries will have the same aggregate income $Y$, wage $w$ and relative cost of labor $x$.

## 5.1 Career-path decisions

In steady state, the value of being a worker and the value of being a domestic entrepreneur are given by $W_w = \frac{w\beta}{1-\beta}$ and $W_d = \frac{w\beta}{1-\beta}\left(\frac{a}{x}\right)$. They equal, respectively, the expected present dis-

[16] We rule out both the licensing alternative (on this see Ethier (1986), Horstmann and Markusen (1987), and Ethier and Markusen (1996)) and "vertical" FDI, in which the production process is fragmented across countries (on this see Helpman (1984), Helpman (1985), Markusen (2002, Ch. 9)). There is a general consensus that the overwhelming proportion of FDI is horizontal rather than vertical.

[17] We could in principle allow foreign entrepreneurs to hire local managers to help them solving local problems. This would not change the results provided that the talent of the foreign entrepreneurs – and their knowledge of the local circumstances – still affects the productivity of the firm. This happens under reasonable assumptions. For instance, it happens in a world where the ability of the foreign entrepreneur contributes to the choice of the *quality* of the local manager. In any case, this would introduce an unnecessary level of complexity.

counted value of the future streams of wages and profits. The value of becoming a multinational entrepreneur and operating abroad for the rest of life is $W_f = \sum_{s=1}^{\infty} \beta^s \left( \frac{ab(s)}{x} - 1 \right) w$.

It is now convenient to define the degree of globalization as *the weighted average of the disadvantage of being a foreigner*, with weights reflecting the point of view of an individual who survives and discounts the future with probability $\beta$.

**Definition 3** *The degree of globalization, i.e. the inverse of the distance between countries, is measured by* $c \equiv \sum_{s=1}^{\infty} \frac{\beta^s}{\sum_{s=1}^{\infty} \beta^s} b(s) \in [0, 1]$.

If two countries are identical $P_0 \to \infty$ and $c \to 1$, with $c$ monotonously increasing in $P_0$ (see Definition 2).[18] In our comparative statics exercise we will look at the effects of an exogenous increase in globalization, represented by an increase of $c$.

We can now rewrite $W_f$ as $W_f = \frac{w\beta}{1-\beta} \left( c\frac{a}{x} - 1 \right)$ and notice that if an agent chooses to become a domestic entrepreneur she loses the option to be a worker. Thus, the condition to be a domestic entrepreneur is $W_d \geq W_w$, while the condition to become a foreign entrepreneur (where there is no such an opportunity cost) is simply $W_f \geq 0$.

Two additional remarks are in order. First, if an agent chooses to become a multinational entrepreneur, she will remain so the rest of her life (as $b(t)$ increases monotonously over time). Second, no agent chooses to be an entrepreneur abroad but not at home (as $W_f \geq 0 \Rightarrow W_d \geq W_w$). From these observations, the next result follows:

**Result 4** *Career-path decisions are determined by talent* $a$*, globalization* $c$*, and the endogenous variables* $Y$ *and* $w$ *summarized by* $x$*:*

- *An agent is a worker only if* $a \leq x$*, with* $W_w = \frac{w\beta}{1-\beta}$.
- *An agent is a domestic entrepreneur if* $x \leq a \leq \frac{x}{c}$*, with* $W_d = \frac{w\beta}{1-\beta} \left( \frac{a}{x} \right)$.
- *An agent is a multinational entrepreneur only if* $\frac{x}{c} \leq a$*, with* $W_d + W_f = \frac{w\beta}{1-\beta} \left[ \frac{a}{x} + \left( c\frac{a}{x} - 1 \right) \right]$.

Result 4 implies that agents self-select into the different career paths in a way that is consistent with the empirical evidence on the cross-sectional distribution of firm-size and productivity across domestic and foreign-owned firms. In particular, in the model only the largest and most efficient domestic firms open foreign subsidiaries. The empirical evidence indeed shows that the home activities of multinational firms are in general larger and more productive than national firms with no foreign subsidiaries.[19] Additionally, in the model foreign subsidiaries are larger (and more productive) the larger the home activities of the multinational firm and the longer they have been operating abroad.[20]

## 5.2 Equilibrium

**Labor market.** In each country, the aggregate labor supply is given by the number of individuals who choose not to be entrepreneurs. Thus, as in the closed economy case, $L_S(x) = F(x)$.

[18] The lowest value of $c$ is actually $\sum_{s=1}^{\infty} \frac{\beta^s}{\sum_{s=1}^{\infty} \beta^s}$ which approaches zero only as $\beta \to 0$.

[19] See Helpman et al. (2003) and Barba Navaretti and Castellani (2003).

[20] Griffith and Simpson (2001) show that in the U.K. foreign-owned establishments improve their productivity faster with age than U.K.-owned establishments.

The aggregate labor demand is the sum of the demand for labor generated by domestic entrepreneurs and foreign entrepreneurs. Notice that in the determination of the foreign labor demand, each generation of foreign entrepreneurs has initial size $1-\beta$ (the agents' birth rate), and in each period only a fraction $\beta$ survives. Given that the individual discount rate and the survival rate coincide,[21] from Result 4 and equation (8), the domestic and foreign labor demand are respectively:

$$L_D^d(x) = \int_x^1 \frac{a}{x} dF(a) \tag{9}$$

$$L_D^f(x) = \begin{cases} \left(1 - F\left(\frac{x}{c}\right)\right) + c\int_{\frac{x}{c}}^1 \frac{a}{x} dF(a) & \text{If } x \leq c \\ 0 & \text{If } c \leq x \end{cases} \tag{10}$$

Both the labor supply and the domestic labor demand are as in the closed economy case. However, now foreign producers demand labor too. Their demand is decreasing in $x$, approaches infinity as $x$ approaches zero, and is zero if $x \geq c$.

**Result 5** *There exist two functions $x(c)$ and $z(c)$ determining the threshold levels of talent needed to become a domestic entrepreneur and to operate a foreign subsidiary, respectively:*

$$x(c) : [0,1] \to [0,1], \qquad x(c) = \begin{cases} X^A & \text{if } c \leq X^A \\ \hat{x}(c) & \text{if } X^A \leq c \end{cases}$$

*where $\hat{x}(c)$ is the (unique) solution of $x$ to:*

$$1 = [1 - F(x)] + \int_x^1 \frac{a}{x} dF(a) + \left[1 - F\left(\frac{x}{c}\right)\right] + \int_{\frac{x}{c}}^1 \frac{a}{\frac{x}{c}} dF(a) \tag{11}$$

*and:*

$$z(c) : [0,1] \to [0,1], \qquad z(c) = \begin{cases} 1 & \text{if } c \leq X^A \\ \frac{x(c)}{c} & \text{if } X^A \leq c \end{cases}$$

Equation (11) simply states that labor supply equals total labor demand (domestic plus foreign). To understand the intuition behind Result 5, notice that no individual chooses to set up a firm abroad if $c < x \Leftrightarrow 1 < z(c)$. Thus, if there are large differences between entrepreneurial environments, i.e. if $c < x$, the total labor demand just equals the domestic labor demand (see figure 2(a)). Thus, not surprisingly, for relatively high learning costs (where relatively high means precisely that $c < X^A$), the economy is *de facto* in autarchy and $x(c) = X^A$.

[21] As in all overlapping generations models, if there was individual discounting beyond the survival rate, the sum across people of the size of the cohort after $s$ periods in the foreign market would differ from the individual discount factor of that period. The model in such a case would *not* be intractable, but it would be difficult to define globalization, as there would be a further factor in the demand for labor. Globalization, as it is now, weights the disadvantage of being a foreigner from the point of view of the individuals. In the other case, the weights would depend on the cohort size. If the subjective discount was $\beta$ and the survival rate was $\lambda$, the value of the average from the point of view of the individual (that, thus, determines the productivity thresholds) would be $c \equiv \sum_{s=1}^{\infty} \frac{\beta^s \lambda^s}{\sum_{s=1}^{\infty} \beta^s \lambda^s} b(s)$, while the value of the average appearing in the total labor demand of foreign entrepreneurs would be $\hat{c} \equiv \sum_{s=1}^{\infty} \frac{\lambda^s}{\sum_{s=1}^{\infty} \lambda^s} b(s)$. The effects of an increase of $P_0$ would differ in the two cases, as the weight given to any point in the future differs in the two cases. While the algebra would be substantially more involved, no deeper insights would be gained.

Differently, if the degree of globalization is large enough, i.e. if $X^A < c$, the demand for labor is, in the relevant range, the sum of both the domestic and foreign demand, as shown in figure 2(b). In this case, in equilibrium, both domestic and foreign entrepreneurs hire labor in the domestic country. Therefore, the aggregate labor demand is larger than in autarchy. As the supply of labor is not affected by the possibility of cross-border investments, in any equilibrium with multinational entrepreneurs labor is relatively more expensive ($X^A < x(c)$) and the number of workers (entrepreneurs) is larger (smaller) than in autarchy.[22]

**Goods market.** In equilibrium, the income generated in each country (independently of the earner's nationality) has to be equal to total production. Taking into account the definition of $x$ in (2) and the definition of $z(c) \equiv \frac{x(c)}{c}$, the following Result holds:

**Result 6** *Given $x(c)$ and $z(c)$, the equilibrium wage and aggregate income are respectively:*

$$w(c) : [0,1] \to \mathbb{R}, \quad w(c) = [1 - F(x(c))]\, E(a \mid x(c) < a) + c\,[1 - F(z(c))]\, E(a \mid z(c) < a) \quad (12)$$

$$Y(c) : [0,1] \to \mathbb{R}, \quad Y(c) = 2w(c) \left[ \int_{x(c)}^{1} \frac{a}{x(c)} dF(a) + \int_{z(c)}^{1} \frac{a}{z(c)} dF(a) \right] \quad (13)$$

This completely characterizes the steady state as a function of $c$. Notice that the wage, in equation (12), is a weighted sum of the average productivities of domestic and foreign entrepreneurs, the weights reflecting the proportion of each group.

Before moving to the comparative statics exercise, it is useful to determine the steady state value of an agent with talent $a$ as a function of $c$. In order to do that, it is convenient to first define the following two functions:

**Definition 4** $\theta(c) : [0,1] \to \mathbb{R}, \quad \theta(c) = \frac{w(c)}{x(c)} = \frac{Y(c)}{2w(c)}$.

$\theta(c)$ determines the profits obtained in the domestic market "per unit of talent". In other words, the expected operating profit of domestic entrepreneurs with talent $a$ is $\theta(c) \times a$.

**Definition 5** $\phi(c) : [0,1] \to \mathbb{R}, \quad \phi(c) = \frac{w(c)}{z(c)} = c\,\theta(c)$.

$\phi(c)$ determines the profits (gross of the fixed cost) obtained in the foreign market "per unit of talent". Thus, the expected net operating profit of foreign entrepreneurs with talent $a$ is: $\phi(c) \times a - w(c)$.

