



Essays in International Trade

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Thesis submitted for assessment with a view to obtaining the degree of
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Abstract

This thesis tackles three topics in international trade: (i) the motives behind restrictions on Foreign Direct Investments (FDI) and the role of investment agreements, (ii) the determinants of services trade policies, and (iii) the role of domestic institutions in affecting trade flows and the gains from trade.

Tariffs have almost completely disappeared but various barriers that restrict FDI still remain. Many trade agreements and Bilateral Investment Treaties (BITs) have been signed to lower tariffs and reduce the risks of expropriation whereas few agreements have been signed to lower entry barriers. The first chapter looks at the interaction between political and economic motives for protectionism. Lobbies give contributions to the governments to affect the policies. The repatriation of profits by foreign affiliates leads governments to restrict the entry of multinationals. Given these two motives, the cooperative outcome, which differs from the chosen policy, can be implemented through an agreement. However I highlight two reasons that can explain why such agreements might be unnecessary. First foreign lobbying counteracts domestic lobbying and, under certain conditions, can push the government to choose the cooperative outcome without signing an agreement. Second the presence of tax havens where firms shift their profits removes the gains from cooperation and makes an agreement unnecessary.

The second chapter focuses on the determinants of services trade agreements. Most of the literature on trade policy and agreements has focused on goods, tariffs and trade agreements whereas, in this paper, we study services, foreign direct investment and services agreements. We provide a rationale for governments to commit to liberalize.

The third chapter contributes to the debate on the role of various institutions in affecting economic exchanges. We focus here on the role of contract enforcement in shaping the optimal organization of firms and the allocation of entrepreneurs across sectors. Different institutional qualities are a source of comparative advantage and export specialization. We find that liberalization leads to asymmetric gains of trade in terms of productivity and reallocation of resources. The country with the poorest institutions benefits less from trade than the country with the best institutions.

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Overview of the thesis chapters

This thesis contributes to two debates in international trade: (i) the motives behind trade and Foreign Direct Investments (FDI) restrictions and the role of agreements to reduce these barriers, and (ii) the role of domestic institutions in determining trade flows and the gains from trade.

Tariffs have almost completely disappeared but various barriers that restrict FDI and trade in services still remain. The first two chapters study the political and economic motives behind these barriers. Lobbying by industries that value protectionism leads governments to choose higher barriers than the optimal level. A first contribution of this thesis is to focus on the interaction between domestic and foreign lobbies with diverging interests. Influential foreign lobbies could counteract the influence of domestic lobbies for more protectionism. Governments value both domestic and foreign interests while deciding on trade and FDI barriers. A second contribution is to unveil a new economic motive behind barriers that restrict the entry of multinationals (horizontal FDIs). The presence of profit shifting or the repatriation of profits by multinationals is a motive for governments to restrict the entry of multinationals. Foreign affiliates only redistribute part of their profits in the country where they sell their products. The rest is either repatriated home or relocated in tax havens to avoid paying corporate taxes. Foreign affiliates enter the country, compete with domestic firms and repatriate part of their profits. Restrictions emerge when the losses of revenue due to decreasing domestic profits exceed the benefits of lower prices due to more competition. However governments do not take into account the repatriated profits of their firms abroad and choose inefficiently high barriers.

For each of the previous motives, I highlight the role of agreements as (i) a commitment device to help governments avoiding political pressures and the resulting economic inefficiencies and (ii) a solution that allows governments to cooperate and choose Pareto-optimal barriers. A main contribution of this thesis is to study the conditions under which governments choose not to sign agreements. In the case of political lobbying (i) a government that is good at bargaining with lobbies receives high contributions that might compensate for the consumers' losses. In the case of lack of cooperation (ii), an agreement becomes unnecessary if foreign lobbying sufficiently counteracts protectionist forces or if the presence of a third country, a tax haven, undoes the benefits from cooperation between countries.

Domestic institutions affects the optimal organization of heterogenous firms, their final productivity and their comparative advantages to export in an open economy. At the aggregate level they affect the aggregate productivity per sector, the trade flows and the welfare gains from trade. The third chapter of this thesis focuses on institutions that define the lack of not of contract enforcement between suppliers and final producers. Similarly to technology and labor and capital stocks, this chapter shows that the presence of contract enforcement institutions drives the production specialization across sectors of goods that require different number of intermediate inputs. In such a model, the quality of institutions then affects the optimal allocation of entrepreneurs across sectors and the specialization of countries according to their comparative advantages. This results in the gains of trade to depend whether the specialization of a country in a sector benefits the sector with the most productive firms or not. The intuition is that countries that have poor institutions specialize in sectors where the least productive firms are, which can result in aggregate productivity and welfare losses from trade liberalization.

Chapter 1

Profit shifting and FDI restrictions

1.1 Introduction

Tariffs have almost completely disappeared but various Foreign Direct Investment restrictions remain for multinationals (OECD 2010). A large number of trade agreements and Bilateral Investment Treaties (BITs) have been signed whereas few agreements aim at reducing barriers to FDI. FDI is not covered by the WTO and BITs only deal with the risks once a multinational has established. Only 2% of BITs have a chapter on entry restrictions. Why do we see so few agreements removing FDI restrictions? Could the contemporary rise of tax havens where multinationals can shift their profits explain the absence of FDI agreements? While the determinants of tariffs and of trade agreements have been largely studied, there is little analysis of the determinants of FDI restrictions and of investment agreements. I focus on investment agreements that reduce (ex-ante) FDI restrictions whereas most existing investment agreements focus on (ex-post) equitable treatment and expropriation protection once the multinational firm has entered.

In this paper I first study the economic and political determinants of FDI restrictions. The repatriation of profits by multinationals is the main economic determinant of FDI restrictions. This leads governments that do not cooperate to choose inefficient barriers to FDI. An investment agreement can then help them to commit to efficient policies and lower FDI restrictions. However we observe that very few investment agreements to reduce these barriers have been signed. This paper provides two arguments to explain why (i) some countries have lowered their barriers without signing an agreement and why (ii) some countries have kept high barriers and do not want to sign such agreements. In order to understand these facts, I add two additional features: a political dimension where lobbies can give contributions and a tax haven where part of the profits can be shifted.

Lobbying by foreign multinationals to counteract lobbying by domestic firms can explain unilateral reforms to remove barriers to FDI without signing agreements. The presence of a tax haven where firms shift their profits removes the gains from cooperation and makes non-cooperative policies efficient. FDI restrictions remain and investment agreements become unnecessary.

I proceed in four steps. First I build a model to study the economic and political determinants of FDI restrictions. Governments choose whether to restrict the entry of foreign affiliates and multinationals can shift their profits across borders. Domestic markets suffer from imperfect competition and FDI policies are a substitute for domestic reforms to liberalize by allowing more foreign firms to enter and compete with domestic firms. I define the non-cooperative game between the two governments and find an economic rationale for foreign entry restrictions. Foreign affiliates decrease domestic firms' profits and relocate their profits abroad. However the profits from foreign sales that are repatriated and finally benefit domestic consumers are not taken into account when governments decide their policies. These policies are inefficient and agreements that implement the cooperative outcome could allow countries to implement the efficient outcome. It is therefore surprising to observe that very few investment agreements to reduce (ex-ante) FDI restrictions have been signed. I need to complement the model with additional features.

In a second part I look at the political dimension of the policy choice. I allow both domestic firms and foreign affiliates to give contributions to the government. There are two main contributions in this part. First I contribute to the literature on lobbying and trade policies by providing a deeper analysis of the role of foreign lobbies and their interaction with domestic lobbies. Second I consider a bargaining game with more than two agents and use the "coalitional bargaining equilibrium" definition of Compte and Jehiel (2010) to study the outcome when the government and more than one lobby bargain. The policy outcome depends whether the government and all lobbies participate in the bargaining process or not. Sub-coalitions between the government and one lobby only can form and affect the policy decision. I consider the size of the coalition as endogenous and study the conditions under which each sub-coalition emerges. I then show that lobbying by foreign firms can implement the outcome of an agreement under certain restrictions. For an agreement to be redundant, there are three conditions: (i) the foreign lobby should be part of the decision coalition, (ii) profits' repatriation should be sufficiently low, and (iii) governments should sufficiently value foreign contributions compared to domestic contributions. This explains why some countries liberalize and reduce their FDI restrictions without signing agreements.

Third I consider the addition of a tax haven where firms can locate part of their profits. A tax haven is an isolated location without consumers nor producers. The repatriation of profits from one country to another does not take place any more. Part of the profits disappear in the tax haven. Non-cooperative entry policies are now efficient and the gains from cooperation that explain the need for agreements disappear. This explains why some countries choose high barriers and do not want to negotiate agreements. Tax agreements that reduce the role of profit shifting to tax havens are expected to be a first step towards more investment agreements.

I conclude by providing empirical evidence that profits repatriation affects the level of FDI restrictions. I use two datasets that quantify restrictions: the OECD index of FDI restrictions and the World Bank index of foreign restrictions in the services sector. I build two proxies for the multinationals' behavior: a weighted index of corporate tax rates and a weighted index of growth rates. I show that they significantly affect the level of restrictions. When studying both OECD and non-OECD countries, I show that corporate tax rates and growth opportunities in the host country are complement. Lower corporate tax rates only lead to higher policies if growth opportunities are expected.

I contribute first to the literature on trade policies and trade agreements. Motives behind tariffs and trade agreements have been extensively studied through the terms-of-trade literature (Johnson (1953-54), Grossman and Helpman (1995), Bagwell and Staiger (1999)) and the commitment literature (Maggi and Rodriguez-Clare (1998, 2007)). More recently Ossa (2011) build on the Krugman 'new trade' model to show that countries impose inefficiently high tariffs in order to attract firms to locate and increase employment. Mrazova (2009, 2011) use oligopolistic models and show that profit-shifting from the foreign firms towards the domestic firms is a rationale for protectionism. I use a similar oligopolistic model to study the impact of consumer's taste for variety and firms' repatriation on FDI restrictions. Blanchard (2010b) shows that international ownership can mitigate the reasons why countries choose inefficient policies such that a trade agreement can become unnecessary. In my paper I study direct barriers to FDI rather than tariffs and the role of investment agreements rather than trade agreements. To my knowledge, I am among the first to fully study the determinants of FDI entry barriers. Compared to traditional models on tariffs, my paper on horizontal FDIs allows to study non-tradable services or goods facing prohibitive tariffs. Previous papers on the terms-of-trade motive do not cover the case of non-tradable services whose trade had been growing in the last decades. It also brings the possibility for multinationals to choose where profits are redistributed. In the case of exports, all profits benefit owners in the country of origin. In the case of

FDIs, it is more complicated and the location of profits becomes a political parameter for governments when choosing FDI policies. Similarly to previous works, profit shifting is a determinant for trade barriers but it here happens inside multinationals that relocate profits from their affiliates towards the parents.

Lobbying as a determinant for trade policies and agreements has been extensively studied (Maggi and Rodriguez-Clare (1998, 2007), Grossman and Helpman (1994), Gawande et al. (2012))¹ but few papers focus on foreign lobbying. Several papers (Conconi (2003), Antràs and Padró i Miquel (2011a), Aidt and Hwang (2008) and Aidt and Hwang (2014)) have highlighted the positive role of foreign influence on trade policies. Compared to the others Antràs and Padró i Miquel (2011a) develops a political model with a voting mechanism and considers government to government pressures instead of a foreign lobbying channel. Empirical papers have shown the positive impact of foreign lobbying on trade barriers in the US (Gawande et al. (2006)) and on tourism and development in the Caribbean (Gawande et al. (2009)). In my paper I derive the conditions under which foreign lobbying can make an agreement unnecessary by pushing for more entry. Another contribution of the paper is to consider endogenous sub-coalitions between some lobbies and the government.² Compared to Maggi and Rodriguez-Clare (1998), bargaining with more than two players is more difficult to model. I use the concept of "coalition bargaining equilibrium" from Compte and Jehiel (2010) and study the possible outcomes depending on which coalition emerges from the game.

Finally I discuss the effects of the presence of tax havens and tax agreements on FDI. Evidence of a positive effect has proven elusive (Blonigen and Davies (2001), di Giovanni (2005), Davies (2004), Blonigen and Davies (2004), Blonigen et al. (2014)). In this paper I study the effect of profit shifting on FDI policies rather than on FDI flows. Profit shifting through transfer pricing has been shown to mainly benefit a few tax havens (Davies et al. (2014), Vicard (2015), Zucman (2014)). I show that the existence of tax havens lead to high FDI barriers and few agreements to reduce these barriers. Tax treaties that curb the few main tax havens or make transfer pricing very expensive are shown to reduce FDI barriers and make agreements more likely.

