



Topics in International Economics

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Thesis submitted for assessment with a view to obtaining the degree of
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To my supervisors.
In order of appearance:
Fernando Vega-Redondo
Andrea Mattozzi
Bernard Hoekman

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Abstract

This thesis contributes to three debates in international economics: (i) the integration process of migrants' communities; (ii) the role of economic institutions in international trade and (iii) the determinants and the effects of services trade policy. For different reasons, all debates are high on the global governance agenda.

The phenomenon of international migration leads to the existence of disadvantaged minorities within mature host economies. The social cohesion in the recipient countries as well as the general attitude toward further international mobility depend upon the policy capacity to govern the integration of migrant communities. In the first chapter of the thesis I offer a positive analysis of integration policies with a specific focus on the labor market.

As for the second debate, recent studies have shown that economic institutions such as contract enforcement, regulatory quality and the like are important determinants of trade patterns as well as crucial factors shaping the effects of trade policy. The second chapter of the thesis contributes to this literature looking at the role of contract enforcement in a trade model with heterogeneous firms, endogenous firm organization and institutions-driven comparative advantage. We find that, in countries with a fragile institutional framework, aggregate productivity might not benefit from the reallocation of resources due to trade liberalization.

The third chapter carries on with the analysis of institutions introducing the third debate on services trade. In particular, we demonstrate empirically that, under weak institutions, lower restrictions to trade in services fail to benefit the manufacturing sectors that use services as intermediate inputs. Trade in services has surged but high restrictions remain. Little has been done to understand the determinants of services trade commitments. In the fourth chapter of the thesis we identify the degree of services input intensity into a national economy as an important factor behind the willingness to commit to services trade openness.

Contents

Overview of the Thesis Chapters	vii
1 The political economy of migrants integration	1
1.1 Introduction	1
1.2 Related literature	4
1.3 The model	5
1.3.1 Equilibrium in the labor market	5
1.3.2 Political economy equilibrium	11
1.3.3 Comparative statics	14
1.4 Conclusions	16
2 Institutions and firms' organization: asymmetric effects of trade on productivity and welfare	19
2.1 Introduction	19
2.2 Trade and productivity: new stylized facts	22
2.3 The model	25
2.3.1 The economic environment	25
2.3.2 Equilibrium under autarky	29
2.3.3 Equilibrium under free trade	38
2.3.4 Costly trade	51
2.4 Conclusions	52
3 Services trade restrictiveness and manufacturing productivity: the role of institutions	54
3.1 Introduction	54
3.2 Motivation and Related Literature	56
3.3 Empirics	60
3.3.1 Empirical model and identification strategy	60
3.3.2 Data	63
3.3.3 Results	64

3.3.4	Robustness checks	67
3.4	Theory	75
3.4.1	The setup	76
3.4.2	Closed and open regimes: the role of institutions	78
3.5	Conclusions	79
4	The political economy of services trade agreements	81
4.1	Introduction	81
4.2	Empirical motivation	84
4.2.1	Services as inputs	85
4.2.2	Trade in services through horizontal FDI	85
4.2.3	Services input intensity as a determinant of services trade commitment	87
4.2.4	Toward a theory of services trade policy	92
4.3	Theoretical Model	93
4.3.1	The set up	93
4.3.2	The equilibrium	97
4.3.3	The political game versus unilateral commitment	102
4.4	The model with Foreign lobbying	105
4.4.1	The political game with foreign lobbying only	105
4.4.2	The political game with national lobbying and imperfect foreign lobbying	108
4.4.3	Imperfect foreign lobbying and commitment	111
4.5	Conclusions	113
	Bibliography	114
A	Appendix to Chapter 1	123
A.1	Proofs	123
A.2	MIPEX data and regression analysis	130
B	Appendix to Chapter 2	133
B.1	Data and methodology	133
B.2	Final firms' organization: a framework for a fully micro-funded application of Costinot' theory	135
B.3	Proofs	137
B.4	Technical details for the numerical exercise about the free-trade equilibrium	148
C	Appendix to Chapter 3	150

C.1	Appendix tables	150
C.2	Input Penetration Measures	152
C.3	Proofs	153
D	Appendix to Chapter 4	156
D.1	Appendix Figures and Tables	156
D.2	Proofs	163
D.3	Derivations of expressions in Subsection 4.4.3	172

Overview of the thesis chapters

This thesis contributes to three debates in international economics: (i) the integration process of migrants' communities; (ii) the role of formal economic institutions in international trade and (iii) the determinants and the effects of services trade policies.

The first chapter addresses the issue of migrants' integration into a host country economy, with a specific focus on the labor market. Migrants participation into the receiving country labor market entails an economic trade-off. On the one hand it benefits the economy through positive spillovers. On the other, it may harm the low-skilled (low-wage) native workers. Taking this trade-off into account, the chapter offers a positive theory of migrants integration, defined as a set of policies that enhance the opportunities of a disadvantaged migrant community to participate in the host country labor market. I build a simple game theoretic model describing a static economy with migrant and native workers. I derive testable implications on the relationship between the level of integration implemented in a political economy and some key parameters of both the labor market and the demographic composition in the host country. Suggestive cross-country empirical evidence supports my theoretical findings.

In the second chapter, joint work with Mathilde Lebrand and Alberto Osnago, we deal with formal economic institutions in international trade. Contract enforcement and, more generally, the business environment is crucial in a world where producers of final goods need to source inputs from other suppliers. Weak institutions create uncertainty over the provision of intermediate goods demanded by final producers. Firms adapt the organization of their production to the local institutional environment. In this chapter we build a theoretical model that allows heterogeneous producers to choose their sector of production and we study how trade affects the relocation of final producers and resources across sectors. The quality of institutions and the ex-ante distribution of productivity determine the endogenous organization of the firms and, in turn, the sector in which each final producer specializes. The most productive producers are shown to be relatively

better at producing more complex goods and in equilibrium they choose to specialize in the most complex sectors. In a world where countries differ in institutional quality, we study how trade liberalization leads to asymmetric effects on the allocation of intermediate suppliers across final producers and industries, as well as on aggregate productivity and welfare. Consistent with results in the literature, the model predicts a positive effect of trade liberalization on aggregate productivity in the country with good institutions. On the other hand, it unveils a negative effect in the country with weak institutions. This asymmetric effect is larger when the difference in institutions is higher.

The third chapter, coauthored with Cosimo Beverelli and Bernard Hoekman, carries on with the discussion on economic institutions and introduces the topic of trade in services. In particular, we study the effect of services trade restrictiveness on manufacturing productivity for a broad cross-section of countries at different stages of economic development. We find that reducing services trade restrictiveness has a positive indirect impact on the manufacturing sectors that use services as intermediate inputs in production. We identify a critical role of institutions in shaping this effect: countries with high institutional capacity benefit the most from services trade policy reforms in terms of increased productivity in downstream industries. We argue that this reflects the characteristics of many services and services trade and we provide a theoretical framework to formalize our suggested mechanisms.

Finally in the fourth chapter, joint work with Mathilde Lebrand, we study the determinants of openness policies in the context of trade in services. We provide new empirical evidence that more liberal GATS schedules were chosen in small economies with a high services input penetration. To rationalize this new finding, we build a theoretical trade policy framework with lobbying from both national firms and foreign affiliates. We focus on services as intermediate inputs that are produced by a few firms under oligopolistic competition and can only be traded through a foreign affiliate (Mode 3). Using this framework, we show that higher foreign entry restrictions due to national lobbying reduce competition among services producers and decrease final production. We then identify a new commitment motive for horizontal FDI in case of trade in services when the inefficiencies due to political frictions are too severe. Finally, we show that foreign contributions can lead to higher or lower entry restrictions depending on the number of national providers. Consistent with this, the government's incentives to commit to an agreement depend not only from his bargaining power but also on his valuation of foreign contributions.

Chapter 1

The political economy of migrants integration

1.1 Introduction

The integration of migrant communities is a primary concern for policy makers in mature receiving countries. Integration policies are important components of any political agenda and they often become one of the mostly publicly debated issues. Integration is a broad phenomenon, encompassing cultural, legal as well as economic dimensions. The same complexity is reflected in the policies for integration, from the laws prohibiting ethnic, racial and religious discrimination to those regulating access to nationality.

The present paper focuses on the economic aspect of integration adopting a labor market perspective. In this context, the relevant policies are those that affect the incentives of migrants to access and participate in the host country labor market.

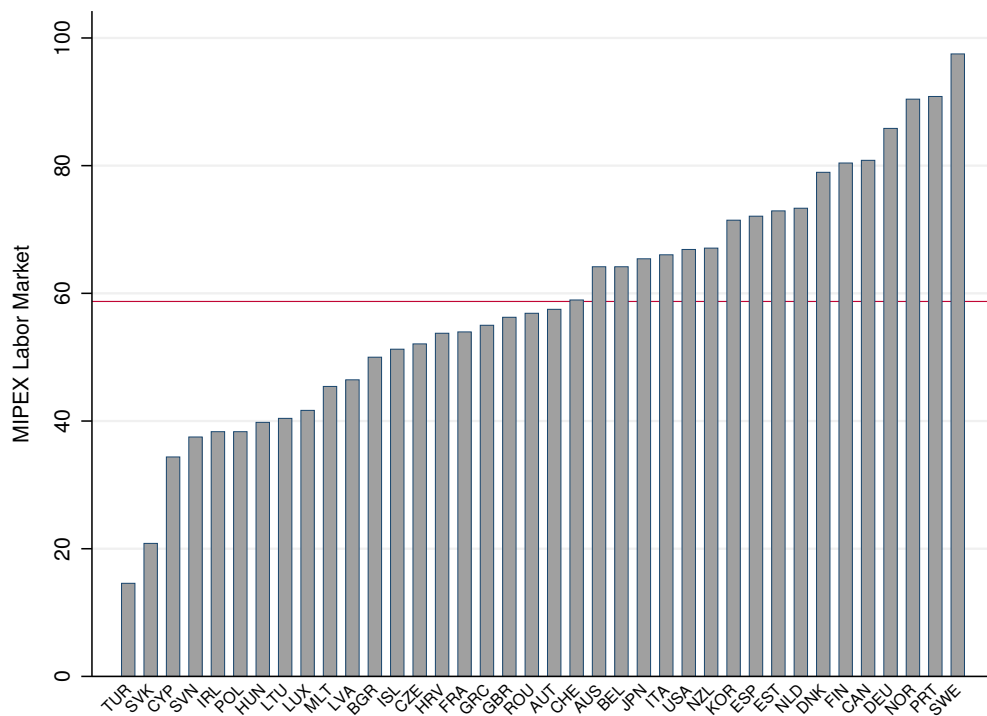
Migrants participation entails a well documented economic trade-off for receiving countries. On the one hand it benefits the economy through positive spillovers. On the other, it may harm the low-skilled (low-wage) native workers (see for instance Borjas, 2003; Dustmann et al., 2005; Ottaviano and Peri, 2012; Dustmann et al., 2013). Taking this trade-off into account, we study how integration is achieved as a policy outcome in host economies.

Available data shows that there exists significant cross country heterogeneity in policies targeting labor market integration of migrant communities. Figure 1.1 plots the MIPEx Labor Market Mobility (LMM) indicator for the year 2014 in the 38 host countries covered by the MIPEx project.¹ Those include all EU countries plus non EU traditional and

¹MIPEx is a joint survey project of the Barcelona Centre for International Affairs and the Migration

new countries of immigration. The MIPEX LMM indicator reflects the level of integration embedded in policies targeting migrants' access to labor market; access to general support such as public employment offices but also higher education and vocational training; migrants specific support, such as - for instance - targeted work-related trainings or specific bridging/work placement programmes; and workers' rights (in many countries - including the US and the UK - migrant workers are excluded from parts of the social security system). The indicator goes from a value of zero to 100, representing full integration. Its average value for the MIPEX countries in 2014 is 58.7 (horizontal line in Figure 1.1).

Figure 1.1: Migrants' integration across countries: labor market focus



How do different values of integration emerge across countries? What are the determinants of integration policy outcomes? In order to answer those question, we build a positive theory of integration given the trade-off embedded in migrants labor market participation.

We derive our results from a game theoretic model framed on a static economy with no migration decision. This is a key assumption: the scope of the paper is not to study why agents decide to migrate. Nor to understand how the number and the characteristics of

Policy Group. A complete description of the database as well as the full data in downloadable format can be found at <http://www.mipex.eu/>.

those migrants allowed to enter in the host country are determined. Instead, we will be looking at mature migration economies parametrized by a fixed stock of migrants. The focus of the paper is on the set of policies that ameliorate the economic conditions of the disadvantaged migrant minority in the receiving labor market. Non homogeneous payoffs across immigrants and natives workers is an important feature of the labor market in mature host economies: high educated migrants face more difficulties in getting a job than their native-born peers. Moreover, when they get it, they often have to pay fixed costs in terms of lower access to the social security system, language barriers and the like (see OECD/EU, 2015). Integration is represented by more symmetric labor payoffs across the two groups of native-born and migrant workers.

In the model, migrant and native workers are characterized by a fixed and identical distribution of ability.² All the agents compete for vacancies in a two sectors economy. The two sectors differ in terms of wage scheme: we call H the high wage sector and L the low wage one. In particular, the individual wage that is paid in sector H depends positively on both the ability of the worker and the average ability of the agents hired in the sector. This wage technology reflects the positive spillovers of migrants participation. High skilled migrants hired in H are likely to increase the average ability and this has a positive impact on the native-born workers in the sector. Moreover, the labor market is such that the probability of being hired in H is a non decreasing function of the individual ability and depends on an exogenous mass of vacancies K . Instead, any agent competing for a job in sector L is hired with probability one. Finally, migrant workers have to pay a cost associated with a job position in sector H . This cost is a negative function of the level of integration.

The trade-off embedded in migrants labor market integration is captured by our economic environment: higher integration allows the best migrants to compete for better jobs (positions in sector H). On the one hand, this might have positive externalities for some natives due to the wage technology in H . On the other, more able migrants hired in the sector might reduce the probability for some natives to get a position in H . We derive the equilibrium level of integration as the outcome of a political economy where only native workers vote and their preferences are aggregated through simple majority voting.

The model delivers testable implications on the relationship between the level of integration implemented in equilibrium and some key parameters of the labor market as well as on the demographic composition in the host economy. Suggestive evidence from the MIPEX data supports our theoretical findings.

²Looking at the British labor market, Dustmann et al. (2005) have found a remarkable similarity in the skill distributions of the native and migrant workforce. This is supportive of our working assumption of identical ability distributions.

The rest of the paper is organised as follows. Section 1.2 discusses related literature; section 1.3 introduces the model and derives the results; section 1.4 offers conclusions.

1.2 Related literature

The paper contributes to the literature on the political economy of migration policies. From the seminal work of Benhabib (1996) many authors have investigated the formation of migration policy platforms. In particular they have been focused on policies concerning the size, the skill and the capital holding composition of migration flows. Ortega (2005) presents a dynamic extension of the model in Benhabib (1996) with heterogeneous skills and voting migrants. In his paper, the mechanics shaping the equilibrium size and skill composition of the migrant community is the trade-off between skill complementarity migration and the shift in political power due to the assumption of voting migrants. Similar results are derived by Dolmas and Huffman (2004). Facchini and Mayda (2008) study an analogous problem using a different approach: the authors consider an international factor mobility model with skilled and unskilled labor. They derive equilibrium quotas and skill composition policies using both a median voter framework and a simple lobbying model. The present paper studies a different set of policy variables, i.e. integration policies. To the best of our knowledge this is the first attempt to address migrants' integration from a political economy perspective.

Furthermore, our analysis relates to the theoretical work in Eguia (2010). The author presents a model where the natives set the cost that has to be sustained by the migrants in order to assimilate the social norms required for integration. This cost is chosen strategically as a screening mechanism to select those agents that, within the worse-off group, are willing to assimilate. In our model integration is the policy parameter that affects the cost that migrants have to pay in order to compete in the high payoff sector of the economy. Our analysis highlights the side of integration that depends upon economic policies (labor market access) while in Eguia (2010) the focus is on the cultural side of integration, described by the author as the process of adaptation to the norms, the values and the codes of the native population.

1.3 The model

1.3.1 Equilibrium in the labor market

Players and Types There are two populations of agents (workers) in the economy. Denote with $P = \{N, M\}$ the set of populations and call p a generic element of P . N is the population of natives and M of migrants. Each population p is characterized by a continuous mass μ^p . Let us consider strictly positive masses ($\mu^p > 0 \forall p \in P$), normalize the total mass of agents to 1 ($\sum_{p \in P} \mu^p = 1$) and assume $\mu^N > \mu^M$. Agents are heterogeneous in terms of ability θ . Ability is distributed independently in each population according to a continuous uniform distribution on the support $[0, 1]$. Denote with $F(\cdot)$ the *cdf* of θ and with $f(\cdot)$ its *pdf*.

Space of Available Actions Actions represent the sector in which a worker competes for a job. $A_{p,\theta} = \{H, L\} \forall p \in P$ and $\theta \in [0, 1]$. Abilities are common knowledge and the workers simultaneously decide in which sector to compete for a job. Agents are standard utility maximizers that take into account the labor market structure. In particular, there exists an exogenous hiring technology such that,

- jobs are not scarce in sector L : everyone competing for a job in L is hired;
- there is a continuous mass K of jobs available in sector H . Let us consider the case $\mu_N < K < 1$. The available jobs are allocated among agents competing in H from the most skilled worker downward. Denote the probability of being hired in sector H by p^H . Given perfect information and no frictions in the labor market the probability p^H will be perfectly foreseen by the agents and it will take either value 0 or 1.

Moreover, there exists an exogenous wage technology³ that pays a strictly positive fixed wage w^L for a job in sector L and w^H for a position in H . We assume that w^H is a function of both the individual ability of the agent and the average ability of the workers employed in H . We denote the average ability by θ^H . Formally,

$$w^H = w(\theta, \theta^H) \tag{1.1}$$

We assume that $w(\cdot, \cdot)$ is continuous, differentiable and increasing in both arguments.

³Behind this reduced form approach the reader can think of the wage technology as the outcome of a collective bargaining process.

Strategies Within a given population p , individual strategies are mappings from the type space to the action space. The strategy of an individual i in population p will be

$$s_i^p : [0, 1] \longrightarrow \{H, L\} \quad \forall i \text{ and } p \quad (1.2)$$

Let us denote the continuous strategy profile of the agents in population p as S^p . We call instead S_{-i}^p the strategy profile of all the population p agents but i .

Payoffs For any native worker i of ability θ , the payoffs are given by the following equations

$$U_i^N(H, S_{-i}^N, S^M | \theta) = w(\theta, \theta^H(S^N, S^M)) p^H(\theta | S^N, S^M) \quad (1.3)$$

$$U_i^N(L, S_{-i}^N, S^M | \theta) = w^L \quad (1.4)$$

For any migrant worker i of ability θ we have instead

$$U_i^M(H, S_{-i}^M, S^N | \theta) = \left[w(\theta, \theta^H(S^N, S^M)) - c(I) \right] p^H(\theta | S^N, S^M) \quad (1.5)$$

$$U_i^M(L, S_{-i}^M, S^N | \theta) = w^L \quad (1.6)$$

The payoffs specification is crucial: it incorporates the disadvantage of migrant workers in competing for a job in H : the migrants have to pay a non negative cost $c(\cdot)$ which is a function of the level of integration I . We take $I \in [0, 1]$ where 0 and 1 represent the minimum and maximum integration respectively; we assume $c(\cdot)$ strictly decreasing, with $c(1) = 0$.

In this section we characterize the equilibria in the labor market considering I as an exogenous parameter. In order to do that we need to derive an expression for the functions $p^H(\cdot | \cdot, \cdot)$ and $\theta^H(\cdot, \cdot)$. First, denote with $\Theta_H^{s^p} := (s^p)^{-1}(H)$ the set of types such that a worker in population p of type $\theta \in \Theta_H^{s^p}$ will be prescribed by strategy s^p to play action H . Assuming Lebesgue-measurability of $\Theta_H^{s^p}$ for any possible strategy s^p we can write the mass of workers in population p that will play H according to s^p as

$$\phi^{s^p} = \mu^p \int_0^1 \mathbb{1}_{\{\Theta_H^{s^p}\}} f(\theta) d\theta$$

Given the hiring technology described above we have that

$$p^H(\theta | S^N, S^M) = \begin{cases} 1 & \text{if } \sum_{p \in P} \phi^{s^p} < K \\ \begin{cases} 1 & \text{if } \theta \geq \tilde{\theta} \\ 0 & \text{if } \theta < \tilde{\theta} \end{cases} & \text{if } \sum_{p \in P} \phi^{s^p} \geq K \end{cases} \quad (1.7)$$

where $\tilde{\theta}$ is such that

$$\sum_{p \in P} \mu^p \int_{\tilde{\theta}}^1 \mathbb{1}_{\{\Theta_H^{s^p}\}} f(\theta) d\theta = K \quad (1.8)$$

Notice that the first row in the right hand side of (1.7) describes the case in which the strategy profiles S^N and S^M are such that the workers competing for a job in H are less than K : the hiring technology will thus hire any worker competing for a job, regardless of her type. If instead a mass of workers greater than K is competing for a job in H , the hiring technology will hire from the most skilled worker downward until the K vacancies are filled: formally it fixes the threshold $\tilde{\theta}$ such that every worker with a type $\theta < \tilde{\theta}$ will have a zero probability of being hired in H . In this context - when there are not enough vacancies for all the workers competing in H - it is useful to denote with $\tilde{\Theta}_H^{s^p, s^{-p}} := \Theta_H^{s^p} \cap [\tilde{\theta}, 1]$ the set of types θ such that $s^p(\theta) = H$ and $p^H(\theta|S^N, S^M) = 1$. For any population p , the mass of workers belonging to $\tilde{\Theta}_H^{s^p, s^{-p}}$ will be denoted by

$$\tilde{\phi}^{s^p} = \mu^p \int_0^1 \mathbb{1}_{\{\tilde{\Theta}_H^{s^p, s^{-p}}\}} f(\theta) d\theta \quad (1.9)$$

We can now write the expression for the average ability of the workers hired in sector H , that is

$$\theta^H(S^N, S^M) = \begin{cases} \frac{1}{\sum_{p \in P} \phi^{s^p}} \sum_{p \in P} \phi^{s^p} E[\theta | \theta \in \Theta_H^{s^p}] & \text{if } \sum_{p \in P} \phi^{s^p} < K \\ \frac{1}{\sum_{p \in P} \tilde{\phi}^{s^p}} \sum_{p \in P} \tilde{\phi}^{s^p} E[\theta | \theta \in \tilde{\Theta}_H^{s^p, s^{-p}}] & \text{if } \sum_{p \in P} \phi^{s^p} \geq K \end{cases} \quad (1.10)$$

Let us start the analysis of the pure strategy Nash equilibria of the game through the following result:

Lemma 1.1 *If the strategy profile (S_*^N, S_*^M) is a pure strategy Nash equilibrium in the labor market, then it is an equilibrium in threshold strategies of the kind (θ_*^N, θ_*^M) such that*

$$s_*^p(\theta) = \begin{cases} H & \text{if } \theta \geq \theta_*^p \\ L & \text{if } \theta < \theta_*^p \end{cases} \quad \forall p \in P \quad (1.11)$$

Proof. See Appendix D.2.

The characterization of pure strategy Nash equilibria of the labor market is given by the next result. For the sake of simplicity we characterize the possible set of equilibria assuming the following restrictions on the payoffs' parameters:

A1. $w(0, \frac{1}{2}) \geq w^L$

A2. $w(1, \frac{1}{2}) - c(0) \leq w^L$

The first assumption implies that, in an economy without migrants, the less skilled native worker prefers to compete in H (notice that she will be hired in H for sure). The second assumption instead restricts the analysis to those cases in which, given zero integration and all the native population competing for a job in H , the most skilled migrant prefers to compete in L (even if she has probability 1 of being hired in H).

Lemma 1.2 *The profile of thresholds (θ_*^N, θ_*^M) such that*

$$s_*^p(\theta) = \begin{cases} H & \text{if } \theta \geq \theta_*^p \\ L & \text{if } \theta < \theta_*^p \end{cases} \quad \forall p \in P$$

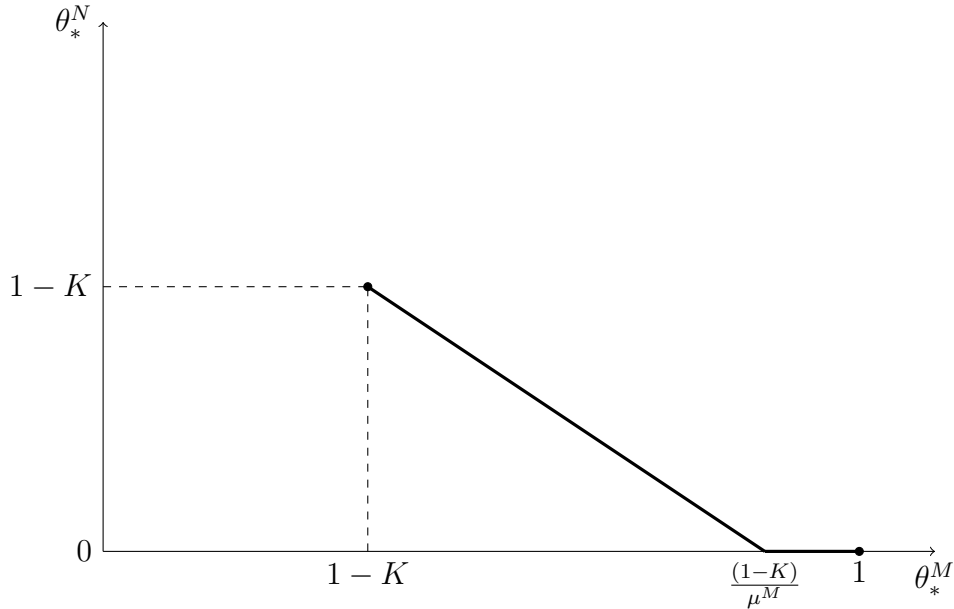
is a pure strategy Nash equilibrium in the labor market if and only if it belongs to the set

$$\left\{ (\theta^N, \theta^M) \mid \left(\theta^N = -\frac{\mu^M}{\mu^N} \theta^M + \frac{1-K}{\mu^N} \wedge \theta^M \in \left[1-K, \frac{1-K}{\mu^M} \right] \right) \vee \left(\theta^N = 0 \wedge \theta^M \in \left[\frac{1-K}{\mu^M}, 1 \right] \right) \right\}$$

Proof. See Appendix D.2.

The solid line in Figure 1.2 represents the set of all potential pure strategy Nash equilibria. At this stage nothing prevents us to think that, for some values of the parameters I , w^L , K and for some specifications of $w(\cdot, \cdot)$ and $c(\cdot)$, we will get multiple equilibria or no equilibrium at all.

Figure 1.2: Set of potential Nash equilibria in pure strategies



We are interested in the behavior of the equilibria for any possible value of I in the policy

space $[0, 1]$. In order to get the next result we have to put some more structure on the function $w(\cdot, \cdot)$: in particular, let us assume that, for any potential equilibrium (θ^N, θ^M) where $\theta^N = 0$ the following inequality is verified

$$\frac{\partial w(\theta^M, \theta^H)/\partial \theta^M}{\partial w(\theta^M, \theta^H)/\partial \theta^H} > -\frac{d\theta^H(\theta^M)}{d\theta^M} \quad (1.12)$$

Mathematically, this condition requires the total derivative of $w(\cdot, \cdot)$ with respect to individual ability to be positive when computed at the migrants' equilibrium ability threshold.⁴ Given this regularity condition we can state the following

Proposition 1.1 *For any fixed value of $I \in [0, 1]$, the equilibrium (θ_*^N, θ_*^M) exists and it is unique. Moreover, θ_*^M as a function of I is continuous and non increasing (θ_*^N is non decreasing in I).*

Proof. See Appendix D.2.

The upper diagram in Figure 1.3 shows the qualitative behavior of the equilibrium thresholds as functions of the policy variable I . The lower diagram shows instead the equilibrium mass of natives workers (dotted curve), immigrants workers (dash dotted curve) as well as of all workers (black curve) employed in sector H for any value of I .

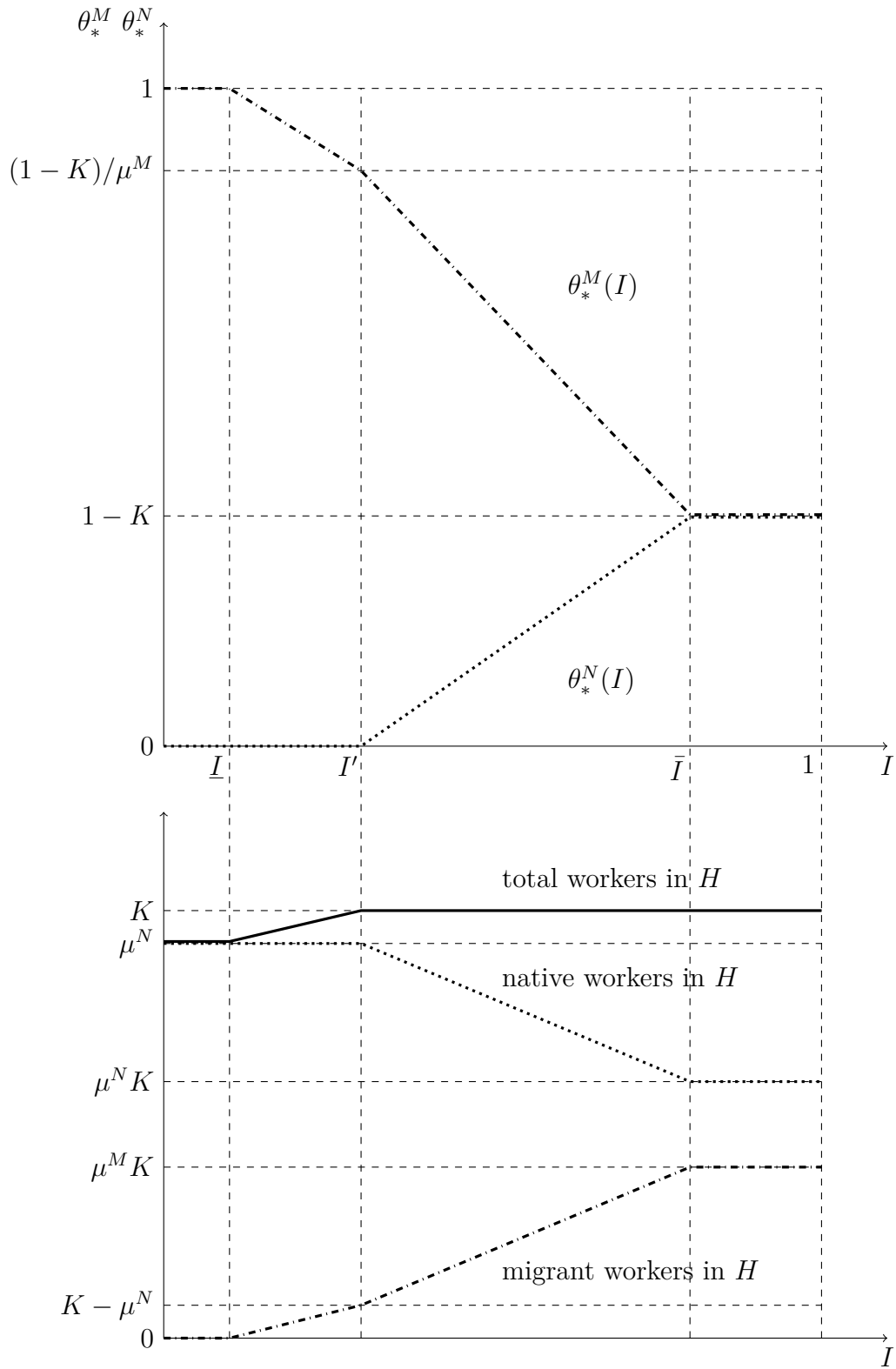
When the level of integration is low enough, even the most skilled migrant prefers to get a job in sector L . In this case the equilibrium thresholds are 0 for the natives and 1 for migrants meaning that all the native population competes and is hired in H while all the migrants get employed in L . Therefore in sector H there will be a mass μ^N of native workers, no migrants and a mass $K - \mu^N$ of unfilled vacancies.

Consider now the level of integration \underline{I} such that the most skilled migrant worker is indifferent between H and L . Above \underline{I} there will be an increasing mass of migrants from the right side of the skill distribution willing to compete for a job in H . Until the $K - \mu^N$ vacancies are not filled completely, the migrants competing will be hired in H for sure and the equilibrium thresholds will be 0 for the natives and some continuous and decreasing function of integration (starting from 1) for migrants. The mass of natives in H will be still μ^N while the mass of migrants hired in H will start increasing with I .

At the level of integration for which the mass of competing migrants fills all the $K - \mu^N$ vacancies (we call this level of integration I'), the indifferent migrant has type $\frac{1-K}{\mu^M}$. Above I' , for any further mass of migrants hired in H there will be an analogous mass of natives from the left side of the skill distribution that will have 0 probability of being hired (their ability is lower than the one of the new migrants willing to compete). In this case the

⁴Notice that, in equilibrium, the function $\theta^H(\cdot, \cdot)$ can be expressed as a function of the migrants' threshold strategy - θ^M - alone since the natives' one - θ^N - can be univocally derived from it.

Figure 1.3: Qualitative behavior of the equilibrium thresholds and of the worker composition in sector H as functions of the level of integration I



equilibrium threshold for the natives starts to depart from 0 and the one for migrants continues to decrease below $\frac{1-K}{\mu^M}$. What happens in H for levels of integration above I' ? The equilibrium mass of native workers hired in the sector starts to decrease while the mass of migrants continues to increase with I . This commovement is such that the K vacancies are always filled completely.

Finally, consider the level of integration \bar{I} such that the ability type of the indifferent migrant is identical to the ability type of the less skilled native employed in H . In equilibrium this type is $1 - K$. For any value of $I \geq \bar{I}$ the probability of being hired in H will be 0 for any worker with a type $\theta < 1 - K$. Therefore above \bar{I} the equilibrium thresholds will stay constant and equal to $1 - K$. The mass of natives employed in H reaches its minimum level of $\mu^N K$ and the mass of migrants its maximum of $\mu^M K$.

1.3.2 Political economy equilibrium

In this section we consider a voting procedure on the policy variable I . Before the workers's decision, natives agents vote and the level of integration is implemented accordingly to the voting outcome. A median voter political economy equilibrium aggregates the natives' preferences over I . The timing of the economy is represented in Figure 1.4.

Figure 1.4: Timing of the economy



For any $\theta \in [0, 1]$ we want to determine the preferred integration policy of a type θ native agent. Intuitively, the trade-off that she faces is the following: a high level of integration might let high skill migrants enter sector H , enhancing the average productivity in the sector and, in turns, increasing the salary of any other worker in H . On the other hand, high integration might force some natives to compete for a job in L , making impossible for them to be hired in H . The preferred integration policy of a type θ native is the one that maximizes the average ability in sector H , provided that the equilibrium threshold is such that the type θ native gets a job in H . Formally, the preferred policy of a type θ native solves the following maximisation problem

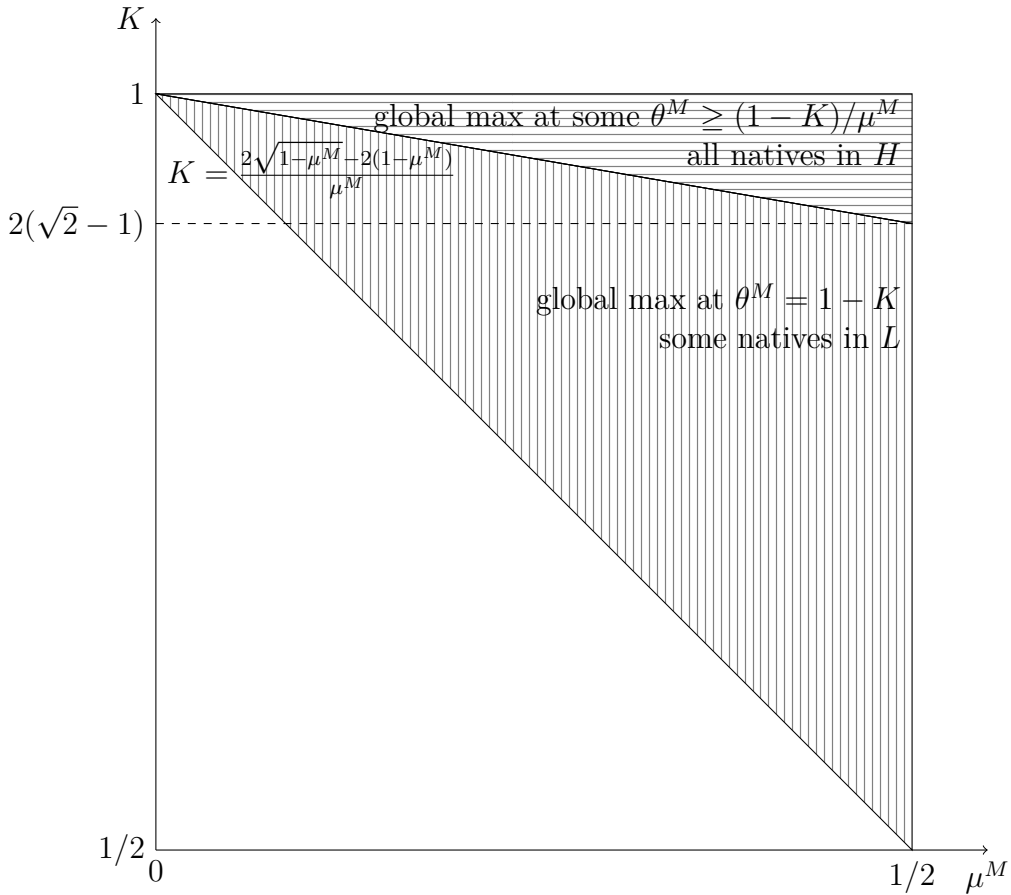
$$\max_{I \in [0,1]} \theta^H(\theta_*^M(I)) \quad \text{s.t.} \quad \theta_*^N(I) \leq \theta \quad (1.13)$$

The mapping from the voter's type to the solution(s) of problem (1.13) can have different

forms depending on the values of the parameters K and μ^M .⁵ The possible cases depend upon the shape of the function $\theta^H(\theta^M)$ and its local and global maxima.

In particular we can distinguish two relevant cases. In the first one, the average ability in sector H is globally maximised hiring more able migrants instead of less able natives until the K vacancies are completely filled (the argmax being $\theta^M = 1 - K$). This happens either when the K vacancies are not too many or if the relative mass of migrants is not too big (vertical-lines area in Figure 1.5). If instead there is a big number of vacancies or the relative mass of migrants is high enough, the global maximum for θ^H is reached at $\theta^M \geq (1 - K)/\mu^M$ (horizontal-lines area in Figure 1.5). Under this second case all the natives get a position in H when θ^H is at its maximum.

Figure 1.5: Global maxima of θ^H on the μ^M - K space



Consider the first case (θ^H has a unique global maximum for $\theta^M = 1 - K$). A native worker with type $\theta < 1 - K$ would solve problem (1.13) choosing I_* such that $\theta_*^N(I_*) = \theta$. Intuitively, she would prefer a level of integration as high as possible under the constraint

⁵Given our normalization assumption $\mu^N + \mu^M = 1$ the only relevant demographic parameter is the relative mass of migrants $\mu^M/(1 - \mu^M)$, which is strictly monotone, increasing function of μ^M .

that the probability of being hired in H the next period is equal to 1. Notice that for a voter of type $\theta = 0$ the preferred level of integration will be the highest one delivering the equilibrium threshold $\theta_*^N = 0$, i.e. I' . On the contrary, a native of type $\theta \geq 1 - K$ will never run the risk of losing her potential job position in H : any level of integration that gives the $\theta^M = 1 - K$ in equilibrium would solve problem (1.13). In particular this is true for any value of I in the set $[\bar{I}, 1]$. From Proposition 1.1 we know that θ_*^N is non decreasing in I (more precisely, it is strictly increasing on $[I', \bar{I}]$). Therefore for any type $\theta \in [0, 1 - K)$ the preferred policy of the voter will be an increasing function of her ability type. In the second case - where $\theta^H(\theta^M)$ has a unique global maximum at $\theta^M \geq (1 - K)/\mu^M$ - for any ability type θ the constraint of problem (1.13) will not be binding at the optimum. Therefore, every native worker prefers the policy that maximizes θ^H .

The following result characterizes the political economy equilibrium under classical Downsian electoral competition⁶

Proposition 1.2 *the political economy equilibrium I_* always exists. Moreover, If the parameters μ^M and K are such that the following condition holds*

$$\mu^M K < 2\sqrt{1 - \mu^M} - 2(1 - \mu^M) \quad (1.14)$$

I_* can take any value in $[\bar{I}, 1]$, where

$$\bar{I} := c^{-1} \left[w \left(1 - K, 1 - \frac{K}{2} \right) - w^L \right] \quad (1.15)$$

Otherwise, $I_* = I''$, where

$$I'' := c^{-1} \left[w \left(\frac{1 - \sqrt{1 - \mu^M}}{\mu^M}, \frac{1 - \sqrt{1 - \mu^M}}{\mu^M} \right) - w^L \right] < \bar{I} \quad (1.16)$$

Proof. See Appendix D.2.

The equilibrium described in Proposition 1.2 reflects the preferences of the median voter. The standard uniform distribution of abilities and our assumptions on the parameters imply that the median voter has an ability type $\theta = 1/2 > 1 - K$. Within this simple framework the median voter is always hired with probability one in sector H . Therefore, the following results have to be interpreted in a context where at least half of the voting population does not suffer an economic loss due to migrants' participation in the labor

⁶Classical Downsian electoral competition consists in the following. Two candidates maximize the probability of winning. First, electoral platforms are announced. Second, majority voting aggregates the preferences of the native workers. Finally, the winner's platform is implemented assuming perfect commitment.

market.⁷ The natives workers which might suffer from migrants' participation are those on the left tail of the ability distribution. This is in line with a general empirical finding that the negative effects of migration (if any) are concentrated asymmetrically on the low-skilled (or low-wages) native workers (see for instance Borjas, 2003; Dustmann et al., 2005; Ottaviano and Peri, 2012; Dustmann et al., 2013). Our model implies that the preferred policy of those native workers (from a 0 ability type to $\theta = 1 - K$) might be a lower level of integration. Intuitively, this is the case when the number of vacancies is sufficiently low. Notice that the constraint on K is less tight when the relative stock of migrants is small. When there is enough excess labor demand in sector H (above the size of the native population), no native worker is risking her position in H and the optimal integration policy is the same for every ability type.

1.3.3 Comparative statics

The lower bound integration in the first case of Proposition 1.2, \bar{I} , is increasing in K and w^L . For the sake of simplicity, we assume that the implemented policy is always the minimum value \bar{I} .⁸ Instead, the level of integration implemented in the second case, I'' , is decreasing in μ^M (increasing in μ^N) and increasing in w^L .

The first interesting finding is that integration is always increasing in w^L . We interpret the L sector as a metaphor for those economic opportunities that a migrant worker has, irrespectively of the degree of integration. These go from the opportunities in the informal economy to those low skill positions for which the native labor supply is shrinking. Concrete examples are jobs in the domestic sector (carers and house keepers), in the construction sector, in agriculture. The better those opportunities are in terms of wages and working conditions the higher the opportunity cost for a migrant to compete for a better position (a job in sector H); therefore the level of integration needed to attract the most skilled migrants to the jobs that have positive externalities for the natives should be higher as well.

Secondly, when the average ability in the H sector is maximized not hiring those workers (natives and migrants) with an ability type smaller than $1 - K$, the exogenous mass of vacancies K is relevant in determining the equilibrium outcome while the relative stock of migrants μ^M is not. In particular we have that integration is increasing in K . More job positions in H mean the possibility for any type θ voter to be keen to attract -

⁷This restriction is consistent with the recent empirical evidence on the effect of migration for natives' employment and wages. For instance, looking at the labor market in the UK, Dustmann et al. (2013) estimate that only 20% of natives workers suffer some wage reduction because of migration.

⁸In order to justify this assumption we can think of some strictly increasing implementation costs of integration.

ceteris paribus - more migrants in the sector. This translates into a higher integration in equilibrium. In our reduced form labor market, we can interpret a higher value of K as a higher employment capacity of the economy. Employment capacity matters for the equilibrium value of integration when it is small enough. In particular, this constraint is less tight the lower the relative stock of migrants in the economy (see condition (1.14) in Proposition 1.2). In those environments higher employment capacity increases the benefits for the natives of migrants's participation in sector H and allows for higher values of integration in equilibrium.

Finally, the model tells us that, when the average ability in H is maximized keeping all native workers in the sector, the demographic composition of society becomes relevant in the place of employment capacity. In particular, the equilibrium value of integration is increasing in the relative share of migrants μ^M . Given the uniform distribution of abilities, the higher the number of migrants, the higher the positive externalities that natives agents can get from integration (formally, the maximum of $\theta^H(\theta^M)$ is increasing in μ^M).

Rough evidence from the MIPLEX database, confirms the positive relationship between integration and w^L and suggests that the MIPLEX economies satisfy condition (1.14) of Proposition 1.2. We proxy the payoff in sector L with the log of per capita GDP scaled by the size of the shadow economy in a country (share of GDP).⁹ Measures of the shadow economy come from the database in Schneider et al. (2011). Employment capacity and the relative stock of migrants are measured as the employment to population ratio and the stock of international migrants (share of population) respectively.¹⁰

Figure 1.6 plots the linear regression estimate of the conditional expectation function for the MIPLEX (labor market mobility) index given the (proxy for) payoff in sector L .¹¹ Consistently with the model, the estimated slope coefficient is positive and statistically significant (+26.862, p-value 0.011) meaning that - ceteris paribus - we expect more policies for integration in MIPLEX countries with higher payoffs in the shadow economy.

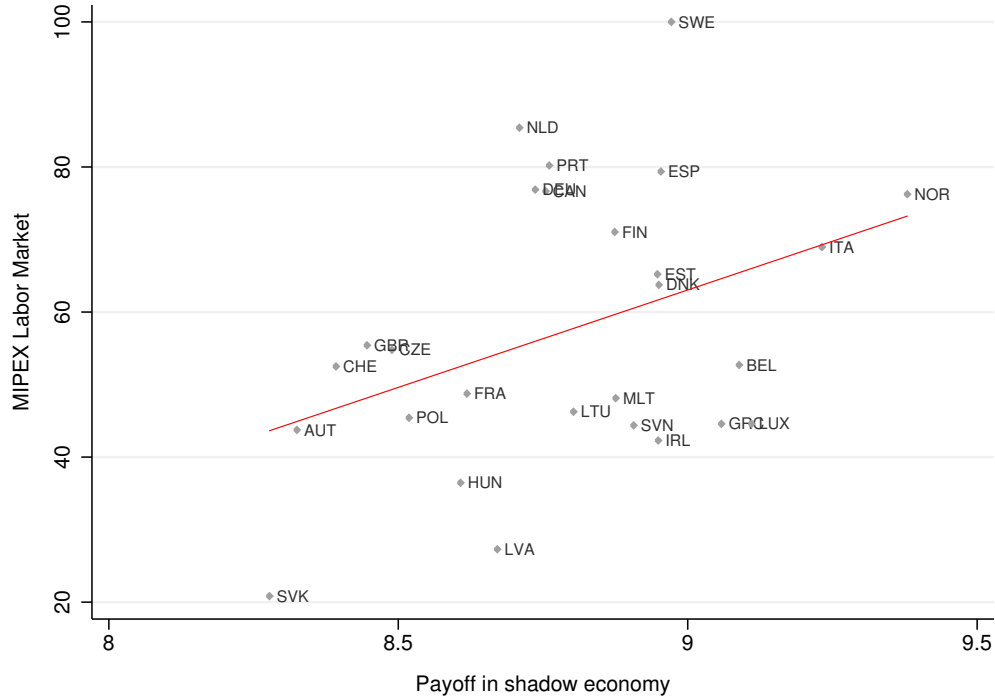
Figures 1.7 and 1.8 plot the same estimation conditioning for employment capacity and stock of migrants. The role of K appears predominant with respect to the role of μ^M . As predicted by our model when condition (1.14) is verified, the relationship between integration and employment capacity (red line in Figure 1.7) is positive and significant (slope coefficient equal to +1.533; p-value 0.008). Moreover, our data suggest that there is no particular relationship between integration and the relative stock of migrants (slope

⁹Formally the proxy for w^L in country c is given by $\ln[(\text{shadow economy share of GDP})_c \times (\text{per capita GDP (PPP)})_c]$.

¹⁰Descriptive statistics for the variables employed in the empirical exercise are given in Table A-1.

¹¹The estimation results for this and the following exercises are given in Table A-2.

Figure 1.6: Migrants' integration and w^L in 2007



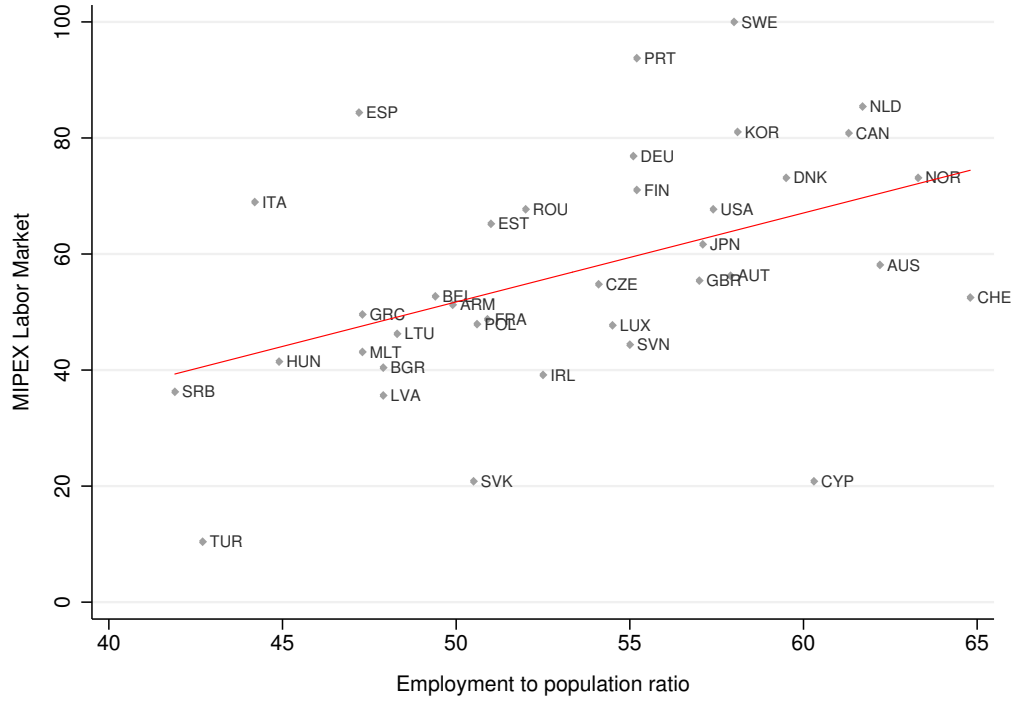
coefficient in Figure 1.8 equal to +0.329; p-value 0.456).