**Result 7** *Given that $W_w(c)$, $W_d(c|a)$ and $W_f(c|a)$ denote the value of a worker, of a domestic firm and of a foreign firm as a function of c, for a given level of talent (a) of the entrepreneur, the value of an individual with talent a is the following function $V(c|a) : [0,1] \to \mathbb{R}$:*

$$\begin{aligned} V(c|a) &= \max\{W_w(c), W_d(c|a), W_d(c|a) + W_f(c|a)\} \\ &= \begin{cases} W_w(c) = \frac{\beta}{1-\beta} w(c) & \text{If } a \le x(c) \\ W_d(c|a) = \frac{\beta}{1-\beta} a\theta(c) & \text{If } x(c) \le a \le z(c) \\ W_d(c|a) + W_f(c|a) = \frac{\beta}{1-\beta}\left[a(\phi(c) + \theta(c)) - w(c)\right] & \text{If } z(c) \le a \end{cases} \end{aligned}$$

[22] The fact that in each country the mass of entrepreneurs becomes smaller does not mean that the number of firms that operate in each country is smaller, as both domestic and foreign firms are active. Actually, the mass of products will typically increase. Section 6.1 discusses this issue further.

Result 7 summarizes the results obtained so far pinning down the value function of a generic individual with talent $a$ as a function of the degree of globalization $c$. This will be useful in the next section where we analyze the welfare effects of globalization.

# 6 The Effects of Globalization

In this section we analyze the implications of the model concerning the effects of globalization on the distribution and the level of income. We compare how individuals with different values of $a$ fare in the steady states of worlds characterized by different values of $c$.[23]

## 6.1 Effects on the Thresholds of Talent, GDP and Wages

From figures 2(a) and 2(b) it is clear that $x(c)$ is an increasing function. Given that the elasticity of $x(c)$ is smaller than one, the threshold to become a foreign entrepreneur $z(c)$ is a decreasing function of $c$. In words, two different effects take place when the entrepreneurial environments become more similar. On the one hand the average local firm becomes more productive, as the least talented entrepreneurs become workers. On the other hand the threshold to become a foreign entrepreneur decreases, and relatively less talented agents opt to open subsidiaries abroad. Formally:

**Result 8** $\forall c \geq X^A \Rightarrow \left\{ \frac{dx(c)}{dc} \frac{c}{x(c)} \in (0,1) \right\}$ *and* $\left\{ \frac{dz(c)}{dc} \frac{c}{z(c)} = \frac{dx(c)}{dc} \frac{c}{x(c)} - 1 \in (-1,0) \right\}$.

It is now convenient to characterize a fully integrated world in which the countries have exactly the same entrepreneurial environment, i.e. $c = 1$. This is not equivalent to a single double-sized economy, because in the two-country integrated world setting up a production activity requires a manager in each location. Thus, there are no increasing returns generated by FDI.

**Definition 6** *Call $X^I$ the threshold to become domestic entrepreneur in the fully integrated economy with $c = 1$. Then, $z(1) = x(1) = X^I$, where $X^I$ is the (unique) value such that:*

$$1 = \left[1 - F(X^I)\right] + \int_{X^I}^{1} \frac{a}{X^I} dF(a) + \left[1 - F\left(X^I\right)\right] + \int_{X^I}^{1} \frac{a}{X^I} dF(a) \tag{14}$$

Notice in figure 3 that as $c$ moves from $X^A$ to 1, the threshold to become domestic entrepreneur $x(c)$ increases monotonically from $X^A$ to $X^I$, while the threshold to engage in FDI $z(c)$ decreases from 1 to $X^I$. This implies that $X^A < X^I$ for all $c < 1$.

Combining Results 7 and 8 we can now characterize the value function of each agent.

[23] The proofs of the results contained in this section are offered in a separate appendix available on-line.

**Result 9** *The career paths and value functions of the agents are as follows:*

$$a \leq X^A \quad \Rightarrow V(c|a) = W_w(c) \qquad \forall c$$

$$X^A \leq a \leq X^I \quad \Rightarrow V(c|a) = \begin{cases} W_d(c|a) & \text{If } X^A \leq c \leq x^{-1}(a) \\ W_w(c) & \text{If } x^{-1}(a) \leq c \leq 1 \end{cases}$$

$$X^I \leq a \leq 1 \quad \Rightarrow V(c|a) = \begin{cases} W_d(c|a) & \text{If } X^A \leq c \leq z^{-1}(a) \\ W_d(c|a) + W_f(c|a) & \text{If } z^{-1}(a) \leq c \leq 1 \end{cases}$$

Result 9 implies that the agents can be categorized into three types according to how their career paths depend on the degree of globalization. This classification will prove helpful later on in the analysis of the distributional effects of globalization as individuals in different categories are affected by globalization in ways that are qualitatively different.

1. Individuals with a low level of talent ($a < X^A$) always choose to be workers.

2. Individuals with an intermediate level of talent ($X^A \leq a \leq X^I$) choose to be domestic entrepreneurs if the degree of globalization is *low* enough ($c$ smaller than $x^{-1}(a)$) and workers otherwise. The reason is that globalization raises wages making the worker option more attractive, and shrinks domestic profits making the entrepreneurial career less attractive. Agents within this group never consider opening a foreign subsidiary.

3. Individuals with a high level of talent ($X^I \leq a \leq 1$) choose to be entrepreneurs even in a fully integrated economy. Their dilemma is whether to run or not a foreign subsidiary. They do so if the degree of globalization is *large* enough ($c$ larger than $z^{-1}(a)$).

In the model more similar entrepreneurial environments expose low-productivity domestic entrepreneurs to competition from highly-talented foreign entrepreneurs. As a response, they either become workers or produce less because of the higher wages due to the higher labor demand. This improved allocation of talent results in higher aggregate output, wages and productivity:

**Result 10** *The steady state values of wages and output are larger the smaller the entrepreneurial distance between countries, i.e.* $\frac{dw(c)}{dc} \geq 0$ *and* $\frac{dY(c)}{dc} \geq 0$.

Thus, if it was possible to redistribute at no cost, globalization would be Pareto improving. There are nevertheless distributional aspects to the story, to which we now turn.

### 6.2 Effects on Domestic and Foreign Profits

Higher wages are good news to workers but cannot be good news to entrepreneurs. Indeed, the increase in labor demand that pushes wages up has a first order negative effect on the income of domestic entrepreneurs. However, in our imperfectly competitive setting, globalization also generates a positive aggregate demand externality, i.e. a (second order) positive effect on firms profits *via* higher aggregate demand (see Result 10). In general, the magnitude of this

second effect depends on the shape of the distribution of talents, which determines both how many domestic entrepreneurs become workers after an increase in globalization and the market shares of the entrepreneurs. Thus, in order to establish results on the distributional effects of globalization we need to impose restrictions on the distribution of talent. We will assume that the distribution of talents is such that the following property holds:

**Property 1 (Non-Decreasing Mass of Talent.)** *We assume that* $f(a)$ *is such that* $\frac{d\{af(a)\}}{da} = f(a) + af'(a) \geq 0$ *for all* $a \in [X^A, 1]$.

This property simply states that the total "mass of talent" does not decrease as the level of talent increases. It holds in the whole family of Pareto distributions, which includes the uniform, and it even holds if the marginal is decreasing. We can now prove the following result:

**Result 11** *If property 1 holds, an increase in the degree of globalization reduces the steady state profits per unit of talent of domestic entrepreneurs, i.e.* $\frac{d\theta(c)}{dc} \leq 0$*, and increases the total number of entrepreneurs (domestic and foreign) in the market, i.e.* $\frac{d(1-F(x)+1-F(z))}{dc} \geq 0$.

Result 11 implies that, as globalization rises, wages grow faster than GDP. Thus, domestic firms make lower profits per unit of talent.[24] Foreign profits are also negatively affected by higher wages. However, the reduction in the learning cost is a first order effect in the opposite direction. As the latter effect dominates, foreign profits are increasing in the degree of globalization:

**Result 12** *The steady state operating profit (gross of the fixed cost) of foreign subsidiaries* $\phi(c)$ *increases with globalization:* $\frac{d\phi(c)}{dc} \geq 0$*. Moreover, for highly-talented individuals who own a foreign subsidiary, an increase in* $c$ *increases the net profit obtained from foreign subsidiaries, i.e.* $\frac{dW_f(c|a)}{dc} = a\frac{d\phi(c)}{dc} - \frac{dw(c)}{dc} \geq 0$ *if* $a \geq z(c)$.

Results on $\theta(c)$, $\phi(c)$ and $w(c)$ are summarized in figure 4. Notice that given a certain level of talent $a$, the value of being a worker is $w(c)$, the value of being a domestic entrepreneur is $a \times \theta(c)$ (which is strictly decreasing in $c$ and increasing in $a$), and the value of running a foreign subsidiary is $a \times \phi(c) - w(c)$ (which from Result 12 is increasing in both $a$ and $c$ for all individuals that indeed choose to run a foreign subsidiary). Thus, a marginal increase in globalization increases the value of being a worker, decreases the value of a domestic firm and increases the value of a foreign subsidiary (at least for those who choose to run one).

Summing up, we have established that domestic entrepreneurs dislike a marginal increase in globalization while workers enjoy it. Owners of foreign subsidiaries have mixed feelings about it, as a marginal increase in globalization raises profits abroad while reducing profits at home. Yet, in the model professional careers are endogenous. The next section determines the distributional effects of globalization as a function of the exogenous characteristic of the agents, their talent, rather than as a function of their endogenous profession.

### 6.3 The Distributional Effects of Globalization

We first determine the effects of globalization on the relative well-being of the individuals (section 6.3.1) and then identify winners and losers from globalization in absolute terms (section 6.3.2).

[24] If property 1 does not hold, the number of entrepreneurs may decrease as a consequence of an increase in $c$. The profits of the domestic firms could, then, in principle even go up in spite of the higher wages, as there would be a smaller mass of entrepreneurs sharing a larger cake (Result 10 states that $Y$ always increases with $c$).

### 6.3.1 Globalization and the Distribution of Income

Globalization raises the wage rate, thus favoring workers, and reduces the operating profits per unit of talent ($\theta$) of domestic firms, thus harming domestic entrepreneurs. Workers' income must therefore improve relative to the income of the domestic entrepreneurs and the difference between middle- and low-income agents must decrease. Moreover, as globalization increases, domestic entrepreneurs only suffer from the fall in domestic profits, while multinational entrepreneurs also enjoy higher foreign profits. Thus, the well-being of multinational entrepreneurs always improves vis-a-vis domestic entrepreneurs. Formally:

**Result 13** *The ratio of the value of being a worker to the value of being a domestic entrepreneur, given by* $\frac{W_w(c)}{W_d(c|a)} = \frac{x(c)}{a}$*, is monotonously increasing in c, i.e.* $\frac{d\frac{W_w(c)}{W_d(c|a)}}{dc} \geq 0$.