The paper is organized in four parts. After detailing the model, I first describe the non-cooperative game between the two countries when governments simultaneously choose

¹Compared to Grossman and Helpman (1994) I show that governments might prefer an agreement over lobbying. Compared to Maggi and Rodriguez-Clare (1998, 2007), lobbying can do better than agreement because of the presence of foreign lobbying.

²In the paper I do not tackle the issue of lobby formation and the free-rider problem like Bombardini (2008). Considering that foreign affiliates and domestic firms can both form a lobby, I focus on the issue of endogenous sub-coalitions between the government and one lobby only.

their policies through a bargaining game with their lobbies. Then I discuss whether an agreement is necessary when foreign lobbying pushes for more entry. I then consider the possibility for firms to shift profits towards tax havens through transfer pricing. Finally the last part provides empirical evidence that higher profit shifting affects foreign restrictions.

1.2 A model of foreign entry restrictions

I consider two countries, Home and Foreign(*), that have symmetric economic and political structures. I now describe the economic and political systems of country Home in detail.

1.2.1 Preferences, technology and industry equilibrium

Preferences Demand functions are identical across countries. There are M firms that produce one good each in country Home. No exports are allowed here and the final number of firms that produce is here determined by the FDI policy. The representative consumer of country Home has a quasilinear-quadratic utility function of the form:

$$\mathbb{U}(q_0, \bar{q}) = q_0 + AQ - \frac{\delta}{2}Q^2 - \frac{1-\delta}{2} \sum_{i=1}^M q_i^2 \quad (1.2.1)$$

where A is a positive constant, q_i is the consumption of firm i 's product, $\bar{q} = (q_1, \dots, q_M)$ is Home's consumption vector, Q is the aggregate consumption ($Q = \sum_{i=1}^M q_i$) and q_0 is Home consumption of the numeraire good. The parameter δ is the substitution index between goods which ranges from 0 to 1. Consumers decreasingly value variety for higher value of the substitution index. When $\delta = 0$ goods are independent and consumers value a balanced consumption bundle. When $\delta = 1$ goods are homogenous and consumers do not care about variety. Maximizing utility, the inverse demand for firm i 's good is

$$p_i = A - (1 - \delta)q_i - \delta Q \quad (1.2.2)$$

with q_i the consumption of firm i 's good and Q the aggregate consumption of all firms' goods.

Technology This paper looks at horizontal FDIs and greenfield investment. Foreign multinationals can set up an affiliate in country Home to start producing and access

foreign markets³. The objective of multinationals is only to sell to foreign consumers and not to re-import intermediate goods. For simplicity we assume either that tariffs or other trade costs are prohibitive or that the product is non-tradable. There are two types of firms that produce in country Home: domestic firms and foreign multinationals. All firms are assumed to have identical production capacity. There is no additional cost for a multinational to open an affiliate abroad. Once the multinational has been allowed to enter the country to produce, there is no cost difference between a domestic firm and a foreign affiliate. All products have the same price. There is a total number of firms M from which M_n are domestic firms and the rest $M_f = M - M_n$ are affiliates from Foreign firms. In the rest of the paper I focus on the short-term equilibrium and assume that the number M_n of domestic firms is exogenous. I use the model of trade with oligopoly used in Mrazova (2011) which is an adaptation of Yi's (1996) extension of the Brander (1981) model. Compared to Mrazova (2011), I allow the number of firms and therefore individual profits to vary according to the government's policy. The consumer's utility depends on both the price and the number of varieties. Strategic interactions between firms depends on the substitution index δ : the higher δ , the more direct is the competition between firms.

Each firm, either a domestic firm or a foreign affiliate, produces an individual quantity $q(M)$ and the total production is given by $Q = M \times q(M)$. All firms produce with constant returns to scale at the same marginal cost z in terms of the numeraire good. All firms are similar and solve $\max_q \pi = (p - z)q$. The first-order condition is

$$p - z - q = 0 \tag{1.2.3}$$

In the Cournot equilibrium,

$$p = \frac{A + z(1 + \delta(M - 1))}{2 + \delta(M - 1)} \quad \text{and} \quad q = \frac{A - z}{2 + \delta(M - 1)} \tag{1.2.4}$$

Prices and individual quantities are decreasing in the total number of firms and the substitution index.

Repatriation of profits A main difference between a model with exports and a model with horizontal FDIs is the possibility or not for firms to choose where to locate their profits. When firms access foreign markets through horizontal FDIs they can leave part

³Horizontal FDI can substitute or complement cross-border exports or be the main mode of provision for non-tradable goods and services. The "non-tradability" of services has been quantified by Jensen (2011) who uses the location of firms and their distance to consumers in the US to build such an index.

of their foreign sales' profits abroad and repatriate the rest of these profits. Therefore the location where profits are redistributed is the first crucial difference between domestic and foreign affiliates in the Home country. Domestic Home firms redistribute all their profits from domestic sales to Home consumers whereas foreign affiliates only redistribute part of their profits to Home consumers. The other part is repatriated in the country of origin and benefits Foreign consumers. The repatriation of profits can happen for several reasons: intra-firm trade, return on equity or tax optimization. A large part of profits repatriation is explained by transfers of rights to intellectual property or of other similar intangibles. For example, this covers the provision of non-tradable services such as insurance, hotels, restaurants and retail for which a licence is required from the parent. Other intangible goods are managerial oversight and planning, marketing know-how, or R&D capital. Atalay et al. (2014)) shows that transfers of intangible goods rather than transfers of goods along the production chain can explain a large part of vertical integration. They find that surprisingly one-half of upstream establishments report no intra-firm shipments to downstream establishments. In this paper we consider firms that all produce a similar good and intra-firm trade is limited to transfers of intangibles.

The frontier between repatriation of profits due to transfer of intangibles and profit shifting for other reasons is thin. The literature on profit shifting lists three main methods to shift profits: (i) contribution of equity or allocation of debts towards affiliates in low-tax countries, (ii) tax inversion through the acquisition of a foreign firm that allows the initial firm to move its headquarter in a low-tax country⁴, and (iii) transfer pricing⁵. In this part i model the case of transfers of intangibles inside the firm for which multinationals set a price that does not need to reflect their real cost. Here transfer pricing allows firms to shift profits. Whereas transfer pricing is regulated and should not be used to transfer profits across borders, the enforcement of an arm's length price for intangibles is a real challenge for tax administrations. Similar transfers of intangibles rarely occur in the market and comparable transfers are difficult. Property rights are risky assets that are difficult to assess. We model the repatriation of profits as a pricing decision for an intangible that has to be bought from the parent firm.

I denote by ϕ the fixed amount per unit of sales that is repatriated. It is similar to a higher unit cost for the foreign affiliate but is not considered as such a cost when choosing its price. This parameter is chosen by the headquarter of the multinational to relocate

⁴Tax inversion is especially used by American firms to avoid paying taxes on all their activities. They acquire and merge with a firm in a low-tax country and relocate their headquarters there. High US tax rates still apply to US earnings but not to profits overseas. This differs from cross-border mergers done for strategic business purposes.

⁵This technique allows firms to shift profits by choosing the pricing of goods and services sold between affiliates. The legal price should be the price of the same goods and services paid by an unrelated party.

profits or not. A higher ϕ results in more relocation of profits towards the country of origin. I do not explicitly model the pricing choice by multinationals⁶.

The domestic profit of a Home firm that is fully redistributed to Home consumers is

$$\pi(M) = (P(M) - z)q(M) = \left(\frac{A - z}{2 + \delta(M - 1)} \right)^2 \quad (1.2.5)$$

with $q(M)$ the production per firm when there are M producers and $P(M)$ the price of the good in the Home country. They all depend on the number of firms producing in the country.

The share of a Home affiliate's profit from sales abroad that is redistributed at Home is

$$\pi^{rep}(M^*) = (\phi - z)q^*(M^*) = \frac{(\phi - z)(A - z)}{2 + \delta(M^* - 1)} \quad (1.2.6)$$

with $q^*(M^*)$ the production per firm and $P(M^*)$ the price given the number M^* of producers in the Foreign country.

The profit of a Foreign affiliate from sales at Home that is redistributed in the Home country is

$$\pi^{*f}(M) = (P(M) - \phi^*)q(M) = \frac{[(A - \phi^*) + (z - \phi^*)(1 + \delta(M - 1))][A - z]}{(2 + \delta(M - 1))^2} \quad (1.2.7)$$

with ϕ^* the parameter that defines the profits relocation behavior of a foreign affiliate.

The share of the profits made by a Home affiliate abroad that is redistributed in the Foreign country is

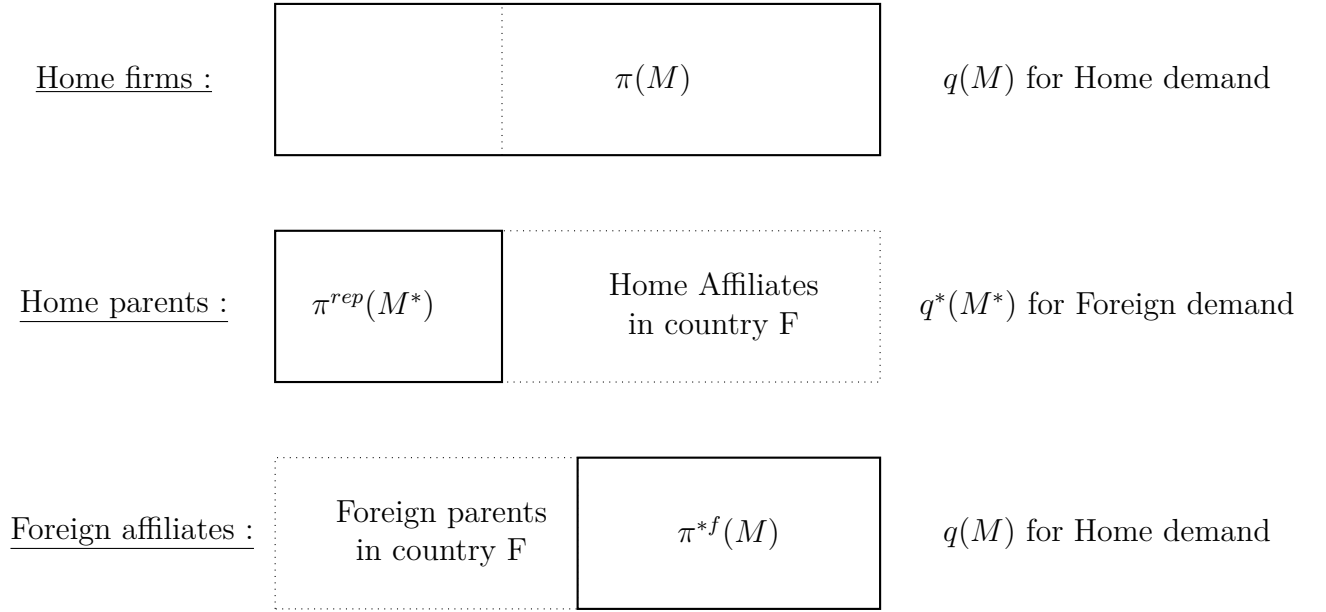
$$\pi^f(M^*) = (P^*(M^*) - \phi)q^*(M^*) = \frac{[(A - \phi) + (z - \phi)(1 + \delta(M^* - 1))][A - z]}{(2 + \delta(M^* - 1))^2} \quad (1.2.8)$$

with $q^*(M^*)$ the individual production per firm in the Foreign country and $P^*(M^*)$ the price given the policy M^* in the Foreign country.

Figure 1.1 represents the profits that are redistributed at Home. Domestic firms leave all their profits at Home, Home parents get a share of the sales from their affiliates abroad, and Foreign affiliates redistribute part of their profits in the host country. The location of

⁶In the empirical section I detail more the determinants of profit relocation. The level of corporate taxes and the existence or not of treaties about double taxation can affect the level of repatriated profits. The presence of tax havens also affects the level of profits that is redistributed in the host country. Finally growth opportunities (growth rates) in the host country lead foreign affiliates to reinvest part of these profits to benefit from the future economic opportunities and to relocate less back in their country of origin.

Figure 1.1: Profits redistributed at Home



profits by multinationals creates a difference between domestic firms and foreign affiliates. All firms have the same individual production, sell at a same price but do not redistribute the same amount of profits at Home.

For the rest of the paper I assume $M_n = M_n^*$ and $\phi = \phi^*$.