Applying our theoretical mechanism to the data and taking this suggestive empirical evidence with the necessary degree of caution, it seems that the employment capacity of the economies in our sample is low enough to be a relevant determinant of integration. A rigorous empirical exercise to test the model's implications goes beyond the scope of this paper and it is left for further research.

1.4 Conclusions

This paper addresses the issue of migrants' integration into a host country labor market. As stated in a recent research report by the OECD and the European Union "the integration of immigrants and their children [is] high on the policy agenda of EU and OECD countries, both from an economic and a social standpoint. The active participation of immigrants and their children in the labour market and, more generally, in public life is vital for ensuring social cohesion in the host country" (OECD/EU, 2015, pg. 9). A critical feature of many host economies is the asymmetry in labor market opportunities between migrant and native born workers. The focus of the paper is on those integration

Figure 1.7: Migrants' integration and employment capacity in 2010

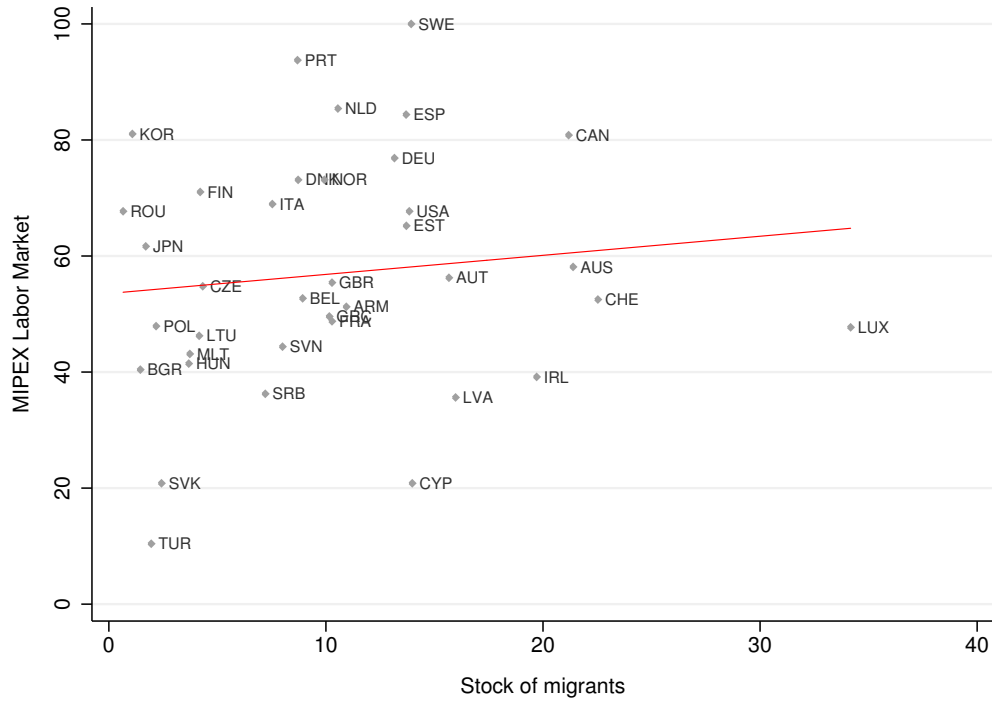


policies that enhance migrants' capacity to access the labor market. We model a simple trade-off embedded in integration policies. On the one hand they allow the best migrants to access the labor market with positive spillovers for the native workers through higher productivity. On the other, high skilled migrant's access might reduce the probability of less skilled native workers to be hired in high productivity sectors.

Our model solves for the integration policy implemented in a political economy where only native workers vote. When the employment capacity of the host country is not too high, the equilibrium requires that some low-skill native agents are not hired in the high productivity sector in order to let more qualified migrants to enter. When this is the case, the level of integration is increasing in the employment capacity of the country. We find rough empirical evidence in support of this result using data from the MIPEX project. Moreover, our model predicts that the level of integration will be a positive function of the opportunities in the informal economy. The higher such opportunities, the more the high-skill migrants tend to avoid positions in the formal market for which they are in a disadvantaged position with respect to native born workers. In order to attract the high skill migrants integration has to be higher.

This paper contributes to the economic literature on migration. It does so introducing a working definition of labor market integration and setting a simple political econ-

Figure 1.8: Migrants' integration and relative stock of migrants in 2010



omy framework to study its determinants given the relevant economic trade-off between the positive spillovers of migrants' participation and its potential negative effect on the low-skill native workers. Our analysis leaves some interesting questions open for future research. On the one hand, relaxing the assumptions of Downsian electoral competition and native voting, would allow us to study the role of special interest groups, ideological preferences as well as migrant voting in determining the level of integration above and beyond the role of modelled economic trade-off. On the other, it is important to bring our theoretical implications to the data, carefully controlling for non economic determinants of integration.

Chapter 2

Institutions and firms' organization: asymmetric effects of trade on productivity and welfare

With Mathilde Lebrand and Alberto Osnago

2.1 Introduction

The reallocation of resources across firms and sectors is a key factor for the economic development of a country. Theoretical papers such as Melitz (2003) and Bernard et al. (2007) and empirical studies such as Pavcnik (2002) and Trefler (2004) have shown that trade liberalization has a positive effect on aggregate productivity and it induces the reallocation of resources towards the most productive firms.¹ Some recent papers, however, provide evidence that these benefits depend on the existence of other non-trade distortions (see for example Freund and Bolaky (2008), Chang et al. (2009) and DeJong and Ripoll (2006)). These distortions, such low regulatory quality, financial constraints, or poor legal and political institutions, particularly affect developing countries and hamper their development.

In this paper, we develop a new channel that leads to distinctive results in terms of aggregate productivity and welfare. We propose a novel mechanism in which institutional distortions adversely affect the gains from trade. In particular the degree of difference in institutional quality between countries leads them to different specializations and creates

¹See also the detailed discussion that can be found in Harrison and Rodríguez-Clare (2010).

asymmetric effects on productivity and welfare. This channel helps explaining how institutional distortions prevent countries, especially those with poor institutions, to benefit from the gains of trade described in the literature.

This paper focuses on differences in business-related institutions, such as contract enforcement, as an important source of comparative advantage (Levchenko (2007), Nunn (2007), Costinot (2009)). In our model, institutional obstacles to doing business affect the firms' choice of production, e.g. which good to produce and the organization of its production. At the country level, the quality of institutions affects how resources are allocated and used across sectors and therefore, at an international level, triggers the pattern of comparative advantage. In particular, countries with better institutions specialize in the production of more complex goods, while countries with weaker institutions specialize in simple industries.

Our theoretical framework delivers two key predictions on the effects of trade liberalization on aggregate productivity and welfare.

First, while it confirms a positive effect of trade on aggregate productivity in the country with good institutions, it unveils a negative effect in the country with weaker institutions, especially when the difference in institutions is very high and trade mainly happens across industries. This prediction results from the reallocation of resources triggered by both the specialization of a country and the endogenous production choices of firms. In fact, after liberalization, resources are reallocated from the comparative disadvantaged sector towards the comparative advantaged one. In addition, since the most productive firms always choose to produce the more complex good, in the country with good institutions resources are attracted by more productive firms and aggregate productivity goes up. The opposite happens in the country with weak institutions: the most productive firms, being in the comparative disadvantaged sector, release resources that are then absorbed by less productive firms. As a consequence of the expansion of the simple sector, new unproductive firms might even start producing. The country with weak institutions would thus see its resources be reallocated to the simple sector where less productive firms operate. This is part of the novel mechanism of our paper. Finally, the asymmetric effect on aggregate productivity is stronger and leads to a decline in aggregate productivity when the institutional difference between the countries, and thus the forces behind the reallocation of resources, are larger.

The second prediction has to do with how trade liberalization affects welfare through prices. In our model, a large difference in institutions is shown to increase the aggregate price and decrease consumers' welfare in the country with good institutions. The intuition is the following. In a monopolistic framework, consumers value diversity and consume all available goods. After trade liberalization, consumers from the country with good

institutions have now access to and consume varieties produced in the other country. Since the other country has weaker institutions, the marginal costs of firms producing in this country are relatively higher and therefore their goods are relatively more expensive. In addition, when the gap in the quality of institutions between the trading partners is particularly high, the adverse effect of trade on prices and thus on welfare is amplified.

The new results of our paper are achieved thanks to the introduction of two novelties in the theoretical framework, namely the firm's organization that reflect how heterogeneous producers adapt to their local institutional environment and the endogenous choice of the sector by final producers. As to the first novelty, while relying on Costinot (2009) to model the firm's level impact of institutions on organization, we introduce firms heterogeneity and take into account the impact of institutions on aggregate productivity through the reallocation of resources. Firms optimally choose their horizontal degree of fragmentation by dividing the provision of their intermediate inputs among different suppliers.² The key trade-off comes from the gains and the costs of specialization. The gains are due to a fixed learning cost for each intermediate inputs to be supplied, and the costs from the probability that a supplier does not provide its subset of intermediate inputs. This probability ultimately depends on institutions in the form of contract enforcement. Better contract enforcement implies a higher probability that the supplier provides the intermediate inputs. This trade-off defines a marginal cost of production that depends on the productivity of each producer, the complexity of the good and the quality of contract enforcement.

Second, we build an original framework in which final producers endogenously choose their sector. Our approach differs from Bernard et al. (2007) where firms only decide whether to produce or not given the sector. In our model, producers choose their sector depending on their marginal cost of production and the aggregate prices. The marginal cost of production in a sector is a function of the idiosyncratic productivity of each producer and the quality of contract enforcement that determines its endogenous organization. Aggregate prices instead depend on the role of institutions in determining comparative advantage. In line with Costinot (2009) we show that the country with the best institutions has a comparative advantage in the complex industry whose outputs require a high number of intermediates. In this framework, the most productive firms are shown to always choose to produce the complex good for all level of contract enforcement. In contrast with Bernard et al. (2007) who find positive effects of trade on aggregate productivity for all possible cases, our model shows that introducing this endogenous choice might lead countries with weak institutions to lose in terms of productivity and welfare from trade liberalization.

²In a different set up, also Conconi et al. (2012) examine how trade liberalization affects the organizational structure of firms.

The outline of the paper is as follows. In Section 2.2 we describe some stylized facts on the linkages between trade and productivity. Section 2.3 first details the equilibrium in autarky and the optimal organization of the firms. Then it studies the effect of trade openness with a focus on the free-trade case. Furthermore, we discuss here the extension of a costly trade equilibrium and show that it delivers similar qualitative results. Section 2.4 concludes.

2.2 Trade and productivity: new stylized facts

Some recent works have provided evidence that benefits from trade depend on the existence and the degree of other non-trade distortions and the feasibility of removing them. For example, Freund and Bolaky (2008) show that business regulation is an important complementary policy to trade liberalization. Their empirical analysis show that in countries with low barriers to entry there is a positive relationship between openness to trade and growth whereas in regulated economies the relationship is negative. Chang et al. (2009) provide evidence that, in addition to barriers to entry, also infrastructure development and labor market flexibility are crucial to enhance the growth effects of openness.³ Our paper adds to this literature by constructing a framework in which business related institutions are crucial in the determination of gains from trade.

We explore how trade can affect economic performance and growth through its direct effect on productivity. Our model predicts that opening to trade can adversely affect the aggregate productivity in a country with weak institutions. Evidence of this negative effect of trade can be found in two recent papers and the case study illustrated below. Lu (2010) embeds the one-sector Melitz (2003) model into a comparative advantage framework and shows that in sectors where China has a comparative advantage, Chinese exporters were on average less productive than firms serving only the domestic market. Using Chinese data, Fan et al. (2011) show that the number of exporters and the share of exporting revenues are positively correlated with tariff in sectors with a comparative disadvantage.

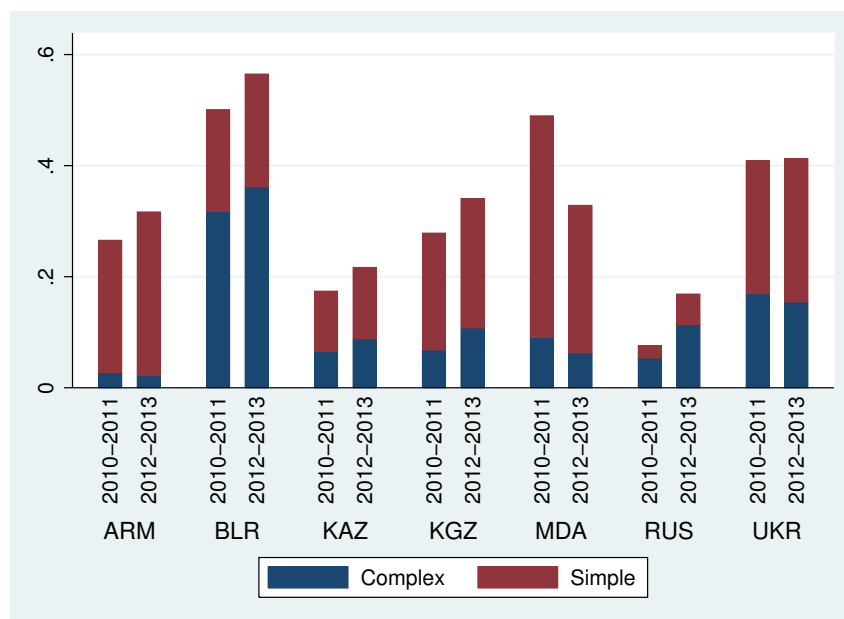
A recent liberalization episode among Commonwealth of Independent States (CIS) countries represents a good example of how institutional quality affects the gains from trade liberalization. The idea of a free trade area among CIS the emerged already right after the break up of the Soviet Union in 1991. Twenty years later, in October 2011, Russia, Ukraine, Belarus, Kazakhstan, Kyrgyzstan, Tajikistan, Moldova and Armenia signed a Treaty on a Free Trade Area between members of the Commonwealth of Independent

³DeJong and Ripoll (2006) find a positive relationship between tariffs and growth rates for the world's poorest countries, but a negative relationship for rich countries.

States (CIS-FTA). The agreement was enforced starting from September 2012. The CIS-FTA simplified the network of trade relationship between CIS by replacing existing bilateral and multilateral trade agreements and effectively eliminated export and import duties on a host of goods.⁴

Export data from COMTRADE in figure 2.1 show that ex-Soviet countries are well integrated among each other: a part from Russia, between one fifth and more than half of the exports of CIS is directed towards other countries in the group. Moreover, figure 2.1 shows that intra-CIS exports increased for almost all countries in the period 2012-2013 after the entry into force of the CIS-FTA. The CIS-FTA thus represents a liberalization event that we can use to analyze the effects across industries of an increase in trade. Finally, the figure shows that countries like Armenia and Kyrgyzstan export mainly simple goods such as food and wearing apparel whereas Belarus and Russia export complex goods such as refined petroleum products and chemicals to other CIS countries.⁵ The quality of institutions is a potential source of this pattern of specialization.

Figure 2.1: Average exports between CIS, 2010-2013



The historical experience and data from the World Bank suggest that business-friendly institutions are likely to be an important issue in CIS. The Doing Business database provides information about the quality of business related institutions for all countries in the World. Table 2.1 shows the quality of contract enforcement in the countries

⁴Exemptions are included in the agreement but they will ultimately be phased out.

⁵Simple (complex) industries are industry with complexity below (above) the median. Details about the complexity of industries are reported in Appendix B.1.

involved in the CIS-FTA.⁶ Among this sample of countries, Belarus has the best contract enforcement whereas Armenia lacks behind all other CIS.⁷

Table 2.1: Average contract enforcement in CIS, 2010-2013

Country	AVG contract enforcement DTF
Armenia	55.35
Belarus	79.90
Kazakhstan	68.02
Kyrgyzstan	64.63
Moldova	74.78
Russia	76.11
Tajikistan	67.76
Ukraine	67.19

Averages over the period 2010-2013 of distances to the frontier of contract enforcement are reported. Higher values correspond to better institutions.

Measures of productivity for Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia and Ukraine at the industry level (2 digits ISIC Rev. 3.) before and after the CIS-FTA can be constructed using the firm level data available in the World Bank Enterprise Survey. Details about the dataset and the construction of productivity are provided in Appendix B.1. We can then determine if changes in exports or comparative advantage are positively related to changes in productivity in these countries during a liberalization episode.

Armenia and Kyrgyzstan, the countries with the lowest level of contract enforcement among CIS, experienced a decrease in average aggregate productivity after 2012.⁸ Moreover, a more disaggregated analysis shows that, in the period under consideration, Armenia experienced an increase in revealed comparative advantage in manufacturing of food and beverages, a simple industry, but the average productivity in that industry decreased sharply.⁹ A negative relationships between improvements in comparative advantage and declines in productivity can be found in manufacturing of textiles, another simple sector, in Kyrgyzstan. In Ukraine too, increases in comparative advantage in manufacturing

⁶As defined in the dataset, contract enforcement assesses the efficiency of the judicial system by following the evolution of a commercial sale dispute over the quality of goods and tracking the time, cost and number of procedures involved from the moment the plaintiff files the lawsuit until payment is received. For additional details, see the Doing Business web page <http://www.doingbusiness.org/>

⁷The average and median levels of contract enforcement in the World in the period 2010-2013 are 60 and 60.4 respectively. The variance of the variable is 164.1 in the sample of all countries, and 55.9 in the CIS sample.

⁸In our data, also Moldova, Russia and Belarus present lower aggregate productivity in 2012 and 2013 with respect to 2008 and 2009 while Ukraine and Kazakhstan have higher aggregate productivity.

⁹Revealed comparative advantage is calculated using the Balassa index, Balassa (1965).

of food and beverages and non-metallic mineral products have been accompanied by decreases in productivity.¹⁰

The examples of Armenia and Kyrgyzstan reported above are not definitive evidence of negative effects of trade in countries with weak institutions and we are not claiming any causal relationship. However, this simple empirical evidence suggests that the positive selection of firms triggered by trade liberalization is complex and depends on additional factors such as the quality of institutions.

2.3 The model

2.3.1 The economic environment

We consider two countries indexed by $k \in \{H, F\}$ that have similar economic structures. Each country has two sectors, S and A , producing differentiated goods under monopolistic competition and a numeraire sector, X , producing a homogenous good under perfect competition¹¹. S and A produce respectively simple and advanced goods. The production of simple goods is characterized by a lower degree of complexity (properly defined later). Each country has a population of L workers and there is no mobility of workers across countries. Every worker is endowed with a fixed number of hours h . We first describe in detail the economic structure in country H .

Demand

We assume Cobb-Douglas utility across sectors and CES across varieties:

$$U = \mathbf{S}^{\alpha_S} \mathbf{A}^{\alpha_A} X^{\alpha_X}$$

¹⁰A weak negative correlation between changes in RCA and changes in TFP in countries with weak institutions can also be found in a wider sample of countries. We also run a simple OLS regression using data from all countries surveyed from the World Bank. Controlling for country-industry variables such as the share of imports of an industry in a country and the country share of world imports in an industry, time-, country-, and industry-fixed effects, the correlation between changes in RCA and changes in TFP is positive but not significant. However, the coefficient of an interaction term between changes in RCA and a dummy equal to one for weak institutions suggests that there is a negative significant correlation between the two variables in countries with weak institutions.

¹¹The presence of the numeraire allows us to pin down the wage level and to focus on the price effects of trade liberalisation. The homogeneous numeraire good is produced under perfect competition. One unit of X requires one unit of labor to be produced, so that the wage in the numeraire sector is $w = 1$. At the equilibrium, within country labor mobility makes sure that the wage w_i is the same for the sectors $i \in \{S, A\}$. For the rest of the paper we denote w the wage for all the sectors and we will focus our discussion on the the two sectors S and A .

where \mathbf{S} and \mathbf{A} are the standard aggregate consumption levels for simple and advanced goods defined as

$$\mathbf{S} := \left[\int_{\omega \in \Omega^S} c(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \quad \text{and} \quad \mathbf{A} := \left[\int_{\omega \in \Omega^A} c(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \quad \text{with } \sigma > 1.$$

Ω^i stands for the set of available varieties for each sector with $i \in \{S, A\}$. We assume $\alpha_X, \alpha_S, \alpha_A > 0$ and $\alpha_X + \alpha_S + \alpha_A = 1$.

Supply: Final Firms and Suppliers

Simple and advanced goods have to be produced according to their degree of complexity, which is the size of the continuum of intermediate goods required for the final production. The production of a simple good requires fewer intermediate goods than the production of an advanced good. We denote by z^i the size of this continuum for $i \in \{S, A\}$, with $z^S < z^A$. For the sake of clarity we explicitly distinguish between final and intermediate goods, the former being the ones entering the consumption bundle. Moreover, we call *final firms* (or simply *firms*) the producers of the simple and advanced final goods. Intermediate goods instead are provided by *suppliers* (properly defined later).

For each sector, the problem of a final firm is to efficiently organize the production of all the intermediate goods across suppliers. We assume that a final firm is characterized by an exogenous, idiosyncratic level of productivity φ . The productivity of the final firm affects the productivity of its suppliers as well as the way suppliers are organized to produce the final good¹². The parameter φ is distributed according to a probability density function g on the support $(0, +\infty)$. We denote with G the associated cumulative distribution function. We posit that g is the same for the two countries. Given productivity φ , a final firm will choose whether to produce and in which sector to do so. Contrary to most of the models with multi-sectors economies and a monopolistic competition (e.g. Bernard et al. (2007)), in our framework the final firms choose in which sectors to produce and are not ex-ante affiliated to one sector.

For simplicity, we assume that one supplier consists of one worker endowed with h working hours. For each intermediate good, the supplier has to first spend time learning how to produce it. Then, actual production happens through a linear technology. The productivity of a supplier depends on the productivity of the final firm. Consider a supplier that has to provide a certain number of intermediate goods for a final firm with a productivity φ . For each intermediate good the supplier needs $\frac{1}{\varphi}$ hours to learn how to produce

¹²We can consider this productivity level as a final firm-specific knowledge or as the ability of its manager.

it and $\frac{1}{\varphi}$ hours for the actual production of one unit of it. The higher the productivity of the final firm, the more productive to learn and to produce a supplier becomes.

Denote with $\mathbb{Y}(\varphi)$ the number of final good's units u that a final firm with productivity φ plans to produce. The number of hours l necessary to learn and produce one intermediate good for the production of $\mathbb{Y}(\varphi)$ units of the final variety are given by the following expression:

$$l := \int_{u \in \mathbb{Y}(\varphi)} \frac{1}{\varphi} du + \frac{1}{\varphi} \quad (2.1)$$

The learning cost of one intermediate good and the marginal productivity of a supplier in a final firm with productivity φ are the same across sectors.

Final firms produce under monopolistic competition and face a fixed production cost $f > 0$. We assume that all the sector-specific intermediate goods have to be provided in order to produce one unit of any final variety¹³.

Firms' Organization and Institutions

Our modeling strategy for the organization of the final firms follows closely the theoretical structure introduced by Costinot (2009).

Let us consider a final firm with productivity φ in sector i . Each unit of the final good that the firm wants to produce requires one unit of each intermediate good in $[0, z^i]$. The final firm has to choose the number of its suppliers - we posit that suppliers cannot produce intermediates for more than one final firm - and, most importantly, it has to allocate the provision of intermediate goods across them. The final firm pays a wage w to each chosen supplier, irrespectively of the actual provision of the intermediate goods. It can be shown that the final firm optimally partitions the interval $[0, z^i]$ into N identical ranges of intermediate goods and assigns each range to a different supplier. Moreover, it optimally assigns the same range to the same supplier across as many units of final goods as it takes to deplete the supplier's endowment of hours¹⁴. As a result, the suppliers chosen by the final firm are divided into groups of size N . Each member of a group is specialised in z^i/N intermediate goods: it spends $z^i/N\varphi$ hours in learning how to produce them, and the remaining $h - z^i/N\varphi$ hours of its endowment in producing them.

We crucially assume that the suppliers' activity can be hampered by institutional obstacles such as corrupted bureaucracies, unexpected taxation or violation of property

¹³This is analogous to the O-ring theory by Kremer (1993).

¹⁴Our framework takes as given many important intermediate results of the Costinot theoretical structure. We provide a fully micro funded application in Appendix B.2.

rights¹⁵. The quality of institutions, therefore, determines the probability with which every single supplier is able to fulfill the provision of intermediates it has been assigned to. Formally, we define a successful provision indicator for a given supplier as

$$\mathbb{I}(supply) = \begin{cases} 1 & \text{with probability } e^{-\frac{1}{\theta}} \\ 0 & \text{with probability } 1 - e^{-\frac{1}{\theta}} \end{cases} \quad (2.2)$$

where $\theta > 0$ captures the quality of institutions. When $\mathbb{I}(supply) = 0$ the supplier fails the provision of all the intermediate goods it was responsible for. As a consequence, the final firm is not able to produce those units of the final good, which the supplier's provision was intended to contribute to. Low values of θ are associated with low probabilities of successful provision and therefore represent weak institutional frameworks. For θ going to $+\infty$ instead, the probability of successful provision tends to 1, minimizing the uncertainty in the production process of the final firm.

The optimal organization of a final firm coincides with the optimal choice of N , the size of the suppliers' group producing intermediates for each unit of final good or, in other words, the degree of fragmentation of intermediates' provision across suppliers. The trade-off behind this optimal decision is intuitive: on the one hand, a higher fragmentation allows the final firm to leave its suppliers with a greater amount of hours for the actual production of intermediates (each supplier is specialized in a smaller range of intermediates and therefore has to allocate less hours into learning). On the other hand, a higher degree of fragmentation enhances uncertainty in the production process of the final firm: a single supplier failing its provision compromises the production of units of final goods, independently on the provision of all the other members of its group.

In our model, institutions affect the organization of the final firms and their frontier of production. Moreover, the quality of institutions is the only parameter that differs across the two countries. If the two countries trade among each other, institutional heterogeneity is the source of comparative advantage and therefore it creates potential trade opportunities. Before turning to the analysis of trade regimes, we present our modelling framework and derive results for a country in autarky.

¹⁵A complementary assumption would be the existence of imperfect contract enforcement. In this environment a supplier is able, with a certain probability, to shirk on the provision of intermediates that was assigned to it by a final firm.

2.3.2 Equilibrium under autarky

The consumers' problem

We apply the two-stage budget procedure using the aggregate income \mathcal{R} and the aggregate price indexes

$$P^i = \left[\int_{\omega \in \Omega^i} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}} \quad \forall i \in \{S, A\}$$

The Cobb-Douglas specification implies fixed expenditure shares for the two sectors: $P^S \mathbf{S} = \alpha_S \mathcal{R}$ and $P^A \mathbf{A} = \alpha_A \mathcal{R}$. In order to get rid of any demand side effects in determining the comparative advantage under free trade we assume $\alpha_S = \alpha_A = (1 - \alpha_X)/2$.¹⁶ We denote by α this parameter. In addition we take R as the aggregate income net of the expenditure for the numeraire good X , $R = (1 - \alpha)\mathcal{R}$. For every sector, consumption across varieties is given by the following equations:

$$c(\omega) = \begin{cases} \mathbf{S} [p(\omega)/P^S]^{-\sigma} & \text{if } \omega \in \Omega^S \\ \mathbf{A} [p(\omega)/P^A]^{-\sigma} & \text{if } \omega \in \Omega^A \end{cases} \quad (2.3)$$

The firms' problem: optimal organization

The final firm chooses how to organize its production through the allocation of the intermediate-good production among the suppliers. The optimal organization strategy is a number of suppliers denoted by N (called degree of fragmentation) associated to an optimal allocation of intermediate goods for each supplier.

First, we denote by $y(\varphi)$ the expected production given the initial plan of production $\mathbb{Y}(\varphi)$ that is produced in case of no uncertainty. Given that all suppliers have the same probability to fail intermediates' provision, the expected production of the final firm is given by:

$$y(\varphi) = \mathbb{P}(\mathbb{I} = 1)^{N(\varphi)} \int_{u \in \mathbb{Y}(\varphi)} du \quad (2.4)$$

with $N(\varphi)$ the number of suppliers in a team of a final firm with productivity φ . $\mathbb{P}(\mathbb{I} = 1)^{N(\varphi)}$ defines the probability that all the suppliers successfully provide their range of intermediate goods such that the final good can be produced. Supplier level probabilities of failed provision are multiplied by each other because the final good is produced only if all the intermediate goods required to its production are supplied.

We can derive the production technology of a final firm of productivity φ in the sector

¹⁶Krugman (1980) shows how the country with higher internal demand for a sector will develop a comparative advantage in the production of the sector specific varieties.

with complexity $z \in \{z^S, z^A\}$ of a country with institutions θ and determine its optimal organization $N^*(\varphi, z, \theta)$. Given the total mass S of suppliers working in in the final firm, its maximization problem can be written as¹⁷

$$\max_N pe^{-\frac{N}{\theta}} \frac{\varphi}{z^i} S \left(h - \frac{z^i}{\varphi N} \right) - w(S + f) \quad (2.5)$$

The optimal organization - or degree of fragmentation - of the final firm is given in the following

Proposition 2.1 (*Degree of fragmentation*) *The optimal number of suppliers for a final firm with productivity φ in the sector with complexity z in a country with institutions θ is:*

$$N^*(\varphi, z, \theta) = \frac{z}{2h\varphi} \left(1 + \sqrt{1 + \frac{4\theta h\varphi}{z}} \right) \quad (2.6)$$

Proof. See Costinot (2009).

The final good is produced when each of the N suppliers have supplied their range of intermediate goods. The degree of fragmentation depends upon exogenous parameters as stated in the following

Observation 2.1 (*Comparative statics*) N^* decreases in φ , increases in z and θ .

This comparative static result tells us that higher productivity, lower complexity or worse institutions decreases the fragmentation of the production by the final firm. This comes from the trade-off explained in Costinot (2009) between the gains and costs of fragmentation. The learning cost for each intermediate good creates gains of fragmentation as a supplier with a smaller interval of goods can be more specialized and produce more. However the uncertainty in the supply of intermediates due to the poor quality of institutions creates costs of fragmentation of the final production.

A higher productivity decreases the learning cost per supplier but does not affect the uncertainty level due to the quality of institutions. The gains of fragmentation are reduced with a higher productivity and the final firm decreases its optimal degree of fragmentation. Second, a higher degree of complexity for the final good increases the number of intermediate goods to provide and the hours to be dedicated to the learning process. The gains of fragmentation increase with a higher degree of complexity and the final firm expands its optimal degree of fragmentation. Finally, a higher quality of institutions di-

¹⁷The computation is similar to Costinot (2009) and is detailed in the Annex. $e^{-\frac{N}{\theta}}$ is the probability for teams of N suppliers to get all the intermediate goods provided and $\left(h - \frac{z^i}{N\varphi} \right)$ the number of hours left for production for each supplier after the learning process.

rectly decreases the costs of fragmentation and the final firm increases its optimal degree of fragmentation. We provide a graphical illustration of the comparative statics result in Figure 2.2 and 2.3.¹⁸

Figure 2.2: The degree of fragmentation N^* for the two sectors S and A in one country

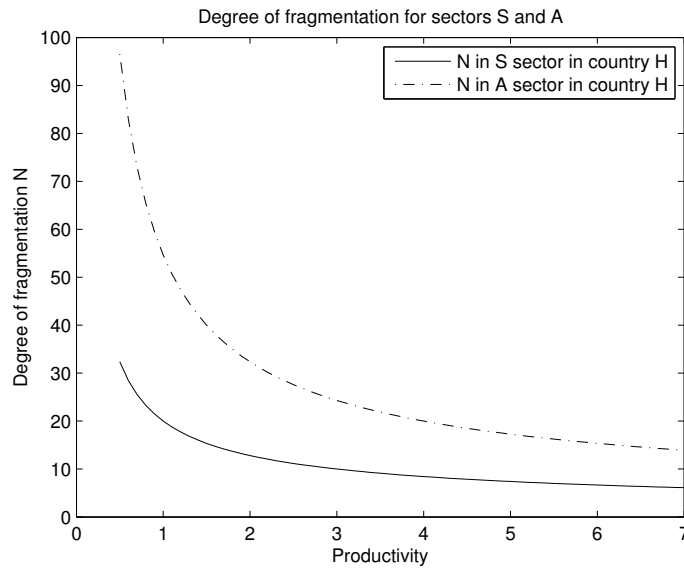
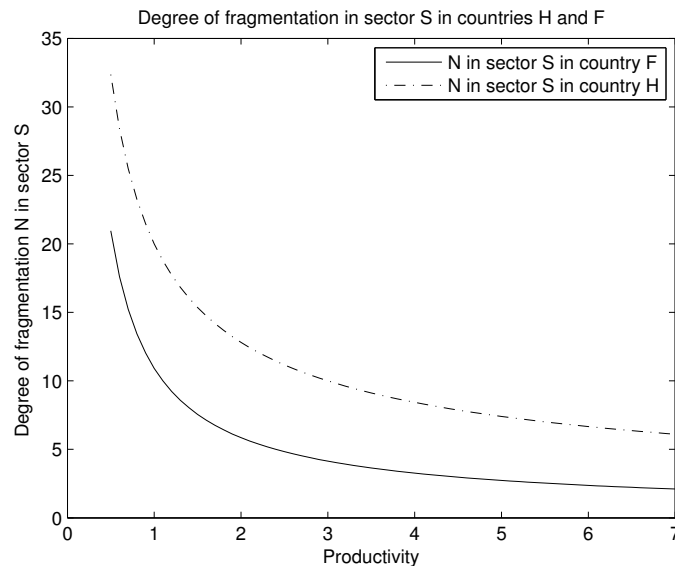


Figure 2.3: The degree of fragmentation N^* for two countries with different qualities of institutions θ^H and θ^F in one sector



¹⁸The general patterns shown in Figure 2.2 hold for any level of institutions. The general patterns in figure 2.3 hold for any level of complexity.

The fragmentation of production directly affects production chains, outsourcing and the productivity of firms. One example is Fally (2012) that shows that fragmentation weighted by the value added of each range of intermediates has decreased over the last decades in the US. The explanation he gives is the increase of services in production that are usually not so fragmented and are provided close to the customers. Our model provides another mechanism for which a higher productivity of final firms, a lower complexity of final goods or a fall in the quality of institutions can also explain this fall of fragmentation.

The firms' problem: production and sector decision

In this subsection we derive the optimal pricing rule and the profit function for firms of productivity φ . We then determine which firms choose to produce and in which sector they do so. For the rest of the paper we denote by $N^i(\varphi)$ the optimal organization of the final firm of productivity φ in sector $i \in \{S, A\}$ in a country with a quality of institutions θ , such that $N^i(\varphi) = N^*(\varphi, z^i, \theta)$.

Let us consider a final firm with a productivity level φ producing a variety in Ω^i under the institutional framework θ . The final firm chooses the optimal total mass of suppliers $S^i(y)$ summing up all the suppliers required to produce y , the whole amount of final good:

$$S^i(y) = \frac{z^i}{\varphi} e^{\frac{N^i(\varphi)}{\theta}} \left(h - \frac{z^i}{\varphi N^i(\varphi)} \right)^{-1} y \quad (2.7)$$

Given optimal organization, we define the inverse of the marginal productivity of a final firm's supplier as¹⁹

$$\beta^i(\varphi) := \frac{\partial S^i(y)}{\partial y} = e^{\frac{N^i(\varphi)}{\theta}} \left[\frac{h\varphi}{z^i} - \frac{1}{N^i(\varphi)} \right]^{-1} \quad (2.8)$$

The maximization problem of the final firm can be written as

$$\max_y p^i(y)y - w \left[S^i(y) + f \right] \quad (2.9)$$

For the rest of the paper we set the wage w equal to 1. Following Dixit and Stiglitz (1977) we posit that the market share of each final firm is small enough in order to be neglected in the pricing decision of the others. This assumption (supported by the infinite number

¹⁹This level of productivity differs from the initial distribution of productivity parameters φ and results from the optimal strategy of the firm to organize the production depending on the complexity of the goods.

of firms in our set up) together with the constant elasticity of substitution gives us the following expression for the elasticity of demand faced by the final firm:

$$\epsilon^i(\varphi) = \epsilon = \frac{1}{1 - \rho} \quad \text{where} \quad \rho = \frac{\sigma - 1}{\sigma} \quad (2.10)$$

The pricing rule is defined by the standard mark-up over the marginal cost:

$$p^i(\varphi) = \frac{\beta^i(\varphi)}{\rho} \quad (2.11)$$

The profit function is given by

$$\pi^i(\varphi) = \frac{R}{2\sigma} \left[\frac{P^i \rho}{\beta^i(\varphi)} \right]^{\sigma-1} - f \quad (2.12)$$

Let us begin our analysis of the profit function with the following

Observation 2.2 (*Properties of the profit function*) $\forall \varphi, \forall i$ $\pi^i(\varphi)$ is continuous and monotonically increasing in φ . Moreover $\lim_{\varphi \rightarrow 0} \pi^i(\varphi) = -f$ and $\lim_{\varphi \rightarrow +\infty} \pi^i(\varphi) = +\infty$.

The contribution of this paper is to allow final firms to be mobile across sectors. Each final firm optimally chooses in which sector to produce depending on the expected profits in each sector given its productivity. Optimal production and sector decision under autarky is given by the following

Proposition 2.2 (*Production and sector decision*) If the autarky equilibrium (properly defined later) exists, (i) there exists one productivity threshold φ^{SA} such that $\pi^S(\varphi^{SA}) = \pi^A(\varphi^{SA}) > 0$; (ii) there exist two productivity thresholds φ^{eS} and φ^{eA} such that $\pi^S(\varphi^{eS}) = \pi^A(\varphi^{eA}) = 0$ and $\varphi^{eS} < \varphi^{eA}$; (iii) a final firm chooses whether and in which sector to produce according to the following scheme:

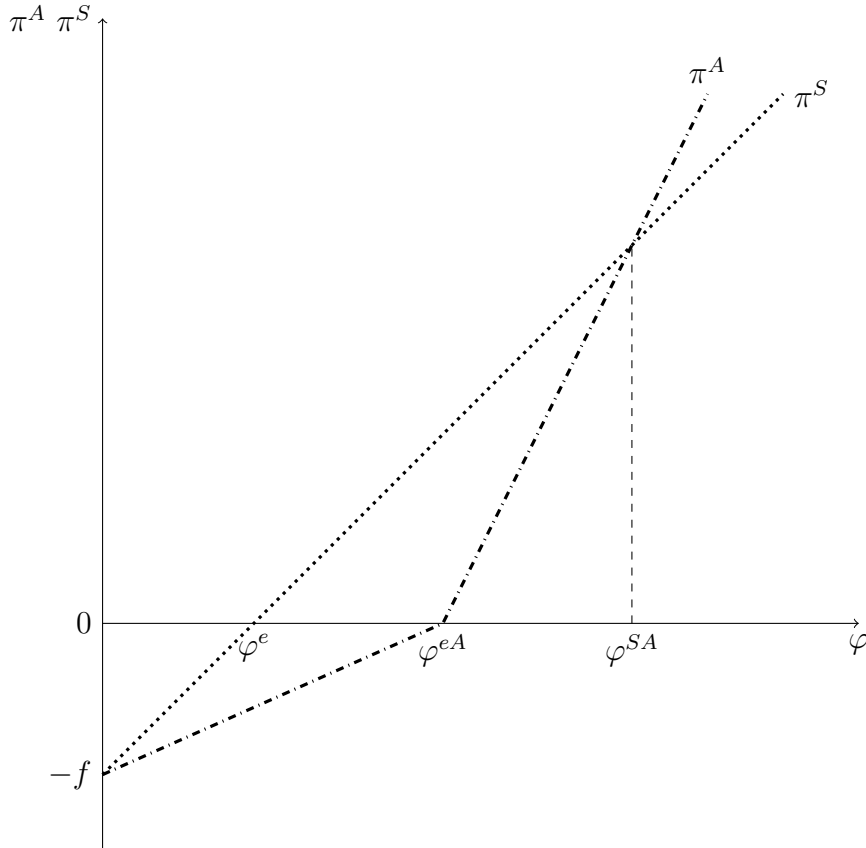
- if $\varphi < \varphi^e$ with $\varphi^e = \varphi^{eS}$, the firm does not produce any good,
- if $\varphi \in [\varphi^e, \varphi^{SA})$, the firm produces a variety in sector S ,
- if $\varphi \geq \varphi^{SA}$, the firm produces a variety in sector A .

Proof. See Appendix B.3.

Proposition 2.2 shows the existence of the two thresholds φ^{eS} and φ^{eA} from which a firm can make non negative profits. The threshold φ^{eS} is shown to be the lowest level of productivity that enables a firm to make non negative profits, we call it the *entry threshold* and we drop the S from its superscript. A firm that draws a productivity parameter below φ^e exits the market and never starts producing. The choice threshold

φ^{SA} is defined as the productivity level for which a firm is indifferent between producing in one of the two sectors. We provide a graphical representation of the entry and choice thresholds in Figure 2.4 where we rely on a simplified representation of the profit functions for the two sectors.

Figure 2.4: Profits as function of productivity



Proposition 2.2 also states that for any quality of institutions, firms in the advanced sector are more productive than the firms in the simple sector. A firm with a productivity between φ^e and φ^{SA} produces a simple variety, and with a productivity above φ^{SA} an advanced variety. This important result is explained by the fact that the ratio of the marginal costs $\beta^S(\varphi)/\beta^A(\varphi)$ is increasing in the productivity. This implies that final firms are increasingly better at producing a variety in sector A relatively to a variety in sector S . What matters here is the relative ratio, as more productive firms are always better (lower marginal costs) to produce a variety in each sector. However more productive firms are relatively better at producing a variety in sector A .

Aggregation: prices and profits

We define the average marginal costs $\tilde{\beta}^S$ and $\tilde{\beta}^A$ in the two sectors which is determined by the cutoff productivity levels φ^e and φ^{SA} as follows.

$$\tilde{\beta}^S = \tilde{\beta}^S(\varphi^e, \varphi^{SA}) = \left[\frac{1}{G(\varphi^{SA}) - G(\varphi^e)} \int_{\varphi^e}^{\varphi^{SA}} (\beta^S(\varphi))^{1-\sigma} g(\varphi) d\varphi \right]^{\frac{1}{1-\sigma}}$$

and

$$\tilde{\beta}^A = \tilde{\beta}^A(\varphi^{SA}) = \left[\frac{1}{1 - G(\varphi^{SA})} \int_{\varphi^{SA}}^{\infty} (\beta^A(\varphi))^{1-\sigma} g(\varphi) d\varphi \right]^{\frac{1}{1-\sigma}}$$

Calling M the total mass of firms active either in S or in A , we can write the aggregate price indexes for the two sectors as

$$P^S = (M^S)^{\frac{1}{1-\sigma}} p^S(\tilde{\beta}^S) \quad \text{and} \quad P^A = (M^A)^{\frac{1}{1-\sigma}} p^A(\tilde{\beta}^A).$$

with $M^S = \left[\frac{G(\varphi^{SA}) - G(\varphi^e)}{1 - G(\varphi^e)} \right] M$ and $M^A = \left[\frac{1 - G(\varphi^{SA})}{1 - G(\varphi^e)} \right] M$, denoting respectively the mass of firms producing a variety of the simple and the advanced goods. Finally, aggregate profits Π are given by the following expression:

$$\Pi = M\bar{\pi} = M \left[\frac{G(\varphi^{SA}) - G(\varphi^e)}{1 - G(\varphi^e)} \bar{\pi}^S + \frac{1 - G(\varphi^{SA})}{1 - G(\varphi^e)} \bar{\pi}^A \right]$$

with $\bar{\pi}^S$ and $\bar{\pi}^A$ the average profits defined as

$$\bar{\pi}^S = \frac{\int_{\varphi^e}^{\varphi^{SA}} \pi^S(\varphi) g(\varphi) d\varphi}{[G(\varphi^{SA}) - G(\varphi^e)]} \quad \text{and} \quad \bar{\pi}^A = \frac{\int_{\varphi^{SA}}^{\infty} \pi^A(\varphi) g(\varphi) d\varphi}{[1 - G(\varphi^{SA})]}$$

Timing and free-entry condition

Following Melitz (2003) we model a process of firms' dynamics. Every period there is a mass M_e of potential entrants. At this stage the potential entrants are identical. In order to draw a productivity parameter from the distribution $g(\cdot)$ they have to pay a fixed entry cost f_e thereafter sunk. Once the firm knows its productivity, it decides whether to engage in production and in which sector to do so. Those decisions are taken anticipating optimal pricing behavior, which in turn embeds optimal organization determined taking prices as given.²⁰ Thus, only the potential new firms with a productivity level higher than φ^e finally enter the production process. Every period will be characterized by a mass M

²⁰As in Dixit and Stiglitz (1977) we assume that the market shares of the firms are small enough not to trigger the strategic consideration of the opponents' pricing behavior.

of active firms which is the sum of the firms active in the two sectors: $M = M^A + M^S$. For every active firm in every period, there is a positive probability δ of exogenous death. At the beginning of the period a proportion δ of the incumbent firms M_{-1} disappears. The dynamics is given by: $M = (1 - \delta)M_{-1} + (1 - G(\varphi^e))M_e$. We will focus on the steady states of this dynamic process, where $M = M_{-1}$ and $[1 - G(\varphi^e)]M_e = \delta M$. The expected profits from drawing a productivity level has to be equal to the cost f_e of having a draw. From this we derive the firm entry condition:

$$V = \frac{[1 - G(\varphi^e)]}{\delta} \bar{\pi} = f_e \quad (2.13)$$

with V the ex-ante utility of the firm over time and $\bar{\pi}$ the average ex-post profit in the economy. We use the expressions of the average profits to rewrite the free-entry condition as a function of the the two thresholds (φ^e and φ^{SA}) and other exogenous variables:

$$\begin{aligned} V(\varphi^e, \varphi^{SA}) = & \frac{f}{\delta} \left\{ [G(\varphi^{SA}) - G(\varphi^e)] \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi^{SA})] \left\{ \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \frac{\beta^S(\varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \end{aligned}$$

Goods and labor markets

The goods market clearing condition requires that the share of revenues from a sector equals the share of expenditures into it:

$$R_S = \alpha_S R \quad \text{and} \quad R_A = \alpha_A R$$

Suppliers are used to enter the production process as well as to produce. S^e denotes the total number of suppliers used in the entry process (notice that S^e is not sector specific) and S_i^p denotes the number of suppliers used for production in sector i . Given our simplifying assumption of one worker for each supplier, the total number of suppliers is equal to the number of workers L . The labor market clearing conditions is thus:

$$S^e + S^p = L \quad \text{with} \quad S^p = S_S^p + S_A^p$$

Equilibrium

Proposition 2.3 (*Autarky equilibrium*) *For each country, there exists an autarky equilibrium*

$$\{\varphi^{e*}, \varphi^{SA*}, P^{S*}, P^{A*}, M^*, p^{S*}(\varphi), p^{A*}(\varphi)\}$$

that verifies the optimal behaviour of the consumers and producers, the labor market and good market conditions.

Proof. See Appendix B.3.

All the equilibrium endogenous variables can be pinned down from the vector of thresholds $(\varphi^{e*}, \varphi^{SA*})$. See Appendix B.3 (Proof of Proposition 2.3) for a detailed derivation of the equilibrium under autarky.

Observation 2.3 (*Institutions under autarky*) Under the autarky equilibrium, (i) the entry and choice thresholds φ^{e*} and φ^{SA*} decrease in the quality of institutions; (ii) the marginal costs at both thresholds $\beta^S(\varphi^{e*})$ and $\beta^A(\varphi^{SA*})$ decrease in the quality of institutions; (iii) the average numbers of suppliers per team \tilde{N}^S and \tilde{N}^A , i.e. the average degrees of fragmentation, decrease in the quality of institutions.

Better institutions decrease the cost of production by reducing the uncertainty with which suppliers provide their range of intermediate goods. As a consequence, better institutions reduce the marginal production cost and allow firms with a low exogenous productivity to start producing (entry threshold decreasing in θ). A change in θ affects also the marginal cost $\beta^S(\cdot)$. Following an increase in the quality of institutions, the worst producing firm has a lower exogenous productivity but also a lower marginal cost. The same happens for the worst firm producing in the advanced sector. Finally, we define the average degree of fragmentation in the two sectors by:

$$\tilde{N}^S = \tilde{N}^S(\varphi^e, \varphi^{SA}) = \left[\frac{1}{G(\varphi^{SA}) - G(\varphi^e)} \int_{\varphi^e}^{\varphi^{SA}} (N^S(\varphi))^{1-\sigma} g(\varphi) d\varphi \right]^{\frac{1}{1-\sigma}}$$

and

$$\tilde{N}^A = \tilde{N}^A(\varphi^{SA}) = \left[\frac{1}{1 - G(\varphi^{SA})} \int_{\varphi^{SA}}^{\infty} (N^A(\varphi))^{1-\sigma} g(\varphi) d\varphi \right]^{\frac{1}{1-\sigma}}$$

The average degree of fragmentation in both sectors increase in the quality of institutions. A lower uncertainty about the provision of the intermediate goods leads to higher equilibrium gains of fragmentation.