**Result 14** *The ratio of the value of being a domestic entrepreneur with talent a to the value of being a multinational entrepreneur with talent* $\tilde{a}$*, given by* $\frac{W_d(c|a)}{W_d(c|\tilde{a})+W_f(c|\tilde{a})} = \frac{a}{\tilde{a}(1+c)-x}$*, is decreasing in c, i.e.* $\frac{d\frac{W_d(c|a)}{W_d(c|\tilde{a})+W_f(c|\tilde{a})}}{dc} = -\frac{a\left(\tilde{a}-z(c)\frac{dx/x}{dc/c}\right)}{(\tilde{a}(1+c)-x)^2} \leq 0$.

Using result 9, it is straightforward to express the previous results in terms of talent instead than in terms of professions:

**Result 15** *Any increase in globalization produces a decrease in lower tail inequality and an increase in upper tail inequality:*

$$\forall a, \tilde{a}: \quad a < \tilde{a} < X^I \quad \Longrightarrow \quad \frac{d\frac{V(a|c)}{V(\tilde{a}|c)}}{dc} \geq 0 \tag{15}$$

$$\forall a, \tilde{a}: \quad X^I < a < \tilde{a} \text{ and } a < z(c) \quad \Longrightarrow \quad \frac{d\frac{V(a|c)}{V(\tilde{a}|c)}}{dc} \leq 0 \tag{16}$$

Thus, globalization implies a squeezing of the middle-class, which loses relatively to both low- and high-income agents. The reason is that globalization affects different agents in different ways.

Agents with talent below $X^I$ never operate abroad. The least talented ($a < X^A$) always choose to be workers, and benefit from an increase in globalization. Those with higher talent choose to be workers only if globalization is large enough, and are domestic entrepreneurs otherwise.[25] While entrepreneurial income is proportional to talent, wages are not. Additionally, an increase in globalization makes entrepreneurial income less sensitive to talent (due to the decrease in $\theta$), while wages increase. Thus, globalization reduces the dispersion of income within this group of individuals.

Agents with talent above $X^I$ are always entrepreneurs and have to decide whether to open a foreign subsidiary or not. Those who do not do so undoubtedly lose from globalization, as domestic profits fall. For those who do have a foreign subsidiary globalization has the redeeming property of increasing foreign profits. Thus, globalization necessarily increases the dispersion of income within the group.[26]

[25] In a fully globalized world all agents with talent below $X^I$ are workers.

[26] What complicates matters slightly is that it is not clear what are the effects of globalization on the dispersion of income within the group of agents who operate abroad (notice the qualification in equation (16) that $a < z(c)$).

Thus, the model predicts that an increase in globalization results in a decrease of "lower tail inequality" along with an increase in "upper tail inequality". This is consistent with recent empirical work that shows evidence of increased compression at the bottom of the income distribution and increased dispersion at the top of the income distribution. For instance, Autor et al. (2005), Autor et al. (2006) and Machin and Van Reenen (2007) document that since the 1990's the ratio between the income of the 90th and 50th percentiles ("upper tail inequality") has increased and the ratio of the 50 to 10 percentiles ("lower tail inequality") has decreased in both the US and the UK.

### 6.3.2 Winners and Losers in Absolute Terms

In order to determine who wins and who loses in absolute terms it is useful to refer back to the 3-type classification of the agents outlined in Result 9 at page 17. In a separate appendix available on-line we provide the specific value function for all agents as a function of $c$.

**(1)** Individuals with little talent ($a < X^A$) have a monotonously increasing value function. They always enjoy more globalization, as they are always workers and the demand for their labor services increases when the entrepreneurial environments become more similar.

**(2)** Individuals with an intermediate level of talent ($X^A \leq a \leq X^I$) have a U-shaped value function that achieves a minimum at $c = x^{-1}(a)$, the value of $c$ at which they become workers. Not all of them fare in the same manner after an increase in globalization, though. Those with talent $a = X^A$ are indifferent between career paths in the closed economy and are therefore better off after any increase of $c$ above $X^A$. At the other extreme, individuals with $a = X^I$ are always worse off, as they are always domestic entrepreneurs and never invest abroad. Thus, the agents in this range win or lose from an increase in globalization depending on both the initial and final level of globalization and their own level of talent. Formally:

**Result 16** *Consider two degrees of globalization $c_l$ and $c_h$, with $X^A \leq c_l < c_h \leq 1$. Notice that $X^A \leq x(c_l) < x(c_h) \leq X^I$. Then, there exists a level of talent $a^* = \frac{w(c_h)}{\theta(c_l)}$ such that $x(c_l) < a^* < x(c_h)$ and:*

$$\forall a \in [X^A, X^I] \rightarrow \begin{cases} \text{If } X^A \leq a < a^* & \Rightarrow V(c_l|a) < V(c_h|a) \\ \text{If } a = a^* & \Rightarrow V(c_l|a) = V(c_h|a) \\ \text{If } a^* \leq a < X^I & \Rightarrow V(c_l|a) > V(c_h|a) \end{cases}$$

Within this group, high-ability individuals lose from increased globalization, while low-ability ones win. After an increase in $c$ average income and wages are larger, but the individuals who used to have a valuable asset (their knowledge of the local economy) have (partially) lost it. This knowledge was more valuable the larger the level of talent. In particular, those with relatively large talent, i.e. those with $a \in (a^*, X^I]$, suffer a loss larger than any possible redeeming gain obtained becoming workers. Thus, the agents whose income in an environment with low globalization was not much higher than the wage win from an increase in $c$, because they join the working class and take advantage of the general wage increase. Individuals who were

This is because the fixed cost of operating abroad ($w$) increases with globalization, so that even if operating profits increase globalization may end up compressing the incomes of multinational entrepreneurs. If there was no fixed cost their income would be proportional to their talent, and their ratio would be left unchanged by globalization.

substantially better off than workers are bound to lose from an increase in $c$, even if they end up joining the working class.[27]

**(3)** Agents in the high-talent group ($a > X^I$) are always domestic entrepreneurs, and all run a domestic firm whose profits decrease with globalization. Depending on the degree of globalization, they may choose to run a firm in the foreign country as well, whose profits are instead increasing in the degree of globalization. Thus, highly talented agents gain from an increase in globalization only if the foreign gains are larger than the domestic losses.

Clearly, this cannot be the case for the agents with a relatively low level of talent, as the level of their foreign operations is either small or zero. Even if they choose to run a firm abroad in the more globalized universe, these agents prefer to live in a world with a lower degree of globalization in which they are not active abroad. Formally:

**Result 17** *Consider two degrees of globalization $c_l$ and $c_h$, with $X^A \leq c_l < c_h \leq 1$. Notice that $X^I \leq z(c_h) < z(c_l) \leq 1$. Then, there exists a level of talent $a^*$ such that $z(c_h) < a^*$ and $\forall a \in [X^I, a^*) \Rightarrow V(c_l|a) > V(c_h|a)$.*

Thus, other than workers, only the agents at the very top of the distribution *may* win from globalization. This is because the benefits from an increase in $c$ are larger the larger the size of the foreign subsidiary, which is in turn increasing in talent.

However, without additional restrictions on the distribution of talents it is not possible to establish whether the domestic losses of the most talented agents are smaller or larger than their foreign gains, and therefore whether they win or lose from an increase in globalization. The net outcome can in principle go either ways.[28] In a separate appendix available on-line, we show that if talent is uniformly distributed the gains from foreign subsidiaries are always larger than the losses of domestic firms.[29] In this case the most talented agents are net winners from globalization.

**Result 18** *Consider two degrees of globalization $c_l$ to $c_h$, with $X^A \leq c_l < c_h \leq 1$. Notice that $X^I \leq z(c_h) < z(c_l) \leq 1$. Assume further, that the distribution of talent $F(a)$ is such that $\frac{d(W_d+W_f)}{dc} > 0$ (a sufficient condition is $F(\cdot)$ being uniform). Then, there exists a level of talent $a^*$ such that $z(c_h) < a^* < 1$ and:*

$$\begin{aligned} \forall a \in [X^I, a^*) &\Rightarrow V(c_l|a) > V(c_h|a) \\ \textit{If } a = a^* &\Rightarrow V(c_l|a) = V(c_h|a) \\ \forall a \in (a^*, 1] &\Rightarrow V(c_l|a) < V(c_h|a) \end{aligned}$$

Under the above restrictions on the distribution of talent, the most talented agents enjoy foreign gains that outweigh domestic losses. Thus, the value of being a multinational entrepreneur

[27] Not all the individuals who end up being workers when globalization is high (i.e. when $c = c_h$) prefer the more open world: in particular, the individuals with $a \in \left(a^*, x^{-1}(c_h)\right)$ choose to be workers in the globalized world, but would rather live in the less globalized world and be domestic entrepreneurs.

[28] If the net outcome is negative $a^*$ in Result 17 is equal to one, and all the high-ability agents suffer from an increase of $c$. *Even in this case, however, their losses would always be smaller than the losses suffered by less talented agents who do not invest abroad.*

[29] The uniform assumption is a sufficient, but by no means necessary, condition. In numerical experiments with two countries, we found no combination of parameters where the total profits of multinational entrepreneurs are decreasing in the degree of globalization. Nevertheless we could not prove the generality of this result.

$(W_d + W_f)$ is increasing and the value function of the agents with $a \geq X^I$ is U-shaped in the degree of globalization. This happens not because at some point agents become workers, but because at some point ($c = z^{-1}(a)$) they start enjoying foreign profits.

Summarizing, an increase in globalization **(1)** benefits agents with low levels of talent; **(2)** makes individuals with intermediate talent levels (with talent between the thresholds established in results 16 and 17) worse off; and **(3)** typically benefits the most talented agents. Thus, globalization induces a squeezing of the middle class in absolute, and not only in relative, terms.

# 7 Concluding remarks

This paper first presents empirical evidence on the positive effect of cross-country proximity in "entrepreneurial environments" on bilateral FDI. By exploiting the *OECD International Direct Investment Statistics* and data on nationwide regulation levels from the OECD and the World Bank, we find evidence that larger similarities in the economic environment tend to be associated with larger bilateral FDI, after controlling for the *levels* of regulation in both countries, for countries fixed effects and for time effects.

Motivated by this evidence, we build a general equilibrium model that allows us to study the distributional effects of globalization. In the model, agents are heterogeneous and differ both in their ability to be entrepreneurs and their nationality. Entrepreneurs *may* set up a firm abroad, i.e. engage in FDI. If they do so, they incur in the additional cost of *learning* how the foreign environment works. In this framework, globalization fosters FDI and improves the allocation of talents in the economy boosting wages, output, and productivity. However, not everybody wins. Low-ability agents always gain, as the demand for their labor services increases. Individuals in the middle of the distribution are always worse-off: they lose a valuable asset (exclusive knowledge of the local economy) without gaining anything, as they are not able to compete with high-ability agents in a globalized world. High-ability individuals typically win, and their relative position vis-à-vis the middle-income individuals always improves. Even though they pay higher wages, they reap the benefits of accessing to larger markets: they lose on one asset (knowledge of the local economy) but gain on a second one (cheaper access to the foreign economy).