The FDI policy The only policy instrument of the government is a market access restriction in the production sector. The government chooses the number of foreign firms that can enter and directly compete with domestic producers. More precisely, the government takes as given the number of domestic firms M_n and sets a value for the total number of producers (including domestic and foreign firms) M which directly determines the number of foreign affiliates allowed to produce in the country ($M - M_n$). This is a model without firm entry such that the additional firms are foreign affiliates that start producing in the Home country. This can be interpreted as a model with a short-term perspective or a model with a sector in which entry costs are prohibitive. The only instrument the government can use to lower the frictions from imperfect competition is the FDI policy. A restrictive policy means that few additional foreign firms start competing with domestic firms whereas a liberal policy means that many foreign firms start producing.

The entry of foreign firms is a key channel to liberalize markets, especially in services sectors in which FDI is a major mode of market access. Several papers show that a key channel to explain why liberalization reforms improve the offer of services is the entry of

foreign firms. Arnold et al. (2011) highlight that foreign entry in services sectors is the key channel to improve performance in the manufacturing sectors. The positive role of foreign entrants in other sectors was shown by Javorcik et al. (2008) and Fernandes and Paunov (2012).⁷

1.2.2 The political game

I now introduce the possibility for firms to form lobbies and exert an influence on the government.

The lobbies

I assume that firms are able to coalesce in a lobby in order to affect the FDI policy chosen by the government. I assume that there are two lobbies in each country, the lobby of domestic firms ("the domestic lobby") and the lobby of foreign affiliates ("the foreign lobby"). Each lobby can give contributions to the government at the time when the government chooses the FDI policy. The domestic and foreign lobbies have different objective functions.

The domestic lobby's objective is given by:

$$L(M, c) = M_n \pi(M) - c$$

with c its contribution to the government. Domestic firms value protection against foreign entry at Home. Indeed a higher number of total firms M producing at Home implies a lower price and therefore a lower profit for domestic firms at Home ($\frac{d\pi(M)}{dM} < 0$). The domestic lobby gives contributions in order to increase the restrictions on foreign entry and lower the choice of the final number M .

The foreign lobby's objective is given by:

$$L^f(M, c^f) = (M - M_n) \pi^{*f}(M) - c^f$$

⁷In Arnold et al. (2011), Foreign firms bring know-how and knowledge about new products. Their presence may also lead domestic providers to improve the quality of their products. Javorcik et al. (2008) focus on the Mexican detergent industry and find that the entry of Walmart reduced the distribution cost for detergent manufacturers. Fernandes and Paunov (2012) studies the impact of FDI inflows in producer service sectors on the productivity of Chilean manufacturing firms. They find that foreign direct investment in the services industries fosters innovation activities in manufacturing. This model does not assume any productivity differences between the domestic and foreign firms but suggests that policies restricting foreign entry are central to liberalize some sectors, especially those for which products are non-tradable.

with c^f its contribution to the government. On the contrary, foreign affiliates might give contributions to either lower or increase protection. More entry increases the number of foreign affiliates (extensive margin). However individual affiliates' profits decrease in the number of total firms M (intensive margin). The foreign lobby maximizes the sum of all foreign affiliates' profits that might be decreasing in the number of firms if individual profits decrease too quickly. This can happen when the government wants a lot of new foreign firms to enter in order to lower the frictions from the imperfect competition framework or when the domestic lobby is weak. The Foreign lobby either pushes towards more protection in the same direction as domestic firms or values more foreign entry⁸.

Lower barriers are preferred by the lobby of foreign firms if the gains from an additional entry are higher than the loses :

$$\underbrace{\pi^{*f}(M)}_{\text{extensive margin}} \geq - \underbrace{(M - M_n)\pi^{*f'}(M)}_{\text{intensive margin}} \quad (1.2.9)$$

The government

The government chooses the FDI policy, i.e. the number of total firms, and whether to bargain with the two lobbies or not. When there is no lobby, the government maximizes the utility of the consumer. The social welfare is given by

$$W(M, M^*) = CS(M) + \underbrace{\tilde{\Pi}(M, M^*)}_{\text{national PS}} + \underbrace{\Pi^{*f}(M)}_{\text{foreign affiliates' PS}} \quad (1.2.10)$$

The producer surpluses are the profits that are redistributed to the domestic consumer. The profits from domestic sales that are repatriated are redistributed to the foreign consumer and do not enter the social welfare W . $\tilde{\Pi}(M, M^*)$ denotes the sum of the profits from the domestic sales of the M_n domestic firms and the repatriated profits from the foreign sales of their affiliates abroad ($\tilde{\Pi}(M, M^*) = M_n\pi(M) + (M^* - M_n)\pi^{rep}(M^*)$). $\Pi^{*f}(M)$ denotes the aggregate profits of the foreign affiliates that are not repatriated ($\Pi^{*f}(M) = (M - M_n)\pi^{*f}(M)$).

Following Grossman and Helpman (1994), I assume that the government differently val-

⁸Other intuitions that are not explicitly modeled are the following. Foreign firms do not enter a foreign market at the same time. Multinationals that enter first lobby value more restrictions whereas those that are among the last want to decrease restrictions to enter the market. The presence of conflicting interests is here represented by a foreign lobby that maximizes the aggregate profit of all potential affiliates. The lobby pushes for more entry when an additional entry creates more than the sum of the individual loses due to the decreasing profit. On the contrary it pushes for less entry if the sum of the individual loses is higher than one more entry.

ues the domestic social welfare and the political contributions. An additional difference between domestic firms and foreign affiliates is introduced here. The first difference comes from the location of redistributed profits that differs between domestic firms and foreign affiliates. A second difference is introduced in the political game. I assume an aversion towards foreign influence. Following Gawande et al. (2006), I model this aversion by a government's valuation of contributions that differs across lobbies. Formal rules can restrict contributions from foreign entities⁹. Such contributions might also be perceived as running against domestic interests¹⁰. The aversion of policy-makers towards foreign contributions can be micro-founded through a probability for the government to be punished by the voters if they discover the existence of foreign contributions. However there exists only poorly documented evidence about the effect of foreign lobbying on governments' choices. 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 domestic and foreign contributions.

When the government accepts contributions from the lobbies, his objective is a weighted average of his social welfare W and the political contributions:¹¹

$$\mathbb{G}(M, M^*, c, c^f) = aW(M, M^*) + c + \gamma c^f$$

with γ is the government's valuation of foreign contributions with $\gamma \geq 0$.

This part ends the description of the economic and political structure of country Home. The two countries, Home (no *) and Foreign (*), are symmetric. I now consider the games played by the two countries to decide their FDI policies.

⁹For example the regulations in 1938 and in 1966 were passed by the Congress in the United-States to restrict and ban foreign lobbying are well explained in Corrado et al. (1997) that study the foreign influence in the United States. Limits on foreign political contributions started in 1938 in order to prevent Nazi money from influencing the political debate. Congress passed the Foreign Agent Registration Act that required agents of foreign entities engaged in "political propaganda" to register and disclose their activities. Later on, bans on political contributions in any US election by any foreign government, political party, corporation, or individual were passed. Nowadays all lobbying expenditures have to be registered and the country of origin is to be mentioned according to the Lobbying Disclosure Act.

¹⁰For example, a few years ago Alibaba hired a very influential lobbying firm when planning for a potential takeover bid for Yahoo. The news was largely covered in the media and the coverage showed a certain suspicion around lobbying from Chinese firms (cf article in the New York Times, "Alibaba Taps Lobbying Firm" by Ben Protess on December 29th, 2011). In addition the idea of an American media to be controlled by a Chinese firm was expected to face obstacles in Washington. This example is particular given the prominent role of the Chinese government in his economy and the role of a large media company but still shows that foreign firms face difficulties to invest in the US and that their lobbying activity is particularly covered in the media.

¹¹Similarly to Grossman and Helpman (1994), I rewrite the initial weights (A, B, D) to have the following expression. Initially the expression is given by $G = AW() + Bc + Dc^f$ and is then rewritten $G = aW() + c + \gamma c^f$ with $a = \frac{A}{B-A}$ and $\gamma = \frac{D-A}{B-A}$ with $B > A$.

1.3 The non-cooperative game between the two governments

In this section, countries simultaneously decide their FDI policy (M) in a non-cooperative way. The policy is chosen through either a simple maximisation of the social welfare or a lobbying game. I describe here the outcome in country Home.

The timing There are two periods in this game. At the beginning, the number of domestic firms born in each country (M_n) is fixed. At $t = 1$ the government chooses the FDI policy, i.e the number of foreign affiliates that can enter the country, when playing the political game with the two lobbies or not. At $t = 2$, given the total numbers of firms (M), production and consumption happen. The same timing happens in the other country.

The equilibrium is solved by backward induction starting from the production/consumption equilibrium at $t = 2$. There are no exports such that the price only depends on the number of firms that have entered the country. The solutions are those of an oligopolistic setting with M firms. I now focus on the policy choice of the government at the period $t = 1$.

1.3.1 The non-cooperative game with no lobbying

I first consider the non-cooperative game when there is no lobbying. There is no contributions and lobbies do not exert an influence on the government. The FDI policy is chosen by maximizing the social welfare W . In this non-cooperative game, the government does not consider the impact of its choice on the policy of the other country. Given the policy in the other country M^* , the number of firms that maximizes the social welfare W defined in equation 1.2.10

$$M_0 = \arg \max_M W(M, M^*) \quad \text{st.} \quad M_n \leq M \leq 2M_n \quad (1.3.1)$$

The full expression of M_0 is given in the annex A.1.4. First we can notice that the solution M_0 does not depend on the similar policy choice of the Foreign government M^* because of the linearity of the profits. Second the solution is restricted because the total number of

firms can not exceed the sum of existing firms from the two countries ($M_n + M_n^* = 2M_n$).¹²

Lemma 1.1 *In the non-cooperative game with no lobbying, FDI policies are increasing in the taste for variety (i.e decreasing in the substitution index δ) such that*

$$\begin{aligned} \text{if } \delta = 1 \text{ (homogenous goods)} \quad , \quad M_0 = M_0^* &= \min \left(2M_n, \max \left(\frac{(A - \phi) - M_n(\phi - z)}{(1 + M_n)(\phi - z)}, M_n \right) \right) \\ \text{if } \delta = 0 \text{ (independent goods)} \quad , \quad M_0 = M_0^* &= 2M_n \end{aligned}$$

There exists a threshold δ_0 such that FDI policies are always free-entry ($= 2M_n$) when consumers sufficiently care for variety ($\delta \leq \delta_0$).

Proof. Existence of δ_0 comes from $\frac{\partial M_0}{\partial \delta} < 0$. ■

Lemma 1.1 provides a necessary condition for restrictions to be chosen. Consumers that care a lot about variety have a low substitution index. For $\delta = 0$, every firm is a monopolist in its own market and profits do not decrease in the number of firms any more. Governments then choose high entry which increases the consumer surplus and the foreign producers' surplus without decreasing the domestic producers' surplus. For $\delta = 1$ profits decrease in the number of firms and the government takes into account the producers' losses.

For the rest of the paper I focus on homogenous goods ($\delta = 1$). Consumer have little taste for variety and competition between firms is high. This choice for an extreme value is done for simplicity in order to study the emergence of restrictions chosen by governments.

Lemma 1.2 *In the non-cooperative game with no lobbying, FDI policies, i.e. the number of firms, are decreasing in the repatriation of profits (ϕ). There exists a threshold ϕ_0 such that FDI policies are not restricted when repatriation is sufficiently low ($\phi \leq \phi_0$).*

Proof. Existence of ϕ_0 comes from $\frac{\partial M_0}{\partial \phi} < 0$. The solution is given by: $\phi_0 = z + \frac{A+z(M_n+1)}{1+2M_n(1+M_n)}$. ■

Repatriation of profits creates a first economic motive for foreign restrictions. Foreign affiliates enter the country, compete with domestic firms and therefore decrease domestic firms' individual profits. In addition foreign affiliates only redistribute a share of the profits from their Home sales. The revenue of the Home consumer can be decreasing in more entry if the additional revenues from foreign firms do not compensate the losses from the domestic firms. The rest of foreign affiliates' profits is repatriated and benefits

¹²I previously assumed no firm entry.

the Foreign consumer. In the absence of repatriation of profits ($\phi = z$), governments always choose free-entry to reduce the frictions from imperfect competition. Perfect competition is never reached because the number of affiliates is restricted by the number of foreign firms (M_n) that can open an affiliate. In this paper, for simplicity, I assume that there is no cost of opening an affiliate.¹³ Such a cost could also be a rationale for governments to restrict the number of producers and reduce the inefficiency from the waste of resources due to entry costs. This is not the motive that is explored in this model where governments choose to restrict entry to balance the benefits from more entry which decreases prices and the revenue losses due to the repatriation of profits. Entry is not restricted if repatriation of profits is low enough. Finally it can be shown that entry decreases in the number of domestic firms (M_n). A larger number of domestic firms M_n increases the weight on individual profits, which decrease in the number of foreign firms. The government values more individual profits and tend to decrease entry.