Figures 2.5, 2.6 and 2.7 provide a graphical representation of Observation 2.3 using the results from a numerical simulation of the equilibrium under autarky²¹. The figures plot equilibrium values of respectively the logarithm of the entry and choice thresholds, the marginal costs at the entry and choice thresholds and the average degrees of fragmentation

²¹The parametrisation of our economic framework follows closely the numerical exercise in Bernard et al. (2007): final firms' productivity is drawn from a Pareto distribution with scale parameter 1 and shape parameter 3.4; $\sigma = 3.8$, $f_e = 2$ and $f = 0.1$. Moreover we fix the hours endowment $h = 1$, number of workers $L = 100$, complexity parameters $z^S = 10$ and $z^A = 40$.

as functions of the probability of successful provision $\mathbb{P}(\mathbb{I} = 1) = e^{\frac{-1}{\theta}}$.

Figure 2.5: Entry and choice thresholds φ^{e*} and φ^{SA*} as functions of institutions $\mathbb{P}(\mathbb{I} = 1)$

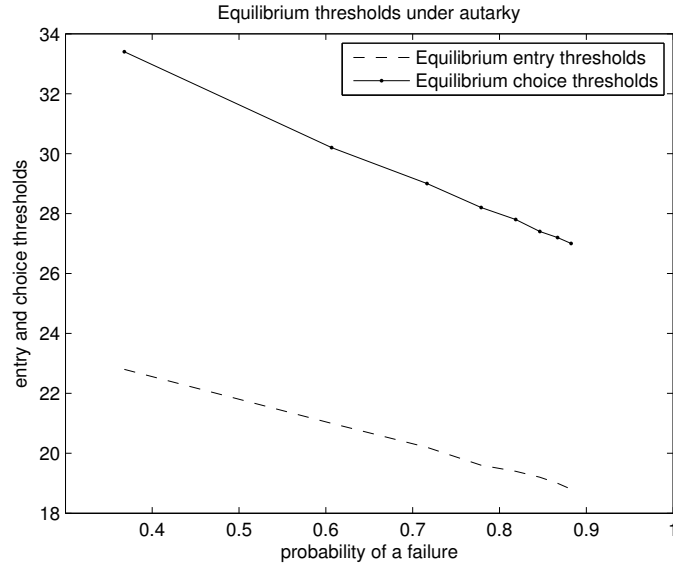
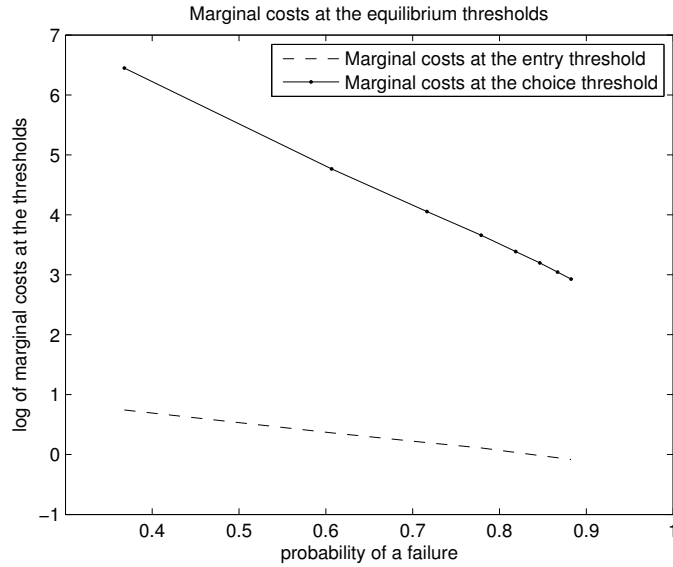


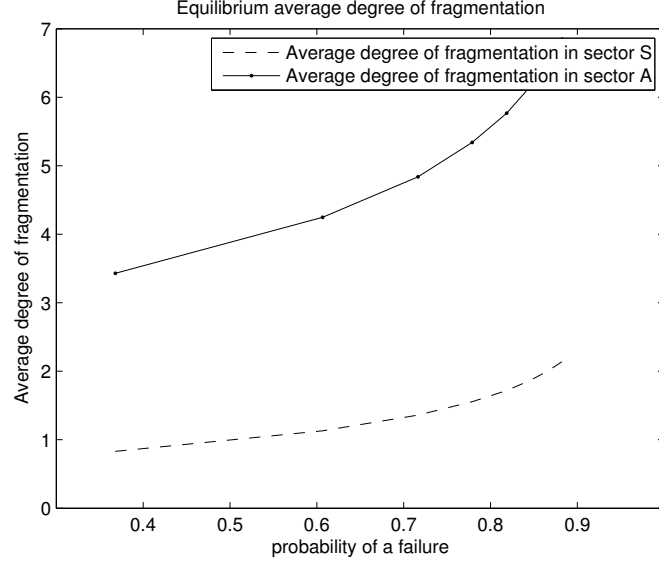
Figure 2.6: Marginal costs at the productivity thresholds ($\beta^S(\varphi^{e*}), \beta^A(\varphi^{SA*})$) as functions of institutions $\mathbb{P}(\mathbb{I} = 1)$



2.3.3 Equilibrium under free trade

In this section we allow countries to trade varieties of the two goods at no costs. The extension to costly trade has similar results and it is briefly discussed in section 2.3.4.

Figure 2.7: Average degrees of fragmentation (\tilde{N}^S, \tilde{N}^A) as a function of institutions $\mathbb{P}(\mathbb{I} = 1)$



We assume that countries only differ in their institutional qualities and that country H has better institutions ($\theta^H > \theta^F$). This difference creates a comparative advantage in one of the two sectors. Contrary to a simple Ricardian model with a single firm, the specialization might not be complete even in the case of no trade costs. Finally we assume that workers are not mobile across countries.

In the free trade equilibrium consumers of both countries have access to foreign varieties, i.e. $\forall k \forall i, \Omega_{FT,k}^i = \Omega_k^i + \Omega_{-k}^i$ where $-k$ is the trade partner country index. The consumers' optimization does not change. Turning to firms, we notice that their optimal organization does not change either. Moreover, the free-trade standard result that all the firms that produce also export holds within our framework as well²². We can notice that two final firms with the same productivity level φ in different countries might not have the same behavior, i.e. the same optimal choice of sector and prices. Given the difference in institutional qualities, a firm with the productivity level φ has a marginal cost $\beta_H^i(\varphi)$ in country H and $\beta_F^i(\varphi)$ in country F . Given that country H has better institutions, the marginal cost of a firm with productivity φ is lower in country H for any variety in any of the two sectors.

The outcome of each final firm's production decision is thus a vector of prices, one for the domestic market (d) and the other for the export one (x). As a consequence of constant elasticity of demand across countries and no trade costs, the two pricing rules will be

²²This is an implication of consumers' love of variety and the assumption of no trade costs.

equal, i.e.

$$p_{k,d}^i(\varphi) = p_{k,x}^i(\varphi) = p_k^i(\varphi) = \frac{\beta_k^i(\varphi)}{\rho} \quad \forall k, i$$

Given that all firms export with the same price they charge on the domestic market, we have that the price indexes are equalized across countries:

$$P_H^i = P_F^i \quad \forall i$$

Denoting with $r_{k,d}$ the k firm's revenue from domestic sales, with $r_{k,x}$ the firm's revenue from exports and with R_k the consumers' total revenue, we can write the free trade revenues and profits of a final firm in k with productivity φ active in sector i respectively as

$$r_k^i(\varphi) = r_{k,d}^i(\varphi) + r_{k,x}^i(\varphi) = \frac{R_k}{2} \left[\frac{P_k^i}{p_{k,d}^i(\varphi)} \right]^{\sigma-1} + \frac{R_{-k}}{2} \left[\frac{P_{-k}^i}{p_{k,x}^i(\varphi)} \right]^{\sigma-1} = r_{k,d}^i(\varphi) \left[1 + \frac{R_{-k}}{R_k} \right]$$

$$\pi_k^i(\varphi) = \frac{r_k^i(\varphi)}{\sigma} - f$$

It is immediate to see that Proposition 2.2 still holds under free trade. Firms' sector-indifference condition defines the choice threshold φ_k^{SA} in both countries. The entry threshold φ_k^e is defined as the productivity level that makes profits in the S sector equal to 0 in country k . The entry and the choice thresholds give the expressions for average marginal costs which are identical to the autarky ones. Notice that the price aggregates are instead different from their autarky counterparts: in fact they take into account the varieties imported from the trading partner and can be written as follows

$$P_k^i = \left\{ M_k^i [p_k^i(\tilde{\beta}_k^i)]^{1-\sigma} + M_{-k}^i [p_{-k}^i(\tilde{\beta}_{-k}^i)]^{1-\sigma} \right\}^{\frac{1}{1-\sigma}}$$

or

$$P_k^i = (M_k^i)^{\frac{1}{1-\sigma}} \frac{\tilde{\beta}_k^i}{\rho} + (M_{-k}^i)^{\frac{1}{1-\sigma}} \frac{\tilde{\beta}_{-k}^i}{\rho}$$

where

$$M_k^S = \frac{[G(\varphi_k^{SA}) - G(\varphi_k^e)]}{[1 - G(\varphi_k^e)]} M_k \quad \text{and} \quad M_k^A = \frac{[1 - G(\varphi_k^{SA})]}{[1 - G(\varphi_k^e)]} M_k \quad (2.14)$$

Firms' dynamics is clearly unchanged with respect to autarky. Country k steady state stability and the firm entry condition are still

$$[1 - G(\varphi_k^e)] M_k^e = \delta M_k$$

and

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi_k^{SA}) - G(\varphi_k^e)] \left\{ \left[\frac{\tilde{\beta}_k^S(\varphi_k^e, \varphi_k^{SA})}{\beta_k^S(\varphi_k^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi_k^{SA})] \left\{ \left[\frac{\tilde{\beta}_k^A(\varphi_k^{SA})}{\beta_k^A(\varphi_k^{SA})} \frac{\beta_k^S(\varphi_k^{SA})}{\beta_k^S(\varphi_k^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \end{aligned} \quad (2.15)$$

Goods' market clearing in country k requires that the expenditure share in each i sector equalizes the domestic revenue of k -owned firms producing an i variety plus the revenue made by foreign firms exporting an i variety to k . Mathematically

$$R/2 = R_{k,d}^i + R_{-k,x}^i \quad \forall k, i$$

Finally, labor market condition does not change with respect to autarky. We can now state the following

Proposition 2.4 (*Free trade equilibrium*) *The free trade equilibrium is defined through the vectors*

$$\{\varphi_k^{e,FT}, \varphi_k^{SA,FT}, P_k^{S,FT}, P_k^{A,FT}, M_k^{FT}, p_k^{S,FT}(\varphi), p_k^{A,FT}(\varphi)\} \quad \text{for } k \in \{H, F\} \quad (2.16)$$

that verify the optimal behaviours of the consumers and the firms, the labor market and good market conditions in each country. The equilibrium under free-trade exists unique.

Proof. See Appendix B.3.

The first step for the analysis of the free trade equilibrium consists in the derivation of the pattern of comparative advantage which is given in the following

Proposition 2.5 (*Comparative advantage*) *Under free trade, the country with better institutions (H) has a comparative advantage in producing varieties in the advanced sector (A).*

Proof. See Appendix B.3.

Reallocation of resources

A novelty of our paper is the assumption that final firms are mobile across sectors. In fact, not only final firms choose whether to produce, but they also decide which good to produce. The ability of firms to choose their sector introduces a new mechanism through which resources can be reallocated across firms and sectors.

The reallocation towards more productive firms of resources that were used in autarky by the least productive firms that exit in free-trade, what we call ‘‘Melitz effect’’, is the only

channel for the reallocation of resources in papers such as Melitz (2003) and Bernard et al. (2007). In Melitz (2003) resources are limited and reallocated towards better firms and so aggregate productivity increases. In Bernard et al. (2007) resources are reallocated within and across industries. In each sector, firms choose whether to produce but do not choose their sector. The “Melitz effect” takes place in both sectors, and is magnified in the sector with the comparative advantage.

What allows us to have different results with respect to Bernard et al. (2007) is the assumption that the free-entry condition is not a condition per sector but a condition for the whole economy.²³ In our model, new export opportunities do not necessarily lead to a higher entry threshold.

The reallocation of resources depends on whether firms exit or enter the production process compared to autarky, which in turns crucially depends on which good the active final firms choose to produce. In general, if the free trade equilibrium entry threshold increases with respect to autarky, resources are reallocated to more productive firms, the so-called “Melitz effect”. A decrease in the equilibrium entry threshold instead leads to a decrease in the whole aggregate productivity and this is what we call an “anti Melitz effect”.

The sector choice introduces another dimension to the analysis of the effects of trade on productivity, both at the sector and at the aggregate level. The comparative advantage dynamics, through changes in the relative price, drives the choice of sector. If the equilibrium choice threshold decreases, firms that were producing in the simple sector in autarky now produce in the advanced sector and resources are reallocated from the simple to the advanced sector. We start looking at the advanced sector, where the effect of trade on productivity depends solely on the movements of the choice threshold. This effect is described in the following

Proposition 2.6 (*Aggregate productivity in A*) *The free trade aggregate productivity in the advanced sector (A) decreases in the country with the comparative advantage in the advanced sector, and increases in the other country compared to autarky.*

Proof. See Appendix B.3.

We provide a graphical representation of Proposition 2.6 in Figure 2.8 and Figure 2.9.

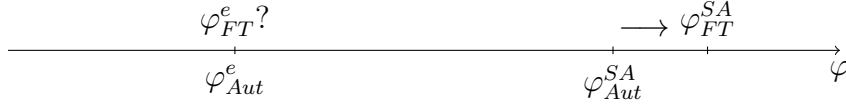
The result from Proposition 2.6 is driven by the choice of firms to produce in one of the two sectors. This choice depends on the comparative advantage of the country. The country

²³The free-entry condition is the expression that drives the results in Melitz (2003) and Bernard et al. (2007). This condition requires the average profit to be equal to the entry cost. The intuition of the result is that higher profit opportunities due to exports lead to a higher entry threshold that reduces the average price in equilibrium.

Figure 2.8: Change in thresholds for the country with good institutions



Figure 2.9: Change in thresholds for the country with poor institutions



with the good institutions has a comparative advantage in the advanced sector and the relative price of the advanced good increases. Firms that were previously producing in the simple sector decide to produce in the advanced sector and get higher profits, and firms with lower productivity φ thus enters the advanced sector. In the other country, the opposite happens and some firms that were previously producing in the advanced sector decide to produce in the simple sector. Firms with higher productivity φ thus decides to produce in the simple sector.

What are the implications of this result for the productivity in the simple sectors and, most importantly, for the aggregate productivity of the two countries? Due to the complexity of our modelling framework we are not able to derive an analytical answer to this question and we need to rely upon a numerical simulation of the equilibrium. Nevertheless, Proposition 2.6 reveals a mechanism that will guide our economic intuition.

Consider country H with good intitutions. The pattern of comparative advantage attracts the final firms into the advanced sector and therefore there are firms that would have produced the simple goods under autarky but produce the advanced goods under free trade. Ceteris paribus, higher complexity of the good calls for higher ‘consumption’ of resources (higher fragmentation of production). Moreover, final firms in this bigger advanced sector benefit from the highest export opportunities, this again calls for higher ‘consumption’ of resources. Given inter industry reallocation of final producers, the final firms above the free trade entry threshold are consuming more resources than what they would have done under autarky. This mechanisms suggests that the resources available for the firms below the free trade choice threshold could be less than what they would have been under autarky. There are other general equilibrium mechanisms that affect the movement of the entry threshold and that we are not able to capture analytically, but the result in Proposition 6 are consistent with an increase in the entry threshold for country H or, in other words, with a “Melitz effect”.

When instead the pattern of comparative advantage attracts firms into the simple sector (in the country with weak institutions), free trade has the opposite effects on resources allocation. On the one hand, all final firms can export and this calls for a higher consumption of resources. On the other hand, the pattern of comparative advantage is such that under free trade there are firms that would have produced an advanced variety under autarky but produce a simple one under free trade. The reduced complexity decreases the degree of fragmentation and, *ceteris paribus*, the consumption of resources. Those two effects on total resources consumption have opposite sign. In the case of country F, the result in Proposition 6 suggests an ambiguous movement of the entry threshold, or in other words, a possible “anti-Melitz effect”.

Numerical analysis of the Free-Trade Equilibrium

Due to the analytical complexity of the model it is not possible to explicitly characterize the key components of the free-trade Equilibrium. We thus turn to a parametric version of the equilibrium. This exercise has two purposes. First, it allows us to get additional results in terms of aggregate productivity and welfare. Second, it enables us to assess the role of institutional proximity on production, sector choices, and trade. The parametrization of the equilibrium follows the numerical exercise in Bernard et al. (2007), and we check our main results for a large range of complexity and institutional parameters²⁴. For the following exercise, we assume that country H has the best institutions ($\theta^H > \theta^F$).

Relative prices

Result 2.1 *The gap between the autarky relative prices and the free-trade relative price decreases in the institutional proximity.*

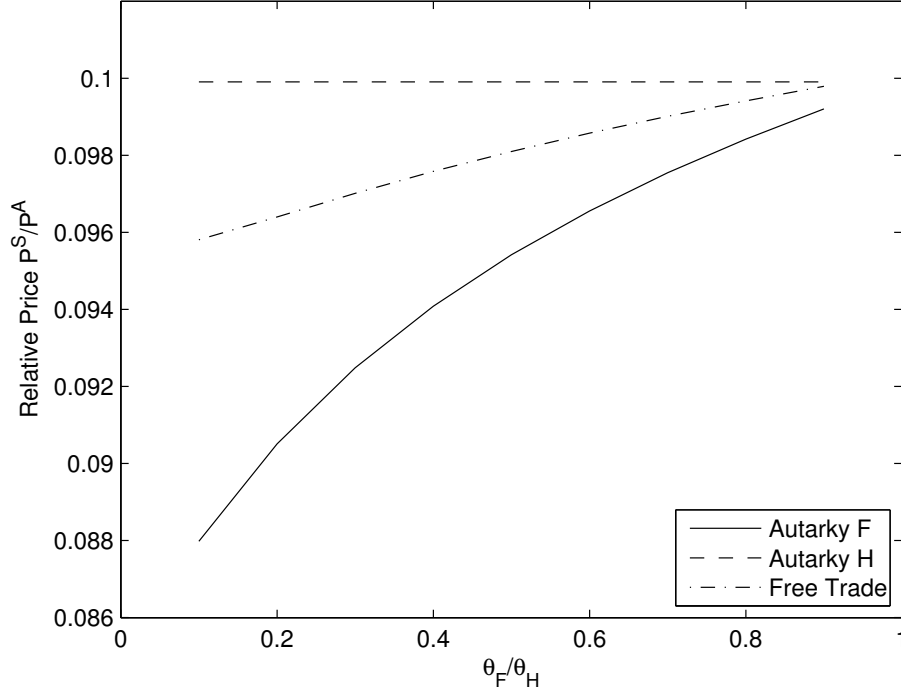
This result is an illustration of the comparative advantage dynamics and its effect on relative price convergence. Figure 2.10 shows the equilibrium relative price P^S/P^A as a function of the ratio θ_H/θ_F which we interpret as an indicator of *institutional proximity*²⁵. Institutional heterogeneity is a source of comparative advantage and the country with the best institutions develops a comparative advantage in the advanced sector. Figure 2.10 shows that the difference between the autarky relative prices in the two countries decreases with the institutional proximity. The middle line represents the free-trade relative price. For large gaps between the autarky relative price and the free-trade price, more firms change sectors. In country H , the relative price of the advanced good increases so more

²⁴All the details of our parametrization are reported in Appendix B.4.

²⁵Variation in θ_H/θ_F is obtained fixing θ_F and letting θ_H increase. By construction, our measure of institutional proximity is also a function of the parameter θ_F and therefore has to be interpreted as conditional on the fixed value of θ_H that we choose for our numerical exercise.

firms choose to produce the advanced good whereas in country F the relative price of the simple good increases so more firms choose to produce the simple good.

Figure 2.10: Relative price P^S/P^A



Aggregate productivity

Proposition 2.6 only gives results for the aggregate productivity in the advanced sector. Our parametrization delivers numerical results for changes in the two thresholds, the entry and the choice, and for changes in aggregate productivity in the two sectors going from autarky to free-trade. The left diagram of Figure 2.11 plots on the vertical axis the *entry ratio*, defined as the entry threshold under autarky over the entry threshold under free trade ($\varphi^e(Aut)/\varphi^e(FT)$), for both countries. The right diagram instead shows the *choice ratio*, defined as the ratio between the choice threshold under autarky and the choice threshold under free trade ($\varphi^{SA}(Aut)/\varphi^{SA}(FT)$).

Result 2.2 *In the country with the best institutions, and the comparative advantage in the advanced sector, the aggregate productivity in the advanced sector (A) decreases but the whole aggregate productivity increases.*

In the country with good institutions, for any level of institutional proximity, the free-trade entry threshold, the level of productivity below which firms in F decide not to produce, increases. This is consistent with the pro-competitive effect of trade liberal-

Figure 2.11: Entry and choice ratio

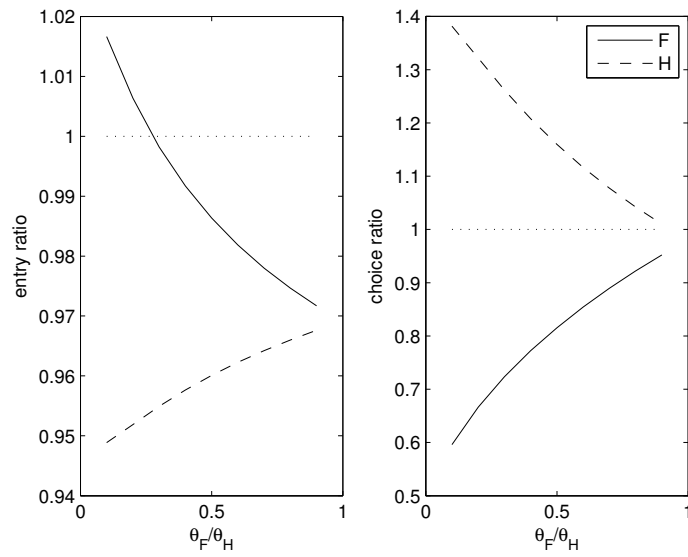
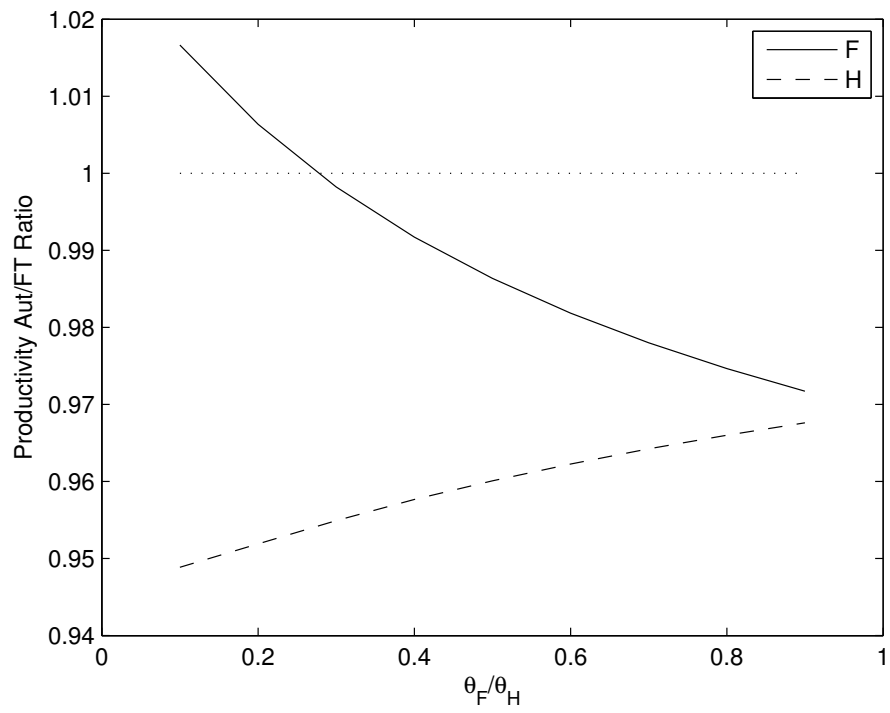


Figure 2.12: Aggregate productivity (Autarky/Free Trade ratio)



ization from Melitz (2003) and Bernard et al. (2007). Export opportunities and the reallocation of firms across sectors increase the average profit. Indeed country H has a comparative advantage in sector A , more firms decide to produce in sector A and the aggregate productivity of sector A decreases (Proposition 2.6). This implies that the aggregate price of sector A increases and the profits of the new firms in this sector as well as the profits of the previous ones increase. Using the free-entry condition, profits of firms in sector S decrease at the equilibrium. In the free trade equilibrium, the least productive firms do not produce any more compared to autarky, and the aggregate price of good S decreases.

Result 2.3 *In the country with the worst institutions, and the comparative advantage in the simple sector, the aggregate productivity in the advanced sector (A) increases but the whole aggregate productivity decreases (increases) for a low (high) institutional proximity.*

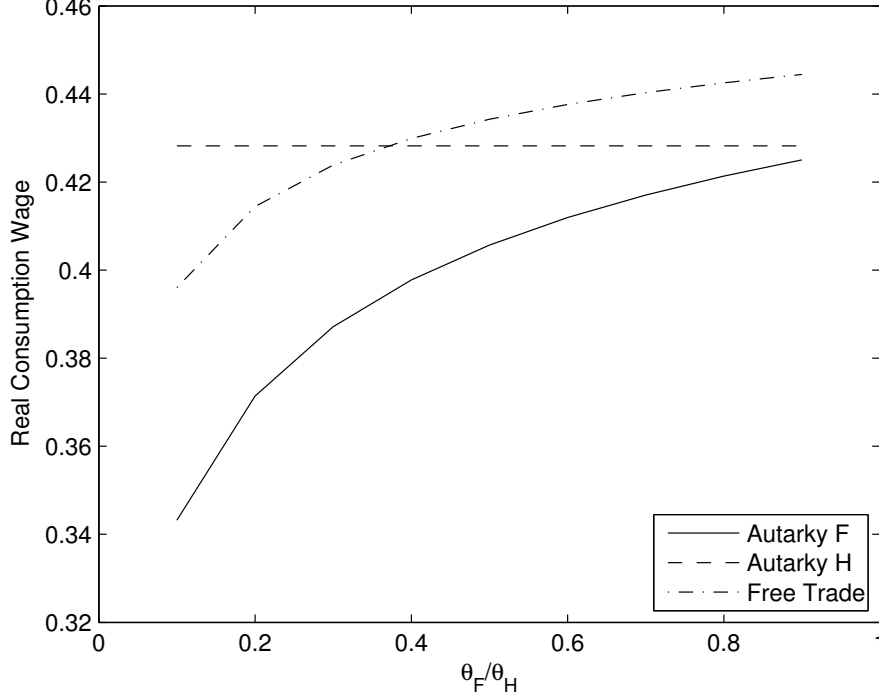
Contrary to country H , there exist institutional parameters for which the entry threshold decreases, what we denoted “the anti-Melitz effect”. Figure 2.11 shows that a low institutional proximity leads to a decrease in the entry threshold. In other words, if the quality of institutions in country F is too low compared to the quality of institutions in country H , free-trade decreases the whole aggregate productivity in country F but increases the whole aggregate productivity in country H compared to autarky. The reasoning is similar to the one for country H . First new export opportunities increase the average profit. Second country F has a comparative advantage in sector S , more firms decide to produce in sector S and the aggregate productivity of sector A increases (Proposition 2.6). This implies that the aggregate price of sector A decreases and the profits of the firms in this sector decrease. The equilibrium effect on prices in sector S is undetermined and depend on the institutional proximity. When countries are similar the variation of the relative price is lower, and fewer firms change sectors. When countries are very different in terms of institutional quality a lot of firms change sectors, and the average profit in sector A decreases a lot. If the fall is sharp enough, the equilibrium effect is to get increasing profits in sector S . This implies a higher aggregate price in sector S and explains why low-productivity firms start producing. In that case free-trade leads worst firms to start producing and some resources are reallocated from more productive firms towards these new firms.

Welfare of Consumers

In a simple Ricardian framework, trade and the comparative advantage dynamics benefit both countries. Adding heterogeneous firms and reallocations of firms across sectors challenges this result, and creates cases for which welfare, measured here as the real

consumption wage, decreases in free-trade compared to autarky.²⁶

Figure 2.13: Real Consumption Wage

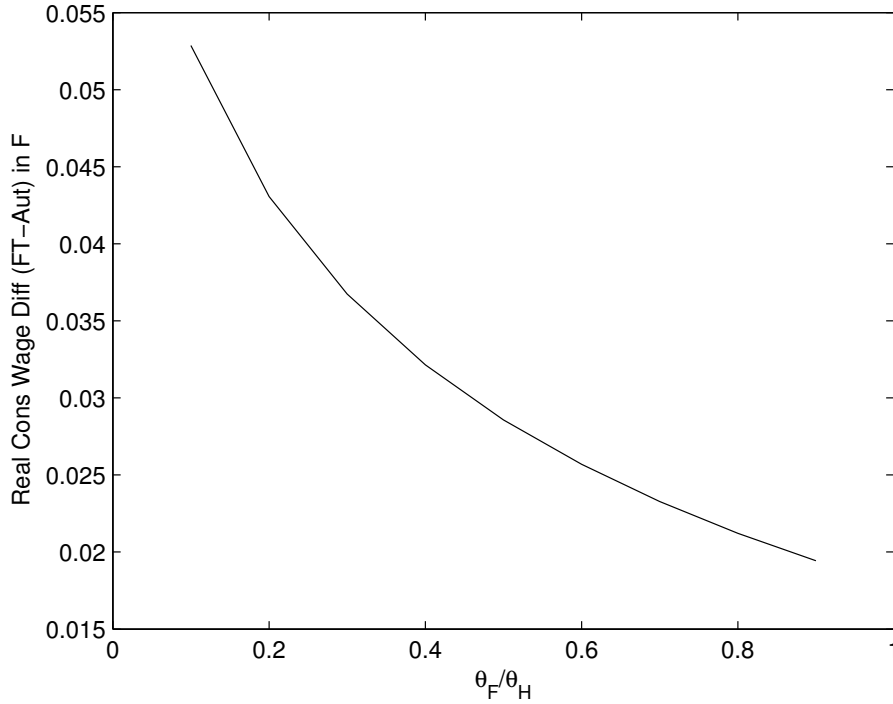


Result 2.4 (i) In the country with the best institutions, and the comparative advantage in the advanced sector, the real wage decreases compared to autarky when the institutional proximity is low. (ii) In the country with the worst institutions, the real wage always increases compared to autarky.

First the real wage is the same for both countries in free-trade by construction. Then Figure 2.13 shows that the real wage in the country with the worst institutions (country F) in free-trade is always higher than the real wage in autarky. Consumers in country F benefit from the opening to trade. The fall in aggregate productivity in country F is compensated by access to cheap varieties from country H . On the contrary, the real wage in country H in free-trade is either higher or lower than the real wage in autarky. It is lower for low institutional proximity values. Thus the fall in aggregate productivity in country F directly affects the aggregate price of imports in country H due to the comparative advantage dynamics and the preference for diversity. When the institutional proximity is low, the specialization due to comparative advantage is strong and consumers in country H buy a lot of varieties of good S from country F . Consumers from country H do not always benefit from free-trade in terms of real wage.

²⁶In the derivation of these results, we do not take into account the love for diversity of consumers.

Figure 2.14: Free Trade Welfare effect in country H



Result 2.5 *In the country with the worst institutions, the welfare gains in terms of real wages are always positive but decrease in the institutional proximity.*

Figure 2.14 shows that the difference between the free-trade real wage and the autarky real wage decreases in the institutional proximity. When we only focus on real wage, the welfare impact depends more on the comparative advantage dynamics than on the access to more varieties. When the institutional proximity is low, the potential gains from the specialization due to comparative advantage are high (large differences in relative prices) and country F benefits a lot from this specialization.

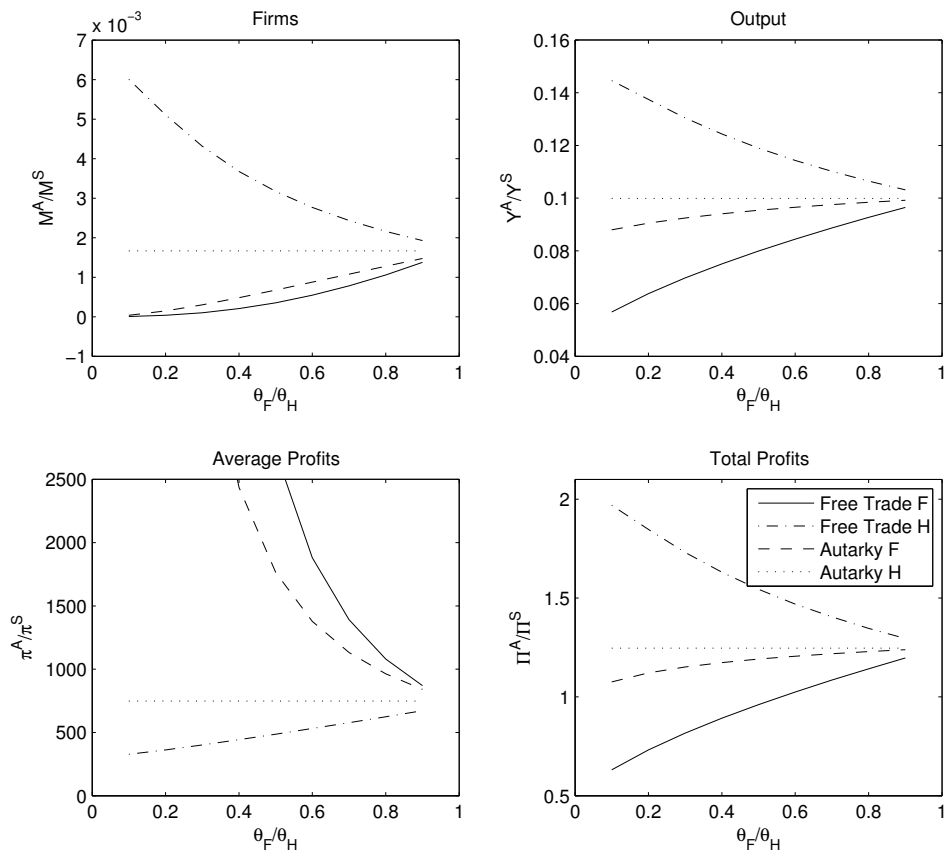
One limit to this analysis of the real wage is our assumption of a fixed wage due to the standard homogeneous good assumption that freezes the wage channel in the free-trade general equilibrium.

Institutional proximity and industrial composition

A nice feature of our model with institutional heterogeneity and endogenous production choices is that we can study the impact of institutional convergence on the production structure of both countries in autarky and free-trade. Figure 2.15 presents the results of this comparative statics exercise.

Result 2.6 *In the country with the best institutions, (i) the relative mass of firms in the*

Figure 2.15: Industrial composition



advanced sector and the relative production are always higher in free-trade but decrease in the institutional proximity, (ii) the relative average profit in the advanced sector is lower in free-trade but the relative total profits are higher.

Result 2.7 *In the country with the worst institutions, (i) the relative mass of firms in the simple sector and the relative production are always higher in free-trade but decrease in the institutional proximity, (ii) the relative average profit in the simple sector is lower in free-trade but the relative total profits are higher.*

All results of this section are symmetric for each country depending on their comparative advantage sector. Figure 2.15 shows that the sector with the comparative advantage is relatively the largest in terms of mass of firms, production and total profits. The differences in the characteristics of sectors are amplified when countries are very different and the gains from specialization potentially high. The results of the average profits follows from Proposition 2.6 that states that the aggregate productivity decreases in sector A in country H whereas it increases in country F . Thus the relative average profit in sector A increases in free-trade in country F but decreases in country H .

When the countries are similar, trade is not driven by specialization due to their comparative advantage. Consumers' love for diversity is the engine of trade and becomes characterized mainly by intra-industry trade. Figure 2.16 shows an output-weighted average of the Grubel Lloyd industry indexes, denoted as WGL ²⁷. Not surprisingly, trade is driven by specialization when differences between countries are high, and increasingly becomes intra-industry the higher the institutional proximity between the two countries.

2.3.4 Costly trade

All the results and simulations above have been assuming that exporting does not require any additional cost. As an extension, we also derived the main propositions when exporting firms have to pay a variable and a fixed costs to export. The results are very similar to the free trade case with a few caveats.²⁸

Compared to the free-trade equilibrium, the presence of fixed costs to export imply that not all the firms export. Therefore, the costly trade equilibrium can be defined similarly

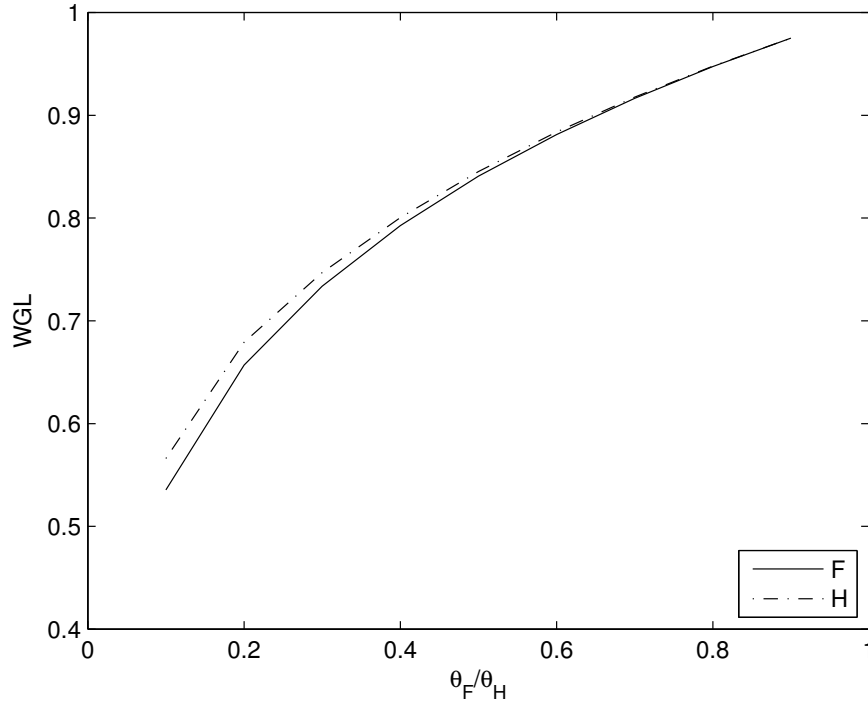
²⁷We computed a weighted version of the Grubel-Lloyd index (see Grubel and Lloyd (1975)) as

$$WGL_k = \sum_{i \in \{S, A\}} \frac{EX_k^i + IM_k^i - |EX_k^i - IM_k^i|}{EX_k^i + IM_k^i} \times \frac{Y_k^i}{Y_k}$$

where weights are the ratio of incomes $\frac{Y_k^i}{Y_k}$.

²⁸Since the main results still hold, here we only highlight the differences between free and costly trade. A formal definition of the equilibrium and the complete derivation of the results is available upon request.

Figure 2.16: Intra-industry trade



to the free trade equilibrium with the addition of two new thresholds that define the productivity thresholds for the exporting firms.

The pattern of comparative advantage under costly trade is also the same as in free trade, i.e. the country with the best (worst) institutions has a comparative advantage in the advanced (simple) sector. However, the specialization is somewhat more extreme: the country with a comparative advantage in the advanced sector only exports in the advanced sector whereas the other country exports in both sectors.

On the other hand, the asymmetric effect of trade on productivity is more nuanced. While the aggregate productivity in the country with the best institutions increases, the effect of trade opening on the aggregate productivity in the country with weak institutions is ambiguous.

2.4 Conclusions

The empirical trade literature has recently suggested that the benefits of free trade depend on the existence of other non-trade distortions. We provide a theoretical framework in which weak institutions create distortions and hamper the creation of gains from trade

in terms of aggregate productivity and welfare.

This is certainly not the first paper that studies the role of institutions in intentional trade. However we introduce some novelties in the theoretical framework that allow to derive original implications regarding the effects of trade in countries with weak institutions.

We propose a monopolistic competition model with heterogeneous firms where comparative advantage are determined by the quality of the business environment. Moreover we allow firms to endogenously choose whether to produce a simple or a complex good, if any.

We first show that most productive firms always choose to produce the more complex good. This result, together with the pattern of comparative advantage triggered by differences in institutions, determine the reallocation of resource when moving from autarky to free trade which ultimately affect the distribution of the gains from trade.

Our paper confirms a positive effect of trade on the aggregate productivity in the country with good institutions. However the effects of trade in a country lacking in business friendly institutions can be negative. Moreover, the asymmetric effects are amplified when the difference in institutions is very high and trade mainly happens across industries.

The complexity of the model prevents us from deriving all the results analytically, thus we need to rely on numerical simulations. Moreover, we exploit numerical simulations also for the analysis of the industrial composition of the two countries. Finally, the main results are shown to be qualitatively the same in costly trade.

Chapter 3

Services trade restrictiveness and manufacturing productivity: the role of institutions

With Cosimo Beverelli Bernard Hoekman

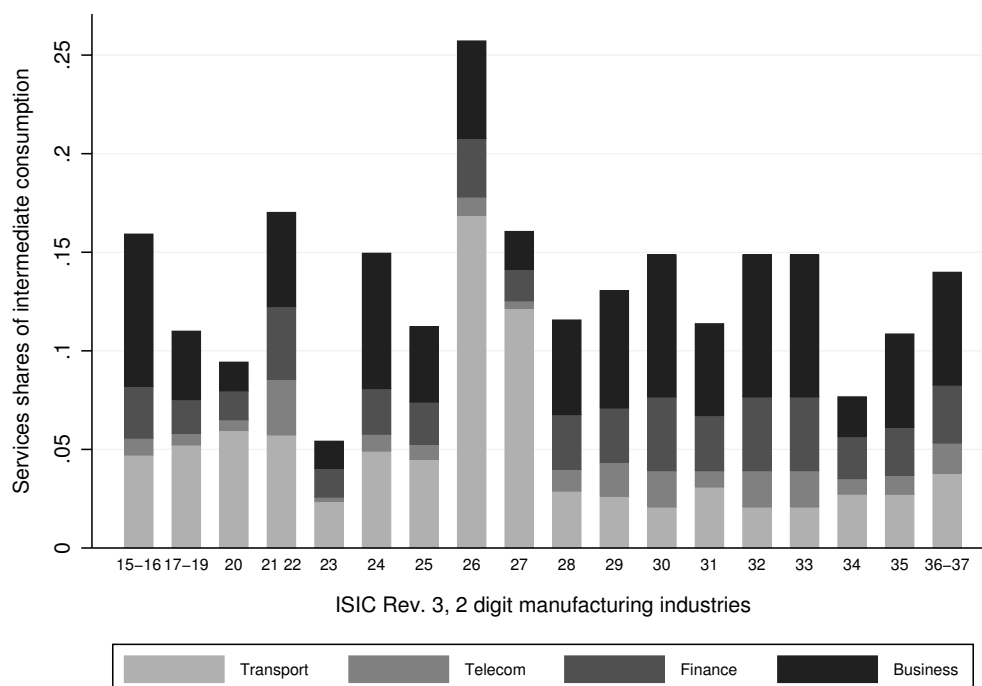
3.1 Introduction

Increasing productivity is an essential ingredient of economic growth and development. A large fraction of such growth originates in the manufacturing sector (Van Ark et al., 2008). The productivity of manufacturing depends, among others, on the availability of high-quality inputs (Jones, 2011). These include machinery and intermediate parts and components, as well as a range of services inputs (Johnson, 2014). Figure 3.1 shows the degree to which 18 two-digit ISIC manufacturing sectors in the US are dependent on four service industries (transport, telecommunications, finance and business services). The average input intensity of these services is around 10%, with a peak of 25% in sector 26 ('Manufacture of other non-metallic mineral products').¹

Trade is an important channel through which firms can improve their access to inputs, either in the form of lowering prices or increasing the variety of products that are available (see for instance Topalova and Khandelwal, 2011). Therefore, the extent to which policies restrict foreign access to upstream services markets is relevant for downstream productivity. The effect of reforms targetting services industries on the performance of

¹Figure 3.1 is constructed using the share of intermediate consumption as measure of input intensity. Appendix C.2 provides more detail on the construction of this measure.

Figure 3.1: Services input penetration in manufacturing



Source: 2005 US IO Table from OECD STAN IO Database

manufacturing has been tested empirically in a number of recent studies. Both studies using firm-level data² and studies using sector-level data³ generally find an economically significant impact of services productivity (or firms' access to services) on productivity in manufacturing.⁴

While this literature has established the importance of the indirect linkage between services trade policy and economic performance of industries that are downstream in the relevant supply chain, less has been done to account for the specific characteristics of services production and exchange in shaping this causal relationship. The main contribution of this paper is to identify the role that economic institutions play as a determinant

²See for example Arnold et al., 2008 (10 countries in Sub-Saharan Africa); Fernandes and Paunov, 2011 (Chilean data with a focus on inward FDI in services); Arnold et al., 2011 (data for the Czech Republic, also with a focus on services FDI); Forlani, 2012 (French data); Duggan et al., 2013 (Indonesian data with a focus on FDI regulations); Hoekman and Shepherd, forthcoming 2015 (119 developing countries); and Arnold et al., forthcoming 2015 (Indian data).

³Sector-level empirical studies in this literature include Barone and Cingano, 2011 (17 OECD economies in 1996); Bourlès et al., 2013 (15 developed economies during the period 1984-2007); Hoekman and Shepherd, forthcoming 2015 (gravity-based analysis of the impact of services trade openness on manufactured exports).

⁴Of course, the link between upstream and downstream performance is not limited to services. Blonigen (forthcoming 2015) is a recent cross-country analysis of the impact of upstream policies in a non-services sector (the steel industry) on downstream economic outcomes.

of the size of this indirect effect. Specifically, we estimate the impact of services trade restrictiveness on manufacturing productivity and demonstrate that the quality of institutions shapes the relationship between upstream services openness and downstream manufacturing productivity. We argue that this is a reflection of the characteristics of services and services trade, which often require a foreign firm to invest or otherwise establish a physical presence in an importing market to sell services. To provide a conceptual framework for our empirical findings, we also develop a simple theoretical model. This embodies key characteristics of services and services trade and identifies why one should expect the observed moderating effect of institutions.

The paper is organised as follows. Section 3.2 motivates the analysis and briefly relates our approach to some of the literature. Section 3.3 turns to the econometric exercise, and presents the database, the specifications and the estimation results. In section 3.4 we develop a simple theoretical framework to rationalise the empirical finding that institutional capacity is a determinant of the magnitude of the positive effect of services trade openness on productivity in downstream industries. Section 3.5 concludes.

3.2 Motivation and Related Literature

Economic institutions and associated measures of the quality of economic governance such as control of corruption, rule of law, regulatory quality, contract enforcement, and more generally the investment and business climate are crucial determinants of economic development.⁵ In the services literature, some studies introduce institutional quality as a determinant of the services trade policy stance (van der Marel, 2015) and of the coverage of services policy commitments made in trade agreements (van der Marel and Miroudot, 2014). Building on the literature that identifies institutions as a trigger for comparative advantage in industries that are more sensitive to the institutional environment (notably complex industries with contract-intensive production processes)⁶, van der Marel (2014) argues that the ability of countries to provide complementary domestic regulatory policies accompanying services liberalization is a source of comparative advantage in downstream goods trade.

⁵See, among others, Acemoglu et al. (2001; 2005) and Rodrik et al. (2004). In the trade literature, a number of studies have looked at institutions as determinants of bilateral trade flows as well as offshoring and FDI decisions at the firm level. Anderson and Marcouiller (2002) build a gravity framework where imports depend on the institutional settings affecting the security of trade and show that weak institutions limit trade as much as tariffs do. Other topics in the institutions and trade literature are the effect of trade outcomes and policies on (endogenous) institutions and the role of informal institutions as social capital and trust. For a general review of the literature we address the reader to WTO (2013).

⁶See Nunn (2007); Levchenko (2007); Costinot (2009).