Thus, consistently with recent empirical evidence, the model predicts globalization to have a U-shaped effect on the distribution of income, worsening the situation of the middle class vis-à-vis the top and the bottom of the distribution.

We leave a number of interesting questions for future research. First, the model suggests that the dynamics of globalization are interesting *per se*. Figure 3 implies that the opposition to a marginal increase in globalization is smaller the larger the level of globalization, suggesting that the number of opponents should decrease over time, as more and more individuals benefit from globalization by either becoming workers or starting to invest abroad. This question is best addressed looking at the transitional dynamics of a full-blown dynamic model. Second, the model may be extended to endogenize the proximity between economic environments in order to analyze the process of nation-building that derives from the fragmentation of a larger unit. We intend to explore these issues both at the empirical and the theoretical level.

# 8 Acknowledgements

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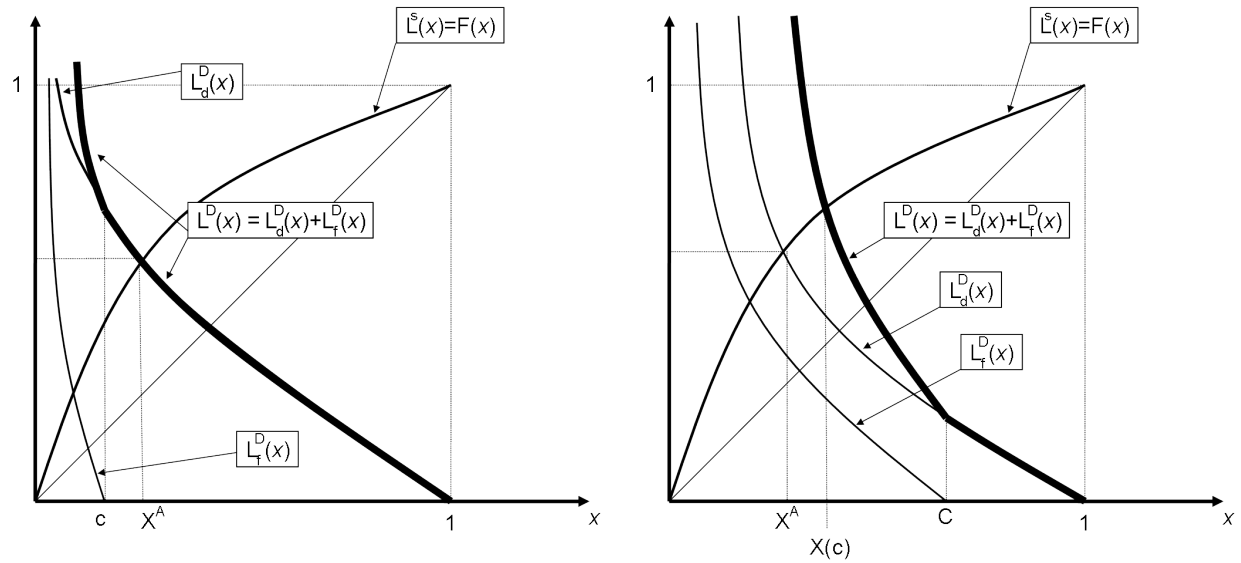
Figure 1: Vertical axis: non parametric prediction from a weighted local linear regression smoother with bandwidth 0.8 of the stock of FDI from country $j$ to country $i$ in years 1981-2002. Horizontal axis: regulatory distance between country $i$ and $j$.




(a) Equilibrium if $c < X^A$

(b) Equilibrium if $X^A < c$

Figure 2: Equilibrium for large (panel 2(a)) and small (panel 2(b)) entrepreneurial distances. In 2(a) the distance between countries is so large ($c < X^A$) that there are no FDI: $x(c) = X^A$. In 2(b) globalization is large enough ($X^A < c$) to allow for FDI: $x(c) > X^A$.

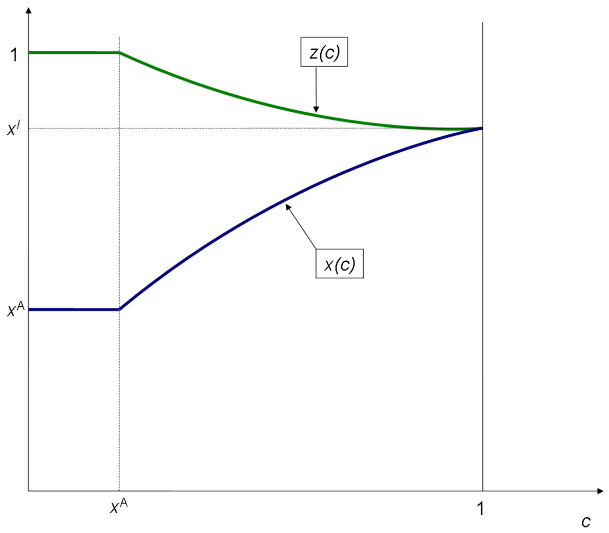



Figure 3: Productivity thresholds for domestic and foreign entrepreneurs as a function of $c$

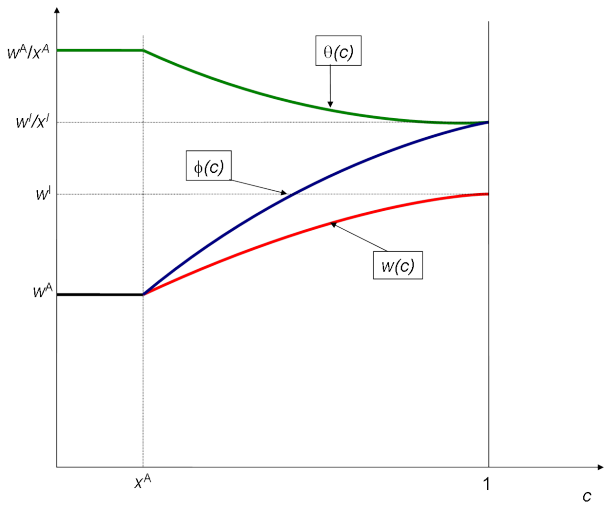



Figure 4: $\theta(c)$, $\phi(c)$ and $w(c)$

Table 1: Descriptive Statistics

| Variable | Mean | Std. Dev. | *N* | Max | Min |
|---|---|---|---|---|---|
| FDI Stocks (million $) | 5617 | 17172 | 5371 | 277613 | -1207 |
| GDP per capita of reporting cty ($) | 19479 | 9518 | 5371 | 44951 | 1781 |
| GDP per capita of partner cty ($) | 20216 | 9780 | 5371 | 44951 | 1194 |
| Population of reporting cty (thousands) | 56604 | 67202 | 5371 | 289821 | 3562 |
| Population of partner cty (thousands) | 47502 | 62461 | 5371 | 289821 | 3439 |
| | | | | | |
| **Geographical variables** | | | | | |
| (Log) distance between main cities | 7.98 | 1.15 | 5371 | 9.9 | 5.38 |
| Common border dummy | .105 | .307 | 5371 | 1 | 0 |
| EU Dummy | .264 | .441 | 5371 | 1 | 0 |
| Nafta dummy | .00894 | .0941 | 5371 | 1 | 0 |
| Latin country dummy | .0317 | .175 | 5371 | 1 | 0 |
| Common language dummy | .105 | .306 | 5371 | 1 | 0 |
| Both in Asia Pacific | .00968 | .0979 | 5371 | 1 | 0 |
| Both in North America | .0227 | .149 | 5371 | 1 | 0 |
| | | | | | |
| **OECD regulation variables: distance between country pairs** | | | | | |
| Product market regulation | .637 | .509 | 5371 | 2.8 | 0 |
| Barriers to Trade and Investment | .812 | .771 | 5371 | 3.3 | 0 |
| Barriers to Entrepreneurship | .749 | .537 | 5371 | 2.9 | 0 |
| State control | 1.1 | .779 | 5371 | 3.6 | 0 |
| Administrative Regulation | .948 | .644 | 5371 | 3 | 0 |
| Economic Regulation | .919 | .663 | 5371 | 3 | 0 |
| Inward-oriented regulation | .793 | .593 | 5371 | 2.8 | 0 |
| Outward-oriented regulation | .745 | .698 | 5371 | 3.3 | 0 |
| Employment protection regulation | 1.32 | .921 | 4698 | 4 | 0 |
| | | | | | |
| **World bank regulation variables: distance between country pairs** | | | | | |
| *Starting a Business* | | | | | |
| N. of procedures | 3.43 | 2.42 | 5371 | 13 | 0 |
| N. of days | 23.7 | 21.7 | 5371 | 105 | 0 |
| Cost (% of income per capita) | 8.83 | 7.39 | 5371 | 35.2 | .1 |
| Minimum capital (% of income per capita) | 44.6 | 49.4 | 5371 | 238 | 0 |
| *Hiring and Firing* | | | | | |
| Difficulty of hiring | 29.5 | 21.8 | 5371 | 78 | 0 |
| Rigidity of hours | 28 | 23 | 5371 | 80 | 0 |
| Difficulty of firing | 23.4 | 20.5 | 5371 | 90 | 0 |
| Rigidity of employment | 24.4 | 16.7 | 5371 | 69 | 0 |
| Firing costs (number of weeks) | 32.6 | 27.1 | 5371 | 133 | 0 |
| *Registering Property* | | | | | |
| N. of procedures | 2.73 | 2.17 | 5371 | 11 | 0 |
| N. of days | 48.1 | 57.9 | 5371 | 203 | 0 |
| Cost (% of property value per capita) | 2.92 | 2.39 | 5371 | 13.5 | 0 |
| *Getting Credit* | | | | | |
| Cost to create collateral | 8.09 | 8.56 | 5371 | 29.5 | 0 |
| Legal rights index | 2.78 | 2 | 5371 | 9 | 0 |
| Credit information index | 1.05 | .847 | 5371 | 3 | 0 |
| Public registry coverage | 68.9 | 165 | 5371 | 637 | 0 |
| Private bureau coverage | 422 | 308 | 5371 | 1000 | 0 |
| *Protecting Investors* | | | | | |
| Disclosure Index | 1.02 | .909 | 5371 | 5 | 0 |
| *Enforcing Contracts* | | | | | |
| N. of procedures | 7.27 | 6.26 | 5371 | 30 | 0 |
| N. of days | 285 | 353 | 5371 | 1342 | 1 |
| Cost (% of debt) | 5.52 | 3.76 | 5371 | 16.9 | .1 |
| *Closing a Business* | | | | | |
| Number of years | 1.05 | .903 | 5371 | 4.1 | 0 |
| Cost (% of estate) | 6.3 | 5.42 | 5371 | 22 | 0 |
| Recovery Rate (cents on the dollar) | 21.7 | 15.4 | 5371 | 66.7 | 0 |

Set of countries: Australia, Austria, Canada, Denmark, Finland, France, Great Britain, Greece, Germany, Hungary, Ireland, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Portugal, Poland, Spain Sweden, Switzerland, Turkey, USA.