Definition 1.1 *Internationally efficient FDI policies maximize the world welfare (the sum of the two countries' welfare): $\max_{(M, M^*)} W(M, M^*) + W^*(M^*, M)$ where W is the welfare of country H and W^* the welfare of country F.*

Proposition 1.1 *The non-cooperative equilibrium with no lobbying is inefficient when profits are largely repatriated ($\phi \geq \phi_0$).*

Proof. The set of Pareto-improving outcomes is given by the interval $[M_0, 2M_n]^2$. ■

In the non-cooperative game, governments do not internalize the impact of their policy on the utility of the other government. The Home government only considers foreign affiliates' profits that benefit the Home consumer. However the Home consumer also benefits from the repatriated profits of the foreign sales that are not taken into account by the government when choosing his policy. Higher entry in the Foreign country implies more Home firms opening an affiliate abroad and therefore more repatriated profits. Both consumers could then benefit from higher entries in the two countries. This leads the equilibrium to be inefficient. However, the number of additional foreign firms that enter the country is limited by the number of firms abroad ($M \leq 2M_n$). When the constraint is binding ($M_0 = 2M_n$), the equilibrium is efficient.

¹³This assumption does not affect the results of this paper given that all firms are the same. Further work should be done to relax this assumption and study heterogenous firms when a cost affects entry. It would also change the objective of the lobby.

1.3.2 The non-cooperative game with lobbying

I now consider the non-cooperative game between the two governments when each government plays a political game. At $t = 1$, the government and the two lobbies can bargain to determine the policy M . The lobbies give contributions to exert an influence on the government. In addition I assume that foreign and domestic contributions can be differently valued.

The bargaining game

Following Maggi and Rodriguez-Clare (1998)¹⁴ I model the political game as a bargaining game between the government and the lobbies. I choose a bargaining game rather than a menu-auction game and study the outcomes of equilibria where not all players choose to bargain. One lobby can choose not to participate in the bargaining game and let the government and the other lobby decide on the FDI policy. I could have considered different cases in which foreign firms are exogenously allowed or not to lobby the government. However, the presence of foreign lobbying is important in the paper and the endogenous formation of bargaining coalitions enriches the results.

Whereas it is easy to model a bargaining game between two players, a game with three players is more demanding. I then use the concept of "coalitional bargaining" developed in Compte and Jehiel (2010). This definition can be applied to bargaining games with any number of players and is conceptually close to the definition used for two players. The difference comes from the possibility for any subset of players to deviate from the grand coalition and form a sub-coalition. In my paper, there are three possible outcomes: the grand coalition with the three players, the sub-coalition between the government and the domestic lobby called "the domestic sub-coalition" and the sub-coalition between the government and the foreign lobby called "the foreign sub-coalition". The two lobbies cannot coordinate not to participate in the bargaining game. The grand coalition solution maximizes the Nash product for the three players, and additional constraints on the final allocations verify that none of the subsets of two players wants to deviate. The equilibrium is the solution of the Nash product maximization given the constraints that no sub-coalition would get more by deviating. However a sub-coalition can form if the grand coalition equilibrium has no solution. I discuss these possibilities later.

¹⁴There are two possibilities to model this political game: the menu-auction game or the bargaining game. They are relatively close and differ only in the way to divide the joint surplus between the different players. In the menu-auction game, the government always gets his outside option, whereas in the bargaining game he gets a share of the joint surplus that depends on his bargaining power.

Definition 1.2 (Bargaining in the grand coalition) *Given the policy in the other country M^* , the policy and contributions that are solutions of the bargaining game between the government and the two lobbies maximize the following constrained Nash product:*

$$\begin{aligned}
(M^G, c^G, c^{fG}) &= \arg \max [G(M, M^*, c, c^f) - G_0]^{\sigma_G} [L(M, c) - L_0]^{\sigma_N} [L^f(M, c^f) - L_0^f]^{\sigma_F} \\
\text{st. } G(.) + L(.) &\geq \mathbb{J}^D \quad (\text{binding domestic sub-coalition}) \\
G(.) + L^f(.) &\geq \mathbb{J}^F \quad (\text{binding foreign sub-coalition})
\end{aligned}$$

with G_0 the outside option of the government, L_0 (L_0^f) the outside option of the domestic lobby (of the foreign lobby) and \mathbb{J}^D (\mathbb{J}^F) the joint surplus of the two players in the domestic sub-coalition (in the foreign sub-coalition). σ_G is the bargaining power of the government.

The following graphic shows the possible four different cases that can appear in this situation.

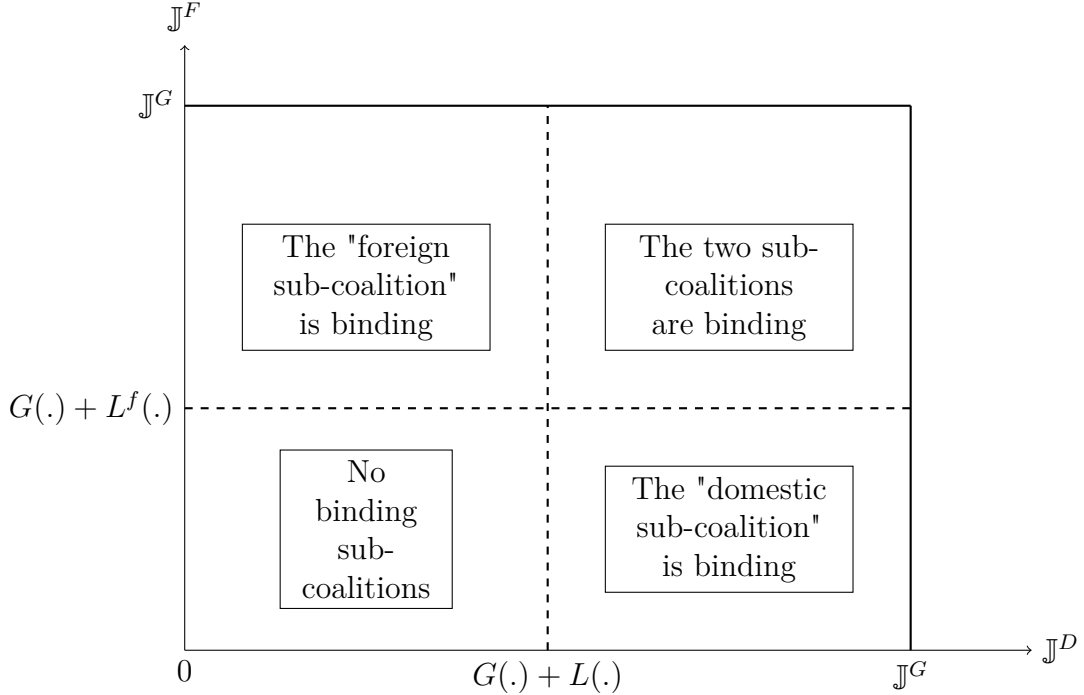


Figure 1.2: The four different cases depending on which constraint is binding.

Lemma 1.3 *In the grand coalition, the solution M^G of the Nash product maximization defined by*

$$M^G \quad \text{st.} \quad aW'(M^G) + \Pi'(M^G) + \gamma\Pi^{*f'}(M^G) = 0 \quad \wedge \quad M_n \leq M^G \leq 2M_n \quad (1.3.2)$$

is efficient as it maximizes the joint surplus of the grand coalition \mathbb{J}^G defined by:

$$\mathbb{J}^G(M) = aW(M) + \Pi(M) + (\gamma - 1)c^f + \Pi^f(M) \quad (1.3.3)$$

Proof. The expression of the foreign contribution (c^f) can be found from the allocation system defined by the bargaining powers of each agent or by the constraints when they are binding. The full proof is done in annex A.1.4. ■

I then define the policies in the sub-coalitions in order to get the outside options and the joint surpluses of the sub-coalitions (\mathbb{J}^D and \mathbb{J}^F) that define the constraints.

Definition 1.3 (Bargaining in the domestic sub-coalition) *Given the policy in the other country M^* , the policy and the contribution that are solutions of the bargaining game between the government and the domestic lobby maximize the following Nash product:*

$$(M^D, c^D) = \arg \max [G(M, M^*, c) - M_0]^{\sigma_G} [L(M, c) - \tilde{L}_0]^{1-\sigma_G}$$

with M_0 the outside option of the government, \tilde{L}_0 the outside option of the domestic lobby.

The solution in the domestic sub-coalition maximizes the joint surplus of the sub-coalition. The outside option of the lobby is the profit given the policy M_0 . M^D is the policy chosen in the domestic sub-coalition such that

$$M^D \text{ st. } aW'(M^D, M^*) + \Pi'(M^D) = 0 \quad \wedge \quad M_n \leq M^D \leq 2M_n$$

Definition 1.4 (Bargaining in the foreign sub-coalition) *Given the policy in the other country (M^*), the policy and the contribution that are solutions of the bargaining game between the government and the foreign lobby maximize the following Nash product:*

$$(M^F, c^{fF}) = \arg \max [G(M, M^*, c^f) - M_0]^{\sigma_G} [L^f(M, c^f) - \tilde{L}_0^f]^{1-\sigma_G}$$

with M_0 the outside option of the government and \tilde{L}_0^f the outside option of the foreign lobby in the sub-coalition game.

Similarly the solution in the foreign sub-coalition maximizes the joint surplus of the sub-coalition with the foreign lobby. The outside option of the lobby is the profit given the policy M_0 . M^F is the policy chosen in the foreign sub-coalition such that

$$M^F \text{ st. } aW'(M^F, M^*) + \gamma \Pi^{*f'}(M^F) = 0 \quad \wedge \quad M_n \leq M^F \leq 2M_n$$

The bargaining game is defined by the FDI policy M^G and the allocations $(G(\cdot), L(\cdot), L^f(\cdot))$ for the three players that depend on the contributions (c^G, c^f) . These allocations are defined either through the maximization of the Nash product according to each player's bargaining power or through the binding constraints. The final allocations depend both on the bargaining powers of the government and the two lobbies, and on the outside options of each player.

The outside option of the government is given by the FDI policy M_0 defined previously. The outside option of the domestic lobby is given by the utility obtained when it does not participate to the lobbying game. Its outside option is $L_0 = M_n \pi(M^F)$ with M^F the policy chosen in the foreign sub-coalition from Definition 1.4. The outside option of the foreign lobby is similarly defined by $L_0^f = (M^D - M_n) \pi^{*f}(M^D)$ with M_N the policy chosen by the domestic sub-coalition.

For the rest of the paper I want to focus on the interesting case when foreign lobbying pushes for more entry and counteracts domestic lobbying.

Lemma 1.4 *There exists a threshold \tilde{M}_n such that $\frac{\partial M^G}{\partial \gamma} \Big|_{\tilde{M}_n} = 0$ and*

$$M_n \leq \tilde{M}_n \Rightarrow \frac{\partial M^G}{\partial \gamma} \leq 0 \quad \wedge \quad M_n \geq \tilde{M}_n \Rightarrow \frac{\partial M^G}{\partial \gamma} \geq 0$$

For the rest of the paper I restrict the set of numbers of domestic firms such that $M_n \geq \tilde{M}_n$.

The number of domestic firms M_n determines the objective of the foreign lobby and its impact on the policy. When there are few domestic firms, the FDI policy chosen by the government is relatively large and the individual profits relatively small. The lobby of foreign firms then pushes for more restrictions to increase individual profits at the cost of reducing the number of affiliates that enter. When there are many domestic firms, the restrictions and the individual profits are higher. The lobby of foreign firms pushes for more entry at the cost of reducing the individual profits of each affiliate. In the first case, foreign lobbying exerts an influence for higher restrictions. A deeper analysis of the objective of the lobby of foreign firms is provided in another work Fiorini and Lebrand (2016). In the rest of the paper, I restrict my analysis to the case of a number of domestic firms large enough so that a higher valuation of foreign contributions leads to more entry.

Lemma 1.5 *Compared to the policy in the grand coalition, entry is lower in the domestic sub-coalition ($M^D \leq M^G$) and higher in the foreign sub-coalition ($M^G \leq M^F$).*

Such ranking directly results from Lemma 1.4. Domestic lobbying pushes towards lower

entry whereas foreign lobbying pushes towards higher entry. In the grand coalition the two lobbies bargain and the solution is a compromise between domestic and foreign interests.