Institutional quality differs widely across countries. To provide an illustration, Figure 3.2 shows the global distribution of the variable ‘control of corruption’ reported in the World Bank’s Worldwide Governance Indicators dataset.⁷ A similar pattern of heterogeneous performance applies for a host of business environment and economic governance indicators. Institutional heterogeneity not only is a direct driver of cross-country income differences, it conditions the benefits from economic reforms such as trade liberalization (Rodriguez and Rodrik, 2001; Winters and Masters, 2013). This conditioning role is also likely to apply in the case of services policies and policy reforms in terms of impacts on downstream industries. Indeed, this can be expected to be particularly important for services given that they often are intangible and non-storable. The former feature often motivates regulation of services providers, while the latter gives rise to a proximity burden, in that the agent performing the service must be in the same location as the buyer or consumer.⁸ Accordingly, exporters of services often must perform some stages of their economic activity in the importing country, where they will be subject to local regulation and affected by the quality of prevailing institutions.⁹

Figure 3.2: Control of corruption across the world

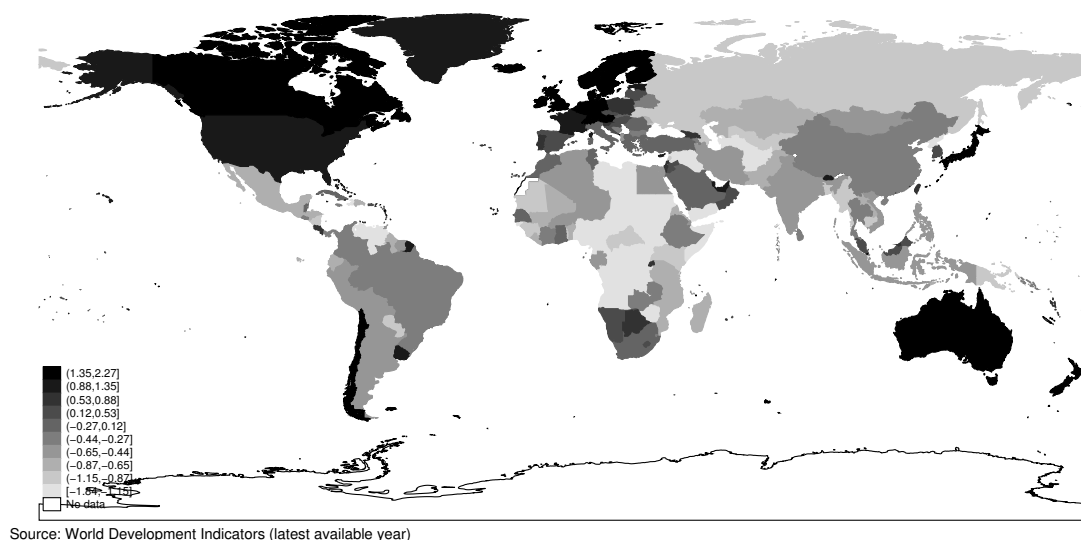


Figure 4.1 presents some preliminary evidence in support of the conjecture that the quality of institutions conditions the effects of services trade policy on downstream industries. We plot productivity in manufacturing sectors (vertical axis) on a measure of services

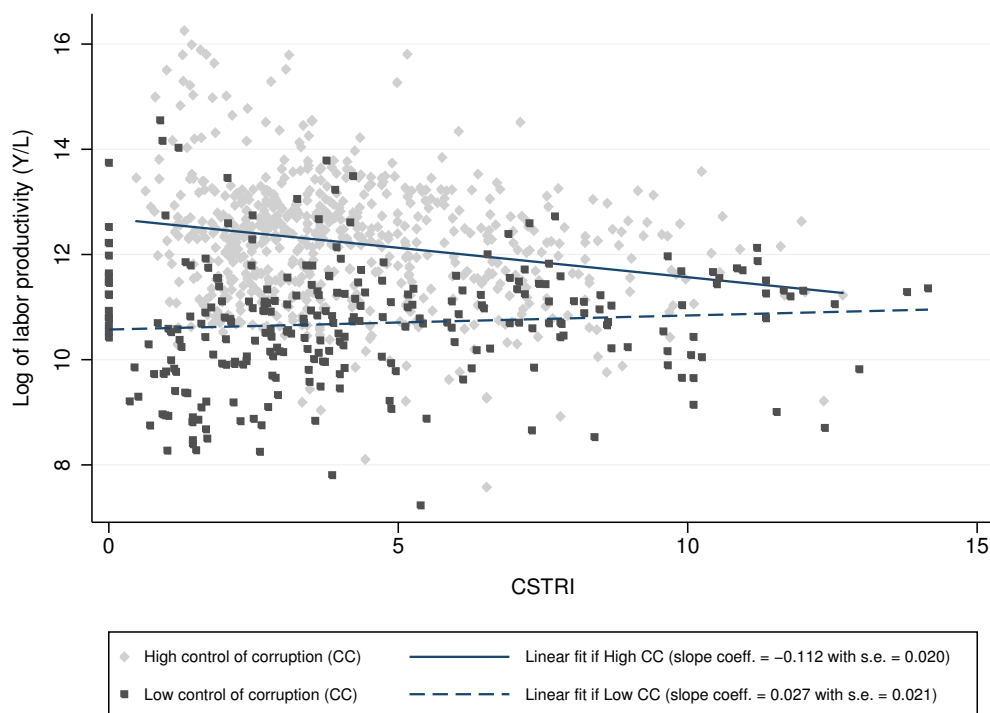
⁷The variable ranges from 2.41 (best performer) to -1.61 (worst performer).

⁸See Parry et al. (2011) for a detailed discussion of the characteristics of services.

⁹The proximity burden is reflected in the broad definition of trade in services used in the WTO General Agreement on Trade in Services (GATS), which includes sales of services through modes 3 (‘commercial presence’) and 4 (‘presence of natural persons’). According to WTO estimates, modes 3 and 4 command a total share of 60% (respectively, 55% and 5%) of world exports of services. Mode 1 (cross-border supply) commands a share of 30% and mode 2 (consumption abroad) a share of 10%.

trade restrictiveness that takes into account the depth of input-output linkages between a given upstream service sector and a given downstream manufacturing sector ($CSTRI$, on the horizontal axis).¹⁰ In the figure, light dots are manufacturing sectors in countries lying above the sample median of the variable control of corruption (the main proxy for institutional quality in the empirical analysis); dark dots are manufacturing sectors in countries lying below this sample median. In the case of countries with high institutional quality, the (solid) regression line is negatively sloped, with a statistically significant coefficient of -0.112. Conversely, for countries with low institutional quality the slope of the (dashed) regression line is not statistically different from zero. These data suggest that institutional quality is a determinant of the potential gains from services trade liberalization.

Figure 3.3: $CSTRI$ and manufacturing productivity across institutional regimes: descriptive evidence



We can think of two broad mechanisms through which institutions may condition the downstream effects of upstream services trade policy, given a presumption that foreign firms must establish some degree of commercial presence in an importing country to contest the market. First, for a given level of trade restrictiveness implied by policy, the institutional environment in a country may affect entry decisions of potential foreign

¹⁰Details on the construction of the productivity variable are provided in Appendix table C-1. We discuss the variable $CSTRI$ in more detail in Section 3.3.

suppliers, giving rise to a selection or ex-ante effect of institutions.¹¹ To illustrate this channel, consider a global provider of telecommunication services, Vodafone. This firm has a direct presence in 21 ‘local’ markets, and an indirect presence in 55 ‘partner’ markets.¹² Of these 76 markets, 19 (25%) are in countries with relatively low institutional quality (measured by the control of corruption variable being less than the sample median) while the other 57 (75%) are in countries with relatively high institutional quality (control of corruption above the sample median). If we consider the markets where Vodafone is not present, either directly or in partnership with a local provider, 87 out of 142 (61%) are in countries with relatively low institutional quality and 55 (38%) are in countries with relatively high institutional quality.¹³ Regression analysis suggests that even after controlling for country size (level of GDP) and for the level of services trade restrictiveness in telecommunications, institutional quality has a positive and statistically significant effect on the probability of Vodafone entering a market by establishing a direct or indirect commercial presence.¹⁴

Second, conditional on entry, the quality of the exporters’ output may depend on the institutional environment of the country where demand is located and the service is performed. A number of recent studies linking firm productivity with the institutional environment in which firms operate confirm this hypothesis.¹⁵

Our empirical analysis differs from existing country-sector studies on the link between upstream restrictions and downstream manufacturing productivity in several respects. Papers such as Barone and Cingano (2011) and Bourlès et al. (2013) focus on OECD countries, a relatively homogenous group of mostly rich economies. Our sample of countries spans 27 nations classified as ‘high income’ by the World Bank, 16 upper middle income countries, 10 lower middle income countries and 4 low income economies. This allows to meaningfully test for heterogeneous effects across countries with very different institutional capacity. Moreover, both papers cited above measure services restrictions using the OECD Product Market Regulation (PMR) indicator for non-manufacturing

¹¹Theoretical models of multinational firms decisions in an international framework with country-level differences in contract enforcement institutions are developed in Antràs and Helpman (2004) and Grossman and Helpman (2005). Bernard et al. (2010) find that better governance in the destination countries is associated with a higher number of affiliates established by foreign multinationals. However, such a relationship is not found to be robust in Blonigen and Piger (2014).

¹²Vodafone data have been collected by the authors from the official Vodafone web page: <http://www.vodafone.com/content/index/about/about-us/where.html>.

¹³A test of equality of means rejects the null hypothesis that the probability of Vodafone’s commercial presence is the same in the two groups of countries with low and high institutional quality (106 countries each), in favour of the alternative hypothesis that such probability is higher in the group of countries with high institutional quality.

¹⁴Regression results are available from the authors on request.

¹⁵See for example Gaviria (2002), Dollar et al. (2005), Lensink and Meesters (2014) and Borghi et al. (2014).

industries. This variable has a strong focus on domestic policies and therefore does not capture the important dimensions of services trade outlined above. Using the World Bank Services Trade Restrictiveness index, Hoekman and Shepherd (forthcoming 2015) focus only on developing countries. Their gravity analysis of the effect of services trade openness on manufacturing exports does not take into account input-output linkages between services and manufacturing.

This paper complements van der Marel (2014), who investigates whether countries with a high level of regulatory capacity are better able to export in goods produced in industries that make relatively intensive use of services. While van der Marel uses a world-average STRI for each service sector (as the sector-level component of the country-sector interaction term representing regulatory capacity, in line with the methodology proposed by Chor, 2010), we use country-level STRI measures to identify and quantify the causal impact of services trade reforms on downstream productivity.

3.3 Empirics

3.3.1 Empirical model and identification strategy

The objective of the empirical analysis is to estimate the impact of service trade restrictiveness on productivity in downstream manufacturing industries, and how institutional quality affects such impact.

We follow the approach pioneered by Rajan and Zingales (1998), assuming that the effect of upstream services trade policy on downstream productivity is a positive function of the intensity of services use as intermediate inputs into downstream sectors. Therefore, the regressor of interest is constructed by interacting a country-sector measure of trade restrictiveness in services with a measure of services input use by downstream industries derived from input-output data. Formally, for any country i and downstream manufacturing sector j , we define a composite services trade restrictiveness indicator ($CSTRI$) as follows:

$$CSTRI_{ij} = \sum_s STRI_{is} \times w_{ijs} \quad (3.1)$$

where $STRI_{is}$ is the level of services trade restrictiveness for country i and services sector s and w_{ijs} is a measure of input penetration of service s into manufacturing sector j of country i . We use for w the shares of total intermediate consumption: w_{ijs} is the share associated to sector s in the total consumption of intermediate inputs (both domestically

produced and imported) of sector j in country i .¹⁶ The baseline productivity regression is then:

$$y_{ij} = \alpha + \beta CSTR I_{ij} + \gamma' \mathbf{x}_{ij} + \delta_i + \delta_j + \epsilon_{ij} \quad (3.2)$$

where the dependent variable is a measure of productivity of downstream manufacturing sector j in country i ; δ_i and δ_j are respectively country and downstream sector individual effects; and \mathbf{x}_{ij} is the column vector of relevant regressors varying at the country-sector level. In the baseline regressions, this vector contains the variable *Tariff*, the logarithm of the effectively applied tariff by country i in sector j . In subsequent robustness checks, we add the variable $\widetilde{\text{Tariff}}$, the logarithm of the weighted average of tariffs effectively applied in manufacturing sectors $k \neq j$ (see Section 3.3.4 for a details on the construction of this variable).

The coefficient β in model 3.2 is expected to be negative. A potential mechanism is the following. Consider a decrease in the variable *CSTRI* as an inflow of a factor of production, services, from abroad. The Rybczinski theorem suggests that additional services will be absorbed by service-intensive industries, which will expand, attracting other factors of production (including domestic services) from less service-intensive industries. These industries will in turn contract, releasing factors of production to the expanding ones. At the same time, the average quality of services increases with services trade liberalization. Even keeping the factor input mix constant, therefore, the productivity of labor in service-intensive (expanding) industries will increase, because each worker will be endowed with the same amount of better-performing services than before the liberalization.¹⁷ The productivity of labor in less service-intensive (contracting) industries should in turn not be affected, as they do not absorb more productive services. In other words, in these industries each worker will be endowed with the same amount of equally-performing services as before the liberalization. Since β represents the average effect across expanding industries – where y should be negatively associated with *CSTRI* – and contracting industries – where the association should be null – β is expected to be negative.

Following the introductory discussion on the role of institutional variables in moderating the effect of services trade restrictiveness on downstream productivity, we allow for heterogeneous effects of the regressor of interest (*CSTRI*) across country-level institutional capacity. Accordingly, we propose the following interaction model:

$$y_{ij} = \alpha + \beta CSTR I_{ij} + \kappa(CSTR I_{ij} \times IC_i) + \gamma' \mathbf{x}_{ij} + \delta_i + \delta_j + \epsilon_{ij} \quad (3.3)$$

¹⁶For the derivation of the shares of intermediate consumption from the IO tables, see Appendix C.2.

¹⁷The same reasoning would also apply to total factor productivity, TFP, because higher-quality services would raise the productivity of all other factors.

where IC_i is a continuous proxy for institutional capacity in country i .¹⁸ In this second specification, the impact of service trade restrictiveness is given by $\beta + \kappa IC_i$ and therefore varies at the country level depending on the institutional framework. In line with the theoretical mechanisms outlined in Section 3.1 and formalized in Section 3.4, the coefficient κ should be negative (the negative effect of $CSTRI$ on y should be larger in countries with high institutional capacity).

We now discuss several identification issues which are common to the two specifications (3.2) and (3.3).

Omitted variables bias

All regressions are estimated including country fixed effects and sector dummies. This neutralizes the risk of estimation bias coming from omitted variables varying at the country or sectoral level. What remains is the variability at the country-sector level. In particular we need to control for those variables that, varying at the country-sector level, are potential determinants of productivity and that can be correlated with services trade restrictiveness. The most relevant candidate is a measure of restrictiveness for trade in goods (imports). Accordingly, we always include, as control, the tariff variable(s) described above.

Endogeneity of the input penetration measure

The intensity of services consumption by a downstream manufacturing sector may be affected by the degree of services trade restrictiveness (less restricted services trade enhancing downstream intermediate consumption) and the productivity in the manufacturing sector itself (more productive manufacturing sectors being able to consume more differentiated services). In the first case the number of manufacturing industries for which the ‘treatment’ (lower trade restrictiveness in the services sector) is likely to have more bite would be increasing with the treatment itself. In the second case we would have an issue of reverse causality. Killing two birds with one stone, we measure w_{ijs} of any country i with the input penetration of service s into industry j for country $c \neq i$. We follow here the assumption widely adopted in the literature originating from Rajan and Zingales (1998), taking the United States’ input-output coefficients as representative of the technological relationships between industries. We therefore set $c = \text{US}$ and remove the US from the sample.

¹⁸We do not include the main effect of IC_i in equation (3.3) as it is accounted for by the country specific effects.

Endogeneity of the services trade restrictiveness measure

Downstream productivity – or lack thereof – could affect the degree of trade liberalization for upstream industries through lobbying, generating a problem of reverse causation. If low productivity industries downstream are the ones lobbying for deeper upstream liberalization, our results would have to be interpreted – at worst – as a lower bound for the impact of services trade openness on manufacturing productivity, conditional on downstream lobbying (this argument is discussed in Bourlès et al., 2013). To account for this and for the more critical case where high productivity manufacturing industries are the ones with the right incentives and capabilities to exert effective lobbying pressure for services trade openness¹⁹, we propose an instrument for services trade restrictiveness. Section 3.3.3 discusses the construction of the instrument and the results of IV regressions.

3.3.2 Data

Given the focus on the role of institutions in shaping the indirect effect of services trade policy, data comprising the maximum variability in country level institutional capacity is needed. The World Bank’s Services Trade Restrictiveness Database (STRD) offers a unique country coverage (103 economies) for services trade policies affecting imports. These include measures on market access; national treatment provisions; and domestic regulation that have a clear impact on trade. The Services Trade Restrictiveness Indexes cover five services sectors – financial services (banking and insurance), telecommunications, retail distribution, transportation and professional services (accounting and legal) – and the most relevant modes of supplying the respective service. These are commercial presence or FDI (mode 3) in every sub-sector; in addition, cross-border supply (mode 1) of financial, transportation and professional services; and the presence of service supplying individuals (mode 4) only for professional services (see Borchert et al., 2012 for a detailed description of the database). In the empirical analysis, we alternatively use the STRI aggregated across all available modes or the mode 3 STRI. Since we consider the role of importing countries’ institutions, the absence of information on mode 2 (consumption abroad) in the STRI data is harmless. STRI data does not vary over time. It captures the prevailing policy regimes in the mid-2000s.

Data on input penetration comes from the mid-2000s OECD STAN IO Tables, where sectors are mapped to the ISIC Rev. 3 classification and aggregated at the 2 digits level. Productivity measures are constructed using data from the UNIDO Industrial Statistics Database. The data varies across countries, years and manufacturing sectors

¹⁹The latter case is more critical because it would imply an upward bias in the estimated coefficients.

(ISIC Rev. 3). The key feature of the UNIDO database is that it provides the widest country coverage with respect to possible alternative sources, such as EU KLEMS or OECD STAN.²⁰ Following Hoekman and Shepherd (forthcoming 2015), we use labor productivity as a proxy for industry productivity.²¹

Data on institutional capacity is from the World Bank’s Worldwide Governance Indicators. Tariff data is from UNCTAD TRAINS.

The estimation sample includes 57 countries and 18 manufacturing sectors (listed in Appendix table C-2). A description of all the variables used in the estimations, including the data sources, is in Appendix table C-1. Descriptive statistics are in Table 3.1.

Table 3.1: Summary statistics

Variable	mean	median	sd	min	max
Productivity	11.76	11.72	1.36	7.23	16.26
CSTRI	4.35	3.61	2.92	0.00	22.62
IC	2.92	2.73	1.01	1.26	5.03
Tariff	0.85	0.92	0.38	0.00	1.61
Tariff	0.88	0.95	0.31	0.23	1.54
From estimation sample of column (8) of Table 3.8					
IC = control of corruption					

3.3.3 Results

The main estimation results for the baseline specification (3.2) and the interaction model (3.3) are given in Table 3.2. The first two columns use the STRI measure aggregated across all modes of supply, while the last two columns focus on measures relevant only for trade through commercial presence (Mode 3).

The estimated coefficient of the composite measure of services trade restrictiveness has the expected negative sign in the baseline specification for both All modes in column (1) and Mode 3 in column (3): less restrictive policy environments are associated with higher productivity in downstream manufacturing. In the first case, however, the estimate is not statistically different from 0, while in the second case (mode 3) it is only weakly statistically significant (0.1 level). Moving to the interaction model, we find a

²⁰The EU KLEMS database covers Australia, Japan, the US and 25 UE countries (O’Mahony and Timmer, 2009). The OECD STAN database covers 33 OECD countries.

²¹To the best of our knowledge there exists no dataset providing more refined measures of industry productivity, such as TFP, for a large and heterogeneous cross-section of countries. Therefore we are bound to rely on labor productivity. This is common to other studies where the research interest lies in wide country coverage (see for instance Rodrik, 2013).

Table 3.2: Baseline and Interaction Model Estimation

	All modes		Mode 3	
	(1)	(2)	(3)	(4)
<i>CSTRI</i>	-0.025 (0.024)	0.065 (0.038)	-0.038* (0.021)	0.052 (0.032)
<i>CSTRI</i> \times <i>IC</i>		-0.041*** (0.014)		-0.039*** (0.012)
Tariff	-0.120 (0.084)	-0.110 (0.083)	-0.323* (0.186)	-0.304 (0.185)
Observations	912	912	912	912
R-squared	0.522	0.526	0.524	0.528

Robust (country-clustered) standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
Country fixed effects and sector dummies always included
IC = control of corruption

statistically significant, negative coefficient for the interaction term. Lower services trade restrictiveness is associated with higher downstream manufacturing productivity, with the estimated effect increasing with country-level institutional capacity. The results of the interaction model suggest that the weak or no significance at the baseline specification level is driven by a composition effect. The role of institutions based on the estimation of the Mode 3 case is further illustrated in Figure 3.4.²²

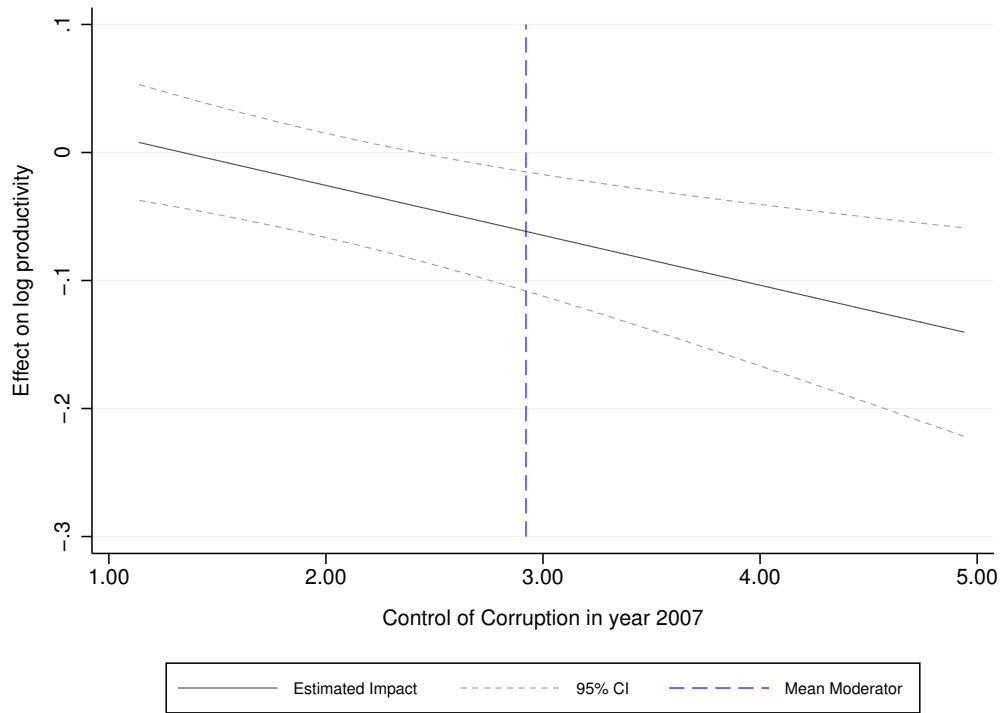
For approximately 95% of our sample the effect of *CSTRI* has the expected negative sign and, for approximately 60% of the observations (those with a level of control of corruption higher than 2.5), the effect is statistically significant at the 0.05 level. The positive effect of lower trade restrictiveness in upstream services sectors increases with institutional capacity. The effect is not statistically different from zero for low levels of institutional capacity (approximately 40% of our sample).

To get a sense of the economic relevance of this result consider the following quantification exercise. Take four countries with similar mean values of the composite measure of services trade restrictiveness *CSTRI* for Mode 3: Austria, Canada, Italy and Tanzania. These countries have very different institutional capacities or performance. Austria and Canada rank respectively 6th and 7th in terms of control of corruption in the sample, while Italy ranks 25th and Tanzania 43rd. Assuming that the four economies adopt the less restrictive services trade regime observed in the UK²³, productivity in downstream

²²The figure reports marginal effects evaluated at 39 values of the control of corruption variable and 95% confidence intervals. The latter are calculated using the Delta method.

²³Such a shift entails a reduction in the *CSTRI* by approximately 45% of a sample standard deviation for each of the 4 selected countries.

Figure 3.4: Impact of one unit increase in *CSTRI* (Mode 3) on the downstream log productivity y



manufacturing increases by 18.2% in Austria, 16.7% in Canada, 7.3% in Italy and only 3.9% in Tanzania.

Finally, the coefficient on Tariff is negative, although not statistically significant, indicating that more protected sectors are also the least productive ones.²⁴

Instrumenting for the services trade restrictiveness measure

As noted above, there are reasons one might be concerned with endogeneity of the *STRI* measures. In the spirit of Arnold et al. (2011; forthcoming 2015), we instrument for $STRI_i$ using the weighted average of *STRI* in other countries $c \neq i$:

$$STRI_{is}^{IV} \equiv \sum_c STRI_{cs} \times SI_{ci} \quad (3.4)$$

²⁴We make no attempt to claim a causal link between tariff protection and sectoral productivity, as this would be beyond the scope of this paper.

where $SI_{ic} \equiv 1 - \left\{ \frac{pcGDP_i}{pcGDP_i + pcGDP_c} \right\}^2 - \left\{ \frac{pcGDP_c}{pcGDP_i + pcGDP_c} \right\}^2$ is a similarity index in GDP per capita between the two countries i and c .²⁵ Such weights should reflect similar trade policy motives, assuring the relevance of the instrument. Moreover, to satisfy the exclusion restriction, the c countries are taken from geographical regions different from that of country i . This minimises the potential linkages between services trade regimes in the c countries and the lobbying activity of i 's manufacturing sector (see section 3.3.1).²⁶

The results are presented in Table 3.3. The instrument passes the standard tests. The results are, however, quantitatively very similar to the baseline results of Table 3.2, suggesting we do not need to be concerned with endogeneity of the services trade restrictiveness measure.

Random services trade restrictiveness

To ensure that our results can be given a clear economic interpretation, we perform a Placebo experiment in which the ‘treatment’ (services trade restrictiveness), rather than being constructed from real data, is randomly assigned. We construct the variable $\widehat{CSTRI}_{ij} = \sum_s \widehat{STRI}_{is} \times w_{ijs}$, where \widehat{STRI}_{is} is a random draw from a uniform distribution with support $[0, 100]$. We then perform 100,000 regressions of model (3.3), each with a different, randomly constructed \widehat{CSTRI}_{ij} , and we estimate the marginal effects. As in the baseline case, we evaluate the marginal effects at 39 values of the control of corruption variable. The resulting dataset, therefore, contains 3,900,000 estimated marginal effects. Out of those, 83% are not statistically different from zero.

Figure 3.5 graphically represents the marginal effects with the confidence intervals – averaged across all the 100,000 regressions. It is apparent that the marginal effects are never statistically different from zero. Our results, therefore, cannot be obtained with random services trade restrictiveness measures.²⁷

3.3.4 Robustness checks

Different moderator variables

As a robustness check we estimate the interaction model (3.3) with alternative institutional variables (M) instead of control of corruption. Table 3.4 shows the results for

²⁵We take the definition of the similarity index from Helpman (1987).

²⁶We thank Ben Shepherd for suggesting using countries c from different regions than i , rather than the same region as i .

²⁷The same results are obtained if the median is used instead of the average. Note that we do not exclude the United States from the sample – although the results are the same when doing so. Confidence intervals for each regression are computed using the Delta method.

Table 3.3: Instrumental variable regressions

	All modes		Mode 3	
	(1)	(2)	(3)	(4)
<i>CSTRI</i>	-0.124*	0.028	-0.027	0.048
	(0.072)	(0.061)	(0.052)	(0.058)
<i>CSTRI</i> \times <i>IC</i>		-0.053***		-0.044***
		(0.019)		(0.017)
Tariff	-0.114	-0.103	-0.120	-0.109
	(0.075)	(0.073)	(0.075)	(0.073)
Observations	912	912	912	912
R-squared	0.515	0.523	0.522	0.526
First-stage F statistics				
<i>CSTRI</i>	44.56	55.17	68.59	34.53
(p-value)	0.00	0.00	0.00	0.00
<i>CSTRI</i> \times <i>IC</i>		39.13		46.68
(p-value)		0.00		0.00
Underid SW Chi-sq statistics				
<i>CSTRI</i>	45.58	219.92	70.15	145.24
(p-value)	0.00	0.00	0.00	0.00
<i>CSTRI</i> \times <i>IC</i>		186.81		244.07
(p-value)		0.00		0.00
Weak id SW F statistics				
<i>CSTRI</i>	44.56	214.78	68.59	141.85
<i>CSTRI</i> \times <i>IC</i>		182.44		238.36
Stock-Wright LM S statistics				
Chi-sq	3.87	9.01	0.33	8.21
(p-value)	0.049	0.011	0.566	0.016

Robust (country-clustered) standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Country fixed effects and sector dummies always included

“SW” refers to Sanderson and Windmeijer (forthcoming)

Instrument for $CSTRI_i$: weighted average of $CSTRI_k$ (see Section 3.3.1)

IC = control of corruption

two alternative measures of institutional capacity and for GDP per capita as a proxy for economic development. When M is defined as an indicator of the quality of institutions such as the rule of law or a measure of regulatory quality, the moderating effect remains unchanged. However, it is not statistically different from zero if we use per capita GDP. The latter finding suggests that it is not differences in average per capita incomes (wealth) that shape the impact of services trade policies on downstream productivity, but that what matters are the institutional dimensions of the business environment that prevails in a country.

Figure 3.5: Impact of one unit increase in *CSTRI* (Mode 3) on y : Random assignment of *STRI*

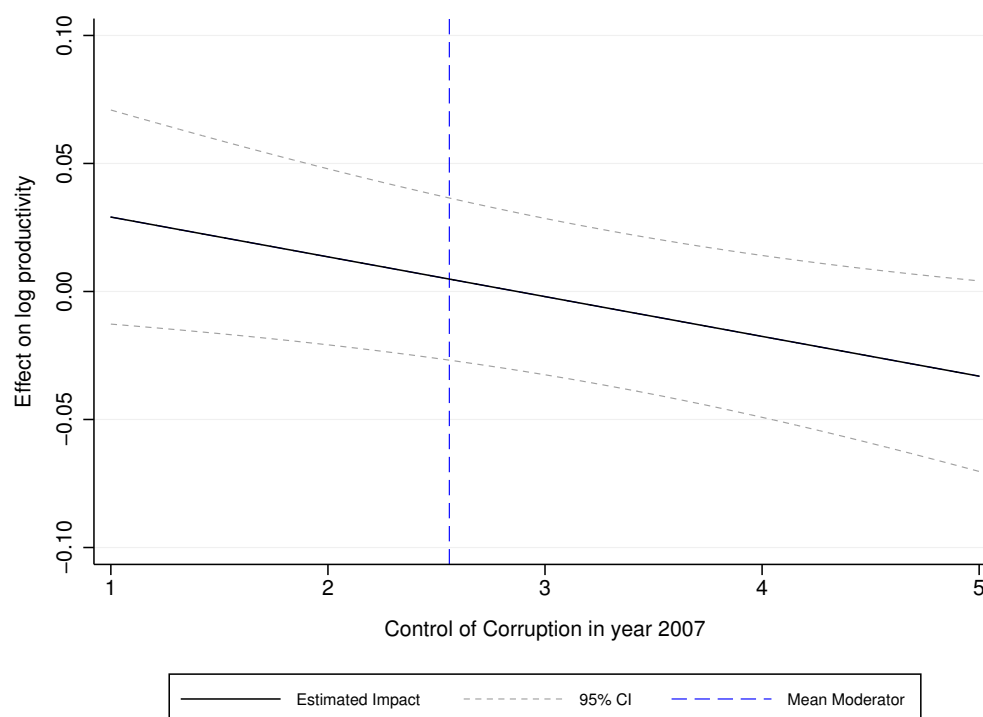


Table 3.4: Interaction model estimation with alternative moderator variables

Moderator (M)	Rule of Law		Reg. Quality		GDP per capita	
	All Modes	Mode 3	All Modes	Mode 3	All Modes	Mode 3
	(1)	(2)	(3)	(4)	(5)	(6)
<i>CSTRI</i>	-0.032 (0.024)	-0.039* (0.021)	-0.034 (0.025)	-0.040* (0.021)	-0.015 (0.024)	-0.027 (0.020)
$CSTRI \times M$	-0.046*** (0.014)	-0.046*** (0.012)	-0.044*** (0.014)	-0.045*** (0.012)	-0.000 (0.000)	-0.000 (0.000)
Tariff	-0.532* (0.287)	-1.498** (0.733)	-0.303 (0.184)	-1.252** (0.619)	-0.800** (0.399)	-1.826** (0.860)
Observations	912	912	912	912	912	912
R-squared	0.527	0.530	0.525	0.529	0.525	0.526

Robust (country-clustered) standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Country fixed effects and sector dummies always included

Alternative input penetration measures

The services input penetration measure adopted in this paper is the ratio between the cost of services inputs and the value of total intermediate consumption of downstream manufacturing industries. This measure differs from the definition of IO technical coefficients, which represent the ratio between services inputs and total output of a downstream sector.²⁸ Our definition does not embed differences in value added across manufacturing sectors, representing therefore a better proxy for technological differences in intermediate input consumption. To test the robustness of our preferred measure of input penetration, we replicate the estimation using both US technical coefficients and the coefficients derived from the US Leontief inverse matrix, which captures also the indirect linkages between upstream and downstream industries.²⁹ Estimation results are given in Table 3.5.

Table 3.5: Estimation with Technical and Leontief IO coefficients

IO weights	Technical				Leontief			
	All modes		Mode 3		All modes		Mode 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>CSTRI</i>	-0.068 (0.052)	0.131 (0.081)	-0.087** (0.043)	0.111 (0.075)	-0.080 (0.082)	0.172 (0.133)	-0.103 (0.062)	0.176 (0.144)
<i>CSTRI</i> \times <i>IC</i>		-0.093*** (0.027)		-0.085*** (0.026)		-0.116*** (0.042)		-0.119** (0.049)
Tariff	-0.122 (0.084)	-0.085 (0.084)	-0.330* (0.186)	-0.260 (0.186)	-0.126 (0.085)	-0.078 (0.087)	-0.344* (0.187)	-0.241 (0.197)
Observations	912	912	912	912	912	912	912	912
R-squared	0.523	0.529	0.525	0.531	0.522	0.527	0.525	0.529

Robust (country-clustered) standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Country fixed effects and sector dummies always included

IC = control of corruption

The sign and statistical significance of the estimated coefficients is robust across all measures of input penetration. Given the smaller size of technical and Leontief IO weights with respect to the shares of total intermediate consumption, the higher coefficient estimates in Table 3.5 generate economic effects that are similar in magnitude.

Given the heterogeneity of the countries in our sample, one can question the representa-

²⁸The ratio between the cost of services inputs and the value of the downstream industry output is the proxy for direct input penetration usually adopted in the empirical literature on the indirect effect of services policies on manufacturing (see for example Barone and Cingano, 2011).

²⁹For a derivation of those alternative input penetration measures from the IO Table, see Appendix C.2.

tiveness of the US as the baseline country for the IO linkages. In Table 3.6 we present results using the services shares of manufacturing intermediate consumption derived from China's 2005 IO accounting matrix. China was classified as lower middle income country by the World Bank in 2006.³⁰ Therefore it represents a more representative baseline for our estimation sample which includes both middle and low income countries. The sign and statistical significance of the coefficient estimates are not affected by the use of China's data. The higher values of the coefficients using Chinese IO data suggests that the use of US data is a conservative choice for the economic quantification of the results.

Table 3.6: Estimation with Chinese input penetration measures

	All modes		Mode 3	
	(1)	(2)	(3)	(4)
<i>CSTRI</i>	-0.081 (0.050)	0.135 (0.090)	-0.099** (0.043)	0.083 (0.083)
<i>CSTRI</i> \times <i>IC</i>		-0.094*** (0.032)		-0.078** (0.030)
Tariff	-0.085 (0.086)	-0.084 (0.084)	-0.277 (0.188)	-0.270 (0.187)
Observations	912	912	912	912
R-squared	0.526	0.529	0.528	0.531
Robust (country-clustered) standard errors in parentheses				
* p<0.10, ** p<0.05, *** p<0.01				
Country fixed effects and sector dummies always included				
China excluded from the estimation sample				
IC = control of corruption				

Barone and Cingano (2011) argue that country-specific measures of input intensity carry an idiosyncratic component which is likely to be related to the trade restrictiveness regime. In that case the sign of the estimation bias would be ambiguous, requiring a robustness check which does not rely on country-specific weights (Ciccone and Papaioannou, 2006). We follow the approach adopted by Barone and Cingano (2011) and instrument the US shares of services s in total intermediate consumption with:

$$w_{js}^{IV} \equiv \hat{\delta}_j + \hat{\gamma}_j STRI_{\bar{c}s} \quad \forall s \quad (3.5)$$

where $\hat{\delta}_j$ and $\hat{\gamma}_j$ are estimates from the following sector s -specific regression in which

³⁰In 2006 China had a per capita GNI (Atlas method) of 2,050 US dollars. For that year the GNI per capita interval for lower middle income countries was fixed by the World Bank at 906-3,595 US dollars.

country \bar{c} has been excluded from the sample:³¹

$$w_{ijs} = \delta_i + \delta_j + \gamma_j STRI_{is} + \epsilon_{ij} \quad \forall s \quad (3.6)$$

The input intensity measures derived in (3.6) minimise by construction the idiosyncratic component present in any country-specific proxy. Consistently with the literature, we chose country \bar{c} to be equal to the US.³² We also perform this IV exercise by setting \bar{c} equal to Sweden, the country with the lowest average STRI values across services sectors (both for Mode 3 and for All modes) of the countries in the sample used for equations (3.6).³³ The results are presented in Table 3.7.

Although the statistical significance of the estimated coefficients is reduced (especially in the case where \bar{c} is set equal to Sweden), their signs and magnitudes are in line with the baseline results.

Finally, to show how important input-output relationships between upstream services and downstream manufacturing are, we have performed a counterfactual Placebo analysis with randomly generated input penetration coefficients. The procedure is similar to the one adopted by Keller (1998). In a regression in which a country's R&D is affected by a weighted average of foreign countries' R&D – with weights given by bilateral import shares – the author replaces bilateral import shares from trade data with random shares, drawn from a uniform distribution with support $[0, 1]$. Likewise, we create the variable $\widehat{CSTRI}_{ij} = \sum_s STRI_{is} \times \tilde{w}_{ijs}$, where \tilde{w}_{ijs} are random draws from a uniform distribution with support $[0, 100]$. As in Section 3.3.3, we perform 100,000 regressions and estimate 3,900,000 marginal effects, with a 95% confidence interval. Out of the estimated marginal effects, 79% are not statistically different from zero. Marginal effects with the confidence intervals – averaged across all the 100,000 regressions – are presented in Figure 3.6. They are never statistically different from zero. Our results, therefore, cannot be obtained with

³¹This methodology was introduced by Ciccone and Papaioannou (2006) to instrument US industry capital growth. Our estimates are obtained accounting for the fact that the dependent variable in (3.6) is fractional, applying the specification suggested in Papke and Wooldridge (1996).

³²A rationale for this is that the US is one of the least regulated countries in a historical perspective (Barone and Cingano, 2011).

³³Estimation of the models (3.6) requires country specific input intensity measures (w_{ijs}) and services trade restrictiveness measures ($STRI_{is}$). The sample size therefore is determined by the intersection of the country coverage of the OECD STAN IO Database and that of the World Bank STR Database. This intersection includes 32 countries: Australia, Austria, Brazil, Bulgaria, Canada, Chile, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, South Korea, Lithuania, Mexico, Netherlands, Poland, Portugal, Romania, South Africa, Spain, Sweden, Turkey, United Kingdom and United States. This limited intersection in the country coverage of the two databases does not allow to perform a robustness check that makes use of the shares of intermediate consumption specific to each country (the baseline estimation sample counts 57 countries plus the US). In any event, the endogeneity issues associated with country-specific input intensity measures would have made this particular robustness check quite problematic (see Section 3.3.1).

Table 3.7: Non country-specific input penetration: IV regressions

Country \bar{c}	United States				Sweden			
	All modes		Mode 3		All modes		Mode 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>CSTRI</i>	-0.053 ^{##} (0.035)	0.013 (0.054)	-0.051 ^{##} (0.032)	0.019 (0.049)	-0.050 [#] (0.035)	0.001 (0.055)	-0.044 [#] (0.031)	0.008 (0.048)
<i>CSTRI</i> \times <i>IC</i>		-0.030 [#] (0.021)		-0.030 ^{###} (0.018)		-0.024 (0.022)		-0.023 [#] (0.018)
Tariff	-0.088 (0.074)	-0.081 (0.073)	-0.089 (0.074)	-0.082 (0.073)	-0.088 (0.074)	-0.082 (0.073)	-0.089 (0.074)	-0.084 (0.073)
Observations	930	930	930	930	930	930	930	930
R-squared	0.526	0.529	0.527	0.531	0.526	0.529	0.528	0.531
First-stage F								
<i>CSTRI</i>	460.67	251.95	367.65	222.42	341.13	181.57	303.24	177.45
(p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>CSTRI</i> \times <i>IC</i>		303.94		243.94		186.83		189.05
(p-value)		0.000		0.000		0.000		0.000
Underid SW Chi-sq								
<i>CSTRI</i>	470.93	253.35	375.84	194.00	348.73	177.88	309.99	171.21
(p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>CSTRI</i> \times <i>IC</i>		346.70		279.28		191.29		217.86
(p-value)		0.000		0.000		0.000		0.000
Weak id SW F								
<i>CSTRI</i>	460.67	247.54	367.65	189.55	341.13	173.80	303.24	167.28
<i>CSTRI</i> \times <i>IC</i>		338.75		272.87		186.90		212.86
Stock-Wright LM S								
Chi-sq	2.50	4.77	2.68	5.40	2.14	3.33	2.14	3.96
(p-value)	0.114	0.092	0.102	0.067	0.143	0.190	0.143	0.138

Robust (country-clustered) standard errors in parentheses

p<0.20, ## p<0.15, ### p<0.11, * p<0.10

Country fixed effects and sector dummies always included

US not excluded from the estimation sample

Instrument for $CSTRI_{ij}$: $\sum_s STRI_{is} \times w_{js}^{IV}$ (see Section 3.3.4)

IC = control of corruption

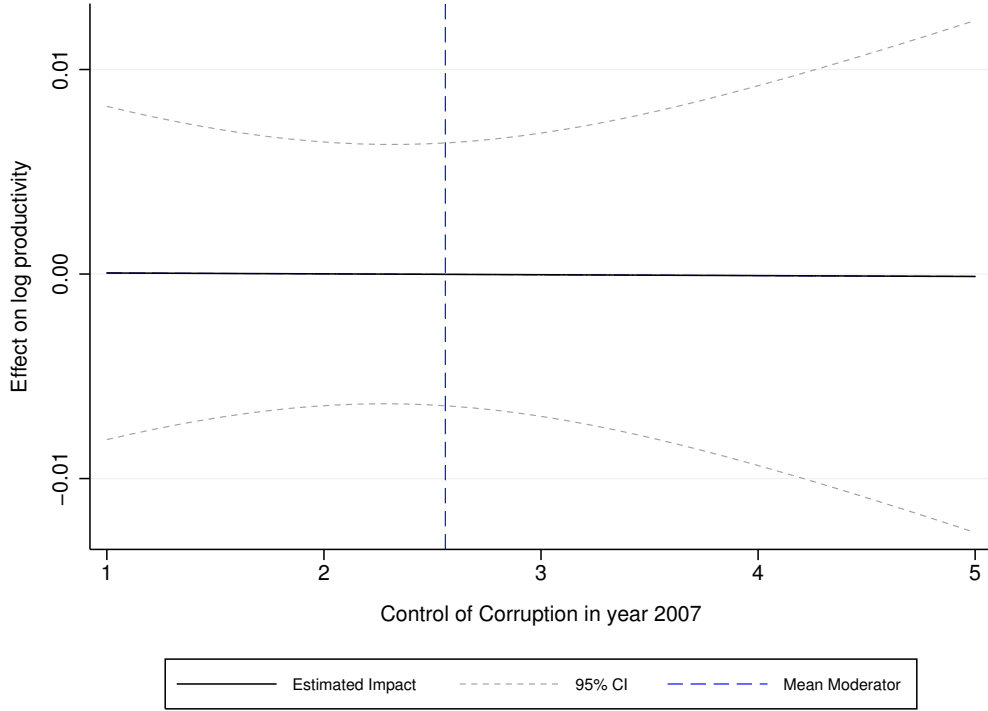
random input penetration measures.

Additional tariff controls

Import protection for other manufacturing sectors $k \neq j$ should also matter – as shown, among others, by Goldberg et al. (2010). To control for this, we augment model (3.3) with the variable Tariff, constructed as:

$$\widetilde{\text{Tariff}} = \sum_k \tau_{ik} \times w_{jk} \quad (3.7)$$

Figure 3.6: Impact of one unit increase in *CSTRI* (Mode 3) on y : Random assignement of w



where τ_{ik} is the log of effectively applied tariffs by country i in manufacturing sector $k \neq j$ and the weights w_{ijk} are the input penetration coefficients of k in j from the US IO table.

The results are in Table 3.8. The variable $\widetilde{\text{Tariff}}$ has always the expected negative sign (higher tariffs in upstream manufacturing sectors reduce productivity in downstream manufacturing) and it is statistically significant when the variable Tariff is excluded from the estimations (columns (1)-(2) and (5)-(6)). Most importantly, the coefficients on the interaction term between *CSTRI* and the institutional capacity variable (control of corruption) are the same as in the corresponding baseline regressions of Table 3.2.

Variations in country and industry coverage

The baseline and interaction models were re-estimated excluding each of the 57 countries in the estimation sample at a time. Results are extremely robust in terms of magnitude (variations smaller than 20%) and statistical significance of the coefficients. Results remain quite robust when dropping each of the 18 manufacturing sectors at a time: the signs of the key coefficients are unchanged, although in a few cases the coefficient of the

Table 3.8: Estimation with tariffs in other manufacturing sectors

	All modes				Mode 3			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>CSTRI</i>	-0.024 (0.024)	0.063* (0.038)	-0.024 (0.024)	0.063 (0.038)	-0.038* (0.021)	0.053 (0.032)	-0.038* (0.021)	0.052 (0.032)
<i>CSTRI</i> \times <i>IC</i>		-0.041*** (0.014)		-0.041*** (0.014)		-0.039*** (0.012)		-0.039*** (0.012)
Tariff			0.002 (0.139)	0.013 (0.140)			-0.220 (0.371)	-0.204 (0.377)
$\widetilde{\text{Tariff}}$	-0.246* (0.136)	-0.232* (0.133)	-0.248 (0.216)	-0.252 (0.214)	-0.565* (0.297)	-0.534* (0.289)	-0.223 (0.599)	-0.217 (0.601)
Observations	912	912	912	912	912	912	912	912
R-squared	0.523	0.526	0.523	0.526	0.524	0.528	0.524	0.528

Robust (country-clustered) standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Country fixed effects and sector dummies always included

IC = control of corruption

interaction term varies more than 20% (never more than 50%). Results of these 300 regressions (57 plus 18 for Mode 3 and All modes, both with the baseline specification and the specification with interaction) are available upon request.

3.4 Theory

In this section we propose a theoretical framework that provides some insights into the empirical finding that institutional capacity is an important moderator variable for the positive effect of services trade openness on productivity in downstream industries. The framework proposes two different channels through which institutions can have an impact. The first channel centers on the trade decision (ex ante). The second channel operates conditional on engaging in exports. A key feature of the framework is to recognize that the proximity burden means that foreign suppliers must perform some part of the service in the destination (importing) country. As a result, the institutional environment in the destination country is a determinant of an exporter's payoff. If institutions are not perfectly observable for firms that are located abroad, the ability to identify countries with higher quality institutions will be one parameter differentiating firms: only the best firms, those providing higher quality services, will have the capacity to detect the best countries. Countries with high quality institutions will attract foreign firms that provide on average better services than foreign firms in countries with weaker institutions. As a consequence, the downstream industries in countries with high institutional capacity will benefit more

from services trade openness. This ‘selection effect’ is complemented by a second channel which is active given an export decision (ex post). Both the exporters’ payoff and the quality of their services performance is sensitive to the institutional environment in which they have decided to operate. Thus, for any level of exporters’ productivity, the average quality of foreign services performance in an institutionally weak environment will be less than in countries with robust institutions.

3.4.1 The setup

The economy consists of two countries indexed by $i \in \{1, 2\}$. The two countries have an identical economic structure while they differ in terms of institutional setting, which we define as the capacity of a country to minimise the exposure of the economic agents active within its territory to harmful unexpected changes in the operating environment. This definition captures the different dimensions of institutional capacity explored in our empirical exercise: from control of corruption, to rule of law, to regulatory quality.³⁴ Each country is characterised by an industry Y using intermediate input x . We take a reduced form approach assuming that the average productivity y in the downstream industry of country i is a function of the average quality q of the intermediate input x available in the country. Formally,

$$y_i = f(q_i) \quad \forall i \quad (3.8)$$

with f strictly positive, increasing and concave and $q_i \in [0, 1] \quad \forall i$. We assume that each country has a minimum-quality domestic supply of x , such that, if the countries are closed to international transactions in x the productivity of the downstream sector is $y_i = f(0) \quad \forall i$.

The international supply of x consists of a continuum of heterogeneous exporters located outside the two-country system described above and indexed by φ , which corresponds to a productivity parameter varying on the support $[0, 1]$ such that exporter $\varphi = 0$ has a minimum productivity while exporter $\varphi = 1$ is the most productive. Exporters have to choose where to export x among the potential destination countries. Once the destination country is chosen, trade takes place. However, because of the promity burden, this often will involve a stage in which the foreign firm must undertake activities in the territory of the selected destination country. To capture this, we introduce an intangibility parameter $\tau \in [0, 1]$ that determines the relative importance of this ‘performance stage’. This allows x to range from being fully tangible (all production occurs in the exporting country) to fully intangible (all activities must be performed in the importing nation). If it is fully

³⁴Examples include unexpected corruption episodes, restrictions on key complementary investments or movement of personnel, sudden changes in the authorizing regulatory framework.

tangible the product is called a ‘good’. In all other cases it is a ‘service’. In the latter case, during the stage of services performance in the importing country i , the foreign firm confronts unexpected shocks in the operating environment that follow a homogeneous Poisson process with rate parameter θ_i . For each unexpected event the foreign firm incurs a unitary cost which does not vary across destination countries. The expected payoff of exporting the intermediate service input x with intangibility τ to country i is given by:

$$E[\pi_i(\varphi)] = g(\varphi) - \theta_i\tau \quad (3.9)$$

with g positive, increasing and concave. To restrict the analysis to exporters – i.e. to firms that get non negative payoffs by exporting – we assume that $g(0) > 1$. θ captures the institutional setting in country i with high values of θ being associated with fragile institutions. For simplicity we restrict³⁵ the support of θ to the interval $(0, 1]$. Similarly, we assume that the quality of exporters’ output depends positively on their productivity and negatively on the θ parameter of the selected destination country in instances where x possesses some degree of intangibility: unexpected negative events not only affect exporters’ payoffs but also the quality of their output x . Formally,

$$E[q_i(\varphi)] = k(\varphi) - \theta_i\tau \quad (3.10)$$

with k positive, increasing and concave. We assume that $k(0) > 1$ to focus on foreign firms that produce higher quality than domestically supplied intermediate inputs. This assumption reflects the usual new trade theory implication that exporting firms have superior properties than non-exporting ones. This framework makes the exporter’s payoff as well as the quality of the exported output a function of the institutional quality of the selected destination country in all cases where a product has some degree of intangibility.³⁶

Finally, we assume that the institutional capacity of potential destination countries is not perfectly observable and that the productivity φ determines the precision with which an exporter can estimate the true value of θ . For each potential destination country i , exporters observe a signal ϑ_i instead of θ_i . The signals are independently distributed

³⁵This restriction makes the number of unexpected shocks a fraction instead of an integer without modifying the economic meaning of the payoff function.