Table 2: Closest and farthest country pairs

| Closest | Farthest |
|---|---|
| AUS-IRL | FRA-GBR |
| CAN-AUS | GBR-GRC |
| DEN-CHE | GBR-ITA |
| FIN-AUT | GBR-POL |
| GBR-AUS | GBR-PRT |
| GBR-CAN | GBR-TUR |
| GER-AUT | GRC-AUS |
| IRL-GBR | GRC-CAN |
| JPN-AUT | GRC-IRL |
| JPN-GER | ITA-CAN |
| NLD-AUT | NZL-GRC |
| NLD-FIN | NZL-POL |
| NLD-GER | NZL-TUR |
| NLD-JPN | POL-AUS |
| NOR-FIN | POL-CAN |
| NZL-AUS | POL-ESP |
| NZL-CAN | POL-IRL |
| NZL-USA | PRT-CAN |
| PRT-ESP | TUR-AUS |
| SWE-AUT | TUR-CAN |
| SWE-FIN | TUR-IRL |
| SWE-GER | USA-GRC |
| SWE-NLD | USA-ITA |
| USA-AUS | USA-POL |
| USA-CAN | USA-PRT |
| USA-GBR | USA-TUR |

Table 3: **OECD variables: log-linear model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Common language | 0.102 | 0.107 | 0.098 | 0.091 | 0.096 | 0.102 | 0.108 | 0.085 | 0.081 |
| | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.009)*** | (0.008)*** |
| *Distance between regulations:* | | | | | | | | | |
| Product market regulation | -0.027 | | | | | | | | |
| | (0.011)* | | | | | | | | |
| Barriers to Trade and Investment | | 0.023 | | | | | | | |
| | | (0.011)* | | | | | | | |
| Barriers to Entrepreneurship | | | -0.037 | | | | | | |
| | | | (0.008)*** | | | | | | |
| State control | | | | -0.048 | | | | | |
| | | | | (0.009)*** | | | | | |
| Economic Regulation | | | | | -0.039 | | | | |
| | | | | | (0.009)*** | | | | |
| Administrative Regulation | | | | | | -0.023 | | | |
| | | | | | | (0.007)*** | | | |
| Overall outward-oriented regulation | | | | | | | 0.025 | | |
| | | | | | | | (0.012)* | | |
| Overall inward-oriented regulation | | | | | | | | -0.058 | |
| | | | | | | | | (0.011)*** | |
| Employment protection regulation | | | | | | | | | -0.040 |
| | | | | | | | | | (0.008)*** |
| R-squared | 0.841 | 0.841 | 0.841 | 0.842 | 0.841 | 0.841 | 0.841 | 0.842 | 0.843 |
| N | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4485 |

Table 4: **World Bank variables: log-linear model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Common language | 0.102 | 0.101 | 0.101 | 0.100 | 0.099 | 0.087 | 0.081 | 0.082 | 0.103 |
| | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.007)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.007)*** |
| *Distance between regulations:* ***Starting a Business*** | | | | | | | | | |
| N. of procedures | -0.035 | | | | | | | | |
| | (0.009)*** | | | | | | | | |
| N. of days | | -0.039 | | | | | | | |
| | | (0.013)** | | | | | | | |
| Cost (% of income per capita) | | | -0.031 | | | | | | |
| | | | (0.008)*** | | | | | | |
| Minimum capital (% of income per capita) | | | | -0.034 | | | | | |
| | | | | (0.015)* | | | | | |
| *Distance between regulations:* ***Hiring and Firing*** | | | | | | | | | |
| Difficulty of hiring | | | | | -0.047 | | | | |
| | | | | | (0.008)*** | | | | |
| Rigidity of hours | | | | | | -0.068 | | | |
| | | | | | | (0.010)*** | | | |
| Difficulty of firing | | | | | | | -0.088 | | |
| | | | | | | | (0.010)*** | | |
| Rigidity of employment | | | | | | | | -0.071 | |
| | | | | | | | | (0.009)*** | |
| Firing costs (number of weeks) | | | | | | | | | -0.055 |
| | | | | | | | | | (0.010)*** |
| R-squared | 0.841 | 0.841 | 0.841 | 0.841 | 0.842 | 0.842 | 0.843 | 0.843 | 0.842 |
| N | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 |

Note to tables 3 and 4. Dependent variable: log of FDI stocks. The distance between regulations is measured as the absolute value of the difference between the source and the host country regulations. The level of regulation in both countries is accounted for by a time-varying measure of PMR (evaluated in 1998 and 2003). All specifications include the following control variables: host and source country fixed-effects, host and source country (log) GDP and (log) population, year dummies, and (log) distance between main cities; common language dummy, EU dummy, NAFTA dummy, latin countries dummy, common land borders dummy, both in Asia dummy, both in North America dummy. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust standard errors in parentheses.

Table 5: **World Bank variables: log-linear model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Common language | 0.109 | 0.108 | 0.109 | 0.107 | 0.104 | 0.106 | 0.102 | 0.110 |
| | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.007)*** | (0.008)*** | (0.008)*** | (0.008)*** |
| *Distance between regulations:* ***Registering Property*** | | | | | | | | |
| N. of procedures | -0.025 | | | | | | | |
| | (0.009)** | | | | | | | |
| N. of days | | -0.067 | | | | | | |
| | | (0.012)*** | | | | | | |
| Cost (% of property value per capita) | | | -0.023 | | | | | |
| | | | (0.010)* | | | | | |
| *Distance between regulations:* ***Getting Credit*** | | | | | | | | |
| Cost to create collateral (% of income per capita) | | | | -0.006 | | | | |
| | | | | (0.014) | | | | |
| Legal rights index | | | | | -0.041 | | | |
| | | | | | (0.009)*** | | | |
| Credit information index | | | | | | -0.037 | | |
| | | | | | | (0.007)*** | | |
| Private bureau coverage | | | | | | | -0.016 | |
| | | | | | | | (0.007)* | |
| Public registry coverage | | | | | | | | -0.192 |
| | | | | | | | | (0.018)*** |
| R-squared | 0.841 | 0.841 | 0.841 | 0.841 | 0.841 | 0.841 | 0.841 | 0.842 |
| N | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 |

Table 6: **World Bank variables: log-linear model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Common language | 0.112 | 0.098 | 0.108 | 0.109 | 0.108 | 0.111 | 0.108 |
| | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** | (0.008)*** |
| *Distance between regulations:* ***Protecting Investors*** | | | | | | | |
| Disclosure Index | 0.015 | | | | | | |
| | (0.008) | | | | | | |
| *Distance between regulations:* ***Enforcing Contracts*** | | | | | | | |
| Number of procedures | | -0.055 | | | | | |
| | | (0.013)*** | | | | | |
| Number of days | | | -0.012 | | | | |
| | | | (0.021) | | | | |
| Cost (% of debt) | | | | -0.052 | | | |
| | | | | (0.007)*** | | | |
| *Distance between regulations:* ***Closing a Business*** | | | | | | | |
| Number of years | | | | | -0.008 | | |
| | | | | | (0.010) | | |
| Cost (% of estate) | | | | | | -0.071 | |
| | | | | | | (0.009)*** | |
| Recovery Rate (cents on the dollar) | | | | | | | -0.032 |
| | | | | | | | (0.007)*** |
| R-squared | 0.841 | 0.841 | 0.841 | 0.842 | 0.841 | 0.843 | 0.841 |
| N | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 | 4998 |

Note to tables 5 and 6. Dependent variable: log of FDI stocks. The distance between regulations is measured as the absolute value of the difference between the source and the host country regulations. The level of regulation in both countries is accounted for by a time-varying measure of PMR (evaluated in 1998 and 2003). All specifications include the following control variables: host and source country fixed-effects, host and source country (log) GDP and (log) population, year dummies, and (log) distance between main cities; common language dummy, EU dummy, NAFTA dummy, latin countries dummy, common land borders dummy, both in Asia dummy, both in North America dummy. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust standard errors in parentheses.

# Web appendix to the paper: Who's Afraid of a Globalized World? Foreign Direct Investments, Local Knowledge and Allocation of Talents

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This file contains additional empirical evidence, the proofs of the results offered in Section 6 and the specification of the value function for all agents of the paper "Who's Afraid of a Globalized World? Foreign Direct Investments, Local Knowledge and Allocation of Talents".

## A Results from the Poisson Pseudo-Maximum-Likelihood model

The log-linear specification used in the paper may provide biased estimates if the variance of the *level* error term $\varepsilon_{ijt}$ is a function of the covariates (such as for example the distance between countries), because the expected value of the logarithm of a random variable depends both on the mean and on higher moments of the distribution. Additionally, the log-linear specification forces us to drop all country pairs with zero bilateral FDI.

To address these problems we also generate results from a non-linear model, the Poisson Pseudo-Maximum-Likelihood model (PPML henceforth) that allows to get consistent estimates in the presence of heteroskedasticity and provides a very natural way to deal with zeros of the dependent variable. The PPML model specifies the conditional mean of the dependent variable as follows:

$$E\left[F_{ijt}|covariates\right] = \exp\left(\alpha_i + \eta_j + \tau_t + X_{ijt}\beta + \delta lang_{ij} + \gamma|reg_i - reg_j|\right) \tag{1}$$

Under the assumption that the conditional variance of $F_{ijt}$ is proportional to its conditional mean, the coefficients of the above model can be estimated by solving the very same set of first order conditions used for Poisson MLE on count data.[1] Thus, equation (1) not only allows to get unbiased estimates in the case in which the variance of $\varepsilon_{ijt}$ is a function of the covariates, but it also easily allows to incorporate zero FDI. The coefficients of the model in equation (1) are as easily interpretable as those of the log-linear model as they represent the percentage change in the dependent variable for a unit increase in the independent variable.

[1] See Santos Silva, J.M.C. and S.Tenreyro, (2006), "The Log of Gravity", *Review of economics and Statistics*, 88(4), 641-658 and Head, K. and J.Ries, (2008), "FDI as an outcome of the market for corporate control: Theory and evidence", *Journal of International Economics*, Vol. 74, pp. 2-20.