Equilibrium when contributions are equally valued ($\gamma = 1$)

I present here the outcome of the non-cooperative equilibrium between the two governments when each government can play a bargaining game with his lobbies. I assume first that foreign and domestic contributions are equally valued ($\gamma = 1$) then I relax this assumption in the next part. For simplicity I also assume that the government's bargaining power is null ($\sigma_G = 0$)¹⁵.

Definition 1.5 *The non-cooperation political equilibrium is defined by a pair of FDI policies (M^G, M^{*G}) , domestic and foreign contributions for the Home government (c^G, c^{fG}) and for the Foreign government (c^{*G}, c^{*fG}) that are solutions of the bargaining games in each country, and by prices and quantities defined previously in the Cournot equilibrium.*

Proposition 1.2 *The equilibrium when contributions are equally valued ($\gamma = 1$) has a solution with the grand-coalition bargaining. The FDI policies are given by:*

$$M^G = M^{*G} = \min \left(2M_n, \max \left(\frac{(a+1)[(A-\phi) + M_n(z-\phi)]}{(A-z) + (1+M_n)(a+1)(\phi-z)}, M_n \right) \right) \quad (1.3.4)$$

*The Home government's allocation is given by: $G(M^G, M^{*G}, c^G, c^{fG})$*

$$= \begin{cases} aW(M_0, M_0^*) \wedge c^G, c^{fG} \geq 0 & \text{if at most one sub-coalition is binding and } M^G < M_0 \\ aW(M^G, M^{*G}) \wedge c^G, c^{fG} = 0 & \text{if at most one sub-coalition is binding and } M^G \geq M_0 \\ \mathbb{J}^D + \mathbb{J}^F - \mathbb{J}^G & \text{if the two sub-coalitions are binding.} \end{cases}$$

The Foreign government's allocation is symmetric.

Proof. The grand coalition is always the solution for $\gamma = 1$. A sub-coalition can not lead to a higher total surplus: $\mathbb{J}^D(M^D, M^*) + \Pi^{*f}(M^D) < \mathbb{J}^D(M^G, M^*) + \Pi^{*f}(M^G)$ and $\mathbb{J}^F(M^F, M^*) + \Pi^{*f}(M^F) < \mathbb{J}^F(M^G, M^*) + \Pi(M^G)$. More details in Appendix A.1.4. ■

The grand coalition with the three players is the equilibrium coalition when both domestic and foreign contributions are equally valued ($\gamma = 1$). In the previous part that defines the

¹⁵This assumption is not restrictive. In this paper I do not discuss whether governments prefer either playing the political game to receive contributions or committing in an agreement. Maggi and Rodriguez-Clare (1998) show that there exists a threshold that can explain why some governments sign agreements or not.

equilibrium without lobbying, FDI restrictions are chosen only because of the repatriation of profits by foreign affiliates. I add a political motive to the economic rationale and consider political forces that can exert an influence on governments. The absence of repatriation of profits is not sufficient to have free-entry any more. The effect of lobbying depends on the foreign lobby that can strive for two opposite objectives: more entry or higher restrictions to increase individual profits.

In such bargaining models, the government at least gets his outside option ($aW(M_0, .)$) and gets no more than his outside option when his bargaining power is null. The difference in this paper is explained by the presence of the policy chosen by the Foreign government in the utility function of the Home government. The Home government considers M_0 as his outside option in the bargaining game. The difference comes from the final allocation of the government here. Even if the government has no bargaining power, the equilibrium outcome for the government in Proposition 1.2 can differ from the outcome defined by the outside policy option M_0 ($= aW(M_0, .)$). The reason is that each government chooses his policy without considering the policy of the other government. What is the best outside policy for the government might not be the best policy if the government has considered that the other government would choose the same policy. The outside outcome ($aW(M_0, M_0^*)$) is the equilibrium outcome of the government only when the policy outcome delivered in the grand coalition bargaining is lower than the policy that defines his outside option ($M^G \leq M_0$). In that case the outside outcome is higher than the one obtained by the equilibrium policy choice ($aW(M_0, M_0^*) > (aW(M^G, M^{G*}))$). The interesting part of the proposition arises when the policy solution is higher than the policy chosen $M^G \geq M_0$. As assumed previously, the government has a null bargaining power ($\sigma_G = 0$) and both countries are symmetric. In the first case $M^G \leq M_0$, lobbying leads to more restrictions than what the government would optimally choose in case of no lobbying. His outside option ($aW(M_0, M_0^*)$) is larger than his objective function with the new policy M^G ($aW(M_0, M_0^*) > (aW(M^G, M^{G*}))$) and the government receives positive contributions from at least one lobby. However the entry policy from the bargaining game can be larger (less restrictive) than in the case of no lobbying ($M^G \geq M_0$). The utility of the government after bargaining even without bargaining power is then higher than in his outside option ($aW(M^G, M^{*G}) > aW(M_0, M_0^*)$). The government does not need to be compensated for playing the political game any more. This result contrasts with Maggi and Rodriguez-Clare (1998) in which the government always needs to be compensated. This will allow us to draw interesting results on the gains from having foreign lobbying that can allow the government to reach a better outcome from a social welfare point of view.

Lemma 1.6 *A higher level of repatriation of profits results in lower entry, i.e. higher restrictions, in the two countries.*

Proof. I show that $\frac{\partial M^G}{\partial \phi} \geq 0$ ¹⁶. ■

The economic motive for restrictions still applies when political forces affect the choice of the government. The presence of profit repatriation is necessary to have an outside option different from free-entry ($M^G < 2M_n$). Similarly to the previous part, a higher repatriation of profits provides incentives for the governments to restrict foreign entry. I now compare the FDI policies in the game without lobbying M_0 and the game with lobbying M^G . The outcome depends on the extent to which foreign lobbying counteracts domestic lobbying.

Proposition 1.3 *There exist a 'Lobby threshold' ϕ_L such that entry in the lobbying game is higher than entry in the no-lobbying game ($M^G \geq M_0$) when the repatriation of profits is limited $\phi < \phi_L$. Lobbying is then welfare-improving compared to the outcome with no lobbying.*

Proof. ϕ_L is defined by $M^G|_{\phi_L} = M_0$ given that $M^G|_{\phi=P(M^G)} < M_0$ and $M^G|_{\phi=z} > M_0$. When all profits are repatriated, foreign lobbying does not have an influence on the government. ■

Proposition 1.3 defines the levels of repatriation for which foreign lobbying leads to higher entry than the outcome of the non-political game. According to Proposition 1.2, governments' allocations are given by their outside options and contributions are positive when foreign entry is lower than in the game without lobbying ($M^G < M_0$). On the contrary, the government gets more than his outside option if entry is higher ($M^G \geq M_0$). A higher entry is also chosen in the other symmetric country. The Home consumer then benefits from the higher number of Home parents that repatriate part of their profits from sales in the Foreign country. This is the source of the inefficiency described in Proposition 1.1. The government can then be strictly better-off by playing the lobbying game. Foreign lobbying helps the government to internalize the inefficiency of proposition 1.1. The welfare increases when foreign lobbying helps the government to choose a higher entry level than M_0 . This happens when the level of repatriation is low enough.

¹⁶When the solution is binding ($M^G = M_n$ or $M^G = 2M_n$), a higher level of repatriation of profits does not affect the FDI policy.

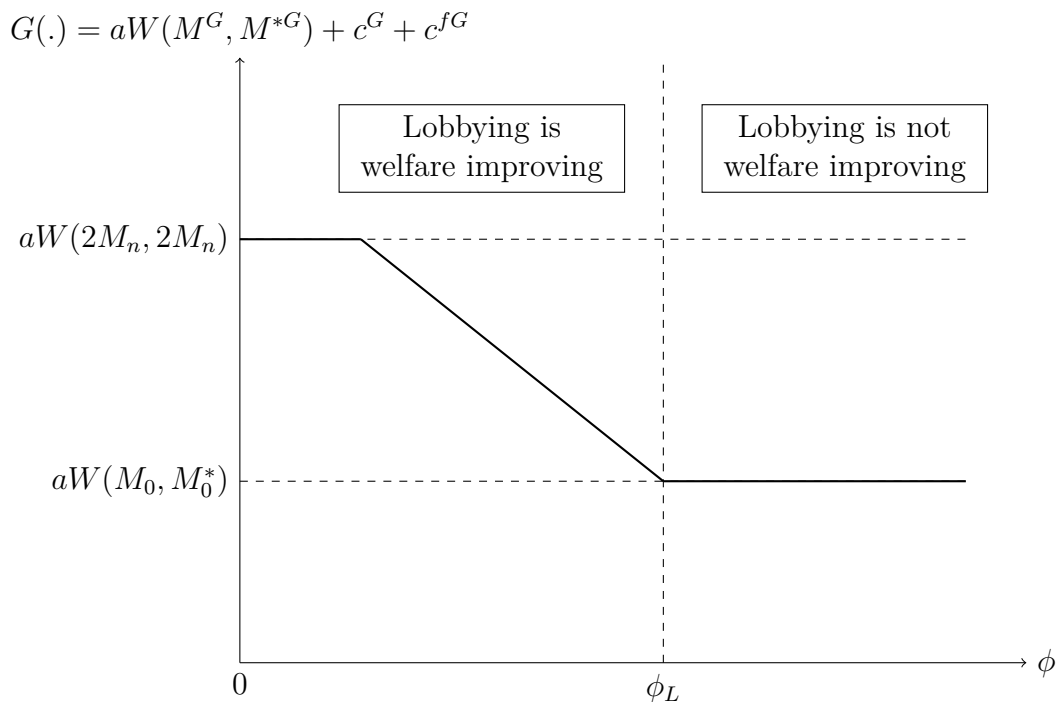


Figure 1.3: The government's allocation for different repatriation of profits ϕ .

Equilibrium when contributions are differently valued ($\gamma \neq 1$)

I now consider that governments differently value foreign and domestic contributions. I discuss whether bargaining in the grand coalition always has a solution. Different valuations directly affect the impact of foreign lobbying in helping governments to decrease their FDI restrictions. Similarly to Gawande et al. (2006) I study the case of foreign contributions being differently valued than domestic contributions. In their paper all lobbies participate in the political game. I extend the model by assuming a bargaining game which brings more possibilities. Bargaining sub-coalitions can be formed in which not all firms participate in the political game. The definition of "coalitional bargaining" from Compte and Jehiel (2010) allows for the formation of sub-coalitions if there is no solution in the grand coalition bargaining equilibrium. However a cost of redistributing the surplus between the players, which is not considered in the paper, emerge when foreign and domestic contributions are not equally valued ($\gamma \neq 1$). I provide the conditions for sub-coalitions to emerge.

Lemma 1.7 *For $\gamma \neq 1$, subcoalitions can form when there is no solution in the grand coalition equilibrium. This happens when the joint surplus for all the players is larger for*

at least one sub-coalition than in the grand coalition.

$$\begin{aligned} \{M^G, c^G, c^{f,G}\} = \emptyset \quad &\Leftrightarrow \\ \mathbb{J}^D(M^D, M^*) + \Pi^{*f}(M^D) > \mathbb{J}^G(M^G, M^*) \quad \vee \quad &\mathbb{J}^F(M^F, M^*) + \Pi(M^F) > \mathbb{J}^G(M^G, M^*) \end{aligned} \quad (1.3.5)$$

Proof. I first show that the total surpluses from the sub-coalitions can be larger than the total surplus in the grand coalition, which was never possible for $\gamma = 1$. The amount of optimal foreign contributions affects the size of the surplus and the total surplus functions can differ from the surplus in the grand coalition¹⁷:

$$\gamma \neq 1 \quad \Rightarrow \quad \begin{cases} \mathbb{J}^N(M, M^*) + \Pi^{*f}(M) \neq \mathbb{J}^G(M, M^*) & \text{if the domestic sub-coalition bargains,} \\ \mathbb{J}^F(M, M^*) + \Pi(M^F) \neq \mathbb{J}^G(M, M^*) & \text{if the foreign sub-coalition bargains} \end{cases}$$

Contrary to Proposition 1.2, it is now possible to have a larger total surplus when a sub-coalition is bargaining than when the grand coalition bargains. Second I show that the grand coalition equilibrium does not have a solution if the total surplus for the three players from either the domestic sub-coalition or the foreign sub-coalition is larger than the total surplus of the grand coalition. The proof comes from the constraints in the grand coalition bargaining. I denote by $G(), L(), L^*()$ the allocations for the government and the two lobbies in the grand coalition. Let's take the case of a surplus strictly higher with the domestic sub-coalition. If a solution exists in the grand coalition, it should respect the following constraints: $G() + L() \geq \mathbb{J}^D(M^D, M^*)$ and $L^*() \geq \Pi^{*f}(M^D)$. This leads to a contradiction because $G() + L() + L^*() = \mathbb{J}^G(M^G, M^*) \geq \mathbb{J}^D(M^D, M^*) + \Pi^{*f}(M^D)$ and by assumption $\mathbb{J}^G(M^G, M^*) < \mathbb{J}^D(M^D, M^*) + \Pi^{*f}(M^D)$. ■

Equilibria with sub-coalitions can emerge given that the surplus for all three players can be larger in a sub-coalition formation than in the grand coalition. This implies that there is not enough surplus generated in the grand coalition to find allocations that verify the constraints. A unit of contribution from the foreign lobby is redistributed to the government and the size of the surplus does not vary with the amount of contributions. This only happens when contributions are differently value ($\gamma \neq 1$). When governments differently value domestic and foreign contributions, the way to share the surplus affects its total size. When $\gamma < 1$, the surplus that is shared between the three players is decreasing in foreign contributions. Only a percentage γ of what is given by the foreign lobby benefits the government. Therefore there is a loss of surplus due to this difference in valuation.