³⁶The type of activity associated with intangibility, mode 3 / FDI, also is used to produce tangible items (goods). A similar framework may well apply to FDI more generally but the mechanism modelled here is qualitatively different because firms producing goods have a choice between exporting and FDI. In the services context the proximity burden requires FDI and / or mode 4 cross-border movement, whereas in the case of goods the export versus FDI decision will take into account the institutional environment and result in more exports relative to FDI than what would be optimal absent the institutional factors. In the case of services it is not feasible to produce in the exporting country and thus the process of performing a service is more sensitive to the institutional environment in the importing country.

according to non-standard uniform probability density functions:

$$\vartheta_i \sim U[q_1(\theta_i, \varphi), q_2(\theta_i, \varphi)] \quad \forall i \quad (3.11)$$

where $q_1 = \theta_i \varphi$ and $q_2 = (\theta_i - 1)\varphi + 1$. This specification implies that an exporter with maximum productivity ($\varphi = 1$) observes - for each potential destination country - a signal which is equal to the true institutional capacity with probability 1. In contrast, the signal observed by an exporter with 0 productivity can take any value in the support of the institutional capacity parameter with equal probability. In between those two extrema, the size of the interval upon which the signal is uniformly distributed is a decreasing function of the exporter's productivity type.³⁷

3.4.2 Closed and open regimes: the role of institutions

We can now study - under two different institutional environments - the effect of upstream trade openness on downstream productivity. We assume without loss of generality that country 1 has a higher institutional capacity than country 2, i.e. $\theta_1 < \theta_2$. We denote with δ the difference $\theta_2 - \theta_1$. If the two countries are closed to international transactions in x the productivity of the downstream sector is $y_i = f(0) \forall i$. We consider now the case where the two countries open their economies, creating a pool of potential destinations for international exporters. Given φ and τ , each exporter has to decide its destination country based on the realization of the signals ϑ_1 and ϑ_2 . If x is fully tangible ($\tau = 0$), institutional capacities do not affect by construction the payoffs and the exporters choose each country with equal probability. If instead $\tau > 0$, an exporter with productivity φ chooses country 1 if and only if:³⁸

$$g(\varphi) - \vartheta_1 \tau \geq g(\varphi) - \vartheta_2 \tau \iff \vartheta_1 \leq \vartheta_2 \quad (3.12)$$

Denote with $\Pi(i|\varphi, \delta)$ or simply $\Pi(i)$ the probability of choosing country i given productivity φ and institutional difference δ . The properties of the probabilistic structure embedded in the exporters' decision problem are given in the following Lemma.

Lemma 3.1 *If x possesses some degree of intangibility ($\tau > 0$),*

(i) $\forall \delta > 0$ and $\varphi > 0$, $\Pi(1) > \Pi(2)$. If $\varphi = 0$, then $\Pi(1) = \Pi(2)$;

³⁷A more parsimonious specification for an equivalent signalling technology is given by q_1 and q_2 satisfying the following properties: $q_1 : (0, 1] \times [0, 1] \rightarrow [0, \theta_i]$ with $q_1(\theta_i, 0) = 0$, $q_1(\theta_i, 1) = \theta_i$, $\partial q_1 / \partial \theta_i \geq 0$, $\partial q_1 / \partial \varphi \geq 0$ and $q_2 : (0, 1] \times [0, 1] \rightarrow [\theta_i, \bar{\theta}]$ with $q_2(\theta_i, 0) = 1$, $q_2(\theta_i, 1) = \theta_i$, $\partial q_2 / \partial \theta_i \leq 0$, $\partial q_2 / \partial \varphi \leq 0$.

³⁸Having a weak inequality in the choice condition reflects our implicit assumption that, when the exporter receives two identical signals, it is 'lucky' and chooses the best country.

- (ii) *the probability of choosing the best (worst) country is a non-decreasing (non-increasing) function of both the exporters' productivity φ and the difference in institutional capacity δ .*

Proof. See Appendix D.2.

Lemma 3.1 point (i) states that, if the two countries are not identical, at any non-zero level of productivity the probability of choosing the best country is higher than the probability of choosing the worst country. Moreover, Lemma 3.1, point (ii) formally restates the selection mechanism of our framework: better exporters get more precise signals about the institutional capacity of potential destination countries and therefore choose to export to the best country with a higher probability. Furthermore, given our specification, the institutional difference between the two countries positively affects the precision of the signal at any level of productivity. The probabilistic structure described in Lemma 3.1 determines the expected average quality of the intermediate input available in each country, which corresponds to the weighted average of the output's expected quality across exporters, with weights given by the probability of exporting to country i . Formally,

$$q_i = \int_0^1 E[q_i(\varphi)] \times \Pi(i) d\varphi \quad (3.13)$$

An immediate corollary of Lemma 3.1 is given by the following

Corollary 3.0 *If x possesses some degree of intangibility ($\tau > 0$), then $y_1 > y_2 > f(0)$.*

Proof. See Appendix D.2.

Openness to trade in the non-fully-tangible intermediate input x increases downstream productivity above its closed economy benchmark everywhere. This effect is higher in the country with a better institutional framework. When comparing the weighted average of the expected quality q_i of output in the two countries, we can identify the two impact channels discussed at the beginning of this section. The difference between the probability of choosing the best country and the probability of choosing the worst, reflects the ex-ante impact channel of institutional capacity. This difference is a function of exporters productivity. The difference between $E[q_1(\varphi)]$ and $E[q_2(\varphi)]$ is constant for any given level of productivity and reflects the ex-post impact channel of institutions.

3.5 Conclusions

Services trade policy reform is an important ingredient for economic development, because services are essential inputs into modern manufacturing. Due to the specificities of services and services trade, however, reducing the restrictiveness of services trade policy

may not be a sufficient condition for the expected positive effect of liberalised service trade on downstream industries.

Using an empirical model that identifies the causal link between services liberalisation and downstream manufacturing productivity, this paper has shown that this conjecture is confirmed by the data. Our estimates imply that the same reduction in services trade restrictiveness would increase manufacturing productivity by 16.7% in a country with high institutional capacity such as Canada, as compared to only 3.9% in a country with low institutional capacity such as Tanzania. Analogous differences hold for countries at equivalent stages of economic development and with similar per capita incomes, like Austria and Italy.

We have formalized these empirical results with a theoretical framework that incorporates the specific characteristics of services and services trade – namely, exporting services firms must to a greater or lesser extent engage in economic activity within importing countries. When international services transactions are liberalised, cross-country differences in institutional capacity generates both a selection effect at the level of the decision whether to engage in trade, and a performance effect that operates once trade decisions have been taken. The interaction of the two factors allows manufacturing firms in countries with good institutions to source higher quality services inputs. Our empirical exercise captures both of these effects at the same time. An empirical quantification of the two effects requires firm-level data for a broad cross-section of countries and is left for future research.

Chapter 4

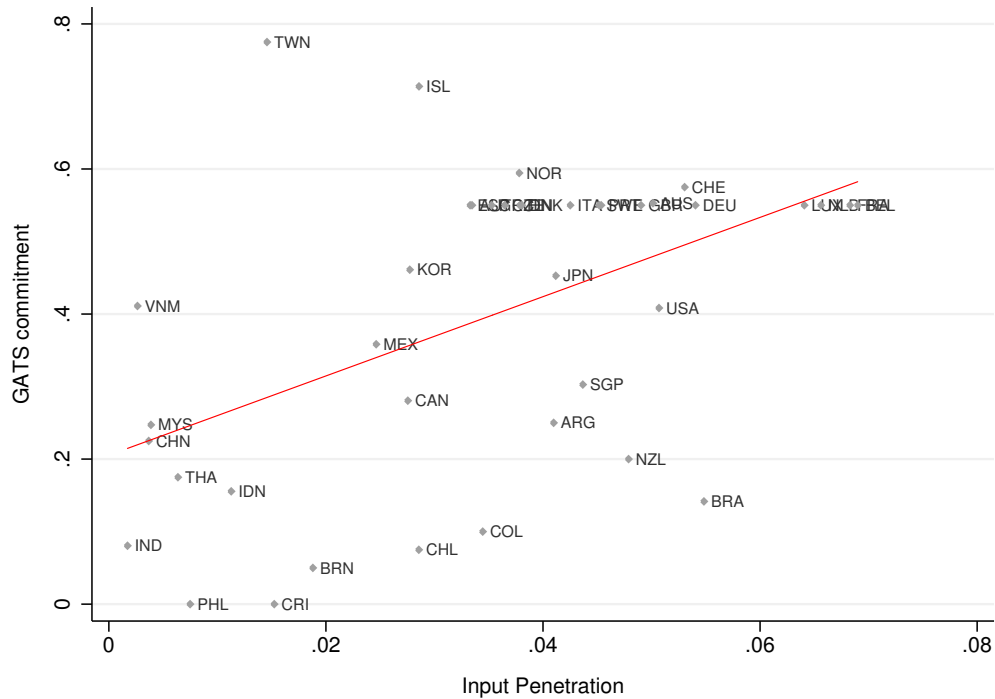
The political economy of services trade agreements

With Mathilde Lebrand

4.1 Introduction

While tariffs have almost completely disappeared for manufactured goods, various barriers remain for trade in services (Borchert et al., 2011). Negotiations have been taking place for a new series of liberalizations to go further than the commitments already made through the General Agreement on Trade in Services (GATS). While the determinants of tariffs and of trade agreements have been studied for final goods, there is little analysis of the determinants of trade barriers and of trade agreements for services. This is surprising given that services sector are large and growing (Jensen, 2011) and that 65% of global cross-border merger and acquisitions deals in the period 1990-2012 happen in services (UNCTAD, 2013). In this paper we demonstrate the significance of the input role of services as determinant of services trade liberalization. We use data on services commitments through the GATS and Input-Output (IO) tables to test this relationship empirically. As first and suggestive evidence, Figure 4.1 shows a positive correlation between GATS commitments at the country level and a measure of input penetration for business services. We then build a theoretical framework to rationalize the role of input penetration on services trade barriers and commitments.

Figure 4.1: Services input penetration and GATS commitments



We proceed in two steps. In the first part of the paper we present some broad patterns that characterize services. Contrary to goods, many services are not tradable (see Jensen (2011) for a measure of tradability for services) and cannot be exported across borders.¹ We show that horizontal FDI as a mode to provide non-tradable services abroad has been increasing over the last decade compared to cross-border exports. Focusing on horizontal FDI, we use data on restrictions for trade in services to show that foreign entry restrictions still apply in many countries, especially in developing countries and emerging economies. Services also matter as inputs for the rest of the economy. Barriers to trade in services affect the productivity of all sectors and reforms in the services sectors have been shown to benefit final producers.² We then show that the level of input penetration for services is indeed a determinant of services commitments made through the GATS. This link gets stronger for smaller economies.

Using these empirical facts, we build a new model with entry restrictions for foreign services producers whose level is chosen by the government. Both national firms and

¹Jensen (2011) details the results of a study that uses the location of services firms in the US to build an index of tradability for services. A service is defined as tradable if its production is very concentrated while being sold to different locations in the US.

²See Section 4.2.1 for a discussion of the literature on the indirect effect of services reforms on the economic outcomes in downstream industries.

foreign affiliates can lobby to influence the policy but foreign contributions are assumed to be undervalued compared to national contributions. We model a bargaining game between the government and the two lobbies. High foreign entry reduces the degree of imperfect competition while the number of national firms is assumed to be fixed and exogenous. Foreign affiliates that enter behave like additional firms and compete with national firms in an oligopolistic framework. We study the political motive behind trade barriers and services commitments. National firms lobby to limit the number of new entrants that reduce their individual profits whereas foreign firms might lobby either for more entry or for higher individual profits. When the two lobbies are active, we show that the number of national firms determines the effect of a higher government's valuation on the policy. A small number of national firms have a small influence on the government and the policy is then less restrictive. When foreign contributions are increasingly valued, they aim first at increasing individual profits rather than at increasing the number of entries and the policy becomes more restrictive. The opposite happens when the number of national firms is large.

Our model also rationalizes our empirical finding showing that a higher services input penetration increases the level of services commitments in small economies. We detail a new motive for small countries to unilaterally commit in order to avoid the political game with lobbies. The timing of the model creates a time-inconsistency problem for the government and explains why it might want to commit even in presence of lobbies that always compensate the government for its loss. This time inconsistency problem arises because final producers invest in capital which is complementary to services inputs and this investment happens before the choice of the foreign entry policy. The government cannot promise to implement free-entry for foreign firms at the beginning of the period. Final producers therefore underinvest in capital at the initial period which ends in lower final production. The government might want to initially commit to credibly implement foreign free-entry. We show that the benefits from committing depend from the government's bargaining power and from the undervaluation of foreign contributions.

This paper contributes, first of all, to the literature on trade policy and the motives behind trade agreements. Our paper is related to the works of Maggi and Rodriguez-Clare, (1998) and (2007) which detail a commitment motive that applies for trade in final goods through cross-border exports. We show that the commitment motive holds in a different framework for services. We depart from these papers along several dimensions. We model services as inputs for final production which are traded through commercial presence instead of cross-border exports. In our paper, the time inconsistency problem arises because final producers initially underinvest in a complementary input whereas the time inconsistency problem in these papers is due to investments in the wrong sectors. Our paper also relates to Ossa (2011) that studies the role of profits as a determinant for

positive tariffs. In our model, positive profits due to the oligopolistic framework are the source of lobbying which creates barriers for trade in services.

This paper also speaks to the empirical literature on services trade policy. Building from the work of Egger and Lanz (2008), we test the role of services input intensity as determinant of commitment to trade liberalization within the GATS framework. Other recent empirical studies on the determinants of commitment to services trade liberalisation include van der Marel and Miroudot (2014) and van der Marel (2015). None of those works though look at the role of input intensity.

A last contribution is made by considering foreign lobbying and its impact on trade policies. Gawande et al. (2006) provide empirical evidence that foreign lobbying decreases trade barriers in the US. Similarly to this paper, we assume that foreign contributions are undervalued by the government. Our paper however studies lobbying by domestic firms only that could be either national firms or foreign affiliates. All firms produce in the same country but have different interests. It is interesting to notice that foreign affiliates might lobby either for more entries or for higher individual profits.

The rest of the paper is organized as follows. Section 4.2 provides the motivating evidence. Section 4.3 presents our baseline theoretical model and Section 4.4 extends it allowing for foreign lobbying. Section 4.5 offers conclusions.

4.2 Empirical motivation

In this section we provide some relevant empirical evidence characterizing trade in services and services trade agreements. We highlight several differences between goods and services that justify the need for a new model to rationalize barriers to services trade in the context of services trade agreements. Models in the literature on trade agreements mainly focus on final goods in perfect or monopolistic competition with free-entry and on the standard mode of provision through cross-border exchanges. The empirical facts presented here show that these assumptions imperfectly apply to the case of services - when they do it at all - and that a new framework is required to study services trade agreements.

4.2.1 Services as inputs

Services are major inputs into modern production processes. Averaging across the 63 countries covered by the OECD ICIO database,³ for each dollar of national production in 2011, 4.7 cents cover the costs of R&D and business services as intermediate inputs, 3.7 cents the cost of transportation services, 3.2 cents that of financial services. Moreover, there is often an increasing trend in the evolution of IO technical coefficients for services from 1995 to 2011: this is the case especially for ICT services, whose cost in terms of intermediate inputs relative to one dollar of total output goes from 0.43 cents in 1995 to 0.86 cents in 2011. The input intensity of producer services⁴ is at the core of the positive impact of service reforms on downstream manufacturing productivity. A growing empirical literature studies the effect of reforms in the services industries on the rest of the economy. Most papers⁵ consider services input intensity into manufacturing industries as the key factor shaping the linkages between services and the downstream sectors. The general result in these studies is a positive effect of pro-competitive services policies for those industries that use services as intermediate inputs.

4.2.2 Trade in services through horizontal FDI.

Contrary to goods, many services are not tradable through cross border exchange. The intangibility and non-storability of many services imposes a proximity burden on the international transactions involving producer services. The GATS defines four mode of services provision in the context of international trade: Mode 1 stands for cross-border trade; Mode 2 implies the movement of the customers to the exporter's country to consume the service; Mode 3 captures trade through commercial presence (also called horizontal FDI); finally Mode 4 implies the (temporary) movement of the exporter's personnel to the customer's country to provide the services. Due to the specificities embedded in the notion of services, trade through commercial presence (horizontal FDI or Mode 3) is particularly relevant. This type of services trade is not accounted for in the EBOP statistics⁶ while its relative share with respect to other modes of provision

³OECD ICIO tables cover OECD countries, the BRICS and several other high and middle income countries. For a detailed country coverage of the OECD ICIO tables see http://www.oecd.org/sti/ind/ICIO2015_Countries_Regions.pdf.

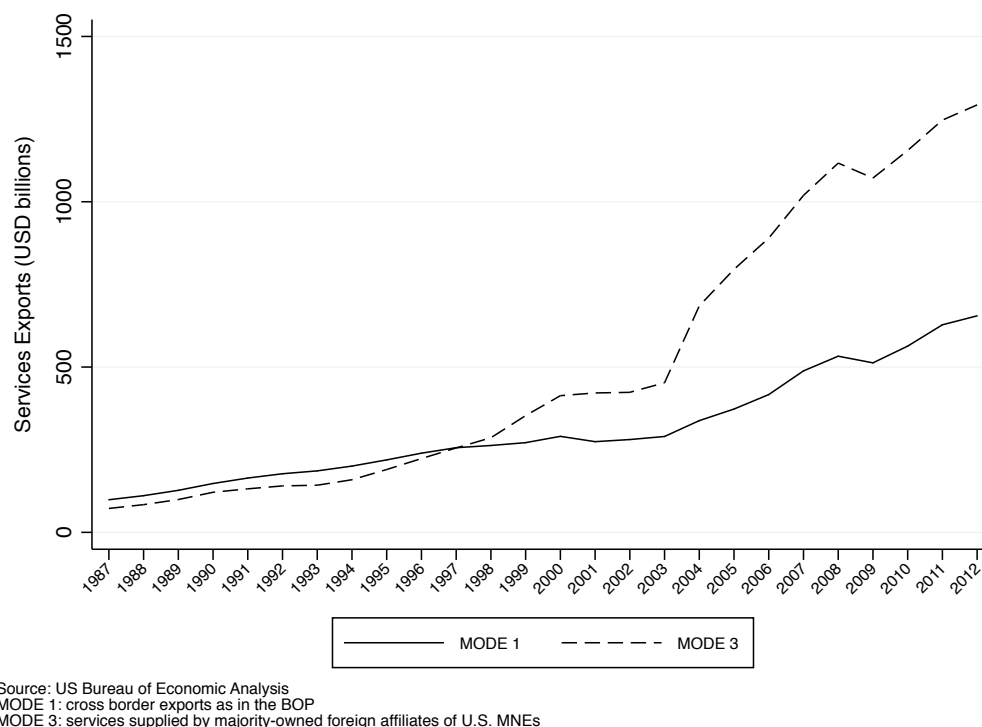
⁴Services input intensity can be measured by Input Output technical coefficients, by Input Output coefficients derived from the Leontief inverse table or through the shares in total intermediate consumption.

⁵See Barone and Cingano (2011), Bourlès et al. (2013) and Beverelli et al. (2015) for industry level evidence and Arnold et al. (2011), Fernandes and Paunov (2011), Hoekman and Shepherd (forthcoming 2015) and Arnold et al. (forthcoming 2015) for results at the firm level.

⁶Extended Balance of Payments Statistics captures Mode 1 (cross border trade) and Mode 2 (customers moving to the exporting country to consume the service) of services provision.

is growing over time. Figures 4.2 and 4.3 compare cross-border trade in services (Mode 1) with foreign affiliates trade in services (FATS, capturing Mode 3) for US exports and imports respectively. At the beginning of the nineties the two modes accounted for equal shares of international transactions while the current value of Mode 3 trade is almost twice the value of Mode 1 for both US exports and imports. Commercial presence is now the main mode of services provision from and to other countries. Mode 3 services trade is

Figure 4.2: Mode 3 in US Services Exports

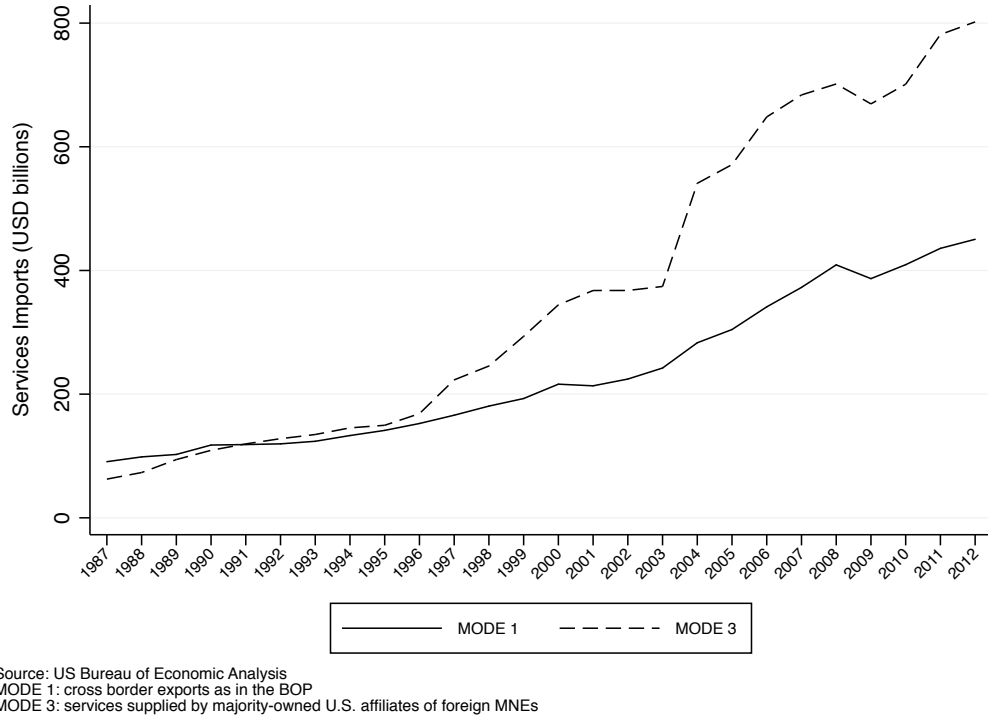


not unrestricted: FDI regulations such as market entry, foreign equity quotas, limit on the number of licences available, nationality requirements for key personnel, discriminatory licensing criteria et cetera represent de facto barriers to services trade.⁷ According to the data of the World Bank Services Trade Restrictiveness Database covering 103 countries and 5 services sectors,⁸ those barriers exist and vary significantly across sectors and countries (see Table D-1). For instance, trade in professional services through commercial presence around the mid 2000s appeared as fully restricted in India, Indonesia, Mali and the Philippines, while it scored as completely liberalised in Bangladesh, Bolivia, Chile, Ecuador, Mozambique, Nicaragua, Russia and Uruguay. FDI regulationa are a crucial

⁷For a detailed discussion on services trade policy and the relationship between modes of provision and policy instruments see Francois and Hoekman (2010).

⁸For a description of the database see Borchert et al. (2012).

Figure 4.3: Mode 3 in US Services Imports



component for services trade agreements such as the GATS⁹ as well as for any strategy of services trade liberalisation.

4.2.3 Services input intensity as a determinant of services trade commitment

In this section we investigate empirically the relationship between the role of services as intermediate inputs into production and the degree of commitment to services trade liberalisation within the framework of trade agreements. The results will inform our modelling strategy in building a theory of services trade policy. Specifically, we regress a measure of GATS commitment to Mode 3 services trade liberalisation (y) on services input intensity (x). To the best of our knowledge, the existing empirical studies on the determinants of services trade agreements do not test for the role of services input intensity. We contribute to this literature by extending the empirical model of GATS commitment in Egger and Lanz (2008) in order to account for an input intensity regressor varying at the country and (services) sector level. We find that the degree of services' input penetration appears to be an important determinant of commitment to services

⁹The reader can refer to Francois and Hoekman (2010) for a complete description of GATS schedules.

trade liberalisation. Furthermore, the link is stronger for economically small countries.

Data and Specification

We work with a sample of 26 high income and 12 middle income countries¹⁰ for a total of 38 countries. Countries are indexed by i . For each country we have information on both services input penetration and GATS commitment for 8 producer services sectors¹¹ indexed by j . The GATS commitment measure comes from the WTO and goes from 0 for no commitment, to 1 for commitment to full liberalization.¹² Input penetration measures are IO technical coefficients derived from OECD ICIO Tables¹³ for the mid nineties. Technically, we define the country specific input penetration of service j as

$$x_j \equiv \frac{\sum_c \iota_{jc}}{\sum_c v_c} \quad (4.1)$$

where ι_{jc} and v_c come from country specific IO tables. ι_{jc} is the cost borne by sector c for the services produced by sector j (domestic production plus imported foreign production) that are used as intermediate inputs into c . v_c instead is the value of c 's total output. If the sums are taken across all the c industries in the country, we can x_j as the cost of the intermediate inputs from sector j for every dollar of total production. Throughout our empirical exercise we will consider services input penetration into both total production and manufacturing production.¹⁴

Our specification rules out estimation biases coming from unobserved heterogeneity at the country level. We do that by adding a number of country level controls (\mathbf{z}) that have been identified as relevant determinants of GATS commitment in Egger and Lanz (2008). Those include log GDP as a measure of economic size, the percentage of population that completed tertiary education as a proxy for skilled-to-unskilled labor ratio, the share of trading partners with which trade has been liberalised via a customs union or free trade area (FTA) and a pre-1996 European Union membership dummy.¹⁵ Furthermore, we

¹⁰For a detailed list of the countries in our sample see Table D-2.

¹¹Table D-3 lists the sectors in our sample.

¹²We are grateful to Martin Roy for sharing the GATS commitment raw data. The construction of the commitment measure is in the spirit of the index introduced in Hoekman (1995) and it is explained in details in Roy (2011). Given that the original database is highly disaggregated at the sectoral level, in order to match commitment with input penetration measures we aggregated sub-sector commitment using industrial weights from Hoekman (1995).

¹³We are grateful to Sebastien Mirodout who shared with us the 2015 release of the OECD ICIO Tables during the testing phase of the data. We derive country specific IO tables from the ICIO database, because of the higher country coverage in the OECD ICIO database with respect to the OECD STAN IO database.

¹⁴For the latter, x_j is constructed summing over only c manufacturing sectors.

¹⁵GDP data come from the World Bank and refer to the year 1993. Data on education come from the Barro-Lee database and refer to the year 1995. The FTA information and the EU dummy come from the

use sector fixed effects (κ) to control for sector level determinants of GATS commitment which are also potentially correlated with input penetration. Finally we include two sets of interaction terms: first we interact the input penetration regressor with sector dummies (D) to control for compositional effects at the industry level. Second, we include the interaction between input penetration and log GDP (GDP). This term is meant to capture the role of economic size in shaping the relationship between services input penetration and GATS commitment. Formally, we fit the following linear model

$$y_{ij} = \alpha + \beta x_{ij} + \gamma(x_{ij} \times GDP_i) + \vartheta' \mathbf{z}_i + \sum_s \delta_s(x_{ij} \times D_s) + \kappa_j + \epsilon_{ij} \quad (4.2)$$

where ϵ is the error term. We use lagged values for our right-hand-side variables to account for potential reverse causality issues.¹⁶ Descriptive statistics for the key variables are reported in Table 4.1.

Table 4.1: Summary Statistics

Variable	Description	#	Mean	Std. Dev.	Min.	Max.
Country-Sector-level						
y	GATS commitment (Mode 3)	304	0.448	0.281	0	1
x	IO coeff. for total output	304	0.019	0.018	0	0.128
x	IO coeff. for manufacturing output	304	0.012	0.015	0	0.102
Country-level						
GDP	log of real GDP (1993)	38	25.899	1.517	22.567	29.642
FTA	free trade area membership	38	0.032	0.036	0	0.080
EU	EU membership	38	0.289	0.454	0	1
$SKILLED$	log tertiary edu compl. (% 1995 pop)	38	1.964	0.661	0.138	3.016

Egger and Lanz (2008) database. We are grateful to Rainer Lanz for sharing the database with us. We report here their definitions of the FTA variable: it ‘is the fraction of countries an economy was engaged with in free trade agreements notified to the WTO between 1970 and 1990’.

¹⁶If GATS commitment would have had an effect on the services input intensity as captured by the mid nineties IO coefficients, it is reasonable to assume a positive sign of this effect: higher commitment to a liberal regime generating a higher input intensity. In that case the sign of the simultaneity bias would be undetermined and in order to fully account for reverse causality issues one would need to find a good instrument for the input intensity variable. Given this, it has to be noted that much of GATS commitment appeared still more restrictive than actual policies (see for example Borchert et al. (2011) here). It is therefore difficult to assume that the GATS schedules would have had such a strong effect on the services international transactions to affect the intermediate services consumption of downstream sectors.

Main Estimation Results

Our estimation results¹⁷ are presented in Table 4.2: the specification in the first column makes use of x as the IO coefficient considering total output, while the second column takes x as the coefficient only for manufacturing production.

Table 4.2: Main Estimation Results

Dep Var: y (GATS Commitment)	(1)	(2)
x	33.241** (10.790)	24.481** (9.113)
$x \times GDP$	-1.203** (0.429)	-0.943* (0.436)
$x \times \text{TRANSPORT}$	-4.717** (1.691)	-2.033 (4.425)
$x \times \text{POST \& TELECOM}$	0.375 (2.305)	-6.574*** (1.347)
$x \times \text{FINANCE}$	-5.319** (1.524)	-2.781 (4.670)
$x \times \text{REAL ESTATE}$	9.887*** (0.413)	9.911*** (1.334)
$x \times \text{RENTING}$	32.494*** (4.584)	33.014*** (4.736)
$x \times \text{IT SERVICES}$	1.084 (1.692)	20.535*** (3.117)
$x \times \text{BUSINESS}$	-0.176 (0.586)	1.173 (3.542)
Observations	304	304
R-squared	0.308	0.285
x measure of input into:	total output	manuf.

Robust standard errors in parenthesis

Statistical significance: *0.1, ** 0.05, *** 0.01

Sector fixed effects and country level controls always included

Construction services as base

The derivative of y with respect to x is given by our previous linear specification

$$\frac{\partial y}{\partial x} = \gamma GDP + \sum_s \delta_s D_s \quad (4.3)$$

The estimated derivative has a sector specific component plus a non-sector specific one which depends on countries' economic size. We are interested in whether and how the

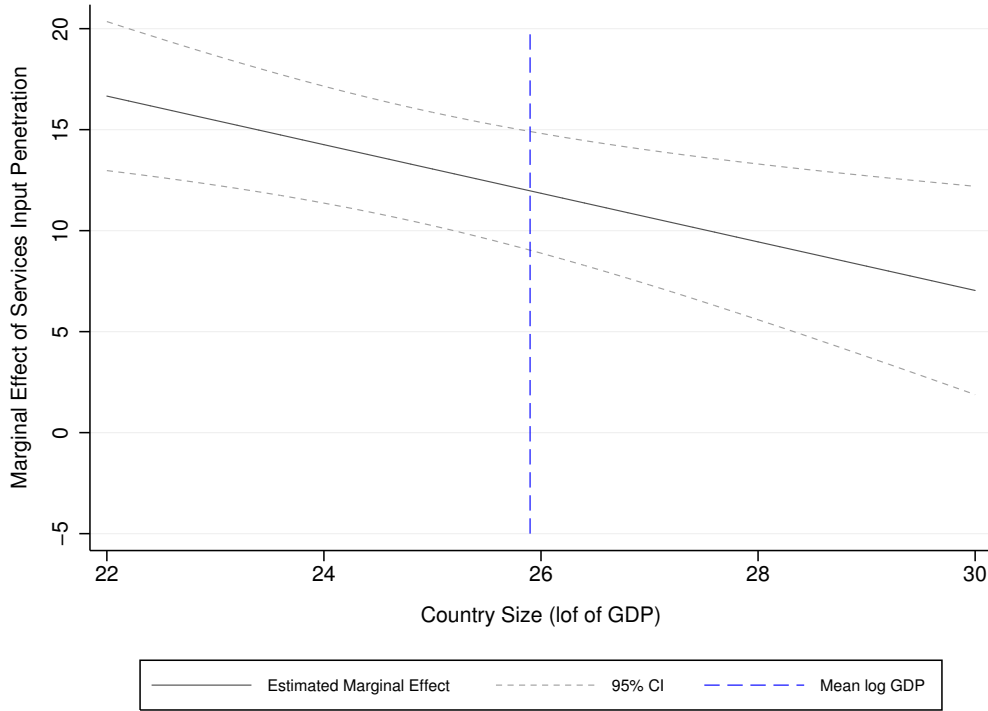
¹⁷The complete set of our estimations is reported in Table D-4.

economic size affects the effect of services input penetration on GATS commitments across sectors. Whether GDP affects the derivative can be assessed taking the first partial derivative of (4.3) with respect to GDP .

$$\frac{\partial(\partial y/\partial x)}{\partial GDP} = \gamma \quad (4.4)$$

The coefficient for the interaction term $x \times GDP$ in Table 4.2 is always negative. Moreover it is significant at the 0.05 level in model (1) and weakly significant in model (2). This result suggests that the relationship between input penetration and GATS commitment is decreasing in country-level economic size. Regarding the effect of input penetration on commitments across sectors, we can report the estimated effect of 1 unit increase in x for each service sector. As an example, Figure 4.4 plots the estimated marginal effect of input penetration on GATS commitment for real estate services as a function of economic size (measured as log of GDP). At any level of economic size the marginal effect of input

Figure 4.4: Marginal effect of input penetration on GATS commitment: real estate services



penetration is on GATS commitment is positive and significant. Moreover it is decreasing in economic size. To get a sense of the economic meaning of this result, consider one standard deviation increase in real estate services input penetration (+.0073) for two countries with different economic size: Costa Rica with a log GDP of 23.2 and Germany

with 28.1 log GDP. The estimates in figure 4.4 suggest that, *ceteris paribus*, this increase in input penetration would have been associated with a higher level of commitment to trade liberalisation in real estate services by 60% of a standard deviation (0.11) in Costa Rica and only by 20% of a standard deviation (0.06) in Germany. Similarly, a one-standard-deviation increase in business services input penetration (+.0189) would have been associated with a higher level of commitment to trade liberalisation in business services by 47% of a standard deviation (0.09) in Costa Rica while in Germany the effect would have been not statistically different from 0. Qualitatively similar results are obtained for ITC services and renting services.¹⁸ This pattern holds for the sector with the highest input intensity in both total production and manufacturing: R&D plus business services. We therefore interpret our estimates as valid empirical motivation for our theoretical analysis.

4.2.4 Toward a theory of services trade policy

The empirical facts presented throughout the section constitutes the basis for our model of commitment to services trade liberalization. Moreover, we showed that services input penetration seems to play a role in affecting the choice of commitment across countries and sectors. This is particularly true for economically small countries, which are usually assumed to be too small to affect the firms' behaviour in other countries. Taking this results into account, we model services as intermediate inputs into a final good industry. This 'input role' of services is at the core of the mechanism for commitment that we propose in this paper. In a model of terms-of-trade for goods, the assumption of a small country means that a domestic tariff does not affect the behaviour of the agents in the other countries nor the world price of the goods. Therefore, for economically small countries, domestic factors such as lobbying pressures might play a crucial role in determining the government's choice over trade policy. The theoretical approach presented in the next session frames the role of services input penetration as determinants of commitment within a trade policy model with lobbying. The framework applies to a small country environment with no terms-of-trade motive.

¹⁸Figures D-1, D-2 and D-3 provide such graphical illustration for renting, ITC, R&D plus business services respectively. As for real estate services, those three sectors show almost always a positive relationship between input penetration and GATS commitment. This positive relationship is also often statistically different from 0. When negative, the relationship is always non statistically different from 0. For other producer services sectors (construction, transports, financial and telecommunication services) the result remains robust for economically small countries while the relationship between input penetration and GATS commitment might become negative and significant for high levels of GDP.

4.3 Theoretical Model

4.3.1 The set up

We consider one country, Home, and the rest of the world. We first describe in detail the economic and political system in country Home. The economic structure consists of 2 sectors: a final sector (F) and an intermediary services sector (S). We assume that only the final good can be consumed.

We assume a representative consumer that consume the domestically-produced final good and a numeraire good¹⁹ that represents the rest of the production. Its utility is given by:

$$\mathbb{U}(x_0, x^F) = x_0 + u(x^F) \quad \text{st. } x_0 + P^F x^F \leq R$$

with x_0 the consumption of the numeraire, x_F the consumption of the final good and R the revenue given by the rents from the ownership of a specific factor. The demand is a function of price and is assumed to be strictly decreasing and twice continuously differentiable. In each country, the demand functions are taken to be identical. We assume that the utility u is quasi-linear and defined by $u(x) = vx - \frac{x^2}{2}$. This implies that the demand for the final good only depends on the price, not on the revenue.

The final good sector (or just final sector) consists of a continuum of measure m of small firms, operating under perfect competition. The firms produce a final good using intermediary services and capital as inputs according to a perfect complements technology:

$$F(k, d^S) = f(\min\{k, d^S\}) \tag{4.5}$$

with the usual assumptions on f being increasing and strictly concave. k and d^S are the demands for capital and services from each final firm. The firms take as given inputs and output prices. By assuming a continuum of small firms we prevent any strategic behaviour in the final sector. In addition capital can be borrowed from foreign lenders and its supply is assumed unlimited. Capital is borrowed at the price τ . The profit of a firm is given by

$$\pi^F(k, x^S) = P^F F(k, x^S) - P^S x^S - \tau k \tag{4.6}$$

In order to pin down the interest rate we normalize $m = 1$ such that τ is determined by the zero-profit condition of the small final firm. All the firms are similar so the aggregate profit function is given by $\Pi^F = \int_0^1 \pi^F dj = \pi^F$. Similarly the aggregate level of capital is

¹⁹The numeraire is produced with constant returns to scale with a cost per unit of one which implies that its price is equal to one.

$K = k$ and the aggregate demand of services inputs is $D^S = d^S$.

The services sector is characterized by a finite number n of firms that operate under a regime of oligopolistic competition à la Cournot. They provide services as inputs to the final sector only. We are interested in trade in the intermediary services. For simplicity, we assume that services can only be provided through commercial presence (Mode 3). We do not allow exports of the intermediary or final products. Some foreign firms create an affiliate that can operate in the customers' country where they employ domestic specific factors. Therefore, the domestic intermediary sector can consists of national and foreign producers.

We denote by n_d the number of national providers.²⁰ The remaining $n - n_d$ services firms operating within the domestic market are offshore affiliates of a foreign firm. We assume that the production of services requires the use of a sector-specific factor²¹ that is available in inelastic supply and non-tradable. The rent of the owners of the specific factors is given by the profits of the services sectors. Finally, we assume that the owners of this sector-specific factor are not mobile across country.

The services firms which are affiliates of a foreign provider have to use domestic sector-specific factors to produce. The owners of the specific factors used in the foreign affiliates own claims on their sector's profits in the same way as those owners whose specific factor is used by the national services firms. All the n services firms are identical in terms of production capacity and they all take the final price P^F as given. The profit of the services firm is given by:

$$\pi^S(q^S) = q^S P^S(Q_-^S + q^S) \quad (4.7)$$

with $P^S(\cdot)$ the price of the services good or service given by the strategic behavior of the firms in a Cournot framework. This price depends on the aggregate supply of services which is equal to the aggregate supply of the other firms Q_-^S plus the individual supply of the firm q^S . Notice that while x^S denotes the services demand by the final sector, q^S is the services supply. Finally the rents of the domestic sector-specific factors used by the domestic firms are given by the net profits of the n_d national firms and the rents of the domestic sector-specific factors used by the foreign affiliates are the net profits of the $(n - n_d)$ foreign affiliates.

We assume that the government can choose a policy to restrict market access in the services sector only. This restriction is the only trade policy instrument we consider in the model. The government chooses the final number n of firms that operate in the

²⁰National providers are a subset of domestic providers. Domestic providers also include foreign affiliates of non-national firms operating in the domestic country.

²¹The sector-specific model has been used in the literature as exemplified by Grossman and Helpman (1994) or Buzard (2014).

services sector to limit the number of non-national services suppliers allowed to produce. More precisely, the government takes as given the number of national firms n_d operating in the economy and sets a value for n which directly determines the number of foreign suppliers allowed to operate in the country.

The timing of the economy is the following. At $t = 0$ there are n_d domestic firms and no foreign services providers. At the first stage $t = 1$, called the *investment stage*, the final-good sector borrows capital K . No production takes place. In the second stage $t = 2$ the government chooses its trade policy by fixing a number of foreign affiliates, $n - n_d$, that can start producing in the services sector. We call this the *trade policy stage*. Finally, at $t = 3$, production in the services sector takes place. The price of services P^S is determined and the final firms buy services inputs. Production and consumption of the final goods take place. We call this the *production stage*.

In the trade policy stage the government maximises the welfare given by the sum of the consumer's surplus, the services and final producers' surplus.²² Given that the $n - n_d$ foreign affiliates use domestic specific factors, the rents from the national firms and the foreign affiliates are equally considered in the revenue of the representative consumer. The social welfare of the government is given by:

$$\max_n W(n|K) = H(n|K) + \Pi^F(n|K) + \Pi^S(n|K) \quad (4.8)$$

with

$$\Pi^S(n|K) = \underbrace{n_d \pi^S(n|K)}_{\text{national firms}} + \underbrace{(n - n_d) \pi^S(n|K)}_{\text{foreign affiliates}}$$

Remark 4.1 *When there is no lobbying, the government chooses free-entry and the number of firms is such that $\pi^S(n) = 0$.*

The government's solution in the absence of special interest groups is free-entry, which means that any foreign affiliate is allowed to start producing. In equilibrium, foreign affiliates enter the services sector until their individual profit falls to zero. This implies that the number of foreign affiliates is determined by the zero-profit condition of a services firm.

We now add the possibility for the national services firms to coalesce into a lobby and to offer contributions to the government in order to maximise their profits. In this model, the rationale behind the lobby activity comes from oligopolistic competition in the services sector. Indeed firms make positive profits in the services sector depending on the total number of suppliers. It is important to carefully make a difference between the national

²²This results is given by the definition of the welfare in a partial equilibrium with a quasi-linear utility function and a numeraire that represents the rest of the economy.

lobby that maximises the aggregate domestic profits of the national firms, and the foreign lobby that maximises the aggregate domestic (made in Home) profits of the affiliates of foreign providers. In this part we focus on the political game between the government and the national lobby only.

The interests of national firms and those of the welfare-maximizing government go in opposite direction. The government wants a high entry of foreign firms in order to decrease the price of services. On the contrary, the number of national firms is fixed and their aggregate profits therefore only depends on the individual profit of each firm. Individual profits in the services sector are decreasing in the trade policy parameter n which defines the number of domestic (national and foreign) services suppliers. Therefore, the owners of the claim over national profits value protection of the services sector against foreign entrants. Their first-best trade policy would be a closed domestic services sector ($n = n_d$). In order to influence the trade policy choice, the national lobby offers contributions to the government through a bargaining process.

The national lobby pays contribution c to the government in order to obtain protection via trade policy n . The political game between the government and the lobby takes place during the trade policy stage, where the two players take the capital borrowed by the final firms K as given. We model the government's objective as in the 'Protection for sale' model in Grossman and Helpman (1994).²³ We look at the Nash solution of a cooperative bargaining problem where the government maximises a weighted average of total welfare and contributions²⁴

$$G(n, c|K) = aW(n|K) + c \quad (4.9)$$

and the national lobby (aggregating the interests of the national services providers) maximises the profits of its members net of contributions

$$L(n, c) = n_d \pi^S(n|K) - c \quad (4.10)$$

²³Buzard (2014) discusses the equivalence between the 'Protection for sale' model and the *deus ex machina* government objective function in Baldwin (1987) that is used in the literature on the political economy of agreements. The Baldwin-type objective of the government is given by

$$W(n|K) = H(n) + \Pi^F(n) + \gamma(C)\Pi^S(n)$$

Instead of receiving contributions, the government directly adds a weight on the surplus that depends on the producer's effort for lobbying. She finds that the two models are equivalent if $\gamma(C) = 1 + \frac{aC}{\Pi^S(n)}$.

²⁴Alternatively we could write the government's objective as the weighted sum of net welfare and contributions.

$$G^N = a_1(W(n) - c) + a_2c$$

from which we derive

$$G = aW(n) + c \quad \text{with} \quad a = a_1/(a_2 - a_1)$$

with the usual assumption that $a_2 > a_1$ (see Grossman and Helpman (1994)).

4.3.2 The equilibrium

Given the timing of the model, we solve this game by backward induction. We start describing the incentives of the producers and consumers in the production stage given the level of investment and the trade policy decided in the previous periods. Then we describe the trade policy stage where the government decides the number of firms to enter the services sector - potentially in the context of a political game played with the national lobby - given the initial level of investment. Finally we solve for the investment stage.

The equilibrium of the production stage ($t = 3$)

Following the literature on the political economy of trade agreements as exemplified by Bagwell and Staiger (2005) and Buzard (2014), we use a partial equilibrium model for the production stage of the model.

Optimal behaviour of the final-good firms. At $t = 3$, investment through capital has already been done so that the cost of borrowing capital τk is sunk.²⁵ During the production stage, with k given, services demand can be derived from the following maximisation problem

$$\max_{d^S} P^F f(d^S) - P^S d^S - \tau k \quad \text{subject to} \quad d^S \leq k \quad (4.11)$$

The individual demand of services by the final firm is implicitly defined as a function of the two prices $d^S(P^S, P^F)$. Finally, all firms are similar so the aggregate demand of services is defined as $D^S(P^S, P^F)$ with $D^S(\cdot) = \int_0^1 d^S(\cdot) di = d^S(\cdot)$ and can be written as

$$D^S(P^S, P^F) = \begin{cases} (f')^{-1}(\frac{P^S}{P^F}) & \text{if } (f')^{-1}(\frac{P^S}{P^F}) \leq K \\ K & \text{otherwise} \end{cases} \quad (4.12)$$

with K the aggregate initial investment.

²⁵If the two decisions on capital and services inputs had taken place simultaneously, the maximisation problem of a representative F firm would have been given by

$$\max_{\{k, x\}} P^F f(\min\{k, x\}) - P^F x - \tau k$$

with solution $x = k$ and k determined from $P^F f'(k) = P^S + \tau$.

Optimal behaviour of the services firms. Firms in the services sector produce during the production stage. The production capacity of each firm is independent from the firm's country of origin and therefore identical across foreign affiliates and national providers. We denote by q^S the supply of one services firm and Q_-^S the aggregate services supply of all the others. For simplicity we assume no cost of producing.²⁶ We can write the problem of the services firm as follows:

$$\max_{q^S} q^S P^S(Q_-^S + q^S) \quad (4.13)$$

We use the aggregate demand in services goods (4.12) assuming a non binding constraint. In addition we assume for f the functional form $f(x) = 1 - e^{-\frac{x}{A}}$ with A positive constant.²⁷ Finally, the aggregate services supply is given by $Q^S(P^F) = nA$.

Optimal behaviour of the representative consumer. The consumer only consumes the final good. We define the demand of the representative consumer for the final good as

$$D^F(P^F) = v - P^F \quad (4.14)$$

with $0 < v \leq 1$. The consumer surplus only depends on the price P^F and is given by $H(P^F) = \frac{(v-P^F)^2}{2}$.

Market clearing. First, the aggregate supply Q^S of services has to match the final-good sector's demand D^S

$$Q^S(P^F) = D^S(P^S, P^F) \quad (4.15)$$

Second, the aggregate production of the final good $F(\cdot)$ has to equalize the demand $D^F(\cdot)$ of the representative consumer

$$F(K, D^S(P^S, P^F)) = D^F(P^F) \quad (4.16)$$

The equilibrium of production. Given the initial investment K and the trade policy n , the equilibrium in the production stage is defined by the final price $P^F(K, n)$ and the services price $P^S(K, n)$ that satisfy the optimal behaviour of the representative consumer, the optimal behaviour of the services and final firms and the market clearing conditions for the final goods and the service intermediate input.

²⁶Given that the sector is oligopolistic, it is not a strong assumption on the profits made by services firms.

²⁷This functional form is chosen for tractability reasons. It results in a constant optimal individual supply function $q^S(P^F) = A$.

Final-good firms use services and capital as inputs and choose their production plan according to the prices of the two inputs (P^S, τ) . For simplicity, we assume for the rest of the paper that the price of capital is low enough so that the complementarity of inputs implies that only the relative price of the services affects the final firm's decision. Therefore the initial aggregate investment is not binding - $K \geq D^S$ - and the demand function for the service input is simply given by $D^S(P^S, P^F) = (f')^{-1}(\frac{P^S}{P^F})$.

Given the initial investment K and the trade policy n , we get the following equilibrium solutions:

$$P^F(K, n) = v - f(nA) \quad \text{and} \quad P^S(K, n) = (v - f(nA))f'(nA)$$

Finally standard comparative statics is given by the following

Remark 4.2 *An increase in the total number of services firms n (i) decreases the services price P^S , (ii) decreases the final price P^F , and (iii) decreases the profit function of a services firm.*

Trade policy with national lobbying ($t = 2$)

Following Maggi and Rodriguez-Clare (1998), the choice of trade policy is determined by a cooperative bargaining game between the government and the lobby. In addition, a commitment motive might hold explaining why countries accept to commit initially to their first best in order to tie their hands vis-à-vis national interests groups and to avoid playing the political game with the lobby.