## A.1 Results

Tables 1-4 present the results from the estimation of the PPML model in equation (1). As in the paper, we report the beta coefficients, obtained by estimating the model after having divided all variables by their standard deviations. The results show that the coefficient of the linguistic tie dummy is positive and significant in all specifications and in all tables. Moreover, the point estimates are typically larger than in the log-linear model and range between 10% and 15%. As to regulation proximity, in more than half of the specifications a lower distance in the entrepreneurial environments fosters FDI. The point estimates of the regulation proximity coefficients obtained with the PPML model are, again, typically larger than those obtained with the log-linear model, even though significance is not attained as frequently. On the whole, the results from the PPML model confirm the existence of a negative relationship between the indexes of regulation proximity and FDI.

The overall evidence suggests that, even after controlling for the levels of regulation in both countries, the distance between entrepreneurial environments has a bearing on FDI. In particular, we find that sharing the same language strongly matters and that regulations concerning *Product Markets*, *Labor Markets* (with some emphasis to be placed on firing restrictions), *Credit markets* and *Contract Enforcement* also play a prominent role in shaping bilateral FDI. Notice that these regulations have to do with the way entrepreneurs have to set up firms.

Table 1: **OECD variables: PPML model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Common language | 0.109 | 0.145 | 0.137 | 0.067 | 0.091 | 0.152 | 0.145 | 0.068 | 0.121 |
| | (0.017)*** | (0.013)*** | (0.015)*** | (0.017)*** | (0.017)*** | (0.015)*** | (0.013)*** | (0.020)*** | (0.018)*** |
| *Distance between regulations:* | | | | | | | | | |
| Product market regulation | -0.107 | | | | | | | | |
| | (0.031)*** | | | | | | | | |
| Barriers to Trade and Investment | | 0.005 | | | | | | | |
| | | (0.046) | | | | | | | |
| Barriers to Entrepreneurship | | | -0.027 | | | | | | |
| | | | (0.020) | | | | | | |
| State control | | | | -0.161 | | | | | |
| | | | | (0.022)*** | | | | | |
| Economic Regulation | | | | | -0.135 | | | | |
| | | | | | (0.025)*** | | | | |
| Administrative Regulation | | | | | | 0.015 | | | |
| | | | | | | (0.016) | | | |
| Overall outward-oriented regulation | | | | | | | 0.067 | | |
| | | | | | | | (0.052) | | |
| Overall inward-oriented regulation | | | | | | | | -0.156 | |
| | | | | | | | | (0.029)*** | |
| Employment protection regulation | | | | | | | | | -0.040 |
| | | | | | | | | | (0.016)* |
| R-squared | 0.597 | 0.597 | 0.597 | 0.598 | 0.597 | 0.597 | 0.597 | 0.597 | 0.587 |
| N | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 4599 |

Table 2: **World Bank variables: PPML model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Common language | 0.146 | 0.148 | 0.124 | 0.136 | 0.149 | 0.124 | 0.099 | 0.118 | 0.140 |
| | (0.014)*** | (0.014)*** | (0.015)*** | (0.015)*** | (0.014)*** | (0.014)*** | (0.015)*** | (0.015)*** | (0.013)*** |
| *Distance between regulations:* ***Starting a Business*** | | | | | | | | | |
| N. of procedures | 0.005 | | | | | | | | |
| | (0.027) | | | | | | | | |
| N. of days | | 0.052 | | | | | | | |
| | | (0.050) | | | | | | | |
| Cost (% of income per capita) | | | -0.100 | | | | | | |
| | | | (0.028)*** | | | | | | |
| Minimum capital (% of income per capita) | | | | -0.048 | | | | | |
| | | | | (0.031) | | | | | |
| *Distance between regulations:* ***Hiring and Firing*** | | | | | | | | | |
| Difficulty of hiring | | | | | 0.020 | | | | |
| | | | | | (0.022) | | | | |
| Rigidity of hours | | | | | | -0.091 | | | |
| | | | | | | (0.019)*** | | | |
| Difficulty of firing | | | | | | | -0.162 | | |
| | | | | | | | (0.020)*** | | |
| Rigidity of employment | | | | | | | | -0.081 | |
| | | | | | | | | (0.017)*** | |
| Firing costs (number of weeks) | | | | | | | | | -0.182 |
| | | | | | | | | | (0.027)*** |
| R-squared | 0.597 | 0.597 | 0.597 | 0.597 | 0.597 | 0.597 | 0.598 | 0.597 | 0.597 |
| N | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 |

Note to tables 1 and 2. Dependent variable: Volume of FDI Stocks. The distance between regulations is measured as the absolute value of the difference between the source and the host country regulations. The level of regulation in both countries is accounted for by a time-varying measure of PMR (evaluated in 1998 and 2003). All specifications include the following control variables: host and source country fixed-effects, host and source country (log) GDP and (log) population, year dummies, and (log) distance between main cities; common language dummy, EU dummy, NAFTA dummy, latin countries dummy, common land borders dummy, both in Asia dummy, both in North America dummy. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust standard errors in parentheses.

Table 3: **World Bank variables: PPML model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Common language | 0.145 | 0.145 | 0.146 | 0.143 | 0.151 | 0.110 | 0.158 | 0.147 |
| | (0.013)*** | (0.013)*** | (0.013)*** | (0.013)*** | (0.013)*** | (0.014)*** | (0.016)*** | (0.013)*** |
| *Distance between regulations:* ***Registering Property*** | | | | | | | | |
| N. of procedures | -0.031 | | | | | | | |
| | (0.029) | | | | | | | |
| N. of days | | -0.052 | | | | | | |
| | | (0.040) | | | | | | |
| Cost (% of property value per capita) | | | -0.021 | | | | | |
| | | | (0.027) | | | | | |
| *Distance between regulations:* ***Getting Credit*** | | | | | | | | |
| Cost to create collateral (% of income per capita) | | | | -0.192 | | | | |
| | | | | (0.046)*** | | | | |
| Legal rights index | | | | | -0.087 | | | |
| | | | | | (0.027)** | | | |
| Credit information index | | | | | | -0.150 | | |
| | | | | | | (0.021)*** | | |
| Private bureau coverage | | | | | | | 0.032 | |
| | | | | | | | (0.020) | |
| Public registry coverage | | | | | | | | -0.632 |
| | | | | | | | | (0.039)*** |
| R-squared | 0.597 | 0.597 | 0.597 | 0.597 | 0.597 | 0.598 | 0.597 | 0.598 |
| N | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 |

Table 4: **World Bank variables: PPML model**

| **Regulation Variables** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Common language | 0.123 | 0.090 | 0.167 | 0.165 | 0.148 | 0.143 | 0.145 |
| | (0.016)*** | (0.016)*** | (0.014)*** | (0.014)*** | (0.014)*** | (0.013)*** | (0.013)*** |
| *Distance between regulations:* ***Protecting Investors*** | | | | | | | |
| Disclosure Index | -0.042 | | | | | | |
| | (0.018)* | | | | | | |
| *Distance between regulations:* ***Enforcing Contracts*** | | | | | | | |
| Number of procedures | | -0.266 | | | | | |
| | | (0.035)*** | | | | | |
| Number of days | | | 0.301 | | | | |
| | | | (0.081)*** | | | | |
| Cost (% of debt) | | | | -0.117 | | | |
| | | | | (0.019)*** | | | |
| *Distance between regulations:* ***Closing a Business*** | | | | | | | |
| Number of years | | | | | -0.019 | | |
| | | | | | (0.024) | | |
| Cost (% of estate) | | | | | | 0.034 | |
| | | | | | | (0.035) | |
| Recovery Rate (cents on the dollar) | | | | | | | -0.007 |
| | | | | | | | (0.017) |
| R-squared | 0.597 | 0.598 | 0.597 | 0.598 | 0.597 | 0.597 | 0.597 |
| N | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 | 5244 |

Note to tables 3 and 4. Dependent variable: Volume of FDI Stocks. The distance between regulations is measured as the absolute value of the difference between the source and the host country regulations. The level of regulation in both countries is accounted for by a time-varying measure of PMR (evaluated in 1998 and 2003). All specifications include the following control variables: host and source country fixed-effects, host and source country (log) GDP and (log) population, year dummies, and (log) distance between main cities; common language dummy, EU dummy, NAFTA dummy, latin countries dummy, common land borders dummy, both in Asia dummy, both in North America dummy. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust standard errors in parentheses.

# B Proofs

## B.1 Proof of Result 8

We can rewrite the labor market equilibrium condition (11) in function of $x$ and $z$. We call this relationship LM:

$$1 = [1 - F(x)] + \int_x^1 \frac{a}{x} dF(a) + [1 - F(z)] + \int_z^1 \frac{a}{z} dF(a) \tag{2}$$

Differentiating totally (2) with respect to $x$ and $z$:

$$\left.\frac{dx}{dz}\right|_{LM} = -\frac{-2f(z) - \int_z^1 \frac{a}{z^2} dF(a)}{-2f(x) - \int_x^1 \frac{a}{x^2} dF(a)} \leq 0 \tag{3}$$

And thus, the elasticity of $x$ wrt $z$ along LM:

$$\left.\frac{dx/x}{dz/z}\right|_{LM} = -\frac{-2zf(z) - \int_z^1 \frac{a}{z} dF(a)}{-2xf(x) - \int_x^1 \frac{a}{x} dF(a)} \leq 0 \tag{4}$$

The definition of $z \equiv \frac{x(c)}{c}$ implies that $dx/x = dc/c + dz/z$. Thus:

$$\frac{dx/x}{dc/c} = \frac{2zf(z) + \int_z^1 \frac{a}{z} dF(a)}{2zf(z) + \int_z^1 \frac{a}{z} dF(a) + 2xf(x) + \int_x^1 \frac{a}{x} dF(a)} \in (0, 1) \tag{5}$$

$$\frac{dz/z}{dc/c} = -\frac{2xf(x) + \int_x^1 \frac{a}{x} dF(a)}{2zf(z) + \int_z^1 \frac{a}{z} dF(a) + 2xf(x) + \int_x^1 \frac{a}{x} dF(a)} \in (-1, 0) \tag{6}$$

For any given value of $c$, the number of workers is equal to the mass of agents whose talent is lower than $x(c)$; the number of domestic entrepreneurs who do not invest abroad is given by the mass of agents whose talent lies between $z(c)$ and $x(c)$; and the number of entrepreneurs operating abroad equals the mass of agents with talent larger than $z(c)$.

**QED**

## B.2 Proof of Result 10

First, define two functions:

$$g(x) = g_x \equiv xf(x),$$
$$D(x) = D_x \equiv \int_x^1 \frac{a}{x} dF(a),$$

Notice that both $g(x)$ and $D(x)$ are non negative and that $D(x)$ is decreasing:

$$dD(x) = -(g_x + D_x)\frac{dx}{x}$$

It is now useful to notice that, being $\theta = \frac{Y(c)}{2w(c)}$, equation (13) implies that

$$\theta = (D_x + D_z)$$

Then:

$$d\theta = -\left[(g_x + D_x)\frac{dx}{x} + (g_z + D_z)\frac{dz}{z}\right]$$

Which after some algebra results in:

$$d\theta = -\frac{g_z D_x - g_x D_z}{(2g_z + D_z)}\frac{dx}{x}$$

We can now prove the following two results.