¹⁷All surplus functions were the same for $\gamma \neq 1$. The grand coalition that maximizes this joint surplus always maximizes the joint surplus for the three players.

Proposition 1.4 (Sub-coalitions) *When foreign contributions are undervalued ($\gamma < 1$), we can show that*

- *for any level of government's valuation of foreign contributions, there exists a threshold for the repatriation of profits $\phi^{sub} \in \Phi$ ¹⁸ above which bargaining in the grand coalition has a solution and below which a sub-coalition is formed.*

$$\forall \gamma \in (0, 1), \quad \exists \phi^{sub} \in \Phi \quad st. \quad \begin{cases} \phi \leq \phi^{sub} & \Rightarrow (M, M^*) = (M^G, M^{*G}) \\ \phi \geq \phi^{sub} & \Rightarrow (M, M^*) = (M^D, M^{*D}) \vee (M^F, M^{*F}) \end{cases} \quad (1.3.6)$$

- *for any level of repatriation, there exists a threshold for the valuation of foreign contributions $\gamma^{sub} \in [0, 1]$ above which bargaining in the grand coalition has a solution and below which a sub-coalition is formed.*

$$\forall \phi \in \Phi, \quad \exists \gamma^{sub} \in [0, 1] \quad st. \quad \begin{cases} \gamma \geq \gamma^{sub} & \Rightarrow (M, M^*) = (M^G, M^{*G}) \\ \gamma \leq \gamma^{sub} & \Rightarrow (M, M^*) = (M^D, M^{*D}) \vee (M^F, M^{*F}) \end{cases} \quad (1.3.7)$$

Proof. Annex A.1.4. ■

Proposition 1.4 shows that the grand coalition bargaining is more likely to have a solution when the repatriation of profits is low and the government's valuation is high. When the repatriation is low, the formation of a sub-coalition with the foreign firms only can lead to a better outcome than in the grand coalition. The joint surplus of the government and the foreign lobby can be higher especially when it is costly to transfer money from the foreign lobby towards the government ($\gamma < 1$). When the government's valuation is low, it becomes very costly to bargain in the grand coalition given that foreign contributions decrease the size of the joint surplus. It is therefore more efficient to bargain either only with the domestic or the foreign firms.

Figure 1.4 provides numerical simulations for the FDI policies (the left column) and for the total surpluses of the agents (the right column). Each graphic on the left shows the number of firms when either the grand coalition or one of the two sub-coalitions bargain and each graphic on the right shows the total surplus for all agents when either the grand coalition or one of the two sub-coalitions bargain. They show how these two variables vary with the government's valuation of foreign contributions for three levels of profits' repatriation. Each line shows FDI policies and joint surpluses for a different level of

¹⁸The interval $\Phi = [z, p(2M_n)]$ defines all the possible values for repatriation. We choose the price with the maximum of firms $p(2M_n)$ as an upper limit for the level of repatriation ($\forall M, p(M) \geq p(2M_n)$)

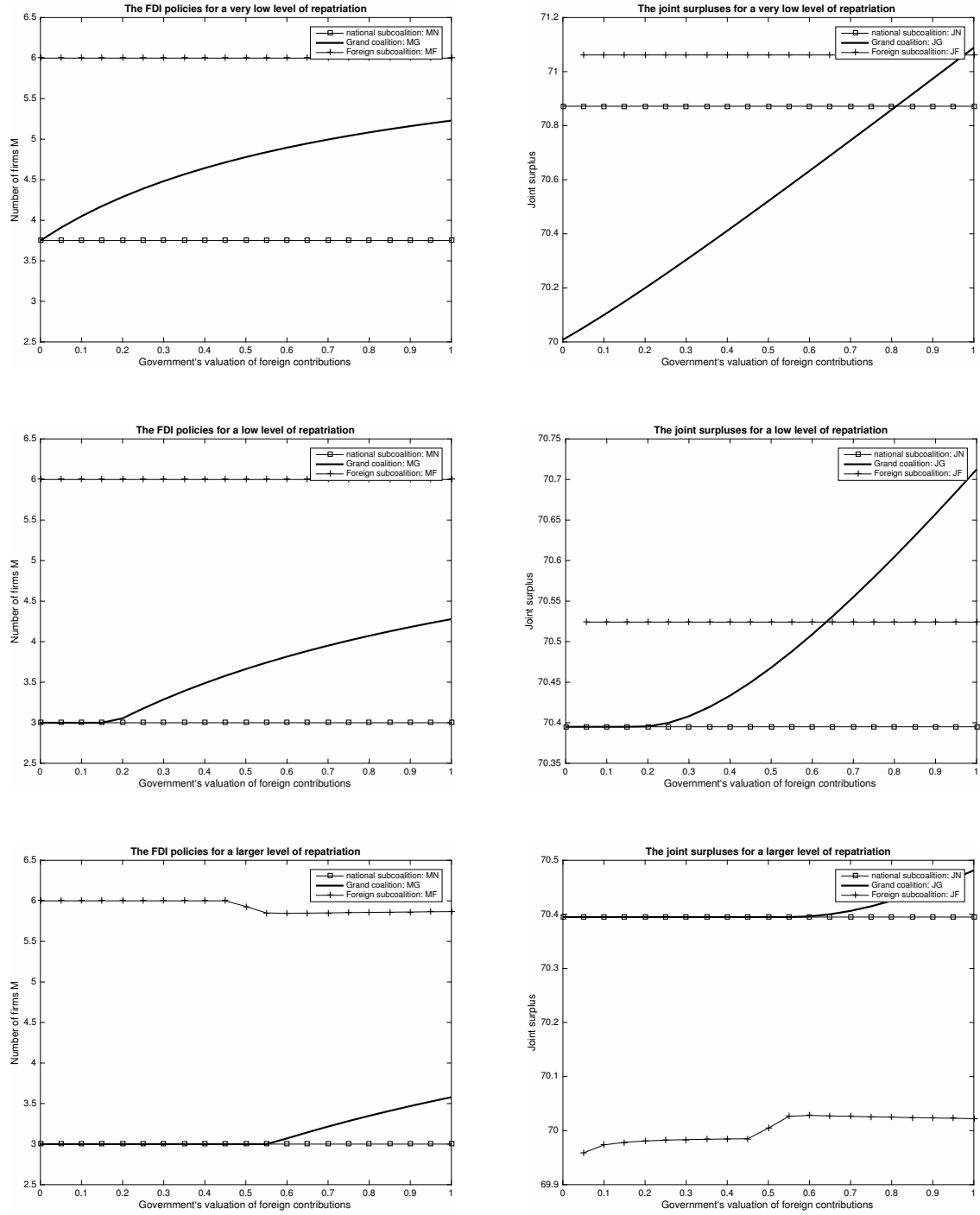


Figure 1.4: Effect of undervaluation of foreign contributions ($\gamma < 1$) on FDI policies chosen in a bargaining game $\{M^D, M^\gamma, M^F\}$ and joint surpluses $\{J^N + \Pi^{*f}, J^\gamma, J^F + \Pi\}$ for different levels of repatriation.

repatriation (low ϕ for the first line and higher ϕ for the second and third lines). The left column shows that the policies bargained in the two sub-coalitions are mostly binding ($M^D = M_n$ and $M^F = 2M_n$) whereas the policy bargained in the grand coalition increases in the government's valuation of foreign contributions. A higher weight on foreign profits leads to a higher entry of foreign firms. On the right, the figures show which surplus is the highest depending on which coalitions bargain. When the level of repatriation is very low (first line), the grand coalition game has a solution only when the government's valuation of foreign contributions is very close to one. The foreign subcoalition generates the highest joint surplus for the rest of the cases which implies that the government will bargain with the foreign lobby only and chooses the FDI policy M^F defined in Definition 1.4. The domestic sub-coalition never emerges when the repatriation is very low. The second line shows the same simulation for a higher value of profits' repatriation. The results are similar but the grand coalition has a solution for smaller values of government's valuation of foreign contributions. When the repatriation of profits increases the surplus generated when bargaining with foreign firms only becomes smaller and smaller compared to the surplus in the grand coalition. In the third case of an even higher repatriation, bargaining with domestic firms and increasing barriers to foreign entry leads to higher joint surplus than in the case of a bargaining with foreign firms only. Indeed more repatriation reduces the profits that are redistributed to Home consumers such that governments should care less and less about their interests and choose a policy that benefits domestic firms more.

In this section, I have shown the existence of an inefficiency in the non-cooperative game given that foreign firms repatriate part of their profits in their country of origin. This leads the government to restrict entry. Depending on the degree of repatriation and of governments' valuation of foreign contributions, foreign lobbying can push for higher entry and help the government to internalize the inefficiency.

1.4 Foreign lobbying and FDI agreements

The presence of repatriation of profits by multinationals is a source of inefficiency when governments non-cooperatively choose their policies. Following Grossman and Helpman (1994), an agreement can solve for the inefficiency and help governments to internalize the externality. I first study the equilibrium when governments cooperatively choose their policy. However foreign lobbying also helps countries to indirectly internalize the externality. Could foreign lobbying then make an agreement unnecessary?

1.4.1 The cooperative game between the two governments

Following Grossman and Helpman (1995) and Maggi and Rodriguez-Clare (2007) I assume that the two symmetric countries play a bargaining game to choose the terms of the agreement¹⁹. There is no lobbying at the time when countries negotiate for an agreement.

Definition 1.6 *An agreement is defined by the outcome of the cooperative game without lobbying.*

The terms of the agreement are defined by

$$(M^{ag}, M^{*ag}) = \arg \max_{M, M^*} W(M, M^*) + W^*(M^*, M) \quad \wedge \quad (M^{ag}, M^{*ag}) \in [M_n, 2M_n]^2 \quad (1.4.1)$$

and consist of $M^{ag} = M^{*ag} = 2M_n$.

The externality problem is internalized by governments in the cooperative game such that an agreement helps governments to choose efficient policies. The repatriated profits of the Home affiliates - given by $(M^* - M_n)[(\phi - z)q^*(M^*)]$ - are now taken into account by the Foreign government when choosing M^* , and vice versa.

1.4.2 Foreign lobbying and FDI agreements

Contrary to Grossman and Helpman (1994) and Maggi and Rodriguez-Clare (1998), the paper does not argue that agreements are not observed because governments prefer playing a domestic political game. Lobbying leads to higher trade barriers in a world where free trade is the optimal solution but is chosen because of the positive political contributions. The same reasoning could be applied here but I ruled out such conclusions by assuming $\sigma_G = 0$ for the whole paper.²⁰ I here discuss whether agreements are not observed because lobbying can also help governments to reduce their FDI barriers. I consider foreign and domestic contributions first to be equally valued and second to be differently valued.

¹⁹I follow Grossman and Helpman (1995) to model bargaining between the two governments using their result that having a transfer payment between the two governments or not gives the same results. I assume here that there is no transfer payments.

²⁰I then do not discuss conditions for which lobbying or an agreement is chosen. Under the assumption of no bargaining power ($\sigma_G = 0$), an agreement is preferred to the lobbying game. Following Maggi and Rodriguez-Clare (1998), I can show that there exists a threshold for the bargaining power such that a government with a high bargaining power does not sign an agreement.

Foreign contributions are equally valued ($\gamma = 1$)

I now discuss whether foreign lobbying can lead to the efficient policies that define the outcome of the agreement when foreign and domestic contributions are equally valued ($\gamma = 1$). I focus on the impact of the level of repatriation on the equilibrium.