Following Binmore et al. (1986) we assume that the two players are different in terms of procedural abilities and preferences (time preferences or attitudes towards risk) so their bargaining weights differ. The government and the lobby play a cooperative bargaining game to determine the trade policy (n) and the contribution (c).

The solution (n^N, c^N) maximises the Nash product:

$$(n^N, c^N) = \operatorname{argmax}_{(c, n) \in \mathbb{R} \times \mathbb{R}^+} \left[aW(n|K) + c - aW(n_0|K) \right]^\sigma \times \left[n_d \pi^S(n|K) - c - n_d \pi(n_0|K) \right]^{1-\sigma} \quad (4.17)$$

The solution of the political game (n^N, c^N) with the national lobby is efficient, i.e. it maximizes the surplus of the government and of the national lobby given by

$$\mathbb{J}^N(n) = aW(n) + n_d \pi(n) \quad (4.18)$$

The threat point is given by the trade policy n_0 . n_0 maximizes the welfare $W(\cdot)$ through free-entry and zero-profit for the services firms. There are no contributions by the lobby in this case. We can notice that the threat point gives the government a utility $W(n_0|K)$ that differs from the one in the game with no lobby. The outside option of the government is no longer the welfare of the game without lobbying. Without lobbying, when choosing investment at $t = 1$ the final firms do not expect any political force to influence the choice of the government afterwards. On the contrary, in the political game with lobbying, investment (K) is made in the anticipation of political frictions over the trade policy decision.

The initial investment stage ($t = 1$)

The final-good firms take as given the level of aggregate capital invested in the sector, which they are too small to affect with their individual demand for capital. Given the complementarity of the inputs, the optimal services demand determined in the final production stage represents an upper threshold for capital borrowing. Due to our previous assumption on the optimal services demand ($K \geq (f')^{-1}(\frac{P^S}{P^F})$), we can write the maximisation program for capital demand using the expected services demand from the production stage $d^S = (f')^{-1}(\frac{P^S}{P^F})$.

$$\max_k P^F f(k) - P^S x^S - \tau k \quad \text{subject to} \quad k \leq (f')^{-1}\left(\frac{P^S}{P^F}\right) \quad (4.19)$$

When the constraint is not binding the solution is given by the first order condition $P^F f'(k) = \tau$, otherwise k is equal to the optimal unconstrained services demand. This defines $d^K(P^S, P^F)$ the individual demand for capital. Given that all firms are similar, the aggregate demand for capital can thus be written as follows:

$$D^K(P^S, P^F) = \min \left\{ (f')^{-1}\left(\frac{\tau}{P^F}\right), (f')^{-1}\left(\frac{P^S}{P^F}\right) \right\} \quad (4.20)$$

To be consistent with our previous assumption on the optimal services demand ($K \geq (f')^{-1}(\frac{P^S}{P^F})$), we use here our assumption that the price of capital is low enough not to be a constraint for the final firms. Therefore, the final aggregate capital demand function is

$$D^K(P^S, P^F) = (f')^{-1}\left(\frac{P^S}{P^F}\right) \quad (4.21)$$

Given our assumption of an unlimited supply of capital from the capital owners, the capital demand is always met. We can notice that the final aggregate capital demand function is decreasing in the relative price of services. Therefore if the services input

becomes more expensive, the final firms will demand less capital input.

The equilibrium definition

We can now define the full equilibrium when the government plays a political game with the national lobby only.

Definition 4.1 (The full equilibrium with national lobbying only) *The equilibrium with the political game between the government and the lobby of national firms is defined by the vector*

$$E_N := \{K^N, n^N, c^N, (P^S)^N, (P^F)^N\} \quad (4.22)$$

that satisfies the optimal behaviours of consumers, firms, the government and the national lobby, and the market clearing conditions for the final good and the inputs (services and capital).

Proposition 4.1 *The trade policy n^N chosen when the national lobby can give contributions is:*

$$n^N = -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right)$$

We can show that (i) under a regularity condition²⁸ the equilibrium with lobbying from national services firms exists and is unique, and that (ii) the trade policy with national lobbying is increasing in the government's social valuation a and decreasing in the number of national firms n_d .

Proof. See Appendix D.2.

We use the analytical expression for the trade policy parameter to derive the following comparative statics results:

$$\frac{\partial n^N}{\partial a} = \frac{n_d}{(a-n_d)(a-2n_d)} \geq 0 \quad (4.23)$$

$$\frac{\partial n^N}{\partial n_d} = \frac{-a}{(a-n_d)(a-2n_d)} \leq 0 \quad (4.24)$$

The number of firms n^N increases in the government's valuation of the welfare (the a parameter). A government that values less contributions chooses a higher number of firms given that imposing no restrictions is the welfare-maximizing solution. Equation (4.24) instead means that the total number of firms decreases in the exogenous number of national firms n_d . A large number of national firms increases the size of the services sector

²⁸The condition is $n_d < a/2$. It ensures that prices and productions are non-negative.

owned by national firms. It becomes more rewarding for the government to decrease the number of foreign entries in order to increase individual profits.

4.3.3 The political game versus unilateral commitment

Similarly to Maggi and Rodriguez-Clare (1998), we allow the government to commit to a trade policy at $t = 0$, i.e. before the investment stage. We assume that the commitment is perfectly enforceable. If the government chooses to commit, his hands are tied for the rest of the game. Therefore, there is no political game between the lobby and the government. The equilibrium with commitment is defined by the following:

Definition 4.2 *The equilibrium when the government commits is given by the vector*

$$E_0 := \{K_0, n_0, P_0^S, P_0^F\} \quad (4.25)$$

that satisfies the optimal behaviours of consumers, firms, the government, and the market clearing conditions for the final good and the inputs (services and capital).

When initially committing, the government chooses free-entry for the foreign affiliates such that individual profits in the services sector are null ($\pi^S = 0$). In addition the level of investment in capital is maximal ($K_0 = An_0 \geq An^N = K_N$). We get the equilibrium solutions using the optimality conditions derived in Section 4.3.2.

$$n_0 = -\ln(1 - v) \quad \text{and} \quad K_0 = (f')^{-1}\left(\frac{P_0^S}{P_0^F}\right) \quad (4.26)$$

$$P_0^S = (v - f(n_0A))f'(n_0A) \quad \text{and} \quad P_0^F = v - f(n_0A) \quad (4.27)$$

The government only maximizes the social welfare W without additional weight on services profits. In that case free-entry for foreign firms is chosen.

We can now compare the equilibrium with commitment with the one when the government and the national lobby are playing the political game. The only source of difference is in the timing. Under commitment the policy is chosen at $t = 0$ whereas under the political game it is chosen at $t = 2$, after the investment decision. Given that the two inputs - services and capital - are perfect complement, the investment decision constrains the rest of the stages.

Under the political game, the final number of firms in the services sector n^N chosen by the government is strictly lower than in the equilibrium with commitment ($n^N < n_0$). Indeed the individual profit is decreasing in the number of firms and n_0 which is the level of free-entry is such that individual profits are null. No commitment leads the government

to play the political game and to choose a more restrictive policy. The government is always expected to play the bargaining game with the lobbies because the bargaining process rewards him with more than his outside option. Firms anticipate the distorted policy when there is no commitment. A policy that is not free-entry for foreign firms implies a higher services price than under commitment. Given the complementarity of the two inputs, a higher services price leads to a smaller demand for the other input. The initial investment K^N made by the final firms is lower than the investment made when there is a commitment K_0 ($K^N < K_0$). There is underinvestment compared to the situation under commitment with free-entry of foreign affiliates. Formally

$$K_0 - K^N = A \ln \left(\frac{a - n_d}{a - 2n_d} \right) > 0 \quad (4.28)$$

Remark 4.3 *Underinvestment, defined by the difference $K_0 - K^N$, is decreasing in the degree by which the government values welfare and increasing in the number of national services firms n_d . Formally*

$$\frac{\partial(K_0 - K^N)}{\partial a} \leq 0 \quad \text{and} \quad \frac{\partial(K_0 - K^N)}{\partial n_d} \geq 0 \quad (4.29)$$

The intuitions behind these results are the following. First, a government that cares more about the social welfare than about his political contributions (higher a) is less influenced by contributions from services firms. The policy chosen in the political game is closer to its optimal when there is no lobbying. This implies that firms expect a price that is going to be smaller and invest more at the beginning when the government cares less about political contributions (higher a). Secondly, a higher number of national firms (higher n_d) implies that the national lobby is stronger and that the government cares more about the individual profits of the national firms. This leads the government to choose a lower policy which implies a higher services price and then a lower level of investment from final firms. Therefore underinvestment increases in the number of national firms.

We can now describe the strategy of the government in the full game. At $t = 0$, the government chooses between committing to a policy and playing the political game. Similar to Maggi and Rodriguez-Clare (1998), the timing is important and creates a time-inconsistency problem that explains why the government might not always choose to play the political game. When playing the political game at $t = 2$, the investment have been made and the decision of the government is constrained by the investment choices of the final firms from $t = 1$. Under the political game, the optimal allocation gives the government his outside option plus a share of the surplus. However the outside option is not the first-best $W(n_0)$ any more. Indeed, underinvestment by final firms prevents

the government to get the first-best. His policy is constrained by the underinvestment made at the beginning and his social welfare is $W(n_0|K)$. The government gets his constrained first-best plus a share of the surplus that depends on his bargaining power. The government can therefore be worse off with respect to the benchmark case $W(n_0)$. Under commitment instead the government has the opportunity to unilaterally set its trade policy at $t = 0$ before the investment stage. The enforcement is perfect such that the policy chosen cannot be renegotiated. More precisely, the government can commit to free-entry (n_0) and tie his hands vis-à-vis the special interest group. The trade-off between the rents from the lobby (cost of commitment) and the initial underinvestment in final firms (cost of the political game) pins down the value of commitment. We define the value of commitment by the difference between the objective of the government under commitment - G_0 - and the one under the political game, G^N :

$$\Omega = G_0 - G^N = aW(n_0, K_0) - aW(n^N, K^N) - c^N \quad (4.30)$$

The following proposition details the strategy of the government at $t = 0$.

Proposition 4.2 *(i) If $\sigma = 0$, the government always benefits from commitment: $\Omega(\sigma = 0) > 0$. (ii) There exists a unique threshold $V \in (0, 1)$ such that $\forall v < V, \exists! \bar{\sigma} \in (0, 1)$ such that $\Omega(\bar{\sigma}) = 0$. Moreover, when the government has a weak bargaining power ($\sigma < \bar{\sigma}$) it benefits from commitment ($\Omega(\sigma) > 0$); when instead the government has a strong bargaining power ($\sigma > \bar{\sigma}$) it benefits from the political game ($\Omega(\sigma) < 0$).*

Proof. See Appendix D.2.

Proposition 4.2 shows that when the government has a bargaining power which is low enough the rents it can extract from the lobby above its reservation utility are very small.²⁹ Therefore the cost of commitment is small relatively to the cost of playing the political game. In that case the government wants to initially commit to a unilateral trade policy. Under technical restriction on the parameter v , there always exists a level of bargaining power above which the cost of commitment is larger than the cost of playing the political game. Therefore a government with a strong bargaining power prefers not to sign the agreement in order to receive the contributions of the lobby.

We have described the commitment motive that explains why governments might want to commit to a services agreement when services are inputs for final productions and are

²⁹The threshold $\bar{\sigma}$ has the following analytical expression

$$\bar{\sigma} = \frac{a[W(n_0|K_0) - W(n_0|K^N)]}{\Pi(n^N|K^N) - \Pi(n_0|K^N)}$$

that comes from the loss of the government by not choosing its first-best when playing the bargaining game (numerator) and from the gains of the lobby that are to be shared (denominator).

provided by foreign affiliates in the host country. The commitment motive arises when lobbying by national firms leads to entry restrictions. Firms underinvest because of the higher price of services inputs. This creates a time-inconsistency problem that might lead the government to choose to initially commit. So far we have assumed that only national firms can coalesce into a lobby. In the next section we relax this assumption and we study the outcome of a game where the affiliates of foreign multinationals can form a lobby and offer contributions to the domestic government (foreign lobbying). Foreign firms' interests differ from national firms' interests. Several issues arise here. Do foreign firms always lobby for more entry? What is the outcome when both national and foreign firms can lobby? What happens when governments undervalue foreign contributions?

4.4 The model with Foreign lobbying

The theoretical analysis of foreign lobbying and its role in shaping services trade policy starts from the simple case where only foreign lobbying takes place. Secondly, we look at the more general case where both foreign and national lobbying take place but foreign lobbying is imperfectly valued by the government.

4.4.1 The political game with foreign lobbying only

In this first part we assume that there is foreign lobbying only. Formally, the economy is the same as the one described in section 4.3 but with a different lobby playing the political game with the government. In the bargaining game, the objective function of the government is given by $G(n, c^f) = aW(n|K) + c^f$ while the objective of the foreign lobby is $L^f(n, c^f) = \Pi^f(n) - c^f$. We denote with c^f the contributions of the foreign interest group. Contrary to national lobbying, foreign lobbying might push trade policy toward higher market access and lower restrictions. However, we show that the first best policy of the foreign lobby is not full liberalization ($n = n_0$) or - in other words - free-entry and zero profit. In addition, we distinguish the extensive margins of the foreign lobby's interest line - which consists in the number of foreign affiliates allowed to enter - and the intensive margins, i.e. the individual profits made by each foreign services provider. Given that the lobby maximizes the aggregate profit of those foreign affiliates, there is a trade-off between increasing the extensive margins (a less restrictive policy) and increasing the intensive margins (a more restrictive policy).

The government and the foreign lobby play a cooperative bargaining game during the

trade policy stage and the solution (n^f, c^f) maximizes the Nash product

$$(n^f, c^f) = \operatorname{argmax}_{(c,n) \in \mathbb{R} \times \mathbb{R}^+} \left[aW(n|K) + c^f - aW(n_0|K) \right]^\sigma \times \left[(n - n_d)\pi^S(n|K) - c^f - (n_0 - n_d)\pi(n_0|K) \right]^{1-\sigma} \quad (4.31)$$

The solution of the political game with the foreign lobby is efficient, i.e. it maximizes the surplus of the government and of the foreign lobby. The surplus that is maximized is $\mathbb{J}^f(n) = aW(n) + (n - n_d)\pi(n)$. We can now give the definition of the equilibrium with foreign lobbying

Definition 4.3 *The equilibrium with the political game between the government and the foreign lobby is defined by the vector*

$$E_f := \{K^f, n^f, c^f, (P^S)^f, (P^F)^f\} \quad (4.32)$$

that satisfies the optimal behaviours of consumers, firms, government and foreign lobby as well as the market clearing conditions for the final goods and the inputs (services and capital).

First we can notice that $n^f < n_0$. Foreign firms do not benefit from free-entry which lowers individual profits to zero. At the same time though too many entries decrease individual profits. The solution to this trade off is given by the following

Proposition 4.3 *The equilibrium trade policy n^f when only the foreign lobby can give contributions is:*

$$n^f = -\ln \left(\frac{(1-v)(1+a-(n^f-n_d))}{(1+a-2(n^f-n_d))} \right) \quad (4.33)$$

We can show that (i) under a regularity condition³⁰ the trade policy exists and is unique, and that (ii) it increases in the number of domestic firms n_d and in the government's social valuation a .

Proof. See Appendix D.2.

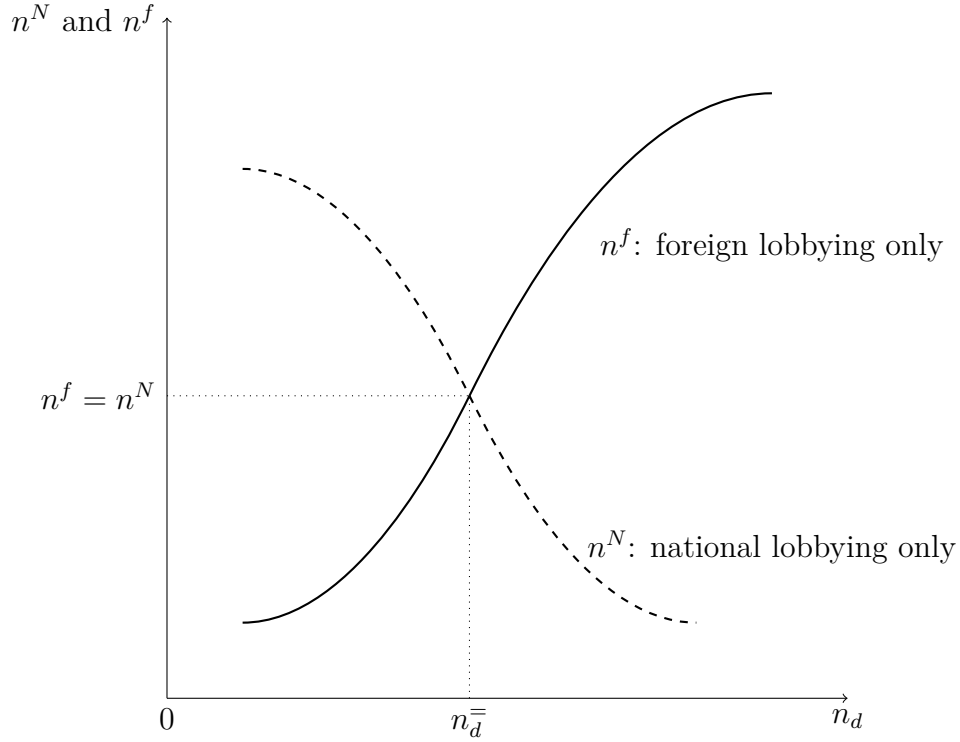
We can now compare and contrast the policy with only national lobbying n^N and the policy with only foreign lobbying n^f .

Remark 4.4 *There exists a mass of domestic firms n_d^- for which the trade policy under domestic lobbying only n^N and the trade policy under foreign lobbying only n^f are equal. When the number of domestic firms is small enough, foreign lobbying leads to a more restrictive trade policy and is not welfare improving.³¹*

³⁰ n^f should be such that $n^f \leq \frac{1+a+2n_d}{2}$ in order for the solution to be well defined.

³¹This result only applies when the parameters are such that the two previous regularity conditions are validated.

Figure 4.5: National versus Foreign lobbying



Proof. See Appendix D.2.

Figure 4.5 offers a qualitative illustration of the result. When the number of national firms is large enough ($n_d > n_d^{\bar{}}$), the result is intuitive. Foreign lobbying pushes towards more entry for foreign firms in the domestic services sector. The policy under foreign lobbying is therefore less restrictive, i.e. the number of final firms is higher, than under national lobbying ($n^f > n^N$). In addition, we observe that the gap between the two policies increases in the number of national firms n_d . For a large number of national firms, the government values the individual profits of each services firm more. Given that individual profits are decreasing in the number of total firms, the government chooses a more restrictive policy, i.e. a smaller number of foreign providers allowed to contest the domestic market. In this case the foreign lobby pushes for higher market access or, in other words, for expanding the extensive margins of the foreign providers' aggregate profits.

The results become less intuitive when the total number of services firms under national lobbying is larger than under foreign lobbying ($n^f < n^N$). We showed that there exists a number of national firms $n_d^{\bar{}}$ for which the policies under foreign and national lobbying are equal. This is explained by the fact that the foreign lobby, which aggregates the total profits of foreign firms, cares about the number of foreign firms allowed to produce

(extensive margins) as well as to the individual profit of each of these firms (intensive margins). This explains why the two trade policy outcomes get closer when the number of national firms decreases. A smaller number of national firms means that the government cares less about the individual profits of national services firms and, *ceteris paribus*, chooses a higher level of entry. Given high market access, the foreign lobby might want to expand the intensive margins of the foreign providers' aggregate profits. This means offering contribution to reduce foreign entry which increases the individual profits of each foreign entrant. In this case, the foreign lobby could be actually more influential than the (small) national lobby and therefore the game with foreign lobby only could lead to a lower entry level.

4.4.2 The political game with national lobbying and imperfect foreign lobbying

In this part we assume that both the national and the foreign lobby can offer contributions to the domestic government. A similar framework with national and foreign interest groups has been applied in other papers. For example, Gawande et al. (2006) study the role of foreign lobbying and assume that foreign contributions are imperfectly valued by the government. Contrary to this work, we model the game between the government and the two lobbies as a bargaining game. Bargaining games with three players are studied in Compte and Jehiel (2010). These authors formally address coalitional complications that arise when the players are more than two. In order to keep the model simple, we assume that none of the players can form sub-coalitions.

Following Gawande et al. (2006), we assume imperfect foreign lobbying. This means that the government does not value a unit of foreign contributions as a unit of national contributions. To capture this imperfection, we add to the government's objective the parameter γ with $0 \leq \gamma \leq 1$. When $\gamma = 0$, foreign lobbying is considered as forbidden or totally inefficient. When instead $\gamma = 1$, foreign contributions are perfectly valued by the government, i.e. there is no difference in valuation between national and foreign contributions. Formally, the government receives the utility

$$G(n, c, c^f) = aW(n) + c + \gamma c^f \quad (4.34)$$

The objective of the national and foreign lobbies remain respectively $L^N(n, c) = n_d \pi(n) - c$ and $L^F(n, c^f) = (n - n_d) \pi(n) - c^f$. The bargaining game solutions are given by the maximization of the Nash product

$$(n^\gamma, c^\gamma, c^{f,\gamma}) = \operatorname{argmax}[G(\cdot) - G_0]^\sigma [L^N(\cdot) - L_0^N]^{\frac{1-\sigma}{2}} [L^F(\cdot) - L_0^F]^{\frac{1-\sigma}{2}} \quad (4.35)$$

The threat point is given here by full liberalization ($n = n_0$), and no political contributions ($c = c^f = 0$). At this stage - when the government chooses its trade policy - the level of investment by the final firms is already chosen and its cost sunk. Therefore the threat point is constrained by the optimal decision of the final firms that, anticipating future political frictions, underinvested at the beginning: $G_0 = aW(n_0|K)$, $L_0^N = \Pi(n_0|K)$ and $L_0^F = \Pi^f(n_0|K)$. The joint surplus is now different from the surplus in the previous cases when foreign contributions are either not allowed or perfectly valued by the government. The FOCs of the Nash product maximization imply that the new trade policy n^γ maximizes $\mathbb{J}^\gamma(n) = aW(n) + n_d\pi(n) + \gamma(n - n_d)\pi(n)$ where the aggregate profits of the foreign affiliates are less valued than the profits of the national firms.

Proposition 4.4 *The trade policy that is the solution of the bargaining between the government and the two lobbies is given by:*

$$n^\gamma = -\ln \left(\frac{(1 - v)(a + \gamma - \gamma n^\gamma - (1 - \gamma)n_d)}{(a + \gamma - 2\gamma n^\gamma - 2(1 - \gamma)n_d)} \right) \quad (4.36)$$

Proof. See Appendix D.2.

We can start noticing that, when national and foreign lobbying are equally valued ($\gamma = 1$), the trade policy does not depend on the mass of national firms in the domestic sector n_d . In this case, the joint welfare to be maximized is the weighted sum of the government's welfare and the total amount of domestic profits by both foreign and national firms ($n\pi(n)$). The government's social welfare does not depend on the mass of national firms since consumers only care about the price of the final good that depends on the total number of domestic intermediate producers (national and foreign). For the general case of $0 < \gamma < 1$ we state the following

Proposition 4.5 *Entry restrictions defined as $n_0 - n^\gamma$ (i) increase in the government's responsiveness to foreign contributions (γ) when the number of national firms is small enough, and (ii) decrease in the government's responsiveness to foreign contributions (γ) when the number of national firms is large enough.*

Proof. See Appendix D.2.

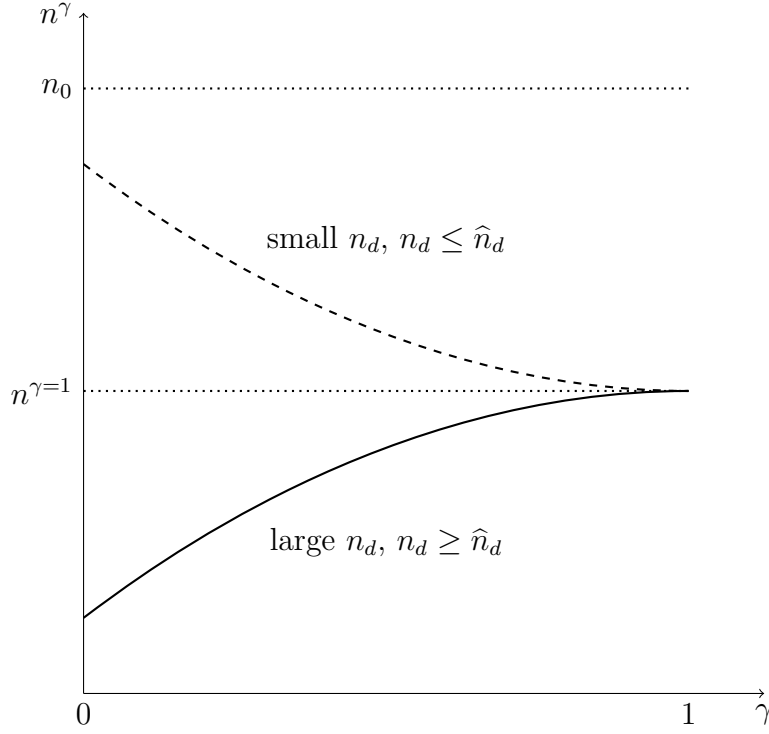
We define the threshold \hat{n}_d for the exogenous number of national firms such that

$$n_d \leq \hat{n}_d \Rightarrow \frac{\partial n^\gamma}{\partial \gamma} \leq 0 \quad \wedge \quad n_d \geq \hat{n}_d \Rightarrow \frac{\partial n^\gamma}{\partial \gamma} \geq 0 \quad (4.37)$$

Figure 4.6 provides a qualitative representation of Proposition 4.5.

Let us start from the baseline case of national lobbying only ($\gamma = 0$). The number of

Figure 4.6: Trade policy n^γ under imperfect foreign lobbying $0 \leq \gamma \leq 1$



national providers n_d reflects the weight of national aggregate profits in the joint surplus, therefore, for small values of n_d the social welfare is valued more and the trade policy outcome is closer to free entry n_0 . For $\gamma > 0$ a new term appears in the joint surplus, and the aggregate profits of foreign providers start to be taken into account. As explained before, the foreign affiliates' aggregate profits depends upon the individual profits of services providers (intensive margins) as well as on the number of foreign affiliates allowed to contest the domestic market (extensive margins). When market access is small (due to a high value of n_d), the extensive margins of these aggregate profits are more important and the foreign lobby pushes for a less restricted regime, against the interests of the national lobby. Therefore, increasing the evaluation of foreign contributions increases market access in the domestic services market. Graphically, this translates into the solid trade policy curve in Figure 4.6 which is increasing in γ .

If instead market access is high under national lobbying only (low value of n_d), the intensive margins of the foreign affiliates' aggregate profits are more relevant: in order to increase the aggregate profits of the (many) foreign providers allowed to contest the domestic market it is optimal to decrease market access enhancing individual profits. In this case, if foreign contributions are accepted $\gamma > 0$, the foreign interest group joins the national one in lobbying for a more restricted regime: the higher the weight on foreign contributions, the lower market access in equilibrium. The graphical counterpart of this

result is given by the dashed trade policy curve in Figure 4.6 which is decreasing in γ .

4.4.3 Imperfect foreign lobbying and commitment

Finally, we study the government's decision to commit under a foreign lobbying framework.³² First, we need to define the commitment value Ω . We focus on the case of lobbying from both national and foreign firms when foreign contributions are undervalued.³³

$$\begin{aligned}\Omega = & aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - \frac{\sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{Lf}}[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\ & - [\frac{\gamma\sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{Lf}}][\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]\end{aligned}$$

This expression allows us to define the bargaining power threshold by $\bar{\sigma}_G$ such that $\Omega(\bar{\sigma}_G) = 0$. $\bar{\sigma}_G$ is implicitly given by the following equation:

$$\frac{\bar{\sigma}_G}{\sigma_L + \bar{\sigma}_G + \gamma\sigma_{Lf}} = \frac{aW(n_0|K_0) - aW(n^\gamma|K^\gamma)}{[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] + \gamma[\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]} \quad (4.38)$$

Due to analytical complexity, we are not able to derive a tractable closed-form solution for the value of commitment and the bargaining power threshold. We use numerical solutions to qualitatively assess the impact of our parameter γ on the commitment value and the willingness for the government to commit.³⁴ In particular, we study the effect of γ on the commitment value Ω for different government's bargaining power. A positive commitment value ($\Omega > 0$) implies that the government prefers to initially commit whereas a negative one means that the government prefers to play the political game. The main contribution of this analysis is to identify the valuation of foreign contributions as an important factor behind commitment decisions - beside the usual bargaining power parameter σ_G .

Let us start from the case of a large initial number of national firms (high value of n_d). As discussed above (see section 4.4.3), trade policy n^γ is increasing in the government's valuation γ (left panel in Figure 4.7). When the foreign lobby pushes for higher market access, the inefficiency due to the political frictions - the loss for the government when playing the political game - is reduced: this effect is stronger, the higher the evaluation of foreign contributions. Moreover, increasing γ has the direct effect of enhancing the

³²For detailed derivations of the mathematical expressions in this section see D.3.

³³The case when only foreign firms can lobby is similar to that when only national firms lobby. It is therefore more interesting to directly focus on the case of two lobbies.

³⁴We present the results for the following values of the parameters: $A = 1$, $v = 0.7$, small $n_d = 0.2$ large $n_d = 0.4$, $a = 0.99$. The key qualitative patterns illustrated in this section are robust across the joint support of the parameters.

value of contribution units and therefore the cost of commitment (foregone contributions). Those two effects work together in reducing the value of commitment Ω as γ increases: for any level of bargaining power, the government is more likely to benefit from playing the political game (right panel in Figure 4.7). Similarly to the previous analysis, a low bargaining power increases the preference of the government for commitment whereas a large bargaining power increases his preference for the lobbying game.

Figure 4.7: Trade policy n^γ and commitment value Ω for a large n_d

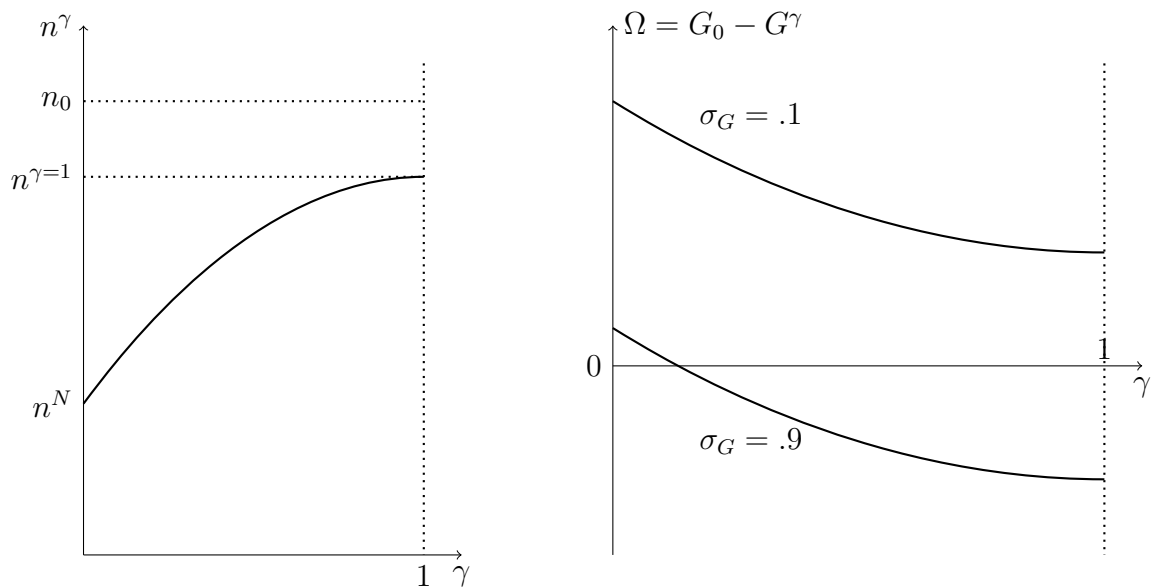
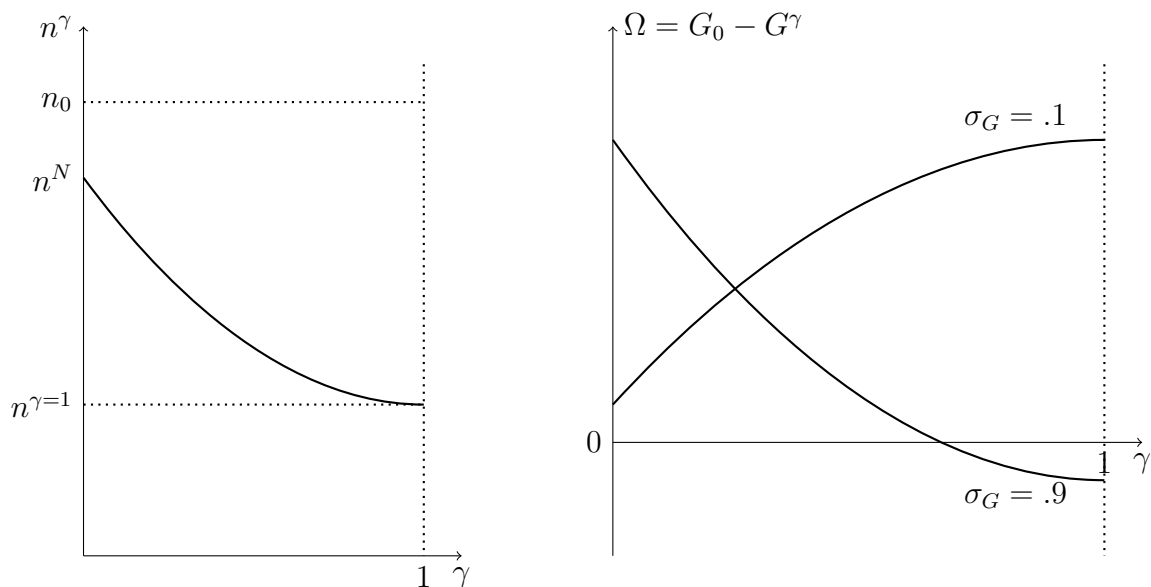


Figure 4.8: Trade policy n^γ and commitment value Ω for a small n_d



In the case of a small initial number of national firms, foreign lobbying has two counter-vailing effects on the value of commitment. The first one is independent on the value of n_d : as in the previous case a higher γ increases the value of contribution units causing a direct increase in the cost of commitment. This effect alone would determine a negative slope of the curve representing the value of commitment as a function of γ . Contrary to the previous case, γ has now the effect of decreasing the equilibrium trade policy (left panel in Figure 4.8): the foreign lobby pushes for higher restrictions in the same way as the national lobby does (see discussion in section 4.4.3). Therefore, an increase in γ has the indirect effect (through the equilibrium trade policy) of enhancing the inefficiency due to the political frictions, i.e. the costs of the political game. This second effect alone would determine a positive slope of the value of commitment as a function of γ .

Which one of the two effects prevails depends on the bargaining power of the government. High values of the bargaining power allow the government to extract bigger political rents and therefore make the direct effect effect of γ on the value of contribution units relatively more important than its indirect effect. In this case the value of commitment is a decreasing function of γ (this case is represented by the “ $\sigma_G = .9$ ” curve in the right panel of Figure 4.8). If instead the bargaining power of the government is low, contributions are much smaller and variations in their unit value (the direct effect of γ) are less important than the indirect effect of γ through the equilibrium trade policy. As a consequence, the value of commitment is a positive function of γ (as depicted by the “ $\sigma_G = .1$ ” curve in the right panel of Figure 4.8).

4.5 Conclusions

This paper contributes to the trade policy literature proposing a theory of unilateral liberalization in services trade. Our modelling assumptions draw from a number of well known facts and new empirical evidence on trade in services. In particular, the empirical analysis identifies services input intensity as an important determinant of commitment to services trade liberalization. In the theoretical model, services are inputs into the final good production and, due to their intangibility and non storability can only be traded through horizontal FDI. Consistently with this, we look at restrictions to foreign entry as the relevant trade policy measures. Oligopolistic competition in the services sector creates a motive to lobby for restricted market access to foreign services providers. This political friction distorts the economic decisions in the upstream sector, reducing social welfare with respect to a free-entry regime. When this inefficiency is too severe to be compensated by political rents, the government might want to commit to free entry by signing a services trade agreement.

Moreover, we extend the theoretical analysis to account for foreign lobbying. We find that the equilibrium trade policy under the political game as well as the value of commitment might change significantly with respect to the framework with only a national lobby. Critically, the foreign interest group can lobby for higher market access when the national services sector is big enough. If instead the national services providers are only a few, the foreign lobby can find optimal to lobby for more restrictions in order to reduce the entrants' individual profits.

Our analysis sheds some light over the motives behind services trade liberalization. While the proposed mechanism builds upon domestic factors such as political pressures coming from national or foreign interests groups, we do not attempt to characterise the outcome of a reciprocal bargaining between (at least) two big trading economies. This modelling strategy is supported by our empirical results which suggests that the strong relationship between input intensity and commitment might not hold for economically big countries (those that might use reciprocal bargaining to solve terms-of-trade types of externality). We leave the theoretical assessment of a terms-of-trade externality in the context of services for future research.

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Appendix A

Appendix to Chapter 1

A.1 Proofs

Proof of Lemma 1.1. Assume by way of contradiction that the equilibrium (S_*^N, S_*^M) is not in threshold strategies. In particular assume that there exist two values θ_1 and θ_2 , with $\theta_1 < \theta_2$, such that $s_*^M(\theta_1) = s_*^M(\theta_2) = H$ and, for any $\theta \in (\theta_1, \theta_2)$, $s_*^M(\theta) = L$ (the same proof can be done for $p = N$). The equilibrium implies that

$$p^H(\theta_1 | S_*^N, S_*^M) = p^H(\theta_2 | S_*^N, S_*^M) = 1 \quad \text{and} \quad (\text{A-1})$$

$$w(\theta_1, \theta^H(S_*^N, S_*^M)) - c(I) \geq w^L \quad (\text{A-2})$$

Notice that $w(\theta_1, \theta^H(S_*^N, S_*^M)) < w(\theta_2, \theta^H(S_*^N, S_*^M))$ by construction and thus

$$w(\theta_2, \theta^H(S_*^N, S_*^M)) - c(I) > w^L \quad (\text{A-3})$$

Consider now a player i in M with any type $\theta \in (\theta_1, \theta_2)$. Denote \hat{S}_*^M the strategy profile where i deviates to H while all the other players in M play as prescribed by S_*^M . Given that $p^H(\theta_1 | S_*^N, S_*^M) = 1$ and $\theta > \theta_1$ we have that

$$p^H(\theta | S_*^N, S_*^M) = 1 \quad (\text{A-4})$$

Moreover, given that $w(\cdot, \cdot)$ is increasing in the first argument, (A-2) implies

$$w(\theta, \theta^H(S_*^N, \hat{S}_*^M)) - c(I) > w^L \quad (\text{A-5})$$

Given (A-4) and (A-5), it is immediate to see that it is profitable for a type θ choose H instead of L , which contradicts our assumption of equilibrium.

The same logic can be used to show a contradiction in the case of threshold strategies of the kind

$$s_*^p(\theta) = \begin{cases} L & \text{if } \theta \geq \theta_*^p \\ H & \text{if } \theta < \theta_*^p \end{cases} \quad \forall p \in P$$

This observation completes the proof. ■

Proof of Lemma 1.2.

Alternative statement, preliminary notation and derivations First, notice that Lemma 1.2 can be rewritten as follows

Lemma A.1 *Consider the following system in θ^N and θ^M :*

$$\begin{cases} w(\theta^M, \theta^H(\theta^N, \theta^M)) - c(I) - w^L = 0 \\ \theta^N = \begin{cases} 0 & \text{if } \theta^M \in (\frac{1-K}{\mu^M}, +\infty) \\ -\frac{\mu^M}{\mu^N} \theta^M + \frac{1-K}{\mu^N} & \text{if } \theta^M \in [1-K, \frac{1-K}{\mu^M}] \\ 1-K & \text{if } \theta^M \in [0, 1-K) \end{cases} \end{cases} \quad (\text{A-6})$$

The profile of thresholds (θ_^N, θ_*^M) such that*

$$s_*^p(\theta) = \begin{cases} H & \text{if } \theta \geq \theta_*^p \\ L & \text{if } \theta < \theta_*^p \end{cases} \quad \forall p \in P$$

is a pure strategy Nash equilibrium in the labor market if and only if one of the following conditions is true:

- (θ_*^N, θ_*^M) solves (A-6) and it belongs to the set $[0, 1-K] \times [1-K, 1]$,
- $(\theta_*^N, \theta_*^M) = (1-K, 1-K)$ if at least one solution of (A-6) belongs to the set $\{1-K\} \times [0, 1-K]$,
- $(\theta_*^N, \theta_*^M) = (0, 1)$ if at least one solution of (A-6) belongs to the set $\{0\} \times [1-K, +\infty)$.

By the result of Lemma (1.1) we can rewrite the mass of workers in population p that will play H according to some threshold strategy θ^p as

$$\phi^{\theta^p} = \mu^p(1 - \theta^p) \quad (\text{A-7})$$

Let us define the the function $\tilde{F}^H(\theta|\theta^N, \theta^M)$ that, given the profile of threshold strategies, for any value of θ gives the total (from both populations) mass of workers competing in H with a type smaller or equal to θ . We can write the expression of \tilde{F}^H as follows

$$\tilde{F}^H(\theta|\theta^N, \theta^M) = \begin{cases} 0 & \text{if } \theta < \min\{\theta^N, \theta^M\} \\ \sum_{p \in P} \mathbb{1}_{\{\theta^p < \theta\}} \mu^p(\theta - \theta^p) & \text{if } \min\{\theta^N, \theta^M\} \leq \theta < \max\{\theta^N, \theta^M\} \\ \theta - \sum_{p \in P} \mu^p \theta^p & \text{if } \max\{\theta^N, \theta^M\} \leq \theta \leq 1 \end{cases} \quad (\text{A-8})$$

It is useful to define the function $G^H(\theta|\theta^N, \theta^M)$ that, given the profile of threshold strategies, for any value of θ gives the total mass of workers competing in H with a type bigger or equal to θ . We can write the expression of G^H as follows:

$$G^H(\theta|\theta^N, \theta^M) = \begin{cases} 1 - \sum_{p \in P} \mu^p \theta^p & \text{if } \theta < \min\{\theta^N, \theta^M\} \\ \sum_{p \in P} \mathbb{1}_{\{\theta^p < \theta\}} [\mu^p(1 - \theta) + \mu^{-p}(1 - \theta^{-p})] & \text{if } \min\{\theta^N, \theta^M\} \leq \theta < \max\{\theta^N, \theta^M\} \\ 1 - \theta & \text{if } \max\{\theta^N, \theta^M\} \leq \theta \leq 1 \end{cases} \quad (\text{A-9})$$

Now we can rewrite the expressions of $p^H(\cdot|\cdot, \cdot)$ and $\theta^H(\cdot, \cdot)$ as

$$p^H(\theta|\theta^N, \theta^M) = \begin{cases} \begin{cases} 1 & \text{if } \theta \geq \min\{\theta^N, \theta^M\} \\ 0 & \text{if } \theta < \min\{\theta^N, \theta^M\} \end{cases} & \text{if } G(\min\{\theta^N, \theta^M\}|\theta^N, \theta^M) \leq K \\ \begin{cases} 1 & \text{if } \theta \geq \hat{\theta} \\ 0 & \text{if } \theta < \hat{\theta} \end{cases} & \text{if } G(\min\{\theta^N, \theta^M\}|\theta^N, \theta^M) > K \end{cases} \quad (\text{A-10})$$

$$\theta^H(\theta^N, \theta^M) = \begin{cases} \frac{1}{\sum_{p \in P} \phi^{\theta^p}} \sum_{p \in P} \phi^{\theta^p} E[\theta|\theta \geq \theta^p] & \text{if } G(\min\{\theta^N, \theta^M\}|\theta^N, \theta^M) \leq K \\ \frac{1}{\sum_{p \in P} \tilde{\phi}^{\theta^p}} \sum_{p \in P} \tilde{\phi}^{\theta^p} E[\theta|\theta \geq \max\{\theta^p, \hat{\theta}\}] & \text{if } G(\min\{\theta^N, \theta^M\}|\theta^N, \theta^M) > K \end{cases} \quad (\text{A-11})$$

where $\hat{\theta}$ is such that

$$G(\hat{\theta}|\theta^N, \theta^M) = K \quad (\text{A-12})$$

and $\tilde{\phi}^{\theta^p}$ is defined as follows

$$\tilde{\phi}^{\theta^p} := \mu^p (1 - \max\{\theta^p, \hat{\theta}\}) \quad (\text{A-13})$$

Body of the proof For the workers in the native population optimality requires that

$$\theta_*^N = \min \left\{ \theta \in [0, 1] : w\left(\theta, \theta^H(\theta, \theta_*^M)\right) p^H(\theta | \theta, \theta_*^M) \geq w^L \right\} \quad (\text{A-14})$$

Looking at the workers in the migrant population it is convenient to define the following sets:

$$Q := \left\{ \theta \in [0, +\infty) : w\left(\theta, \theta^H(\theta_*^N, \theta)\right) - c(I) - w^L = 0 \right\} \quad (\text{A-15})$$

$$B := \left\{ \theta \in [0, +\infty) : p^H(\theta | \theta_*^N, \theta) = 1 \right\} \quad (\text{A-16})$$

Optimality requires that:

$$\theta_*^M \in \begin{cases} \{1\} & \text{if } Q \cap B \neq \emptyset \wedge Q \cap B \cap [0, 1] = \emptyset \\ Q \cap B \cap [0, 1] & \text{if } Q \cap B \cap [0, 1] \neq \emptyset \\ \{\min B\} & \text{if } Q \cap B = \emptyset \end{cases} \quad (\text{A-17})$$

Notice that the first row in (A-17) is not logically correct: if the solution of the indifference condition is above one, the type 1 migrant worker will always choose L . With our notation we are saying that she is always indifferent. This approach reduces the number of cases to consider and does not create any algebraic problem given the continuity of our populations. To solve the logical problem it is sufficient to assume that, whenever $\theta_*^M = 1$, a type 1 indifferent migrant worker will choose H only if 1 is a solution of the indifference condition; otherwise the indifferent migrant will always choose L . Another way to get rid of this problem is to assume that $w(1, \frac{1}{2}) - c(0) = w^L$.

By definition, the profile of thresholds (θ_*^N, θ_*^M) such that

$$s_*^p(\theta) = \begin{cases} H & \text{if } \theta \geq \theta_*^p \\ L & \text{if } \theta < \theta_*^p \end{cases} \quad \forall p \in P$$

is a pure strategy Nash equilibrium in the labor market if and only if it solves jointly (A-14) and (A-17).

Notice that (A-14) is equivalent to

$$\theta_*^N = \min \left\{ \theta \in [0, 1] : p^H(\theta | \theta, \theta_*^M) = 1 \right\} \quad (\text{A-18})$$

This equivalence is given by the following facts:

- $w(0, \frac{1}{2}) \geq w^L$,
- $\frac{1}{2} = \min_{(\theta^N, \theta^M) \in [0,1]^2} \theta^H(\theta^N, \theta^M)$
- $w(\cdot, \cdot)$ is increasing in both arguments.

Given the expression of $p^H(\theta|\theta^N, \theta^M)$ we have that (A-18) is equivalent to

$$\theta_*^N = \min \left\{ \theta \in [0, 1] : G(\theta|\theta, \theta_*^M) \leq K \right\} \quad (\text{A-19})$$

Using the expression of $G^H(\theta|\theta^N, \theta^M)$ we can rewrite (A-18) in the following way:

$$\theta_*^N = \begin{cases} 0 & \forall \theta_*^M \text{ such that } G(0|0, \theta_*^M) < K \\ -\frac{\mu^M}{\mu^N} \theta_*^M + \frac{1-K}{\mu^N} & \forall \theta_*^M \text{ such that } G(0|0, \theta_*^M) \geq K \text{ and } \theta_*^M > -\frac{\mu^M}{\mu^N} \theta_*^M + \frac{1-K}{\mu^N} \\ 1-K & \forall \theta_*^M \text{ such that } G(0|0, \theta_*^M) \geq K \text{ and } \theta_*^M \leq -\frac{\mu^M}{\mu^N} \theta_*^M + \frac{1-K}{\mu^N} \end{cases} \quad (\text{A-20})$$

Notice that (A-18) and (A-17) imply $\theta_*^N \leq \theta_*^M$, therefore (A-20) becomes

$$\theta_*^N = \begin{cases} 0 & \forall \theta_*^M \text{ such that } \mu^N + \mu^M(1 - \theta_*^M) < K \\ -\frac{\mu^M}{\mu^N} \theta_*^M + \frac{1-K}{\mu^N} & \forall \theta_*^M \text{ such that } \mu^N + \mu^M(1 - \theta_*^M) \geq K \text{ and } \theta_*^M > 1-K \\ 1-K & \forall \theta_*^M \text{ such that } \mu^N + \mu^M(1 - \theta_*^M) \geq K \text{ and } \theta_*^M = 1-K \end{cases} \quad (\text{A-21})$$

which can be rewritten as

$$\theta_*^N = \begin{cases} 0 & \text{if } \theta_*^M \in (\frac{1-K}{\mu^M}, 1] \\ -\frac{\mu^M}{\mu^N} \theta_*^M + \frac{1-K}{\mu^N} & \text{if } \theta_*^M \in [1-K, \frac{1-K}{\mu^M}] \end{cases} \quad (\text{A-22})$$

Let us look at the migrant worker's condition. We can rewrite the set B as

$$B = \left\{ \theta \in [0, +\infty) : \theta \geq \theta_*^N \right\} \quad (\text{A-23})$$

and, given (A-22) we have that $B = [1-K, +\infty)$. Therefore (A-17) becomes

$$\theta_*^M \in \begin{cases} \{1\} & \text{if } Q \cap [1-K, +\infty) \neq \emptyset \wedge Q \cap [1-K, 1] = \emptyset \\ Q \cap [1-K, 1] & \text{if } Q \cap [1-K, 1] \neq \emptyset \\ 1-K & \text{if } Q \cap [1-K, +\infty) = \emptyset \end{cases} \quad (\text{A-24})$$

We can put together (A-24) and (A-22) and we get that

- for any $\theta \in Q \cap (1, +\infty)$, $(\theta_*^N, \theta_*^M) = (0, 1)$
- for any $\theta \in Q \cap [1 - K, 1]$, $\theta_*^M = \theta$ and θ_*^N is given by (A-22)
- for any $\theta \in Q \cap [0, 1 - K)$, $(\theta_*^N, \theta_*^M) = (1 - K, 1 - K)$.