### B.2.1 Wages increase with globalization

$$w = x\theta$$
$$\frac{dw}{w} = \frac{dx}{x} + \frac{d\theta}{\theta}$$

Then:

$$\begin{aligned}\frac{dw}{w} &= \left(1 - \frac{g_z D_x - g_x D_z}{(2g_z + D_z)(D_x + D_z)}\right)\frac{dx}{x} \\ &= \frac{D_x D_z + 2g_z D_z + D_z D_z + g_z D_x + g_x D_z}{(2g_z + D_z)(D_x + D_z)}\frac{dx}{x}\end{aligned}$$

Thus, irrespectively of whether assumption 1 holds or not, wages always increase with $c$:

$$\frac{dw}{dc} \geq 0$$

**QED**

### B.2.2 GDP increases with globalization

$$Y = 2x\theta^2 = 2w\theta$$
$$\frac{dY}{Y} = \frac{dw}{w} + \frac{d\theta}{\theta} = \frac{dx}{x} + 2\frac{d\theta}{\theta}$$

$$\begin{aligned}\frac{dY}{Y} &= \frac{dx}{x} - \frac{2g_z D_x - 2g_x D_z}{(2g_z + D_z)(D_x + D_z)}\frac{dx}{x} \\ &= \left(1 - \frac{2g_z D_x - 2g_x D_z}{(2g_z + D_z)(D_x + D_z)}\right)\frac{dx}{x} \\ &= \frac{2g_z D_z + D_x D_z + D_z D_z + 2g_x D_z}{(2g_z + D_z)(D_x + D_z)}\frac{dx}{x}\end{aligned}$$

Thus, irrespectively on whether assumption 1 holds or not, income always increases with $c$:

$$\frac{dY}{dc} > 0$$

**QED**

## B.3 Proof of Result 11

Consider again the two functions defined in the proof of Result 10 (section B.2):

$$g(x) = g_x \equiv xf(x),$$
$$D(x) = D_x \equiv \int_x^1 \frac{a}{x} dF(a),$$

Recall that both $g(x)$ and $D(x)$ are non negative and that $D(x)$ is decreasing:

$$dD(x) = -(g_x + D_x)\frac{dx}{x}$$

Additionally, notice that assumption 1 implies that $g_z > g_x$.

Then:

$$\theta = (D_x + D_z)$$
$$d\theta = -\left[(g_x + D_x)\frac{dx}{x} + (g_z + D_z)\frac{dz}{z}\right]$$

Which after some algebra results in:

$$d\theta = -\frac{g_z D_x - g_x D_z}{(2g_z + D_z)}\frac{dx}{x}$$

Thus, as $x$ increases with $c$, given that $D_x > D_z$ and that assumption 1 guarantees that $g_z > g_x$:

$$\frac{d\theta}{dc} < 0$$

The fact that the number of entrepreneurs operating in the market increases follows from noticing that the labor market equilibrium implies:

$$1 = [1 - F(x) + 1 - F(z)] + \theta$$

Thus, if $\theta$ decreases, $[1 - F(x) + 1 - F(z)]$ must increase.

**QED**

## B.4 Proof of Result 12

Recall that $\phi = \frac{w}{z} = c\theta$. Then,

$$\frac{d\phi}{\phi} = \frac{dw}{w} - \frac{dz}{z} = \frac{2g_xD_x + 3g_xD_z + g_zD_x + 2g_zD_z + D_xD_x + 2D_xD_z + D_zD_z}{(2g_z + D_z)(D_x + D_z)}\frac{dx}{x}$$

Multiplying both sides by $\phi = c\theta = c(D_x + D_z)$, we get:

$$d\phi = \frac{c}{x}\frac{2g_xD_x + 3g_xD_z + g_zD_x + 2g_zD_z + D_xD_x + 2D_xD_z + D_zD_z}{(2g_z + D_z)}dx$$

$$ad\phi = \frac{a}{z}\frac{2g_xD_x + 3g_xD_z + g_zD_x + 2g_zD_z + D_xD_x + 2D_xD_z + D_zD_z}{(2g_z + D_z)}dx$$

$$\begin{aligned} ad\phi - dw = &\frac{a}{z}\frac{2g_xD_x + 3g_xD_z + g_zD_x + 2g_zD_z + D_xD_x + 2D_xD_z + D_zD_z}{(2g_z + D_z)}dx \\ &- \frac{g_xD_z + g_zD_x + 2g_zD_z + D_xD_z + D_zD_z}{(2g_z + D_z)}dx \\ &= \left(\frac{a}{z} - 1\right)\frac{g_xD_z + g_zD_x + 2g_zD_z + D_xD_z + D_zD_z}{(2g_z + D_z)}dx \\ &+ \frac{a}{z}\frac{2g_xD_x + 2g_xD_z + D_xD_x + D_xD_z}{(2g_z + D_z)}dx \end{aligned}$$

Thus it is clear that for those who have foreign subsidiaries the profits of those subsidiaries increase:

$$if \;\; a > z \Longrightarrow \frac{d(a\phi - w)}{dc} > 0$$

**QED**

## B.5 Proof of Result 16

Notice that the value functions of all agents with $a \in [X^A, X^I]$ are U-shaped and that at the right of the minimum ($c = x^{-1}(a)$) they are all equal to $w(c)$, which is independent of $a$, while for smaller $c$ the value function is $a \times \theta(c)$. Continuity of the value function implies the result.

**QED**

## B.6 Proof of Result 17

The proof is straightforward: consider the individual with $a = z(c_h)$, clearly $V(c_l|a = z(c_h)) = W_d(c_l|a = z(c_h)) > W_d(c_h|a = z(c_h)) = W_d(c_h|a = z(c_h)) + W_f(c_h|a = z(c_h))$. By continuity of the value function with respect to $a$, the strict inequality needs to hold also for some values of $a$ larger than $z(c_h)$.

**QED**

## B.7 Proof of Result 18

Assume that $\frac{d(W_d+W_f)}{dc} > 0$. In this case, the individual with $a = 1$ is certainly a net winner from globalization (she gains as she owns a foreign subsidiary $\forall c \geq X^A$). Additionally, we know that the agent with $a = z(c_h)$ loses from the increase. By continuity there is an individual in between who is indifferent ($a^*$), with anybody on her left being a net loser and anybody on her right being a winner.

**QED**

## B.8 Value functions as a function of $c$

As the wage rate is increasing in $c$, it is clear that individuals which always choose to be workers prefer to live in the economy with the highest value of $c$. Result 19 establishes who these individuals are.

**Result 19** *Individuals with talent $a \leq X^A$ always choose to be workers. Their value function is*

$$a \leq X^A \quad \Rightarrow \quad V(c|a \leq X^A) = W_w(c) \quad \forall c \tag{7}$$

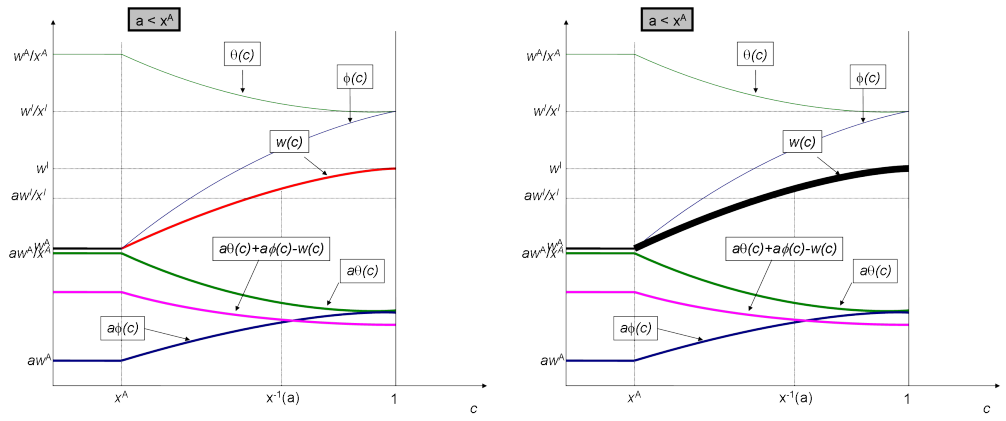
Figure 1 shows the value function of the individuals with a low level of $a$ as a function of $c$. The more similar the economies, the better they are, as they are never going to be entrepreneurs, and more openness implies higher labor demand and higher wages. Figure 1(a) depicts the wage $w(c)$ together with the values of $\theta(c)$ and $\phi(c)$, showing that for any value of $c$ these agents prefer to be workers. In figure 1(b) the bold line marks the best choice (being a worker) out of the three available options ($w$ if workers, $a\theta$ if local entrepreneurs and $a\theta + a\phi - w$ if foreign entrepreneurs).

Let us now consider agents with an intermediate level of talent, i.e. talent between $X^A$ and $X^I$. Those individuals choose to be domestic entrepreneur only if a low level globalization shelters them from foreign competition. If foreign competition increases, because of higher globalization, they prefer to become workers.

**Result 20** *Individuals with talent $a \in [X^A, X^I]$ are workers if $c \leq x^{-1}(a)$ and domestic entrepreneurs (not investing abroad) otherwise. Their value is:*

$$X^A \leq a \leq X^I \quad \Rightarrow \quad V(a|c) = \begin{cases} W_d(c|a) & c \leq x^{-1}(a) \\ W_w(c) & x^{-1}(a) \leq c \end{cases} \tag{8}$$

Figure 2 shows the value function of the individuals with talent between $X^A$ and $X^I$ as a function of $c$. They choose to be domestic entrepreneurs only if there is enough protection from foreign competition that allows to enjoy low wages, i.e. if $c \leq x^{-1}(a)$. As the entrepreneurial environments become more similar both the income as entrepreneur decreases (see Result 11) and the outside option of being a worker becomes more attractive. Once $c$ is such that $a = x(c)$, they are indifferent between the two options. For




(a) $W_w(c|a)$, $W_d(c|a)$ and $W_f(c|a)$ if $a \leq X^A$ (b) $V(a|c)$ if $a \leq X^A$

Figure 1: Value of an individual with very low level of talent, who never chooses to be an entrepreneur even in a closed economy

higher levels of globalization they prefer to be workers, and their income increases with $c$.[2] Thus, their value function is U-shaped. Figure 2(a) shows the value of $a\theta(c)$ and $w(c)$. Figure 2(b) marks the best option available.[3]

We finally consider the individuals with the highest level of talent, i.e. talent between $X^I$ and 1. Those individuals always choose to become domestic entrepreneurs and operate also abroad if the degree of globalization is large enough.