Proposition 1.5 *There exists a threshold $\widetilde{\phi}^{ag}$ such that the non-cooperative entry policies are equal to the terms of the agreement ($M^G = M^{ag}$ and $M^{*G} = M^{*ag}$) when the repatriation of profits is sufficiently low ($\phi \leq \widetilde{\phi}^{ag}$).*

Proof. $\widetilde{\phi}^{ag}$ is defined such that $M^G|_{\widetilde{\phi}^{ag}} = M^{ag} = 2M_n$. Existence given by $M^G|_{\phi=z} = 2M_n$. ■

A limited repatriation of profits allows foreign lobbying to push towards high entry. The policy chosen in the lobbying game can be equal to the terms of the agreement if the foreign affiliates redistribute enough to the domestic consumer such that the governments value their profits. An agreement can be unnecessary to help governments to internalize the externality and foreign lobbying is another channel for governments to choose not to restrict foreign entry. If foreign firms repatriate a lot of their profits, foreign lobbying can not push the government to choose the cooperative outcome. An agreement is therefore needed to fully internalize the inefficiency. This proposition suggests that the economic parameter ϕ can define the situations in which an agreement is necessary compared to the outcome of foreign lobbying.

Foreign contributions are differently valued ($\gamma \neq 1$)

I now discuss whether foreign lobbying can lead to the optimal entry policies when foreign and domestic contributions are differently valued ($\gamma \neq 1$). I focus on results that depend on the government's valuation of foreign contributions.

Proposition 1.6 *There exists a threshold $\widetilde{\gamma}^{ag}$ defined by $M^G|_{\widetilde{\gamma}^{ag}} = M^{ag}$ for which the non-cooperative entry policies are equal to the terms of the agreement if governments sufficiently value foreign contributions ($\gamma \geq \widetilde{\gamma}^{ag}$) and if the grand coalition equilibrium has a solution (cf Proposition 1.4). Otherwise there exists a threshold $\widetilde{\gamma}^{F,ag}$ defined by $M^F|_{\widetilde{\gamma}^{F,ag}} = M^{ag}$ if the foreign sub-coalition is the solution (cf Proposition 1.4). In the case of the domestic sub-coalition, entry policies are never equal to the terms of the agreement.*

A high government's valuation of foreign contributions allows foreign lobbying to exert a large influence on the government towards high entry. The policy chosen in the lobbying game can be equal to the terms of the agreement if foreign contributions are sufficiently

valued. An agreement is therefore not necessary to help governments to internalize the externality. If foreign contributions are not highly valued, foreign lobbying can not push the government to choose the cooperative outcome. An agreement is therefore needed to fully internalize the inefficiency. This proposition suggests that the political parameter γ can define a set of countries for which an agreement is not necessary to internalize the externality. Countries where foreign firms have no influence should rather sign an agreement to lower their restrictions. Foreign lobbying might be a good substitute to an agreement in countries where foreign influence is sufficiently valued.²¹

The following proposition compares the outcomes for the different sub-coalitions.

Result 1.1 *When foreign and domestic contributions are differently valued ($\gamma \neq 1$), I show that*

1. *the set of government's valuations of foreign contributions γ for which the non-cooperative entry is equal than the terms of an agreement is larger in the foreign sub-coalition equilibrium than in the grand coalition equilibrium ($[\widetilde{\gamma}^{ag}, +\infty) \subset [\widetilde{\gamma}^{F,ag} + \infty)$),*
2. *the set of share of profits that is repatriated in the country of origin ϕ for which the non-cooperative entry is equal than the terms of an agreement is larger in the foreign sub-coalition equilibrium than in the grand coalition equilibrium ($[z, \widetilde{\phi}^{ag}] \subset [z, \widetilde{\phi}^{F,ag}]$),*
3. *the non-cooperative entry in the domestic sub-coalition is always lower than the terms of the agreement.*

Proof. More details in Appendix A.1.4. ■

Figures 1.5 and 1.6 illustrate Result 1.1. Result 1.1 implies that the outcome in the foreign sub-coalition is more likely to be Pareto-efficient given that it requires a government's valuation of foreign contributions that is lower than in the case of the grand coalition. Finally bargaining in the domestic sub-coalition leads to restrictive policies which are never equal to the agreement policy.

²¹This is a result that I do not test in the paper but could lead to further empirical work.

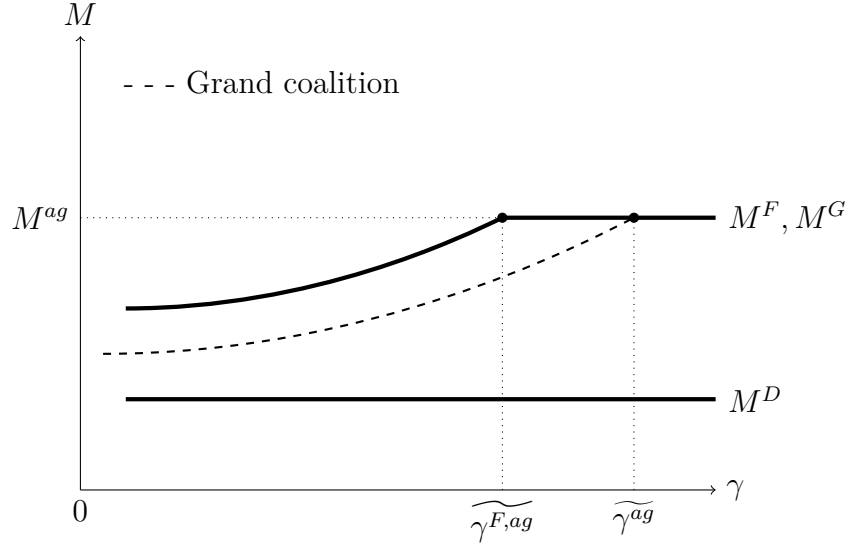


Figure 1.5: The thresholds for which the non-cooperative outcome with lobbying is equivalent to the agreement outcome for a given ϕ .

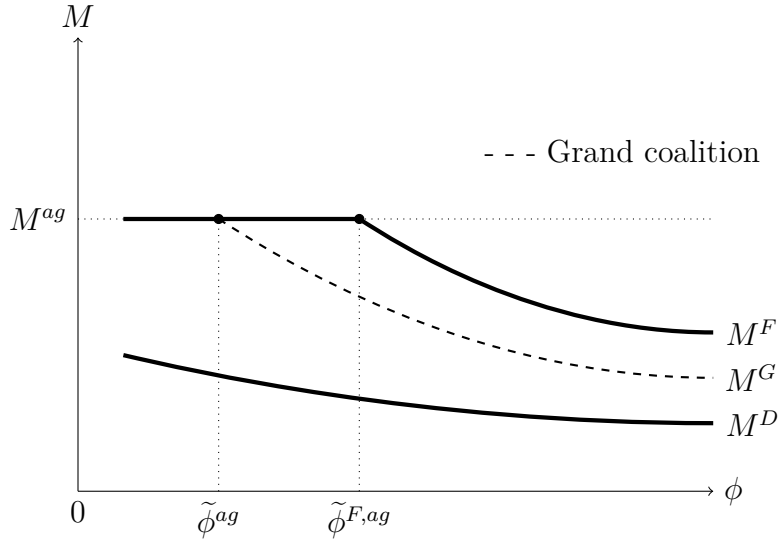


Figure 1.6: The thresholds for which the non-cooperative outcome with lobbying is equivalent to the agreement outcome for a given γ .

1.5 Tax havens and FDI agreements

In this part I consider the opportunity for multinationals to use transfer pricing to shift profits towards tax havens. All firms can shift profits in order to decrease the share of profits that is taxed in the country of origin and in the host country. This possibility affects the choice of FDI policies as well as the role of FDI agreements.

1.5.1 Transfer pricing towards tax havens

I now assume that all firms can locate the parents' profits in a tax haven. A tax haven is defined here as a place where corporate taxes are null and where firms can easily shift profits to. A tax haven has no consumer and profits that are shifted there are assumed not to benefit any country. This assumption can be discussed given that profits in tax havens have been shown to be partly reinvested and to indirectly benefit consumers from the country of origin. For simplicity I assume that these profits are not redistributed to consumers in the short-term. Firms can legally shift profits towards a tax haven if they locate the parents of the firms there. The parents can then provide intangible inputs to the affiliates in the host country where consumers are. These inputs are usually services or intangible goods paid at a price chosen by the firms. This intra-firm price determines the share of profits that is located in the two countries which then determines the FDI policies. Several papers (Davies et al. (2014), Vicard (2015)) have provided empirical proofs of the use of transfer pricing by multinationals to shift profits toward tax havens. Davies et al. (2014) especially finds out that profit shifting through transfer pricing mainly happens towards a few tax havens that are very small countries where no or few consumers live.

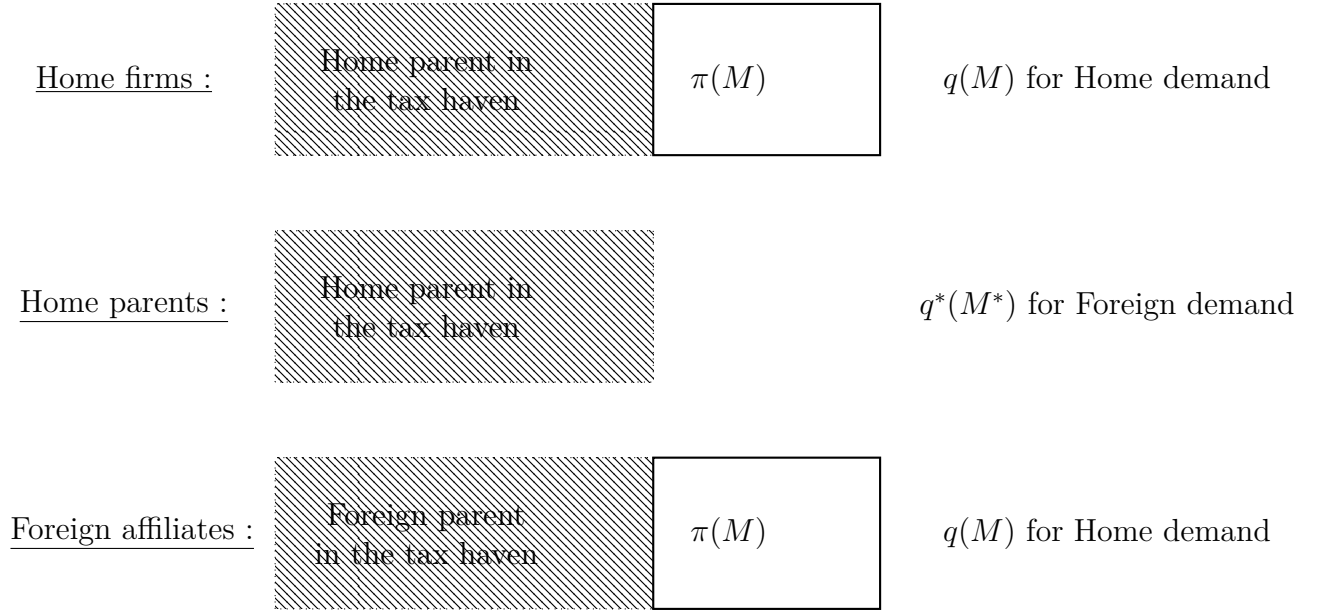
I add the possibility for transfer pricing to the previous model²². Firms choose an intra-firm price ϕ , which corresponds to the previous repatriation parameter. The interpretation of this parameter becomes obvious in the case of transfer pricing. This price can differ from the arm's length price which is the price at which same firms would sell the same input to a third party. The intra-firm price defines the transfer pricing strategy that allows multinationals to shift profits towards tax havens. A high intra-firm price allows them to shift a large part of their profits. I do not model the firms' choice of their intra-firm price which depends on the corporate tax rate of the country and the concealment costs from shifting profits towards tax havens²³. The intra-firm price is assumed to increase in the tax rate of the host country. A higher corporate tax rate in the host country leads firms to shift more profits in the tax haven.

I provide here a similar figure to Figure 1.1 in the first section. Firms can now locate part of their profits in a third country. The shaded areas represent the shares of total profits located in a tax haven that are assumed not to be redistributed to consumers.

²²I follow the model of transfer pricing in Davies et al. (2014).

²³Firms that choose an intra-firm price different from the arm's length price have to incur a concealment cost. The concealment cost depends on the gap price only and is interpreted as the cost of hiring accountants or the fine that a firm pays when it is caught. It might vary across countries.