■

Proof of Proposition 1.1. We can first use the results in Lemma (1.1) and Lemma (1.2) to derive an expression of the equilibrium value of θ^H as a function of the equilibrium value of θ^M :

$$\theta^H(\theta^M) = \begin{cases} \frac{1-\mu^M\theta^M}{\mu^N} - \frac{K}{2\mu^N} - \frac{\mu^M}{2K\mu^N}(\theta^M - 1)^2 & \text{if } \theta^M \in [1 - K, \frac{1-K}{\mu^M}] \\ \frac{1-\mu^M(\theta^M)^2}{2(1-\mu^M\theta^M)} & \text{if } \theta^M \in (\frac{1-K}{\mu^M}, 1] \end{cases} \quad (\text{A-25})$$

We can rewrite the first equation of (A-6) using (A-25) as

$$w(\theta^M, \theta^H(\theta^M)) - c(I) - w^L = 0 \quad (\text{A-26})$$

Consider the left hand side of (A-26) as a function $g(I, \theta^M)$ where $g : [0, 1]^2 \rightarrow \mathbb{R}$

By the theorem of the global existence of the implicit function we have that there exists a unique function $\psi : D \subset [0, 1] \rightarrow \mathbb{R}$ such that $g(I, \psi(I)) = 0 \quad \forall I \in D$; ψ is continuous and takes values in $[1 - K, 1]$ while $D = [\underline{I}, \bar{I}]$ where

$$\underline{I} = c^{-1} \left[w \left(1, \frac{1}{2} \right) - w^L \right] \text{ and } \bar{I} = c^{-1} \left[w \left(1 - K, 1 - \frac{K}{2} \right) - w^L \right] \quad (\text{A-27})$$

Indeed the assumptions of the theorem of global existence of the implicit function are satisfied on the set $D \times [1 - K, 1]$. More precisely,

- g is continuous in $D \times [1 - K, 1]$;
- in $D \times [1 - K, 1]$, g is strictly monotone with respect to θ^M for any fixed I ;
- for any fixed $I \in D$, the function g changes sign varying θ^M in $[1 - K, 1]$.

We have shown existence and uniqueness of the equilibrium for $I \in D$. For any value of $I \in (\bar{I}, 1]$ it is easy to see that the equilibrium exists unique and it is equal to $(1 - K, 1 - K)$. Instead, for any value of $I \in [0, \underline{I}]$ we always have the unique equilibrium $(0, 1)$.

To show that θ_*^M is non increasing in I we start applying the implicit function theorem.

In particular, for any point $(I_0, \theta_0^M) \in D \times [1 - K, 1]$ we have that

- g is C^1 in a neighborhood $V(I_0, \theta_0^M)$ and
- $\frac{\partial g}{\partial \theta^M}(I_0, \theta_0^M) \neq 0$.

Then, by the IFT, there exists a neighborhood $U(I_0)$ such that

$$\psi'(I) = -\frac{\frac{\partial g}{\partial I}(I, \psi(I))}{\frac{\partial g}{\partial \theta^M}(I, \psi(I))} = -\frac{c'(I)}{\frac{\partial w(\theta^M, \theta^H)}{\partial \theta^M} + \frac{\partial w(\theta^M, \theta^H)}{\partial \theta^H} \frac{d\theta^H(\theta^M)}{d\theta^M}} < 0 \quad \forall I \in U(I_0) \quad (\text{A-28})$$

The following facts complete the argument:

- $\forall I \in [0, \underline{I}), \theta_*^M(I) = 1$,
- $\theta_*^M(\underline{I}) = \psi(\underline{I}) = 1$,
- $\forall I \in [\underline{I}, \bar{I}), \theta_*^M(I) = \psi(I)$ which is decreasing in I ,
- $\theta_*^M(\bar{I}) = \psi(\bar{I}) = 1 - K$ and
- $\forall I \in (\bar{I}, 1], \theta_*^M(I) = 1 - K$.

Given the expression of θ_*^N as a function of θ_*^M given by the second equation in (A-6) it is immediate to see that θ_*^N is non decreasing in I . ■

Proof of Proposition 1.2. The mapping from the voter's type to the solution(s) of problem (1.13) can have different forms depending on the values of the parameters K and μ^M . The possible cases depend upon the shape of the function $\theta^H(\theta^M)$ and its local and global maxima. In particular, taking the expression for $\theta^H(\cdot)$ from equation (A-25) and maximizing it we have the following cases:

1. $\theta^H(\theta^M)$ has a unique maximum $\theta_1^H = 1 - K/2$ at $\theta_1^M = 1 - K$. This is the case if $K < \sqrt{1 - \mu^M}$;
2. $\theta^H(\theta^M)$ has a global maximum at θ_1^M and a local maximum $\theta_2^H = \frac{1 - \sqrt{1 - \mu^M}}{\mu^M}$ at $\theta_2^M = \frac{1 - \sqrt{1 - \mu^M}}{\mu^M}$. This is the case if $K > \sqrt{1 - \mu^M}$ and $K < \frac{2\sqrt{1 - \mu^M} - 2(1 - \mu^M)}{\mu^M}$;
3. $\theta^H(\theta^M)$ has a local maximum at θ_1^M and a global maximum at θ_2^M . This is the case if $K > \frac{2\sqrt{1 - \mu^M} - 2(1 - \mu^M)}{\mu^M}$;
4. $\theta^H(\theta^M)$ has two equal maxima at θ_1^M and θ_2^M . This is the case if $K = \frac{2\sqrt{1 - \mu^M} - 2(1 - \mu^M)}{\mu^M}$.

Assuming that when indifferent (case 4.) a voter chooses the lowest level of integration, the result is immediately given from the fact that voters' preferences satisfy Gans-Smart

single corossing condition. ■

A.2 MIPEX data and regression analysis

Table A-1: Summary statistics

Variable	Source	#	Mean	Median	Std. Dev.	Min.	Max.
Integration and w^L							
MIPEX Labor Market, 2007	MIPEX Database	27	57.477	52.708	18.821	20.833	100
Payoff in shadow economy, 2007	Schneider et al. (2011) and WDI, World Bank	27	0.194	0.179	0.064	0.081	0.297
Integration and K							
MIPEX Labor Market, 2010	MIPEX Database	37	56.881	54.792	20.292	10.417	100
Employment to population (15+) ratio, 2010	WDI, World Bank	37	53.354	54.1	6.017	41.9	64.8
Integration and μ^M							
MIPEX Labor Market, 2010	MIPEX Database	37	56.881	54.792	20.292	10.417	100
Stock of international migrants (% of population), 2010	WDI, World Bank	37	10.153	9.929	7.332	0.656	34.171

Table A-2: Estimation of the CEF slope coefficient

Integration	(1)	(2)	(3)
w^L	26.862** (9.738)		
K		1.533*** (0.548)	
μ^M			0.329 (0.437)
Observations	27	37	37
R-squared	0.155	0.207	0.014

Robust standard errors in parenthesis, constant term
always included

Statistical significance: *0.1, ** 0.05, *** 0.01

Appendix B

Appendix to Chapter 2

B.1 Data and methodology

Productivity and trade data

In order to construct measures of productivity, we exploit the data from the World Bank Enterprise Survey. Starting in 2002, the World Bank collects firm level data in its Enterprise Survey dataset. The Enterprise Survey is a firm-level survey of a representative sample of an economy's private sector. The survey covers more than 130 developing and emerging countries in different years between 2002 and 2014. The survey provides detailed information about firms' activity such as sales and other economic variables allowing us to construct a measure of productivity for each firm. Information about the industry in which each firm operates is available at the division level (two digits) of the International Standard Industrial Classification (ISIC Rev. 3).

An additional advantage of the Enterprise Survey is that most of the countries had been surveyed at least twice, therefore we can look at the evolution of aggregate industry productivity across time. In particular, all CIS countries except Tajikistan have been surveyed at least twice by the World Bank. For our purposes we use the 2008 and 2013 surveys for Belarus and Ukraine, 2009 and 2013 for Armenia, Kazakhstan, Kyrgyzstan and Moldova and 2009 and 2012 for Russia. All these surveys a part from Russia in 2012 fall before or after the year of entry into force of the CIS-FTA.

We construct a measure of firms' productivity using the methodology outlined in the paper by Saliola and Seker (2012). Essentially we estimate a firm's total factor productivity (TFP) as the residual of a Cobb-Douglas production function with capital, labor and intermediate goods as factor of production. The regression we run is

$$\log(Y) = \beta_1 \log(K) + \beta_2 \log(L) + \beta_3 \log(I) + \delta + \epsilon \quad (\text{B-1})$$

where Y is the output of a firm operating in an industry in a country in a particular year, K represents firm's capital, L is labor used by the firm and I are intermediate goods employed by the firm in the production. The World Bank Enterprise Survey provides firm level information that can be associated to output and these factor of production. In particular, output is measured as firms' sales, capital is the replacement value of machinery, vehicles and equipment, labor is the total compensation of workers including wages, and intermediate goods are measured as the cost of raw and intermediate materials.

In our baseline regression, we run a pooled regression including all available manufacturing firms in all available countries.¹ In order to control for unobservable variables we include a set δ of fixed effects at the country, industry and year level. For each variable in the regression, we exclude the outliers that are more than three standard deviation away from the mean value of the country as in Saliola and Seker (2012).

Using simple OLS we estimate equation B-1 and interpret the residuals ϵ as the TFP of each firm.² Productivity at the firm level, is then averaged in order to construct the average productivity of the available industries in each country.³

In order to match with firm level data, we retrieve export data at the 2-digits ISIC Rev. 3 from the UN COMTRADE database. For each industry, country and year we construct the revealed comparative advantage (RCA) index (Balassa (1965)) considering only manufacturing goods.⁴

Complexity

In order to classify industries according to complexity, we constructed the PRODY index as defined in Hausmann et al. (2007). The PRODY index gives a sense of the "revealed" technology content of an industry. We calculated the PRODY index using a sample of 133 countries for which we have consistent and reliable trade and GDP data. Trade data is from COMTRADE at the 2 digits ISIC Rev.3 level and GDP per capita is from

¹The World Bank surveys also services firms. However we restrict our analysis to manufacturing firms in order to match firm level data with trade data.

²Given the survey design of the data, we use the sampling weights directly provided by the World Bank. For more information refer to the Methodology page of the Enterprise Survey website: <http://www.enterprisesurveys.org/methodology>

³In order to calculate the average productivity of the industry we weigh each firm using the share of output of a firm on the total output of the industry in a given year.

⁴This corresponds to industries from 15 to 40 in the ISIC Rev 3.

the World Development Indicators published by the World Bank. Table B-1 shows the industries with the largest and smallest values of the index.⁵

Table B-1: Smallest and largest PRODY values

	Product Code	ISIC Rev. 3 Product Description	Average PRODY
Smallest	19	Tanning And Dressing Of Leather; Manufacture Of Luggage, Handbags, Saddlery, Harness And Footwear	8637.316
	15	Manufacture Of Food Products And Beverages	9130.748
	16	Manufacture Of Tobacco Products	10410.57
	10	Manufacture Of Wood And Of Products Of Wood And Cork, Except Furniture; etc.	10411.58
	27	Manufacture Of Basic Metals	12063.41
	32	Manufacture Of Radio, Television And Communication Equipment And Apparatus	23177.29
Largest	30	Manufacture Of Office, Accounting And Computing Machinery	23603.89
	29	Manufacture Of Machinery And Equipment N.E.C.	23785.39
	33	Manufacture Of Medical, Precision And Optical Instruments, Watches And Clocks	24530.68
	23	Manufacture Of Coke, Refined Petroleum Products And Nuclear Fuel	25920.47

B.2 Final firms' organization: a framework for a fully micro-funded application of Costinot' theory

Final firms are indexed with the letter j , suppliers with s and intermediate goods with I . The production of a firm j active in sector i of country k is organized as follows:

- every firm j partitions the sector-specific intermediate goods' space $[0, z^i]$ into N_j^i different product ranges (denote the resulting partition $R_j^i = \{R_{k,j}^i\}_{k=1}^{N_j^i}$), i.e. sets of intermediate goods whose provision is to be assigned to suppliers;
- the firm selects a subset of suppliers, $L_j^i \subset [0, L_k]$. We assume that every supplier can be selected by one firm only. The firm then pays w_k to the supplier irrespectively of the actual provision of intermediate goods;
- for every selected supplier $n \in L_j^i$ and for each unit of the final good $u \in \mathbb{R}^+$, the firm specifies which range R of intermediate goods - if any - has to be provided by that particular supplier for the that particular unit of the final good. Formally the

⁵We averaged the PRODY index in 2006, 2007 and 2008. The full list of 2 digit ISIC industries is available upon request.

firm designs the mapping

$$O_j^i(\cdot, \cdot) : L_j^i \times \mathbb{R}^+ \rightrightarrows \{R_{1,j}^i, \dots, R_{N_j^i,j}^i, \emptyset\}$$

From the mapping $O_j^i(\cdot, \cdot)$ we can identify the units of the final-good-variety produced by firm j in sector i for which supplier n provides the intermediate good I . Calling the set of such units $\mathbb{U}_j^i(n, I)$ we have that

$$\mathbb{U}_j^i(n, I) = \{u \in \mathbb{R}^+ \mid \exists t \text{ such that } I \in R_{t,j}^i \wedge R_{t,j}^i \in O_j^i(n, u)\}$$

The successful provision indicator is given by

$$S_{k,j}^i(n, I, u) = \begin{cases} 1 & \text{with probability } e^{-\frac{1}{\theta_k}} \\ 0 & \text{with probability } 1 - e^{-\frac{1}{\theta_k}} \end{cases} \quad (\text{B-2})$$

for every $n \in L_k$ and for every pair (u, I) such that $u \in \mathbb{U}_j^i(n, I)$. $S_{k,j}^i(n, I, u) = 1$ means that supplier n is able to provide the intermediate good I for the production of the u^{th} unit of the final good produced by j .

We make the following assumptions:

- a supplier that fails the provision of one intermediate good, fails also in the provision of all the others intermediate goods it was responsible for;
- the firm's organisation applies to all the units of the final good;
- the firms cannot assign more than one supplier to one range of intermediate goods;
- suppliers do not interact among each others.

From this framework we can replicate the following important results that we take as given in the body of the paper.

Result Optimal organization implies that each supplier selected by a final firm provides one and only one range of intermediate goods for every final good's unit it is responsible for.

Result Each final firm optimally allocates the same number of intermediate goods across ranges.

The proofs of these results consist of the same identical steps of the analogous results in Costinot (2009) and therefore we omit them here.

B.3 Proofs

Proof of Proposition 2.2 (i) We need to show that the two sector profit functions cross each other once and only once, and that this happens for a positive value of profits. In equilibrium there must be production in both sectors to clear demand. Therefore there must exist two different productivity values φ_1 and φ_2 such that $\pi^S(\varphi_1) > \pi^A(\varphi_1) > 0$ and $\pi^A(\varphi_2) > \pi^S(\varphi_2) > 0$. Given observation 2.2 we just need to check the sign of the second derivative of the profit functions with respect to productivity. We remove the i index since our computations hold for both industries.

$$\begin{aligned}\pi'(\varphi) &= \frac{R}{2\sigma}(\sigma - 1) \left[\frac{P\rho}{w\beta(\varphi)} \right]^{\sigma-2} \times \frac{\overbrace{-w\beta'(\varphi)P\rho}^{<0}}{[w\beta(\varphi)]^2} > 0 \\ \pi''(\varphi) &= \frac{R}{2\sigma}(\sigma - 1) \left\{ (\sigma - 2) \left[\frac{P\rho}{w\beta(\varphi)} \right]^{\sigma-3} \left[\frac{-w\beta'(\varphi)P\rho}{[w\beta(\varphi)]^2} \right]^2 + \right. \\ &\quad \left. + \left[\frac{P\rho}{w\beta(\varphi)} \right]^{\sigma-2} \left[\frac{\overbrace{P\rho\{2[\beta'(\varphi)]^2 - \overbrace{\beta''(\varphi)\beta(\varphi)}^{>0}}^{>0}}{[w\beta(\varphi)]^3}} \right] \right\} > 0 \quad (\text{B-3})\end{aligned}$$

Given that profit functions are both always convex it must be that if they cross they cross only once.

(ii) Existence in equilibrium of φ^e and φ^{eA} such that $\pi^S(\varphi^e) = \pi^A(\varphi^{eA}) = 0$ is a trivial corollary of Observation 2.2. We want to prove that $\varphi^e < \varphi^{eA}$. Assume by contradiction that $\varphi^e > \varphi^{eA}$. Then, $\forall \varphi^+ > \varphi^{SA}$ we have that $\pi^S(\varphi^+) > \pi^A(\varphi^+)$. Using the profit expression and after some algebra we get the following

$$\pi^S(\varphi^+) > \pi^A(\varphi^+) \iff \frac{P^S}{P^A} > \frac{\beta^S(\varphi^+)}{\beta^A(\varphi^+)} \quad (\text{B-4})$$

Analogously, $\forall \varphi^- < \varphi^{SA}$ we have that $\pi^S(\varphi^-) < \pi^A(\varphi^-)$. As before

$$\pi^S(\varphi^-) < \pi^A(\varphi^-) \iff \frac{P^S}{P^A} < \frac{\beta^S(\varphi^-)}{\beta^A(\varphi^-)} \quad (\text{B-5})$$

Combining the two conditions (B-4) and (B-5) we get

$$\frac{\beta^S(\varphi^-)}{\beta^A(\varphi^-)} > \frac{\beta^S(\varphi^+)}{\beta^A(\varphi^+)} \quad (\text{B-6})$$

Defining the function $B(\varphi) := \frac{\beta^S(\varphi)}{\beta^A(\varphi)}$ we can show that $B'(\varphi) > 0$. This contradicts condition (B-6) and completes the proof.

(iii) From (i), (ii) and profit maximisation. ■

Proof of Proposition 2.3

Detailed derivation of the Autarky equilibrium conditions

Average profits as functions of the entry and choice thresholds The average profits in the two sectors are defined by the following expressions:

$$\bar{\pi}^S = \frac{\int_{\varphi^e}^{\varphi^{SA}} \pi^S(\varphi) g(\varphi) d\varphi}{[G(\varphi^{SA}) - G(\varphi^e)]}$$

$$\bar{\pi}^A = \frac{\int_{\varphi^{SA}}^{\infty} \pi^A(\varphi) g(\varphi) d\varphi}{[1 - G(\varphi^{SA})]}$$

We can now derive average profits as functions of the productivity cutoffs:

$$\bar{r}^S = \underbrace{r^S(\tilde{\beta}^S(\varphi^e, \varphi^{SA}))}_{\text{or } r^S(\tilde{\beta}^S)} = \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \underbrace{r^S(\beta^S(\varphi^e))}_{\text{or } r^S(\varphi^e)} \quad (\text{B-7})$$

$$\bar{r}^A = \underbrace{r^A(\tilde{\beta}^A(\varphi^{SA}))}_{\text{or } r^A(\tilde{\beta}^A)} = \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{1-\sigma} \underbrace{r^A(\beta^A(\varphi^{SA}))}_{\text{or } r^A(\varphi^{SA})}$$

and

$$\bar{\pi}^S = \pi^S(\tilde{\beta}^S) = \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \frac{r^S(\varphi^e)}{\sigma} - f$$

$$\bar{\pi}^A = \pi^A(\tilde{\beta}^A) = \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{1-\sigma} \frac{r^A(\varphi^{SA})}{\sigma} - f$$

We still need an expression for $r^S(\varphi^e)$ and $r^A(\varphi^{SA})$ to reach our goal. We use the definitions of φ^e and φ^{SA} :

$$\pi^S(\varphi^e) = 0 \iff r^S(\varphi^e) = \sigma f$$

$$\pi^S(\varphi^{SA}) = \pi^A(\varphi^{SA}) \iff r^S(\varphi^{SA}) = r^A(\varphi^{SA})$$

Moreover, we notice that the revenue ratio of any two firms φ and φ' in sector i becomes

$$\frac{r^i(\varphi)}{r^i(\varphi')} = \left(\frac{\beta^i(\varphi')}{\beta^i(\varphi)} \right)^{(\sigma-1)} \quad (\text{B-8})$$

Using the revenue ratio (B-8) we can substitute $r^S(\varphi^{SA})$ with $r^S(\varphi^e)[\beta^S(\varphi^e)/\beta^S(\varphi^{SA})]^{\sigma-1}$. Rearranging and substituting $r^S(\varphi^e) = \sigma f$ we get

$$r^A(\varphi^{SA}) = \left[\frac{\beta^S(\varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \sigma f$$

Eventually we can write average profits as

$$\begin{aligned} \bar{\pi}^S &= f \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \\ \bar{\pi}^A &= f \left\{ \left[\frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA}) \beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \end{aligned} \quad (\text{B-9})$$

Threshold (φ^{SA}) The choice threshold φ^{SA} is defined as the level of productivity that makes a final firm indifferent across sectors, i.e. such that

$$\pi^S(\varphi^{SA}) = \pi^A(\varphi^{SA})$$

which, using the expression for profits, becomes

$$\left\{ \frac{P^S}{\beta^S(\varphi^{SA})} \right\}^{\sigma-1} = \left\{ \frac{P^A}{\beta^A(\varphi^{SA})} \right\}^{\sigma-1}$$

using the aggregate price expressions and substituting the sectoral mass of firms we get

$$\left\{ \frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^{SA})} \right\}^{\sigma-1} \frac{[1 - G(\varphi^e)]}{M[G(\varphi^{SA}) - G(\varphi^e)]} = \left\{ \frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right\}^{\sigma-1} \frac{[1 - G(\varphi^e)]}{M[1 - G(\varphi^{SA})]}$$

and rearranging

$$\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}}{G(\varphi^{SA}) - G(\varphi^e)} = \left[\frac{\beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{\sigma-1} \frac{\tilde{\beta}^A(\varphi^{SA})^{\sigma-1}}{1 - G(\varphi^{SA})} \quad (\varphi^{SA})$$

The free-entry condition (FE) Given the firms dynamics as described in Melitz (2003) we derive the firm entry condition:

$$V = \frac{[1 - G(\varphi^e)]}{\delta} \bar{\pi} = f_e \quad (\text{B-10})$$

with V being the ex-ante (before the productivity realization) utility of the final firm, $\bar{\pi}$ the average ex-post profit in the economy and f_e the fixed cost that has to be paid initially to draw a productivity level. Decomposing the aggregate average profits we can rewrite the LHS of the above equation:

$$\frac{1}{\delta} \left[[G(\varphi^{SA}) - G(\varphi^e)] \bar{\pi}^S + [1 - G(\varphi^{SA})] \bar{\pi}^A \right] = f_e \quad (\text{B-11})$$

Using the expressions for average profits (B-9) and (B.3) in the two sectors we have:

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi^{SA}) - G(\varphi^e)] \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi^{SA})] \left\{ \left[\frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA}) \beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \end{aligned} \quad (\text{B-12})$$

We use equation (φ^{SA}) to derive an expression for $\left\{ \frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right\}^{1-\sigma}$, in particular we get

$$\left\{ \frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right\}^{1-\sigma} = \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^{SA})]} \left\{ \tilde{\beta}^S(\varphi^e, \varphi^{SA}) \right\}^{1-\sigma} \quad (\text{B-13})$$

We get:

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi^{SA}) - G(\varphi^e)] \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi^{SA})] \left\{ \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^{SA})]} \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \\ & \iff \frac{f}{\delta} \left\{ 2[G(\varphi^{SA}) - G(\varphi^e)] \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \right. \\ & \quad \left. - [G(\varphi^{SA}) - G(\varphi^e)] - [1 - G(\varphi^{SA})] \right\} = f_e \\ & \iff \frac{G(\varphi^{SA}) - G(\varphi^e)}{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}} = \frac{1}{2} \left[\delta f_e / f + 1 - G(\varphi^e) \right] \beta^S(\varphi^e)^{1-\sigma} \end{aligned} \quad (FE)$$

The labor market condition We first solve the number of workers/suppliers needed at the equilibrium for the sector X . Given the technology in this sector, $S_x = X = \frac{\alpha_x \mathcal{R}}{p_x}$. With p_x normalized to 1 we have

$$S_x = \alpha_x \mathcal{R} = \alpha_x w L$$

Labor is used to enter the production process as well as to produce. The economy has a population of L workers. S^e denotes the total amount of suppliers used in the entry process which is not sector specific and S_i^p denotes the total amount of suppliers used for production in sector i . The labor market clearing conditions are:

$$S^e + S^p = L - S_x = (1 - \alpha_x)L \quad \text{with} \quad S^p = S_S^p + S_A^p$$

Every period, each firm in sector i , with a productivity level φ needs f plus $\beta^i(\varphi)y^i(\varphi)$ suppliers to produce the quantity $y^i(\varphi)$ of goods. Total production-labor demand in sector i would be

$$S_i^p = M^i \bar{S}_i^p \quad \forall i$$

where L_i^p denotes average production-labor demand in sector i whose expression is

$$\bar{S}_S^p = \frac{1}{[G(\varphi^{SA}) - G(\varphi^e)]} \left[\int_{\varphi^e}^{\varphi^{SA}} \beta^S(\varphi) y^S(\varphi) g(\varphi) d\varphi + f \right]$$

$$\bar{S}_A^p = \frac{1}{[1 - G(\varphi^{SA})]} \left[\int_{\varphi^{SA}}^{\infty} \beta^A(\varphi) y^A(\varphi) g(\varphi) d\varphi + f \right]$$

Given the following expressions for supply and number of final firms

$$y^i(\varphi) = \frac{r^i(\varphi)}{p^i(\varphi)} = \frac{R}{2} \left[\frac{\rho}{\beta^i(\varphi)} \right]^\sigma (P^i)^{\sigma-1}$$

$$M^S = \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^e)]} M \quad M^A = \frac{[1 - G(\varphi^{SA})]}{[1 - G(\varphi^e)]} M$$

the final labor market clearing condition is:

$$\begin{aligned} & \left(\rho \right)^\sigma \frac{MR}{[1 - G(\varphi^e)]} \left[\alpha_S \int_{\varphi^e}^{\varphi^{SA}} \frac{(P^S)^{\sigma-1}}{\beta^S(\varphi)^\sigma} g(\varphi) d(\varphi) + \right. \\ & \left. + \alpha_A \int_{\varphi^{SA}}^{\infty} \frac{(P^A)^{\sigma-1}}{\beta^A(\varphi)^\sigma} g(\varphi) d(\varphi) \right] + Mf + M_e f_e = (1 - \alpha_x)L \end{aligned}$$

L is exogenously given as the total number of workers in the economy.

Body of the proof The equilibrium thresholds solve the following system of equations:

$$\left\{ \begin{array}{ll} (FE) & V(\varphi^{e*}, \varphi^{SA*}) = f_e \\ (\text{def } \varphi^{e*}) & \pi^S(\varphi^{e*}) = 0 \\ (\text{def } \varphi^{SA*}) & \pi^S(\varphi^{SA*}) = \pi^A(\varphi^{SA*}) \\ & \text{labor and good market clearing conditions} \end{array} \right. \quad (\text{B-14})$$

All the equilibrium endogenous variables can be pinned down from the vector of thresholds

$(\varphi^{e*}, \varphi^{SA*})$. In particular, the number of firms entering and exiting production is given by the stationary equilibrium equation and pinned down by the labor market condition.

We need to show that the following system has at least one solution $(\varphi_*^e, \varphi_*^{SA})$

$$\begin{cases} (\varphi^{SA}) & \frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}}{G(\varphi^{SA}) - G(\varphi^e)} = \left[\frac{\beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{\sigma-1} \frac{\tilde{\beta}^A(\varphi^{SA})^{\sigma-1}}{1 - G(\varphi^{SA})} \\ (FE) & \frac{G(\varphi^{SA}) - G(\varphi^e)}{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}} = \frac{1}{2} \left[\delta f_e / f + 1 - G(\varphi^e) \right] \beta^S(\varphi^e)^{1-\sigma} \end{cases} \quad (\text{B-15})$$

Define the right hand side (RHS) of (φ^{SA}) as $h : \varphi^{SA} \longrightarrow h(\varphi^{SA})$. Consider the following:

1. $\left[\frac{\beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{\sigma-1}$ is strictly increasing in φ^{SA} ;
2. $\frac{\tilde{\beta}^A(\varphi^{SA})^{\sigma-1}}{1 - G(\varphi^{SA})} = 1 / \int_{\varphi^{SA}}^{\infty} \beta^A(\varphi)^{1-\sigma} g(\varphi) d\varphi$ is strictly increasing in φ^{SA} .

We conclude that $h'(\varphi^{SA}) > 0$.

Define the RHS of (FE) as $m : \varphi^e \longrightarrow m(\varphi^e)$. If a solution of (B-15) exists it has to satisfy the following equation

$$h(\varphi^{SA}) = \frac{1}{m(\varphi^e)} \quad (\text{B-16})$$

Given the strict monotonicity of h we can use (B-16) to write the equilibrium value of φ^{SA} as a function of φ^e :

$$\varphi^{SA} = h^{-1} \left(\frac{1}{m(\varphi^e)} \right) =: H(\varphi^e). \quad (\text{B-17})$$

We will now show that (B-15) admits at least one solution of the kind $(\varphi_*^e, H(\varphi_*^e))$. Consider (FE) and rewrite it as an equation in the only unknown φ^e using (B-17)

$$k(\varphi^e) := \int_{\varphi^e}^{H(\varphi^e)} \beta^S(\varphi)^{1-\sigma} g(\varphi) d\varphi - m(\varphi^e) = 0 \quad (\text{B-18})$$

The following properties hold:

1. $k(\cdot)$ is continuous on its domain $[0, +\infty)$;
2. $\lim_{\varphi^e \rightarrow 0} k(\varphi^e) \geq 0$;
3. $\lim_{\varphi^e \rightarrow \infty} k(\varphi^e) = -\infty$.

We conclude that (B-18) has at least one solution applying the intermediate value theorem

to $k(\cdot)$. This implies that also (φ^{SA}) admits at least a solution of the kind $(\varphi_*^e, H(\varphi_*^e))$:

$$(\varphi^{SA}) \iff 1 / \int_{\varphi^e}^{H(\varphi^e)} \beta^S(\varphi)^{1-\sigma} g(\varphi) d\varphi = h(H(\varphi^e))$$

This completes the proof. ■

Proof of Proposition 2.4

Detailed derivation of the Free-Trade equilibrium conditions for one country

Average profits as functions of the entry and choice thresholds The same as under autarky.

Threshold (φ^{SA}) The choice threshold φ^{SA} is defined as the level of productivity that makes a final firm indifferent across sectors, i.e. such that

$$\pi^S(\varphi^{SA}) = \pi^A(\varphi^{SA})$$

which, using the expression for profits, becomes

$$\left\{ \frac{P^S}{\beta^S(\varphi^{SA})} \right\}^{\sigma-1} = \left\{ \frac{P^A}{\beta^A(\varphi^{SA})} \right\}^{\sigma-1} \quad (\varphi^{SA, FT})$$

The free-entry condition (FE) Given the firms dynamics as described in Melitz (2003) we derive the firm entry condition:

$$V = \frac{[1 - G(\varphi^e)]}{\delta} \bar{\pi} = f_e \quad (\text{B-19})$$

with V being the ex-ante (before the productivity realization) utility of the final firm, $\bar{\pi}$ the average ex-post profit in the economy and f_e the fixed cost that has to be paid initially to draw a productivity level. Decomposing the aggregate average profits we can rewrite the LHS of the above equation:

$$\frac{1}{\delta} \left[[G(\varphi^{SA}) - G(\varphi^e)] \bar{\pi}^S + [1 - G(\varphi^{SA})] \bar{\pi}^A \right] = f_e$$

Using the expressions for average profits (B-9) and (B.3) in the two sectors we have:

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi^{SA}) - G(\varphi^e)] \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi^{SA})] \left\{ \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \frac{\beta^S(\varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \end{aligned} \quad (FE, FT)$$

The labor market condition We first solve the number of workers needed at the equilibrium for the sector X . Given the technology in this sector, $S_X = X = \frac{\alpha_X \mathcal{R}}{p_X}$. With p_X normalised to 1 we have

$$S_X = \alpha_X \mathcal{R} = \frac{\alpha_X R}{1 - \alpha_X}$$

Moreover the amount of workers needed for the pre-production stage is by construction

$$S^e = M_e f_e$$

where M_e will be given by steady state stability.

The labor market clearing conditions is thus:

$$L = S^e + S^p + S_X \quad \text{with} \quad S^p = S_S^p + S_A^p$$

Every period, each firm in sector i , with a productivity level φ needs f plus $\beta^i(\varphi)y^i(\varphi)$ production units to produce the quantity $y^i(\varphi)$ of goods. Total production-labor demand in sector i would be

$$S_i^p = M^i \bar{S}_i^p \quad \forall i$$

where \bar{L}_i^p denotes average production-labor demand in sector i whose expression is

$$\begin{aligned} \bar{S}_S^p &= \frac{1}{[G(\varphi^{SA}) - G(\varphi^e)]} \left[\int_{\varphi^e}^{\varphi^{SA}} \beta^S(\varphi) y^S(\varphi) g(\varphi) d\varphi + f \right] \\ \bar{S}_A^p &= \frac{1}{[1 - G(\varphi^{SA})]} \left[\int_{\varphi^{SA}}^{\infty} \beta^A(\varphi) y^A(\varphi) g(\varphi) d\varphi + f \right] \end{aligned}$$

Given the following expressions for supply and number of firms

$$\begin{aligned} y^i(\varphi) &= \frac{r^i(\varphi)}{p^i(\varphi)} = \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^i)^{\sigma-1} [\beta^i(\varphi)]^{-\sigma} \\ M^S &= \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^e)]} M \quad M^A = \frac{[1 - G(\varphi^{SA})]}{[1 - G(\varphi^e)]} M \end{aligned}$$

we can write

$$\begin{aligned}
S_S^p &= \frac{M}{[1 - G(\varphi^e)]} \left[\int_{\varphi^e}^{\varphi^{SA}} \beta^s(\varphi) \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^S)^{\sigma-1} [\beta^s(\varphi)]^{-\sigma} g(\varphi) d\varphi + f \right] \\
&= \frac{M}{[1 - G(\varphi^e)]} \left[\frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^S)^{\sigma-1} \int_{\varphi^e}^{\varphi^{SA}} [\beta^s(\varphi)]^{1-\sigma} g(\varphi) d\varphi + f \right] \\
&= \frac{M}{[1 - G(\varphi^e)]} \left[\frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^S)^{\sigma-1} [\tilde{\beta}^S(\varphi^e, \varphi^{SA})]^{1-\sigma} [G(\varphi^{SA}) - G(\varphi^e)] + f \right] \\
&= \frac{Mf}{[1 - G(\varphi^e)]} + \frac{M}{[1 - G(\varphi^e)]} \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^S)^{\sigma-1} [\tilde{\beta}^S(\varphi^e, \varphi^{SA})]^{1-\sigma} [G(\varphi^{SA}) - G(\varphi^e)]
\end{aligned}$$

Analogously

$$S_A^p = \frac{Mf}{[1 - G(\varphi^e)]} + \frac{M}{[1 - G(\varphi^e)]} \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^A)^{\sigma-1} [\tilde{\beta}^A(\varphi^e, \varphi^{SA})]^{1-\sigma} [1 - G(\varphi^{SA})]$$

Thus

$$\begin{aligned}
S_S^p + S_A^p &= \frac{2Mf}{[1 - G(\varphi^e)]} + \frac{M}{[1 - G(\varphi^e)]} \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma \times \\
&\times \left\{ \left[\frac{P^S}{\tilde{\beta}^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\tilde{\beta}^A(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\}
\end{aligned}$$

Moreover in equilibrium

$$R = w_k(L - S_X)$$

which plugging the expression for L_X and rearranging becomes

$$R = \left(\frac{1 - \alpha_X}{1 - \alpha_X + w_k \alpha_X} \right) w_k L$$

Given our assumptions on the parameters we have that R is the same in both countries. We can thus simplify our production-labor demand expressions

$$S_S^p + S_A^p = \frac{2Mf}{[1-G(\varphi^e)]} + \frac{M}{[1-G(\varphi^e)]} \left(\frac{1-\alpha_X}{1-\alpha_X+w\alpha_X} \right) wL \left[\frac{\rho}{w} \right]^\sigma \times \\ \times \left\{ \left[\frac{P^S}{\beta^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\beta^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\}$$

Using the fact that in equilibrium $w = 1$ we have

$$S_S^p + S_A^p = \frac{2Mf}{[1-G(\varphi^e)]} + \frac{M(1-\alpha_X)L}{[1-G(\varphi^e)]} (\rho)^\sigma \times \\ \times \left\{ \left[\frac{P^S}{\beta^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\beta^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\}$$

The final labor market clearing condition for country k is:

$$L - \alpha_X L - M_e f_e = \frac{2Mf}{[1-G(\varphi^e)]} + \frac{M(1-\alpha_X)L}{[1-G(\varphi^e)]} (\rho)^\sigma \times \\ \times \left\{ \left[\frac{P^S}{\beta^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\beta^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\} \quad (LMC)$$

This equation contains the following unknowns: M , M_e , φ^e , φ^{SA} and the two price aggregates. We can easily replace M_e with M using the steady state stability condition.

Body of the proof Given the above derivations, all the equilibrium quantities can be derived from a system of 8 equations in the following 8 unknowns $\{\varphi_H^e, \varphi_F^e, \varphi_H^{SA}, \varphi_F^{SA}, P^S, P^A, M_H, M_F\}$. The 8 equations are given by $(\varphi^{SA, FT})$, (FE, FT) and (LMC) for both countries plus the expression aggregate price indexes for both sectors (they are equal across countries). The system admits one and only one solution. ■

Proof of Proposition 2.5 We assume that country H has the best institutions. By definition of the choice threshold $\varphi^{SA, k}$ in country $k \in \{H, F\}$, we have:

$$\pi_k^S(\varphi_k^{SA}) = \pi_k^A(\varphi_k^{SA}) \Rightarrow \frac{P_k^S}{P_k^A} = \frac{\beta_k^S(\varphi_k^{SA})}{\beta_k^A(\varphi_k^{SA})}$$

The marginal cost ratio $(\beta^S(\varphi)/\beta^A(\varphi))$ is increasing in φ and in θ as shown in the following steps:

$$\frac{\partial(\beta^S/\beta^A)}{\partial\varphi} = \frac{\frac{\partial\beta^S}{\partial\varphi}\beta^A - \frac{\partial\beta^A}{\partial\varphi}\beta^S}{(\beta^A)^2}$$

$$\frac{\partial(\beta^S/\beta^A)}{\partial\varphi} > 0 \iff \frac{\partial\beta^S}{\partial\varphi}\beta^A - \frac{\partial\beta^A}{\partial\varphi}\beta^S > 0 \iff \frac{\partial\beta^S}{\partial\varphi}/\beta^S > \frac{\partial\beta^A}{\partial\varphi}/\beta^A$$

and by the chain rule, given that β^i takes only real, strictly positive values

$$\iff \frac{\partial \ln \beta^S}{\partial \varphi} > \frac{\partial \ln \beta^A}{\partial \varphi} \quad (\text{B-20})$$

Given that a strictly increasing transformation does not change the behaviour of the derivative's sign we have that $\frac{\partial\beta^i}{\partial\varphi} < 0$ implies $\frac{\partial \ln \beta^i}{\partial \varphi} < 0$. Moreover,

$$\frac{\partial \ln \beta^i}{\partial \varphi \partial z^i} = \frac{-2\varphi h\theta - z^i - z^i \sqrt{1 + \frac{4\varphi h\theta}{z^i}}}{2\varphi^2 h\theta z^i \sqrt{1 + \frac{4\varphi h\theta}{z^i}}} < 0$$

We conclude that inequality (B-20) is verified. Analogously we can show that (β^S/β^A) is increasing in θ , given that

$$\frac{\partial \ln \beta^i}{\partial \theta \partial z^i} = \frac{-2\varphi h\theta - z^i + z^i \sqrt{1 + \frac{4\varphi h\theta}{z^i}}}{2\varphi h\theta^2 z^i \sqrt{1 + \frac{4\varphi h\theta}{z^i}}} < 0$$

Given this intermediate result on the marginal cost ratio we have the following inequality under the autarky equilibrium

$$\frac{\beta_S^H(\varphi_H^{SA*})}{\beta_A^H(\varphi_H^{SA*})} > \frac{\beta_S^F(\varphi_F^{SA*})}{\beta_A^F(\varphi_F^{SA*})}$$

Consequently we get $\frac{P_H^S}{P_H^A} > \frac{P_F^S}{P_F^A}$ for the autarky equilibrium. This defines a comparative advantage for country H to produce varieties of the advanced sector (A) and therefore completes the proof. ■

Proof of Proposition 2.6 Compared to the autarky choice thresholds φ^{SA*} , we can show that the free-trade choice threshold $\varphi^{SA,FT}$ decreases in the country with the comparative advantage in the advanced sector and increases in the other country. We keep assuming

that country H has the best institutions and therefore the comparative advantage in sector A . Proposition 2.5 gives us the following condition

$$\frac{P_F^{S*}}{P_F^{A*}} < \frac{P^{S,FT}}{P^{A,FT}} < \frac{P_H^{S*}}{P_H^{A*}}$$

We use the equality of profits at the choice thresholds in autarky φ^{SA*} and in free-trade $\varphi^{SA,FT}$ for each country

$$\begin{aligned} \pi_k^S(\varphi_k^{SA*}) = \pi_k^A(\varphi_k^{SA*}) &\Rightarrow \frac{P_k^{S*}}{P_k^{A*}} = \frac{\beta_k^S(\varphi_k^{SA*})}{\beta_k^A(\varphi_k^{SA*})} \\ \pi_k^S(\varphi_k^{SA,FT}) = \pi_k^A(\varphi_k^{SA,FT}) &\Rightarrow \frac{P^{S,FT}}{P^{A,FT}} = \frac{\beta_k^S(\varphi_k^{SA,FT})}{\beta_k^A(\varphi_k^{SA,FT})} \end{aligned}$$

and the result that the function β^S/β^A is strictly increasing to get the following implications

$$\frac{P^{S,FT}}{P^{A,FT}} < \frac{P_H^{S*}}{P_H^{A*}} \Rightarrow \frac{\beta_H^S(\varphi_H^{SA,FT})}{\beta_H^A(\varphi_H^{SA,FT})} < \frac{\beta_H^S(\varphi_H^{SA*})}{\beta_H^A(\varphi_H^{SA*})} \Rightarrow \varphi_H^{SA,FT} < \varphi_H^{SA*}$$

The choice threshold is proved to decrease in the country with the comparative advantage in the advanced sector. We use a similar reasoning for the other country. ■

B.4 Technical details for the numerical exercise about the free-trade equilibrium

Given the many similarities of our modelling framework to that in Bernard et al. (2007), our choice of parameters follows closely the numerical exercise in that paper. We assume a Pareto distribution for ex-ante productivity with shape parameter equal to 3.4 and scale parameter equal to 1. We set elasticity of substitution $\sigma = 3.8$, sunk entry costs $f_e = 2$, fixed production cost $f = 0.1$ and probability of exogenous firm death $\delta = 0.025$. Moreover, we posit equal consumers' expenditure share across sectors, which, given the presence in our model of a technical homogeneous good sector, implies $\alpha = 1/3$. We assume the working hours endowment $h = 1$ and the total number of suppliers/workers $L = 100$. In terms of sector complexity we choose $z^A = 40$ and $z^S = 5$. Our results are

robust across other levels of complexity proximity across sectors. Finally, we set the level of institutions in the less fragile country F , $\theta_H = 100$. We perform our simulation across values of the θ_F in the closed interval $[10, 90]$. Our results are robust across other levels of institutions, for instance $\theta_H = 10$ and θ_F varying in the interval $[1, 9]$.

Appendix C

Appendix to Chapter 3

C.1 Appendix tables

Table C-1: Variables list

Variable	Description	Data source
Productivity_{ij}	Log of Labor productivity (output per worker) in manufacturing sector j in country i	UNIDO INDSTAT4, Rev. 3
STRI_{is}	Trade Restrictiveness Index in service sector s in country i	World Bank's Services Trade Restrictions Database
w_{ijs}	Input penetration of service s into manufacturing sector j of country i	OECD I-O Tables (mid-2000)
IC_i	Control of corruption, rule of law, regulatory quality in country i	World Bank's Worldwide Governance Indicators
GDP per capita_i	GDP per capita (current US\$) in country i	World Bank's World Development Indicators
Tariff	Log of effectively applied tariff in manufacturing sector j in country i	UNCTAD TRAINS
$\widetilde{\text{Tariff}}$	Log of weighted average of effectively applied tariffs in manufacturing sectors $k \neq j$ in country i (weights = input penetration of k into j)	UNCTAD TRAINS and OECD I-O Table of the US (mid-2000)

Table C-2: List of countries and sectors in the estimations

Country		Sector
Albania	Kyrgyz Rep.	15-16
Austria	Lebanese Rep.	17-19
Belgium	Lithuania	20
Botswana	Malawi	21-22
Brazil	Malaysia	23
Bulgaria	Mauritius	24
Burundi	Mongolia	25
Canada	Morocco	26
Chile	Netherlands	27
China	New Zealand	28
Colombia	Oman	29
Czech Republic	Peru	30
Denmark	Poland	31
Ecuador	Portugal	32
Ethiopia	Qatar	33
Finland	Romania	34
France	Saudi Arabia	35
Georgia	South Africa	36-37
Germany	Spain	
Greece	Sri Lanka	
Hungary	Sweden	
India	Tanzania	
Indonesia	Turkey	
Ireland	Ukraine	
Italy	United Kingdom	
Japan	Uruguay	
Jordan	Viet Nam	
Korea, Rep.	Yemen	
Kuwait		
Sectors are ISIC Rev. 3 manufacturing industries		

C.2 Input Penetration Measures

Shares of intermediate consumption

Shares of intermediate consumption are derived from the first quadrant of the Input-Output (IO) matrix, i.e. the intermediate demand matrix M . M is a square matrix of dimension n where rows – indexed by r – are the supplying industries (domestic and international) and the columns – c – the using (domestic) industries. The number of industries in the IO table is equal to n . A generic element m_{rc} of the matrix M is the cost borne by sector c for the output produced by sector j (domestic production plus imported foreign production) and used as intermediate input into c . For each services-manufacturing sector pair (s, j) , s ' share of j 's total intermediate consumption is equal to:

$$w_{js} \equiv \frac{m_{sj}}{\sum_{r=1}^n m_{rj}} \quad (\text{C-1})$$

IO technical coefficients

IO technical coefficients are the elements of the square matrix A , defined as:

$$A \equiv YM \quad (\text{C-2})$$

where Y is a dimension n square matrix of zeros, except along the main diagonal, that includes the inverse output of each industry. For each services-manufacturing sector pair (s, j) , the IO technical coefficient is the element a_{sj} of matrix A and it gives the cost of the intermediate inputs from services sector s for one dollar of total production of manufacturing sector j .

Leontief coefficients

The third input penetration measure used in the paper consists of the coefficients derived from the Leontief inverse matrix. The input penetration of services sector s into manufacturing sector j that takes into account the indirect linkages between the supplying and the using sectors is given by the element l_{sj} of matrix L , defined as:

$$L \equiv VB \quad (\text{C-3})$$

where V is a dimension n square matrix of zeros, except along the main diagonal, that includes the value added-output ratios of each industry. B is the Leontief inverse $(I - A)^{-1}$, with A defined in equation (C-2) above.

C.3 Proofs

Proof of Lemma 3.1. We assume WLOG that $\theta_1 < \theta_2$. The probability of choosing the best country $\Pi(1)$ is given by:

$$\Pi(1) = Pr(\vartheta_1 \leq \vartheta_2) = Pr(\vartheta_1 - \vartheta_2 \leq 0) = F_Z(0) \quad (\text{C-4})$$

where Z is the random variable function of the two signals, $Z \equiv \vartheta_1 - \vartheta_2$, and F_Z is its cumulative distribution function. In order to derive the analytical expression for $F_Z(0)$ we need to integrate the joint distribution of the two independent random variables ϑ_1 and ϑ_2 over the area in the joint support on the $(\vartheta_1, \vartheta_2)$ -plane where $\vartheta_2 \geq \vartheta_1$. The joint pdf $p(\cdot, \cdot)$ of two independent random variables is the product of their distributions, therefore:

$$p(\vartheta_1, \vartheta_2) = \frac{1}{q_2(\theta_1, \varphi) - q_1(\theta_1, \varphi)} \times \frac{1}{q_2(\theta_2, \varphi) - q_1(\theta_2, \varphi)} \quad (\text{C-5})$$

and, given our specification of the functions $q_1(\theta_i, \varphi)$ and $q_2(\theta_i, \varphi)$:

$$p(\vartheta_1, \vartheta_2) = \frac{1}{(1 - \varphi)^2} \quad (\text{C-6})$$

Notice that the condition $\theta_1 < \theta_2$ plus our specification of $q_1(\theta_i, \varphi)$ and $q_2(\theta_i, \varphi)$ imply the following two inequalities:

$$q_1(\theta_1, \varphi) = \theta_1 \varphi < \theta_2 \varphi = q_1(\theta_2, \varphi) \quad \forall \varphi > 0 \quad (\text{C-7})$$

$$q_2(\theta_1, \varphi) = (\theta_1 - 1)\varphi + 1 < (\theta_2 - 1)\varphi + 1 = q_2(\theta_2, \varphi) \quad \forall \varphi > 0 \quad (\text{C-8})$$

that become identities for $\varphi = 0$. (C-7) and (C-8) imply that the two points $(q_1(\theta_1, \varphi), q_1(\theta_2, \varphi))$ and $(q_2(\theta_1, \varphi), q_2(\theta_2, \varphi))$ lie always above the 45 degree line in the $(\vartheta_1, \vartheta_2)$ -plane. In order to identify the area in the joint support of ϑ_2 and ϑ_1 where $\vartheta_2 \geq \vartheta_1$ we just have to distinguish the following two cases:

1. if $q_2(\theta_1, \varphi) > q_1(\theta_2, \varphi)$ which, given our specifications is equivalent to the condition $\varphi < 1/(1 + \delta)$, the area where the joint pdf has to be integrated is given in Figure C-1;
2. if instead $q_2(\theta_1, \varphi) \leq q_1(\theta_2, \varphi)$, which means $\varphi \geq 1/(1 + \delta)$, we have that the area

where the joint pdf has to be integrated is given in Figure C-2.