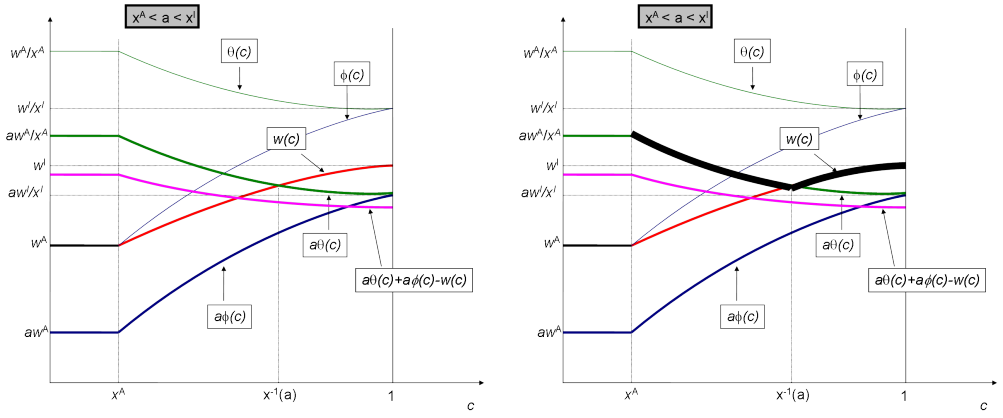
**Result 21** *Individuals with talent $a \in [X^I, 1]$ are always entrepreneurs. They operate abroad if and only if $c \geq z^{-1}(a)$.*

$$X^I \leq a \leq 1 \quad \Rightarrow \quad V(a|c) = \begin{cases} V_d(c) & c \leq z^{-1}(a) \\ V_f(c|a) & z^{-1}(a) \leq c \end{cases} \tag{9}$$

Figure 3 shows the value function of the individuals with $X^I \leq a \leq 1$ as a function of $c$. By definition they are always better off as entrepreneurs than as workers, as in the lowest possible value for a domestic entrepreneur and the highest possible value for a worker (with $c = 1$) they would get $a\frac{w^I}{X^I} \geq w^I$. Only if the economy is sufficiently integrated they choose to operate abroad. Observe that the profits from a foreign subsidiary increases with $c$ and it is negative at $c = X^A$ insofar $a < 1$. Thus, by continuity, there must exist a value of $c < 1$ such that foreign profits are zero, because at $c = 1$ they are necessarily positive, as foreign and domestic subsidiaries produce the same gross profits. The value function is U-shaped as the increase in $c$ produces an increase in the profits of the foreign subsidiary larger than the decrease in the domestic one (under the condition of Result 22). Figure 3(a) shows the value of the different options, and figure 3(b) marks the best option available.

[2]They never consider the possibility of investing abroad, as the value of investing abroad ($a\phi(c) \leq a\theta(c)$) is always lower than the available alternatives.

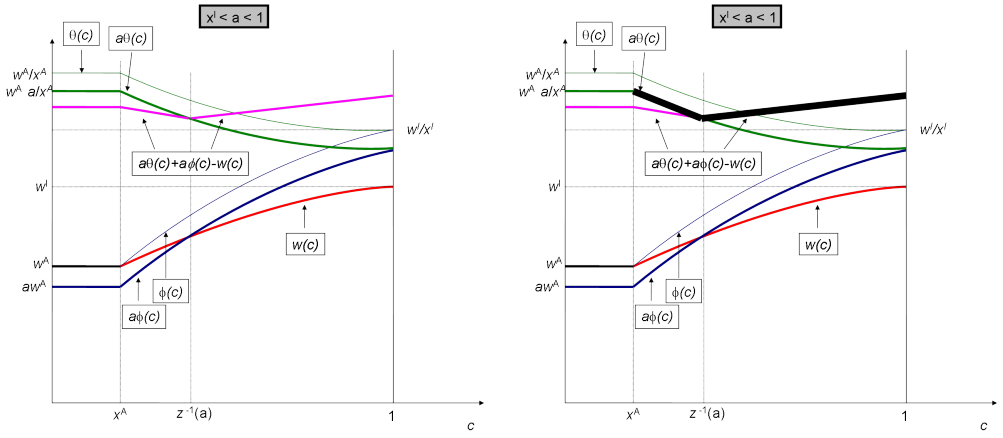
[3]Notice that the individuals with talent $a = X^I$ are indifferent between being workers or entrepreneurs at $c = 1$. If entrepreneurs, they are also indifferent between investing abroad or not.




(a) $W_w(c|a)$, $W_d(c|a)$ and $W_f(c|a)$ if $X^A \leq a \leq X^I$

(b) $V(a|c)$ if $X^A \leq a \leq X^I$

Figure 2: Value of an individual with an intermediate level of talent, who is an entrepreneur only if there is enough protection from foreign competition.




(a) $W_w(c|a)$, $W_d(c|a)$ and $W_f(c|a)$ if $X^I \leq a \leq 1$

(b) $V(a|c)$ if $X^I \leq a \leq 1$

Figure 3: Value of an individual with a high level of talent, who engages in FDI if the degree of globalization is large enough.

## B.9 Uniform distribution of talent

**Result 22** *Assume that talent is uniformly distributed. For agents who have a foreign subsidiary, a marginal increase in c increases the net profit of foreign subsidiaries more than it decreases the profit of the local one:*

$$\textit{If } a \geq z(c) \quad \Rightarrow \quad \frac{d\left(W_d(c|a) + W_f(c|a)\right)}{dc} = \frac{\beta}{1-\beta}\left[a\left(\frac{d\theta(c)}{dc} + \frac{d\phi(c)}{dc}\right) - \frac{dw(c)}{dc}\right] \geq 0 \qquad (10)$$

Let us rewrite the value of foreign entrepreneurs:

$$\begin{aligned} V_f\left(c \mid a > z\right) &= w\left(c\right)\left[a\left(\frac{1}{x\left(c\right)} + \frac{1}{z\left(c\right)}\right) - 1\right] \\ &= \frac{aw\left(c\right)}{x\left(c\right)} + \frac{aw\left(c\right)}{x\left(c\right)}c - w\left(c\right) \\ &= a\theta\left(c\right) + a\phi\left(c\right) - w\left(c\right) \end{aligned}$$

From Result 11 we know that:

$$ad\theta\left(c\right) = -a\frac{g_z D_x - g_x D_z}{2g_z + D_z}\frac{dx}{x} < 0$$

From Result 12 we know that

$$\begin{aligned} ad\phi\left(c\right) - dw\left(c\right) &= \left(\frac{a}{z} - 1\right)\frac{g_x D_z + g_z D_x + 2g_z D_z + D_x D_z + D_z D_z}{2g_z + D_z}dx + \\ &+ \frac{a}{z}\frac{2g_x D_x + 2g_x D_z + D_x D_x + D_x D_z}{2g_z + D_z}dx \end{aligned}$$

Therefore

$$dV_f\left(c \mid a > z\right) = ad\theta\left(c\right) + ad\phi\left(c\right) - dw\left(c\right)$$

$$\begin{aligned} ad\theta\left(c\right) + ad\phi\left(c\right) - dw\left(c\right) &= \left(\frac{a}{z} - 1\right)\frac{g_x D_z + g_z D_x + 2g_z D_z + D_x D_z + D_z D_z}{2g_z + D_z}dx + \\ &+ \frac{a}{z}\frac{2g_x D_x + 2g_x D_z + D_x D_x + D_x D_z}{2g_z + D_z}dx - \frac{a}{x}\frac{g_z D_x - g_x D_z}{2g_z + D_z}dx \end{aligned}$$

As the first term is positive for any $a > z$, let us concentrate on the last two terms:

$$\begin{aligned} &\frac{a}{z}\frac{2g_x D_x + 2g_x D_z + D_x D_x + D_x D_z}{2g_z + D_z}dx - \frac{a}{zc}\frac{g_z D_x - g_x D_z}{2g_z + D_z}dx \\ = &\frac{a}{z}\frac{c2g_x D_x + c2g_x D_z + cD_x D_x + cD_x D_z - g_z D_x + g_x D_z}{c\left(2g_z + D_z\right)}dx \\ = &\frac{a}{z}\frac{D_x\left(2cg_x - g_z + cD_x + cD_z\right) + c2g_x D_z + g_x D_z}{c\left(2g_z + D_z\right)}dx \end{aligned}$$

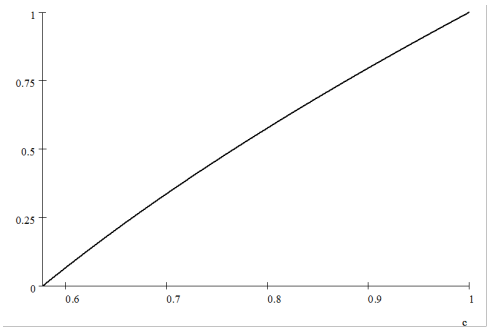



Figure 4: Condition 11 as a function of $c$ assuming a uniform distribution of talent

A sufficient condition for the above expression to be positive is that $(2cg_x - g_z + cD_x + cD_z) \geq 0$:

$$\begin{aligned}
(2cg_x - g_z + cD_x + cD_z) &= 2xcf(x) - zf(z) + c\int_x^1 \frac{a}{x}dF(a) + c\int_z^1 \frac{a}{z}dF(a) \\
&= 2xcf(x) - zf(z) + \int_x^1 \frac{a}{z}dF(a) + c\int_z^1 \frac{a}{z}dF(a) \\
&= \frac{1}{z}\left(2x^2 f(x) - z^2 f(z) + \int_x^1 adF(a) + c\int_z^1 adF(a)\right) \geq 0
\end{aligned}$$

The above condition is always satisfied if talent is uniformly distributed:

$$\begin{aligned}
2x^2 f(x) - z^2 f(z) + \int_x^1 adF(a) + c\int_z^1 adF(a) &= 2x^2 - z^2 + \frac{1}{2}\left[1 - x^2\right] + c\frac{1}{2}\left[1 - z^2\right] \\
&= \frac{3}{2}x^2 - z^2\left(1 + \frac{c}{2}\right) + \frac{1}{2}(1 + c) \geq 0 \qquad (11)
\end{aligned}$$

It is straightforward to check that with a uniform distribution one obtains:

$$\begin{aligned}
X_A &= \sqrt{\frac{1}{3}} \\
z(c) &= \frac{c + \sqrt{c^2 + 3c(1+c)^2}}{3c(1+c)}
\end{aligned}$$

Recalling that $x(c) = z(c) \times c$ condition (11) reads as follows:

$$\frac{3}{2}\left(\frac{c + \sqrt{c^2 + 3c(1+c)^2}}{3(1+c)}\right)^2 - \left(\frac{c + \sqrt{c^2 + 3c(1+c)^2}}{3c(1+c)}\right)^2 \left(1 + \frac{c}{2}\right) + \frac{1}{2}(1+c) \geq 0$$

The above inequality is always positive for $c > X_A = \sqrt{\frac{1}{3}}$ as shown in figure 4.

**QED**