We have now all the ingredients to write the following expression for $F_Z(0)$:

$$F_Z(0) = \begin{cases} \int_{q_1(\theta_1, \varphi)}^{q_1(\theta_2, \varphi)} \int_{q_1(\theta_2, \varphi)}^{q_2(\theta_2, \varphi)} p(\vartheta_1, \vartheta_2) d\vartheta_2 d\vartheta_1 + \int_{q_1(\theta_2, \varphi)}^{q_2(\theta_1, \varphi)} \int_{\vartheta_1}^{q_2(\theta_2, \varphi)} p(\vartheta_1, \vartheta_2) d\vartheta_2 d\vartheta_1 & \text{if } 0 \leq \varphi < \frac{1}{1+\delta} \\ \int_{q_1(\theta_1, \varphi)}^{q_2(\theta_2, \varphi)} \int_{q_1(\theta_2, \varphi)}^{q_2(\theta_2, \varphi)} p(\vartheta_1, \vartheta_2) d\vartheta_2 d\vartheta_1 & \text{if } \frac{1}{1+\delta} \leq \varphi \leq 1 \end{cases} \quad (\text{C-9})$$

Plugging the expressions for the joint distribution $p(\vartheta_1, \vartheta_2)$, for $q_1(\theta_2, \varphi)$, for $q_2(\theta_2, \varphi)$ and rearranging we get:

$$\Pi(1) = F_Z(0) = \begin{cases} \frac{1}{2} + \frac{\delta\varphi}{1-\varphi} \left[1 - \frac{1}{2} \frac{\delta\varphi}{1-\varphi} \right] & \text{if } 0 \leq \varphi < \frac{1}{1+\delta} \\ 1 & \text{if } \frac{1}{1+\delta} \leq \varphi \leq 1 \end{cases} \quad (\text{C-10})$$

The probability of choosing country 2 is then:

$$\Pi(2) = 1 - F_Z(0) = \begin{cases} \frac{1}{2} \left[\frac{\varphi(1+\delta)-1}{(1-\varphi)^2} \right]^2 & \text{if } 0 \leq \varphi < \frac{1}{1+\delta} \\ 0 & \text{if } \frac{1}{1+\delta} \leq \varphi \leq 1 \end{cases} \quad (\text{C-11})$$

Point (i) and (ii) easily follow from the study of $\Pi(1)$ and $\Pi(2)$. ■

Proof of Corollary 3.0. if $\tau > 0$, by construction we have that $E[q_1(\varphi)] > E[q_2(\varphi)] > 0$ $\forall \varphi > 0$ and $E[q_1(\varphi)] = E[q_2(\varphi)] > 0$ for $\varphi = 0$. Moreover, from point (ii) of Lemma 3.1 we know that $\Pi(1) > \Pi(2)$ $\forall \varphi > 0$ and $\Pi(1) = \Pi(2)$ for $\varphi = 0$. Finally, again from Lemma 3.1 we know that there are many values of φ and δ for which both $\Pi(1)$ and $\Pi(2)$ are strictly positive. It follows that:

$$q_1 = \int_0^1 E[q_1(\varphi)] \times \Pi(1) d\varphi > \int_0^1 E[q_2(\varphi)] \times \Pi(2) d\varphi = q_2 > 0 \quad (\text{C-12})$$

The result follows by construction given that $y_i = f(q_i)$ with f strictly positive and increasing. ■

Figure C-1: area in the joint support where $\vartheta_2 \geq \vartheta_1$ (case 1)

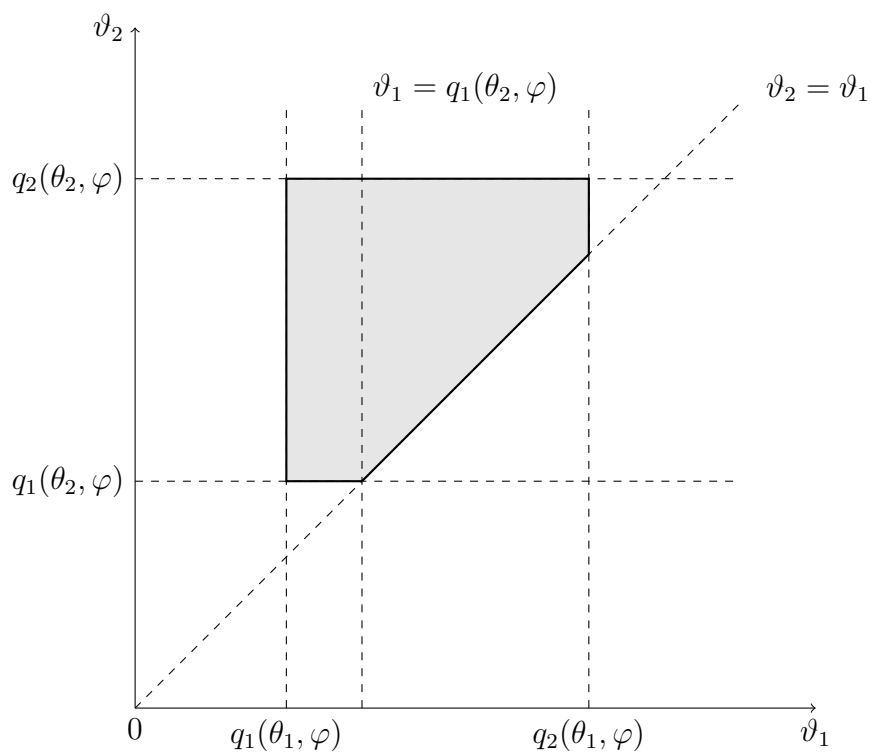
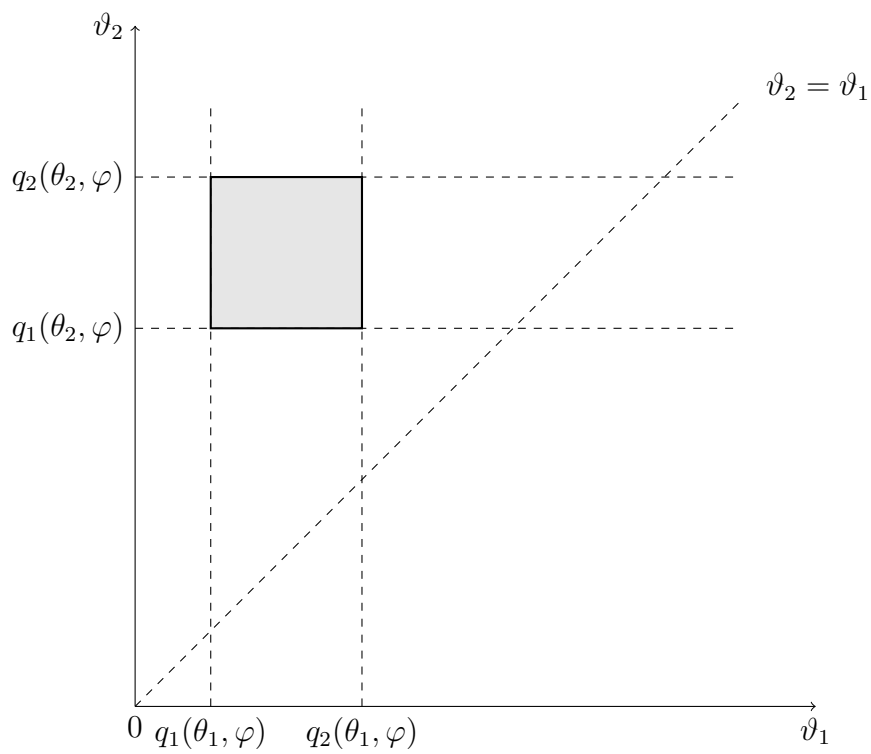


Figure C-2: area in the joint support where $\vartheta_2 \geq \vartheta_1$ (case 2)



Appendix D

Appendix to Chapter 4

D.1 Appendix Figures and Tables

Figure D-1: Marginal effect of input penetration on GATS commitment: renting services

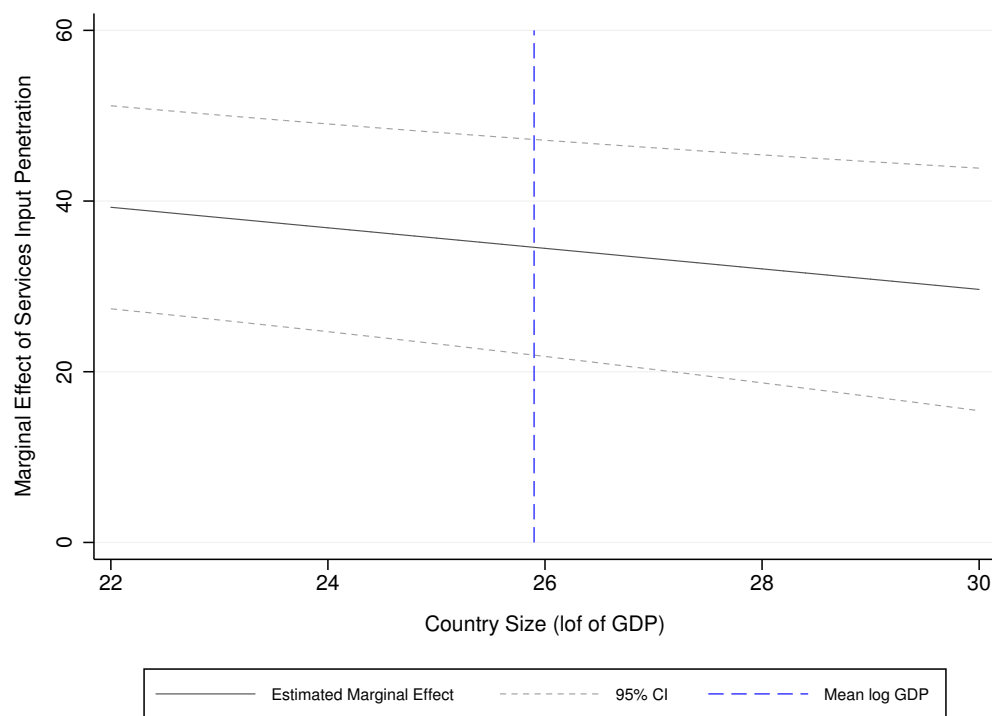


Figure D-2: Marginal effect of input penetration on GATS commitment: ITC services

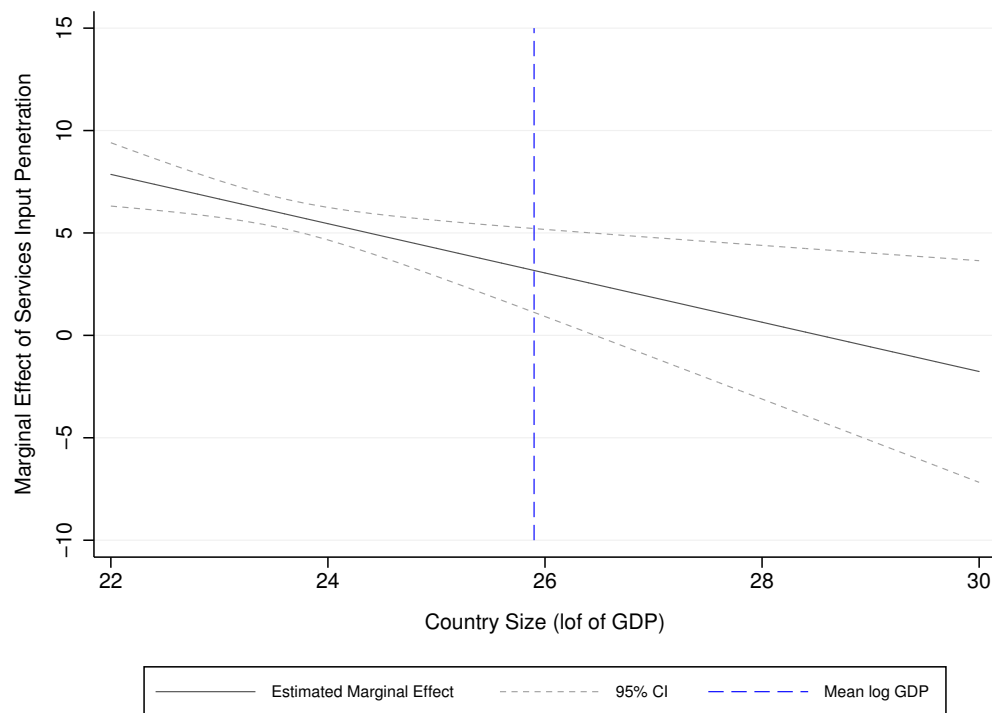


Figure D-3: Marginal effect of input penetration on GATS commitment: business services

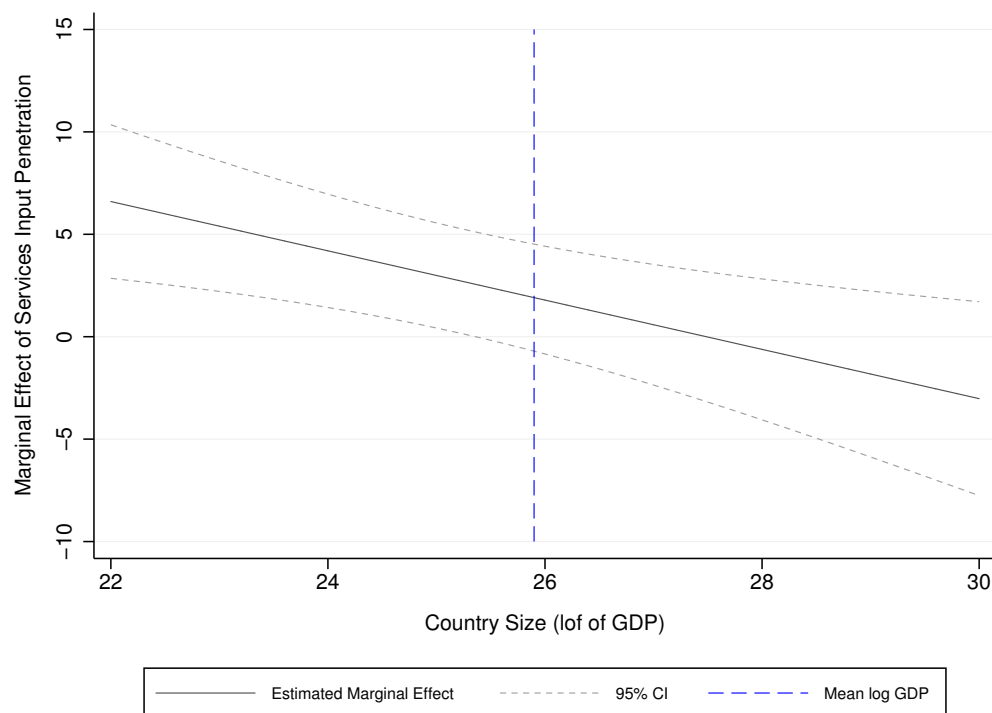


Table D-1: Mode 3 Services Trade Restrictiveness by country and sector

Country	STRI			
	Finance	Telecom	Transport	Professional
Albania	0	0	27.78	25
Argentina	0	0	22.22	50
Armenia	0	0	25	5
Australia	43.54	25	12.5	15
Austria	0	0	36.36	55
Burundi	45.92	0	0	35
Belgium	0	0	34.72	35
Bangladesh	40.31	62.5	54.17	0
Bulgaria	0	25	4.17	55
Bahrain	50	50	55.56	55
Belarus	50	62.5	27.27	20
Bolivia	9.69	25	0	0
Brazil	33.84	0	12.5	50
Botswana	25	50	50	25
Canada	25	50	27.78	40
Chile	25	25	25	0
China	31.46	50	22.22	70
Cote d'Ivoire	15.31	25	16.67	65
Cameroon	19.39	0	33.33	40
Congo, Dem. Rep.	54.08	50	58.33	30
Colombia	25	50	2.08	20
Costa Rica	25	37.5	33.33	20
Czech Republic	0	0	36.36	40
Germany	0	0	36.11	70
Denmark	0	0	26.39	40
Dominican Republic	0	0	22.22	25
Algeria	18.54	25	81.25	40
Ecuador	0	0	0	0
Egypt, Arab Rep.	50	25	55.56	80
Spain	0	0	30.56	20
Ethiopia	100	100	87.5	80
Finland	25	0	26.39	30
France	0	12.5	55.56	50
United Kingdom	0	0	34.72	30
Georgia	9.69	0	0	15
Ghana	25	25	0	50
Greece	0	0	52.78	15
Guatemala	9.69	0	16.67	30
Honduras	0	50	39.58	10

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Table D-1 – *Continued from previous page*

Country	STRI			
	Finance	Telecom	Transport	Professional
Hungary	9.69	0	50	20
Indonesia	25	25	72.22	100
India	50	50	65.28	100
Ireland	0	0	26.39	30
Iran, Islamic Rep.	100	75	54.17	50
Italy	12.93	0	44.44	40
Jordan	30.61	25	72.22	80
Japan	0	25	22.92	50
Kazakhstan	25	25	6.82	5
Kenya	28.23	25	22.22	80
Kyrgyz Republic	6.46	0	40.91	5
Cambodia	3.23	25	34.03	40
Korea, Rep.	0	50	20.83	60
Kuwait	50	75	50	75
Lebanon	25	25	73.33	80
Sri Lanka	25	50	51.39	50
Lesotho	0	25	9.38	20
Lithuania	0	0	25	20
Morocco	9.69	25	22.22	35
Madagascar	25	25	0	35
Mexico	9.69	37.5	68.75	30
Mali	21.77	50	0	100
Mongolia	0	0	27.27	5
Mozambique	15.31	75	0	0
Mauritius	9.69	0	20	40
Malawi	25	50	31.82	15
Malaysia	50	25	58.33	65
Namibia	25	50	34.03	80
Nigeria	34.69	25	20.83	20
Nicaragua	9.69	0	34.03	0
Netherlands	0	0	30.56	40
Nepal	25	50	48.86	75
New Zealand	0	37.5	8.33	10
Oman	34.69	62.5	45	50
Pakistan	50	12.5	19.44	45
Panama	0	25	41.67	60
Peru	25	0	10.42	20
Philippines	40.31	50	50	100
Poland	0	0	31.94	25
Portugal	0	0	34.72	20
Paraguay	25	37.5	0	5

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Table D-1 – *Continued from previous page*

Country	STRI			
	Finance	Telecom	Transport	Professional
Qatar	75	100	63.33	50
Romania	12.93	0	8.33	35
Russian Federation	50	50	8.33	0
Rwanda	25	75	20.31	25
Saudi Arabia	50	25	44.44	70
Senegal	15.31	25	25	25
Sweden	0	0	8.33	20
Thailand	50	50	50	50
Trinidad and Tobago	0	0	23.33	40
Tunisia	34.69	25	61.11	75
Turkey	0	0	34.72	95
Tanzania	25	25	23.61	50
Uganda	18.54	25	6.82	30
Ukraine	25	25	20.83	30
Uruguay	40.31	62.5	47.22	0
United States	25	0	16.67	50
Uzbekistan	25	50	27.27	30
Venezuela, RB	25	25	36.81	90
Vietnam	40.31	50	44.44	10
Yemen, Rep.	34.69	37.5	13.33	70
South Africa	25	25	47.92	60
Zambia	9.69	75	0	50
Zimbabwe	50	62.5	68.18	50

Source: World Bank's Services Trade Restrictions Database

The Services Trade Restrictiveness Index goes from 0 (fully open) to 100 (fully restricted).

Table D-2: List of countries

HICs		MICs
Australia	Japan	Argentina
Austria	Korea	Brazil
Belgium	Luxembourg	China
Canada	Netherlands	Colombia
Chile	New Zealand	Costa Rica
Czech Republic	Norway	India
Germany	Portugal	Indonesia
Denmark	Singapore	Malaysia
Finland	Spain	Mexico
France	Sweden	Philippines
Greece	Switzerland	Thailand
Iceland	UK	Vietnam
Italy	USA	

Income regions follow the World Bank categories for 2014

Table D-3: List of services sectors

DENOMINATION	ISIC Rev. 3
construction	45
transport	60-63
post and telecommunications	65-67
financial intermediation	45
real estate activities	70
renting services	71
IT services	72
R&D and business services	73-74

Table D-4: Main Estimation Results

Dep Var: y (GATS Commitment)	(1)	(2)
x	33.241** (10.790)	24.481** (9.113)
GDP	0.047*** (0.012)	0.034** (0.010)
$x \times GDP$	-1.203** (0.429)	-0.943* (0.436)
EU	-0.050 (0.039)	-0.044 (0.039)
FTA	2.380*** (0.600)	2.443*** (0.589)
$SKILLED$	0.082** (0.026)	0.088*** (0.024)
$x \times \text{TRANSPORT}$	-4.717** (1.691)	-2.033 (4.425)
$x \times \text{POST \& TELECOM}$	0.375 (2.305)	-6.574*** (1.347)
$x \times \text{FINANCE}$	-5.319** (1.524)	-2.781 (4.670)
$x \times \text{REAL ESTATE}$	9.887*** (0.413)	9.911*** (1.334)
$x \times \text{RENTING}$	32.494*** (4.584)	33.014*** (4.736)
$x \times \text{IT SERVICES}$	1.084 (1.692)	20.535*** (3.117)
$x \times \text{BUSINESS}$	-0.176 (0.586)	1.173 (3.542)
Constant	-1.020** (0.337)	-0.681* (0.293)
Observations	304	304
R-squared	0.308	0.285
x measure of input into:	total output	manuf.

Robust standard errors in parenthesis

Statistical significance: *0.1, ** 0.05, *** 0.01

Sector fixed effects always included

Construction services as base

D.2 Proofs

Proof of Proposition 4.1. For the equilibrium solution $n^N = -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right)$ we need to find the parameters for which $n^N < n_0$. Indeed the domestic services firms give contributions to the government to lower the number of final firms. They would not contribute for a number of firms higher than the level chosen in the case of no lobbying. We have

$$n^N = n_0 - \ln\left(\frac{a - n_d}{a - 2n_d}\right)$$

By definition of \ln we need to have $\frac{a-n_d}{a-2n_d} > 0$. Therefore we have either $a-2n_d < a-n_d < 0$ or $0 < a-2n_d < a-n_d$.

The first case is not an equilibrium.

$$\begin{aligned} & a - 2n_d < a - n_d \\ \Rightarrow & \frac{a - n_d}{a - 2n_d} < 1 \\ \Rightarrow & \ln\left(\frac{a - n_d}{a - 2n_d}\right) < 0 \\ \Rightarrow & n^N > n_0 \end{aligned}$$

Therefore when $a - n_d < 0 \Rightarrow n_d > a$, there is no equilibrium with positive contributions. The second case defines the restrictions on the parameter to have an equilibrium solution with positive contributions.

$$\begin{aligned} & a - 2n_d < a - n_d \\ \Rightarrow & \frac{a - n_d}{a - 2n_d} > 1 \\ \Rightarrow & \ln\left(\frac{a - n_d}{a - 2n_d}\right) > 0 \\ \Rightarrow & n^N < n_0 \end{aligned}$$

Therefore we need $0 < a - 2n_d < a - n_d \Rightarrow n_d < \frac{a}{2}$. This defines the regularity condition of the equilibrium. ■

Proof of Proposition 4.2.

(i) WWTS $\Omega(\sigma = 0) > 0$.

$$\Omega = G_0 - G^N = aW(n_0, K_0) - aW(n^N, K^N) - \tilde{c}$$

Using equilibrium expressions we can write

$$\begin{aligned}
aW(n^N, K^N) + c - aW(n_0, K^N) &= \frac{\sigma}{1-\sigma} [\Pi^S(n^N, K^N) - c - \Pi(n_0, K^N)] \\
\Rightarrow c[\frac{1}{1-\sigma}] &= \frac{\sigma}{1-\sigma} [\Pi^S(n^N, K^N) - \Pi(n_0, K^N)] - aW(n^N, K^N) + aW(n_0, K^N) \\
\Rightarrow c + aW(n^N, K^N) &= \sigma [\Pi^S(n^N, K^N) - \Pi(n_0, K^N)] + a\sigma W(n^N, K^N) + a(1-\sigma)W(n_0, K^N)
\end{aligned}$$

$$\Omega = aW(n_0, K_0) - aW(n_0, K^N) - \sigma [\Pi^S(n^N, K^N) - \Pi(n_0, K^N)] + \sigma a [W(n_0, K^N) - W(n^N, K^N)] \quad (\text{D-1})$$

and

$$\Omega(\sigma = 0) = aW(n_0, K_0) - aW(n_0, K^N)$$

Consider the result $S(n_0, K^N) = K^N$. This allows us to write $f(K^N, S(n_0, K^N)) = f(K^N, K^N) := f(K^N)$. We can now write the welfare

$$W(n_0, K^N) = (v - f(K^N))f(K^N) + h(v - f(K^N))$$

Similarly we use the equilibrium result $S(n_0, K_0) = K_0$ to write $f(K_0, S(n_0, K_0)) = f(K_0, K_0) := f(K_0)$. Therefore

$$W(n_0, K_0) = (v - f(K_0))f(K_0) + h(v - f(K_0))$$

Define the function $g(x)$ by $g(x) = (v - f(x))f(x) + h(v - f(x))$ with $h(x) = (v - x)^2/2$. Taking the derivative of g we get $g'(x) = f'(x)(1 - f(x)) > 0$. Moreover we know that $K^N < K_0$. Therefore $W(n_0, K_0) - W(n_0, K^N) > 0$

- (ii) (a) We can express Ω (take its expression in (D-1)) as a linear function of σ of the kind $\Omega(\sigma) = Y\sigma + Z$. First we show that $W(n_0, K^N) - W(n^N, K^N) = 0$. To see this we use the result $S(n_0, K^N) = K^N$ that allows us to write $f(K^N, S(n_0, K^N)) = f(K^N, K^N) := f(K^N)$. We can now write the welfare

$$W(n_0, K^N) = (v - f(K^N))f(K^N) + h(v - f(K^N))$$

Similarly we use the equilibrium result $S(n^N, K^N) = K^N$ to write $f(K^N, S(n^N, K^N)) = f(K^N, K^N) := f(K^N)$. Therefore

$$W(n^N, K^N) = (v - f(K^N))f(K^N) + h(v - f(K^N))$$

We conclude that $W(n_0, K^N) = W(n^N, K^N)$. Given this we have $\Omega(\sigma) =$

$Y\sigma + Z$ with

$$Y = -[\Pi^S(n^N, K^N) - \Pi(n_0, K^N)]$$

and

$$Z = aW(n_0, K_0) - aW(n_0, K^N) (> 0)$$

(b) We show that $Y < 0$. Given equilibrium expressions we can write

$$\pi^S(n^N, K^N) = A\tilde{P}^F f'(K^N)$$

$$\pi^S(n_0, K^N) = \frac{K^N}{n_0} P^F(n_0, K^N) f'(K^N) = \frac{K^N}{n_0} \tilde{P}^F f'(K^N)$$

the second equality comes from the following

$$P^F(n_0, K^N) = v - f(K^N, S(n_0, K^N)) = v - f(K^N) = \tilde{P}^F$$

We can now write the slope Y .

$$\begin{aligned} Y &= -n_d [\pi^S(n^N, K^N) - \pi(n_0, K^N)] \\ &= -n_d \left[A - \frac{K^N}{n_0} \right] P^F f'(K^N) \text{ with } K^N = An^N \\ &= -n_d A \left[1 - \frac{n^N}{n_0} \right] P^F f'(K^N) \end{aligned}$$

Given that $n^N < n_0$ and $f'(K^N) > 0$ we can conclude that $Y < 0$.

From this we can define $\tilde{\sigma}$ such that $\Omega(\tilde{\sigma}) = 0$ and

$$\tilde{\sigma} = \frac{-Z}{Y}$$

(c) We want to find the parameters a, n_d, v for which $\frac{-Z}{Y} < 1$.

Using the results $n^N = -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right)$ and $n_0 = -\ln(1-v)$ we have :

$$\begin{aligned} Y &= (v-1) \left[n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right] + \left[n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right]^2 \\ Z &= \frac{a(v-1)^2}{2} + (v-1)a \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right] + \left[a/2 \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right]^2 \end{aligned}$$

$$\begin{aligned} \Rightarrow \Omega = & \frac{a(v-1)^2}{2} + (v-1) \left[a + \sigma n_d \frac{\ln(\frac{a-n_d}{a-2n_d})}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right] + \\ & + \left[a/2 + \sigma n_d \frac{\ln(\frac{a-n_d}{a-2n_d})}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right]^2 \end{aligned}$$

To simplify the expression, we write $X = \frac{(1-v)(a-n_d)}{a-2n_d}$ and $C = -n_d \frac{\ln(\frac{a-n_d}{a-2n_d})}{\ln(1-v)}$. Therefore we have $-Z = \frac{a}{2}X^2 + a(v-1)X + a\frac{(v-1)^2}{2}$ and $Y = C[X(v-1) + X^2]$. We want to find the parameters for which : $\frac{-Z}{Y} < 1$.

After some algebra we get

$$\tilde{\sigma} = \frac{-Z}{Y} = \frac{\ln(1-v)}{2\ln(\frac{a-n_d}{a-2n_d})(n_d-a)}$$

notice that both the numerator and the denominator of the above expression are strictly smaller than 0, therefore $\frac{-Z}{Y} < 1$ if and only if

$$\ln(1-v) > 2\ln\left(\frac{a-n_d}{a-2n_d}\right)(n_d-a) \quad (\text{D-2})$$

Notice that the LHS of (D-2) is a monotonically decreasing function of v while the RHS of (D-2) is constant with respect to v . Therefore there exists unique a threshold value V such that $\forall v < V$ inequality (D-2) is verified. It is easy to get the expression

$$V = 1 - \exp\left[2\ln\left(\frac{a-n_d}{a-2n_d}\right)(n_d-a)\right]$$

Notice that $V \in (0, 1)$. We conclude that, fixing any pair $(a, n_d) \in \mathbb{R}^+ \times \mathbb{R}^+$ that verify the regularity condition $n_d < a/2$, for any $v < V$, $\tilde{\sigma} < 1$, therefore $\exists! \bar{\sigma}(= \tilde{\sigma}) \in (0, 1)$ such that $\Omega(\bar{\sigma}) = 0$. Since we have already shown that Ω is monotonically decreasing in σ the proof is complete.

■

Proof of Proposition 4.3. First we detail how to find the equilibrium policy n^f . The surplus that is maximised is

$$\mathbb{J}^F(n) = aW(n) + (n - n_d)\pi(n)$$

$$\begin{aligned}
\mathbb{J}^{F'}(n) &= a[(v - f(n))f'(n)] + \pi(n) + \gamma(n - n_d)\pi'(n) \\
0 &= a[(v - f(n))f'(n)] + [v - f(n)]f'(n) - (n - n_d)(f'(n) + v - f(n)) \\
0 &= a[(v - 1 + e^{-n})e^{-n}] + [v - 1 + e^{-n}]e^{-n} - (n - n_d)[2e^{-n} + v - 1]e^{-n} \\
0 &= a[(v - 1 + e^{-n})] + [v - 1 + e^{-n}] - (n - n_d)[2e^{-n} + v - 1] \\
0 &= [a + -2(n - n_d)]e^{-n} + (v - 1)[a + -(n - n_d)]
\end{aligned}$$

The solution of the surplus maximization is

$$n^f = -\ln\left(\frac{(1 - v)(1 + a - (n^f - n_d))}{1 + a - 2(n^f - n_d)}\right)$$

Given this expression we have to show that this is well defined to prove the existence and uniqueness of the equilibrium under foreign lobbying.

Similar to the equilibrium with national lobbying only, we define a necessary condition for the initial parameters for the solution to be well-defined:

$$1 + a - 2(n^f - n_d) > 0 \Rightarrow n^f < \frac{1 + a + 2n_d}{2}$$

Given this necessary condition, we need to prove that there exists a unique solution n^f which is well-defined by this equation.

$$n^f = -\ln\left(\frac{(1 - v)(1 + a - (n^f - n_d))}{1 + a - 2(n^f - n_d)}\right)$$

We define a new function g by

$$g(n^f) = -\ln\left(\frac{(1 - v)(1 + a - (n^f - n_d))}{1 + a - 2(n^f - n_d)}\right)$$

The solution n^f to the joint welfare maximization program is such that $g(n^f) = n^f$. We

denote the denominator by D and the numerator by N. We have:

$$\begin{aligned}\frac{\partial g}{\partial n^f} &= -\frac{D - (1-v)D + 2N}{N D^2} \\ \Rightarrow \frac{\partial g}{\partial n^f} &= -\frac{(1+a)(1-v)}{ND} \\ \Rightarrow \frac{\partial g}{\partial n^f} &< 0\end{aligned}$$

We can now prove the existence and unicity. The function Identity ($n \rightarrow n$) is strictly increasing and starts at 0 and goes towards infinity, whereas the function g is strictly decreasing in n^f and $g(n^f) > 0$. This implies the existence of the solution n^f and its unicity.

Second we show that the trade policy is increasing in the number of domestic firms n_d and in the government's social valuation a .

$$\begin{aligned}\frac{\partial n^f}{\partial n_d} + \frac{1+a-2(n^f-n_d)}{1+a-n^f+n_d} \frac{(-\frac{\partial n^f}{\partial n_d} + 1)(1+a-2(n^f-n_d)) - (1+a-n^f+n_d)(-2\frac{\partial n^f}{\partial n_d} + 2)}{(1+a-2(n^f-n_d))^2} &= 0 \\ \Rightarrow \left[1 + \frac{1+a}{(1+a-2(n^f-n_d))(1+a-n^f+n_d)} \right] \frac{\partial n^f}{\partial n_d} &= \frac{1+a}{(1+a-2(n^f-n_d))(1+a-n^f+n_d)} \\ \Rightarrow \frac{\partial n^f}{\partial n_d} &\geq 0\end{aligned}$$

$$\begin{aligned}\frac{\partial n^f}{\partial a} + \frac{1+a-2(n^f-n_d)}{1+a-n^f+n_d} \frac{(-\frac{\partial n^f}{\partial a} + 1)(1+a-2(n^f-n_d)) - (1+a-n^f+n_d)(-2\frac{\partial n^f}{\partial a} + 1)}{(1+a-2(n^f-n_d))^2} &= 0 \\ \Rightarrow \left[1 + \frac{1+a}{(1+a-2(n^f-n_d))(1+a-n^f+n_d)} \right] \frac{\partial n^f}{\partial a} &= \frac{n^f-n_d}{(1+a-2(n^f-n_d))(1+a-n^f+n_d)} \\ \Rightarrow \frac{\partial n^f}{\partial a} &\geq 0\end{aligned}$$

■

Proof of Remark 4.4. First we show that there exists a mass of national firms n_d^- for which the trade policy under national lobbying only n^N and the trade policy under foreign lobbying only n^f are equal.

$$\begin{aligned}
n^N &= n^f \\
\Rightarrow -\ln\left(\frac{(1-v)(a-n_d^-)}{a-2n_d^-}\right) &= -\ln\left(\frac{(1-v)(1+a-(n^f-n_d^-))}{(1+a-2(n^f-n_d^-))}\right) \\
\Rightarrow \frac{a-n_d^-}{a-2n_d^-} &= \frac{(1+a-(n^f-n_d^-))}{(1+a-2(n^f-n_d^-))} \\
\Rightarrow (a-n_d^-)(1+a-2(n^f-n_d^-)) &= (a-2n_d^-)(1+a-(n^f-n_d^-)) \\
\Rightarrow [-2(a-n_d^-) + (a-2n_d^-)]n^f &= (a-2n_d^-)(1+a+n_d^-) - (a-n_d^-)(1+a+2n_d^-) \\
\Rightarrow -an^f &= -n_d(1+a) + (a-2n_d^-)n_d^- - 2(a-n_d^-)n_d^- \\
\Rightarrow n^f &= n_d^- \frac{1+2a}{a}
\end{aligned}$$

In addition we know that

$$\begin{aligned}
n^f &= n^N = -\ln\left(\frac{(1-v)(a-n_d^-)}{a-2n_d^-}\right) \\
\Rightarrow n_d^- \frac{1+2a}{a} &= -\ln\left(\frac{(1-v)(a-n_d^-)}{a-2n_d^-}\right) \\
\Rightarrow n_d^- &= -\frac{a}{1+2a} \ln\left(\frac{(1-v)(a-n_d^-)}{a-2n_d^-}\right)
\end{aligned}$$

We previously proved that n^N is strictly decreasing in n_d whereas n^f is strictly increasing in n_d . Therefore for $n_d \leq n_d^-$, $n^N \geq n^f$ and $n_d \geq n_d^-$, $n^N \leq n^f$. This proves the second part of the proposition. ■

Proof of Proposition 4.4.

We need to prove that there exists a unique solution n^γ which is well-defined by this equation.

$$n^\gamma = -\ln\left(\frac{(1-v)(a+\gamma-\gamma n^\gamma - (1-\gamma)n_d)}{(a+\gamma-2\gamma n^\gamma - 2(1-\gamma)n_d)}\right)$$

First we define a new function g with two variables γ with $\gamma > 0$ and n^γ such that

$$g(\gamma, n^\gamma) = -\ln\left(\frac{(1-v)(a+\gamma-\gamma n^\gamma - (1-\gamma)n_d)}{(a+\gamma-2\gamma n^\gamma - 2(1-\gamma)n_d)}\right)$$

The solution n^γ to the joint welfare maximization program is such that $g(\gamma, n^\gamma) = n^\gamma$. We denote the denominator by D and the numerator by N. We have:

$$\begin{aligned} \frac{\partial g}{\partial n^\gamma} &= -\frac{D - \gamma D - N(-2\gamma)}{N D^2} \\ \Rightarrow \frac{\partial g}{\partial n^\gamma} &= -\frac{\gamma(a + \gamma)}{N D} \\ \Rightarrow \frac{\partial g}{\partial n^\gamma} &< 0 \end{aligned}$$

We can now prove the existence and unicity. The function Identity ($n \rightarrow n$) is strictly increasing and starts at 0 and goes towards infinity, whereas for γ given, $g(\gamma, \cdot)$ is strictly decreasing in its second argument n and $g(\gamma, 0) > 0$. This implies the existence of the solution n^γ and its unicity. ■

Proof of Proposition 4.5. First we study how the policy n^γ varies with the responsiveness γ of the government to foreign lobbies. Second we determine when the policy chosen by the government ($n^\gamma > 0$) is higher or lower than the one chosen in case of no foreign lobbying (n^N).

First we study how the solution n^γ changes with the responsiveness γ of the government to the lobby of foreign affiliates.

$$n^\gamma = -\ln \left(\frac{(1-v)(a + \gamma - \gamma n^\gamma - (1-\gamma)n_d)}{(a + \gamma - 2\gamma n^\gamma - 2(1-\gamma)n_d)} \right)$$

We call N the denominator and D the numerator.

$$\begin{aligned} \frac{\partial n^\gamma}{\partial \gamma} + \frac{D}{N} \frac{[1 - n^\gamma - \gamma \frac{\partial n^\gamma}{\partial \gamma} + n_d]D - N[1 - 2n^\gamma - 2\gamma \frac{\partial n^\gamma}{\partial \gamma} + 2n_d]}{D^2} &= 0 \\ \Rightarrow [1 - \frac{\gamma}{N} + \frac{2\gamma}{D}] \frac{\partial n^\gamma}{\partial \gamma} &= \frac{-1}{ND} \left\{ D[1 - n^\gamma + n_d] - 2[1 - n^\gamma + n_d]N \right\} \\ \Rightarrow [1 + \gamma \frac{2N - D}{ND}] \frac{\partial n^\gamma}{\partial \gamma} &= -\frac{(D - N) + (D - 2N)[n_d - n^\gamma]}{ND} \\ \Rightarrow [1 + \gamma \frac{a + \gamma}{ND}] \frac{\partial n^\gamma}{\partial \gamma} &= -\frac{(-\gamma n^\gamma - (1 - \gamma)n_d) + (n_d - n^\gamma)(-a - \gamma)}{ND} \\ \Rightarrow [1 + \gamma \frac{a + \gamma}{ND}] \frac{\partial n^\gamma}{\partial \gamma} &= \frac{(n_d + a(n_d - n^\gamma))}{ND} \\ \Rightarrow [1 + \gamma \frac{a + \gamma}{ND}] \frac{\partial n^\gamma}{\partial \gamma} &= \frac{(1 + a)n_d - an^\gamma}{ND} \\ \Rightarrow \text{Sign}\left(\frac{\partial n^\gamma}{\partial \gamma}\right) &= \text{Sign}((1 + a)n_d - an^\gamma) \end{aligned}$$

given that $ND \geq 0$ for the solution to be well-defined.

Therefore

1. If $(1+a)n_d - an^\gamma > 0$ then $\frac{\partial n^\gamma}{\partial \gamma} > 0$
2. If $(1+a)n_d - an^\gamma < 0$ then $\frac{\partial n^\gamma}{\partial \gamma} < 0$

We do not have any closed-form solution for n^γ with $\gamma > 0$. The following part shows that we can still determine the parameters for which n^γ is either decreasing or increasing in γ . First we look at the n^γ in the neighbourhood of $\gamma = 0$ given that we have a closed-form solution for $n^{\gamma=0}$. Second we infer conclusions on the monotonicity of the function.

Let's start in the neighbourhood of $\gamma = 0$ and consider the case (1) where $n^{\gamma=0} < \frac{(1+a)}{a}n_d$. First we consider a small neighbourhood around $\gamma = 0$ and $\gamma > 0$ such that the solution n^γ remains inferior to $(1+a)n_d$ (proof by continuity of n^γ). Then $\forall n^\gamma$ in this neighbourhood, $\frac{\partial n^\gamma}{\partial \gamma} > 0$ from the previous result.

Second we can show by contradiction that $\forall \gamma \geq 0, n^\gamma < \frac{(1+a)}{a}n_d$.

1. We assume that there exists a parameter γ_2 and $n^{\gamma_2} > \frac{(1+a)}{a}n_d$.
2. We are in the case where in the neighbourhood of $\gamma = 0$, $n^{\gamma=0} < \frac{(1+a)}{a}n_d$. By continuity of the solution n^γ and using the theorem of intermediate values, there exists a $\gamma_1 < \gamma_2$ such that $n^{\gamma_1} = \frac{(1+a)}{a}n_d$.
3. Therefore we have $\gamma_1 < \gamma_2$ and $n^{\gamma_2} > \frac{(1+a)}{a}n_d = n^{\gamma_1}$.
4. This contradicts the result that $\frac{\partial n^\gamma}{\partial \gamma} < 0$ for $n^\gamma > \frac{(1+a)}{a}n_d$

To conclude, we have proved that when $n^{\gamma=0} < \frac{(1+a)}{a}n_d$ then $\forall \gamma \geq 0, n^\gamma < \frac{(1+a)}{a}n_d$ and n^γ increases in γ . Similarly we can show that when $n^{\gamma=0} > \frac{(1+a)}{a}n_d$, $\forall \gamma \geq 0, n^\gamma > \frac{(1+a)}{a}n_d$ and n^γ decreases in γ .

Given that we have the closed-form solution of $n^{\gamma=0}$ We can now determine the parameters for which $n^{\gamma=0} < \frac{(1+a)}{a}n_d$ and n^γ increases in γ .

We have that

$$\begin{aligned} n^{\gamma=0} &< \frac{(1+a)}{a}n_d \\ \Rightarrow -\ln\left(\frac{(1-v)(a-n)}{a-2n_d}\right) &< \frac{(1+a)}{a}n_d \end{aligned}$$

We define a function f such that $f(n) = \frac{(1-v)(a-n)}{a-2n} - \exp(-\frac{(1+a)}{a}n)$.

We show that $\forall n, f'(n) = \frac{(1-v)a}{(1-2an)^2} + (1+a)e^{-\frac{(1+a)}{a}n} \geq 0$ if $n \leq \frac{a}{2}$. The latter constraint is the regularity condition ($n_d \leq \frac{a}{2}$) that has restrained our analysis since the beginning. In addition $f(0) = -v < 0$ and $f(\frac{a}{2}) = \infty > 0$.

Therefore using the theorem of intermediate values, there exists a $\tilde{n}_d > 0$ such that:

1. If $n_d \leq \tilde{n}_d$ then $f(n_d) \leq 0$ and $n^{\gamma=0} \geq \frac{(1+a)}{a}n_d$. This defines $S^- = [0, \tilde{n}_d]$.
2. If $n_d \geq \tilde{n}_d$ then $f(n_d) \geq 0$ and $n^{\gamma=0} \leq \frac{(1+a)}{a}n_d$. This defines $S^+ = [\tilde{n}_d, \frac{1}{2a}]$.

We can conclude from this proof that:

1. when n_d is rather small : $n_d \in S^-$

- (a) $n^{\gamma=0} \geq \frac{(1+a)}{a}n_d$
- (b) $\forall \gamma > 0, n^\gamma \leq n^{\gamma=0}$
- (c) $\frac{\partial n^\gamma}{\partial \gamma} \leq 0$

2. when n_d is rather big : $n_d \in S^+$

- (a) $n^{\gamma=0} \leq \frac{(1+a)}{a}n_d$
- (b) $\forall \gamma > 0, n^\gamma \geq n^{\gamma=0}$
- (c) $\frac{\partial n^\gamma}{\partial \gamma} \geq 0$

■

D.3 Derivations of expressions in Subsection 4.4.3

$$\begin{aligned} aW(n^\gamma) + c + \gamma c^f - aW(n_0|K^\gamma) &= \sigma_G \mathbb{J} \\ \Pi(n^\gamma) - c - \Pi(n_0|K^\gamma) &= \sigma_L \mathbb{J} \\ \Pi^f(n^\gamma) - c^f - \Pi^f(n_0|K^\gamma) &= \sigma_{L^f} \mathbb{J} \end{aligned}$$

\Leftrightarrow

$$\begin{aligned} aW(n^\gamma) + c + \gamma c^f - aW(n_0|K^\gamma) &= \frac{\sigma_G}{\sigma_L} [\Pi(n^\gamma) - c - \Pi(n_0|K^\gamma)] \\ \Pi(n^\gamma) - c - \Pi(n_0|K^\gamma) &= \frac{\sigma_L}{\sigma_{L^f}} [\Pi^f(n^\gamma) - c^f - \Pi^f(n_0|K^\gamma)] \end{aligned}$$

\Leftrightarrow

$$\begin{aligned}
c^f &= -\frac{\sigma_{L^f}}{\sigma_L}[\Pi(n^\gamma) - c - \Pi(n_0|K^\gamma)] + \Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma) \\
[1 + \frac{\sigma_G}{\sigma_L} + \gamma \frac{\sigma_{L^f}}{\sigma_L}]c &= \frac{\sigma_G}{\sigma_L}[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] - aW(n^\gamma) + aW(n_0|K^\gamma) \\
&\quad + \gamma \frac{\sigma_{L^f}}{\sigma_L}[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] - \gamma[\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned}$$

\Leftrightarrow

$$\begin{aligned}
c &= \frac{\sigma_G + \gamma\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}}[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad - \frac{\sigma_L}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}}[aW(n^\gamma) - aW(n_0|K^\gamma)] \\
&\quad - \gamma \frac{\sigma_L}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}}[\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned}$$

$$\begin{aligned}
c^f &= \frac{\sigma_{L^f}}{\sigma_L}c - \frac{\sigma_{L^f}}{\sigma_L}[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] + \Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma) \\
&= \frac{\sigma_{L^f}}{\sigma_L} \left[\frac{\sigma_G + \gamma\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} - 1 \right] [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad - \frac{\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} [aW(n^\gamma) - aW(n_0|K^\gamma)] \\
&\quad - \left[\gamma \frac{\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} - 1 \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)] \\
&= \frac{-\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad - \frac{\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} [aW(n^\gamma) - aW(n_0|K^\gamma)] \\
&\quad + \left[\frac{\sigma_L + \sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned}$$

\Leftrightarrow

$$\begin{aligned}
\Omega &= aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - c - \gamma c^f \\
&= aW(n_0|K_0) - aW(n^\gamma|K^\gamma) \\
&\quad - \frac{\sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad + \frac{\sigma_L + \gamma\sigma_{L^f}}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} [aW(n^\gamma) - aW(n_0|K^\gamma)] \\
&\quad - \left[\frac{\gamma\sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned}$$

We proved before that $aW(n^\gamma) = aW(n_0|K^\gamma)$

$$\begin{aligned}
\Omega &= aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - \frac{\sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad - \left[\frac{\gamma\sigma_G}{\sigma_L + \sigma_G + \gamma\sigma_{L^f}} \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned}$$

We define the bargaining power threshold by $\bar{\sigma}_G$ such that $\Omega(\bar{\sigma}_G) = 0$.

$$\frac{\bar{\sigma}_G}{\sigma_L + \bar{\sigma}_G + \gamma\sigma_{L^f}} = \frac{aW(n_0|K_0) - aW(n^\gamma|K^\gamma)}{[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] + \gamma[\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]}$$