Figure 1.7: Profits redistributed at Home



Similarly to the previous section, I find the equilibrium policies in the non-cooperative game without lobbying and then with lobbying in the grand coalition. In case of no lobbying, the government chooses the following policy:

$$M_0^{tax} = \frac{A - \phi}{\phi} \quad (1.5.1)$$

For simplicity I only look at the case of equal valuations of contributions ($\gamma = 1$) which implies that the non-cooperative game equilibrium with bargaining in the grand coalition has a solution. The government chooses the following FDI policy:

$$M^G = \frac{2(A - \phi)}{(\phi - z) - 3(A - \phi)} \quad (1.5.2)$$

Proposition 1.7 *I can show that (i) the non-cooperative outcome without or with lobbying is always efficient and that (ii) free-entry is not the solution of the game without lobbying if the intra-firm price is high enough ($\phi \geq \frac{A}{2M_n+1}$).*

In the previous sections, the externality problem is explained by the repatriation of profits which determines where profits are redistributed. The outcome is inefficient because governments do not consider the profits of their firms that are repatriated back home when choosing their entry policy. In a world with tax havens, the location of profits is the same for domestic firms and foreign affiliates. Governments then choose to restrict foreign entry and increase the profits of their domestic firms given that only a small part

of the total profits made from domestic sales stay in the country. Given that most of the profits "disappear" in tax havens, governments choose restrictions that result from the trade-off between higher prices and higher revenues for consumers.

Previously I show that an agreement allows each government to take into account the domestic profits due to the presence of affiliates abroad. In the non-cooperative game these profits are not considered because they are located in tax havens. Governments only benefit from the profits from sales happening in their country and the policy of the other country does not affect the objective function of the government any more. Therefore an agreement has no role to play in a world with tax havens and foreign lobbying is the only channel to lower restrictions. However given that foreign affiliates shift a large part of their profits abroad foreign lobbying might not be able to lower restrictions.

Lemma 1.8 *Tax treaties that increase the cost of shifting profits or curb tax havens are a first step towards agreements that reduce FDI barriers.*

This result contributes to the debate on the effects of tax treaties on FDI. It defines a new role for tax treaties. Most of the literature (Blonigen et al. (2014)) has focused on the impact of tax treaties on FDI flows. The result 1.8 suggests that tax treaties are a first step for investment agreements to help countries reducing their FDI barriers. The proposition 1.7 states that the presence of tax havens makes the non-cooperative outcome Pareto-efficient and no agreement is necessary. Tax havens should be curbed or pricing transfer should become prohibitive in order to observe more agreements that help countries internalize the externality.

1.6 Empirical analysis

Following my theoretical results ²⁴ I test whether higher repatriation of profits increases foreign restrictions. Given the difficulty to quantify the repatriation behaviors of multinationals across countries and years, I use two proxies that cover the main determinants of the relocation of profits: corporate tax rates and future growth opportunities. I discuss the advantages and drawbacks of such proxies and show that they significantly affect the level of restrictions across countries, sectors and years. I finally discuss other possible channels that could explain this positive result.

²⁴I do not test the predictions of my model regarding the impact of foreign lobbying on restrictions and whether an agreement is chosen or not in different situations.

1.6.1 Data

The dependent variable is given by the level of foreign restrictions. I use two indexes that quantify FDI restrictions: the FDI Regulatory Restrictiveness Index (FDI Index) from the OECD and the Services Trade Restrictiveness Index (STRI) from the World Bank. The first index measures FDI restrictions in 58 countries, covers 22 sectors and is available for 8 years: 1997, 2003, 2006-2014. The second index covers 103 countries that represent all regions and income groups of the world. For each country, five major services sectors are covered: financial services (retail banking and insurance), telecommunications, retail distribution, transportation, professional services (accounting, auditing, and legal services). I focus on services that are characterized by high FDI barriers (Figures A.2 and A.3 in the Data Appendix). In addition Figure A.4 shows that horizontal FDI is the main mode of trade in services. Part of the explanation is that many services are non-tradable and can not be provided through cross-border exports. Additional details are provided in the Data Appendix.

Proxies for the repatriation of profits

The literature suggests three determinants to explain the repatriation of profits by multinationals.²⁵ The difference in corporate taxes and the existence of bilateral treaties on double taxation are the fiscal determinants of repatriation. Second growth opportunities in the host country determine whether profits are repatriated or reinvested in the host country. A last determinant is the existence of tax havens whose consequences are well described in Zucman (2014). In the previous parts I chose not to model the impact of these determinants on the ϕ parameter. I build two proxies for the behaviors of multinationals: a tax index and a growth index.

The Tax Index It quantifies the extent to which a country has a high level of taxes compared to other countries. Multinationals shift profits by comparing tax rates in their investment country and in their country of origin. More precisely the index quantifies the gap between the tax rate of a host country and the tax rates of the countries of origin of the multinationals. I use corporate tax rates data from the OECD that presents effective statutory tax rates taking into account integration or relief to reduce the effects of double taxation. A simple average across foreign countries loses a lot of information. I therefore use weights on tax rates such that countries with more or larger affiliates have more

²⁵Blonigen and Davies (2001) and Blonigen et al. (2014) for the bilateral treaties on double taxation and Overesch and Dreßler (2011), Hanlon et al. (2014), Zucman (2014) for the other determinants.

weight. However I only have FDI data per partner country at an aggregate level or FDI data per industry for the rest of the world. I therefore build two indexes and compare the results. I use inward FDI data at the country level when focusing on partner countries and outward FDI data at the industry level when focusing on industry data.

1. The tax index per industry: I here use data per industry. The world tax rate is the weighted average of tax rates for a representative vector of investing countries per industry and is the same for all countries. I use outward FDIs from all countries to build a world's representative investor in a given sector. I can compare a country tax index and the tax index of this world's representative investor of a given sector. The tax index for country c ($c \in W$) and sector s is:

$$Tax_{c,s} = \tau_c - \tau_s^W \quad \text{with} \quad \tau_s^W = \frac{\sum_{j \in W} \tau_j FDI_{j,s}^{out}}{\sum_{j \in W} FDI_{j,s}^{out}}$$

2. The tax index per country: I here use data per partner country. Data of partner countries are not available per sector for confidentiality reasons. The world tax rate uses the inflows of FDI per partner country for all sector as weights. It reflects the composition of foreign investments in each country and now varies across countries but not across sectors. The Tax index for country c is:

$$Tax_c = \tau_c - \tau_c^W \quad \text{with} \quad \tau_c^W = \frac{\sum_{j \in W-c} \tau_j FDI_{j,c}^{in}}{\sum_{j \in W-c} FDI_{j,c}^{in}}$$

Repatriation of profits is assumed to be increasing in the tax proxy: $\text{Corr}(\phi^*, Tax) \geq 0$. The higher the tax rate in the host country compared to the rate in the country of origin, the more profits are repatriated home.

The growth opportunity Index In addition I build an index that reflects the growth opportunities of a country compared to those in the rest of the world. It complements the tax index. The higher the growth rate compared to a world average, the more profits made by foreign affiliates are not repatriated and are invested in the host country. The growth index is defined as the difference between the growth rate of a country and a world growth rate index. The world index is built as a weighted average of all countries' annual growth rate with the GDP of each country. The index for country c and sector s i:

$$Growth_{c,s} = g_{c,s} - g_{c,s}^W \quad \text{with} \quad g_{c,s}^W = \frac{\sum_{j \in W} g_{j,s} GDP_{j,s}}{\sum_{j \in W} GDP_{j,s}}$$

Repatriation of profits is assumed to be decreasing in the growth index: $\text{Corr}(\phi^*, \text{Growth}) \leq 0$

1.6.2 Methodological issues

There are methodological issues that emerge here. I have to address the endogeneity issue coming from the omitted variable bias and reverse causality. I address the first problem by adding other control variables such as GDP, GDP per capita, added-value per sector and previous binding commitments on restrictions. In addition I use a fixed-effect model for each specification. I add sector, year and country dummies depending on each case to the specification. I also add interaction dummies to test whether the result is robust. Second I address the reverse causality issue. Indeed lower restrictions can lead the government to lower tax rates. For example, a government could decide to lower the tax rate given that more firms are present. Multinationals could also exert pressure on governments to lower taxes. In order to solve for this problem I use lagged values for tax and growth rates. Another problem is the simultaneity bias. I assume that multinationals do not immediately react to a change in policies. An increase in restrictions might send a negative signal to multinationals that are expected to increase repatriation the next periods. I finally test the robustness of the results. I run a similar regression for different set of countries (OECD vs all countries), different FDI restrictions Index (OECD and WB Indexes) and for different years. After presenting the results of the regressions I discuss additional problems on how to interpret the results.

1.6.3 Results

I provide results for two cases and compare their results. First I use the OECD FDI restrictions Index which is available for all sectors but in a limited number of countries. Second I use the WB STR Index which is available for services only but for a larger number of countries.

FDI restrictions in all sectors I use here the FDI Index for OECD countries only. The specification is:

$$RT_{c,s,t} = \alpha + \delta_\tau Tax_{c,s,t} + \delta_g Growth_{c,s,t} + \lambda X + \delta_c + \delta_t + \delta_s + \delta_{c,s} + \delta_{t,s} + \epsilon_{c,s,t}$$

with δ_c , δ_t and δ_s the fixed effects for country c , at year t and in sector s . X is the set of control variables that gather here logGDP and logGDP per capita that are lagged by one period. The interaction fixed effects are the country-sector dummy $\delta_{c,s}$ and the year-sector dummy $\delta_{t,s}$. RT is the level of FDI restrictions. Table 1.1 shows the results²⁶.

Table 1.1: Impact of repatriation on FDI restrictions (OECD Index)

| | OLS with FE | OLS with FE | OLS with FE | OLS with Interaction FE |
|-------------------|-------------------------|---------------------|-------------------------|--------------------------|
| TaxIndex | 0.00482*** [0.00171] | | 0.00460*** [0.00171] | 0.00164*** [0.000399] |
| GrowthIndex | | -0.0747 [0.0454] | -0.0642 [0.0456] | -0.0295*** [0.0106] |
| laglnGdp | -0.213 [0.183] | -0.0934 [0.176] | -0.202 [0.184] | -0.283*** [0.0389] |
| laglnGdpCap | 0.174 [0.194] | 0.0612 [0.187] | 0.175 [0.194] | 0.226*** [0.0408] |
| Observations | 911 | 917 | 911 | 911 |
| Country FE | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Country*Sector FE | No | No | No | Yes |
| Sector*Year FE | No | No | No | Yes |
| R-sq | 0.399 | 0.394 | 0.400 | 0.981 |

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.1 shows that the tax index significantly affects the level of FDI restrictions for all specifications. It is worth noting that it remains significant in the last specification with interaction dummies that capture most of the country-time-sector variations. The positive coefficient on the tax index means that higher taxes relative to the rest of the world (more repatriation) leads to higher FDI restrictions. The negative coefficient on the growth index means that higher growth opportunities (less repatriation) leads to lower FDI restrictions. This is in line with my theoretical results.

FDI restrictions in services I now focus on FDI restrictions in the services sectors and use the WB STR Index. I use the AMNE/OECD database that describe foreign affiliates characteristics (number of employees, sales etc.) in each OECD country. I

²⁶I here show results for the tax index per industry. Similar results are obtained using the tax index per country.

use services industries from the STRI database: banking, insurance, telecom, retailing, maritime, transport and legal services. Whereas the STRI index is available for a large number of countries over the world, the foreign affiliates database (AMNE) is only available for OECD countries. I start by restricting my analysis to OECD countries in order to be able to use the AMNE database then I consider all countries from the STRI database and use outward FDI data from the World Bank. The STRI database only provides one-year data. I use 2008 data for the tax and growth rates. I build the tax index by using the number of employees in foreign affiliates as a measure of foreign presence and add country and sector-specific dummies. Following Barattieri et al. (2015), other control variables are added such as Gdp, Gdp per capita, the level of GATS commitments (STRI_{ur}) and the value added in the manufacturing and in the services sectors. GATS commitments capture the possibilities for government to increase restrictions or not. The specification that is tested is:

$$STRI_{c,s} = \alpha + \delta_\tau Tax_{c,s} + \delta_g Growth_{c,s} + \lambda X + \delta_c + \delta_s + \epsilon_{c,s}$$

with δ_c and δ_s the fixed effects for country c and for sector s . *STRI* is the Services Trade Restrictiveness Index per country c and per sector s . A similar regression with the tax index per industry is added in Appendix.

Results from this new Table are similar to the previous results and support the model. I also observe that GATS commitments made in 1995 are a strong determinant of current restrictions. This is mainly explained by sectors for which governments committed to remove all kinds of restrictions. The index is then equal to zero and remains at zero. The tax index has therefore no impact on the level of restrictions. Countries with higher GDP per capita have lower levels of restrictions. GDP has a rather positive impact on foreign restrictions. Bigger countries have higher restrictions.

FDI restrictions in all countries I here keep all 103 countries from the STRI database. I cannot use the previous tax index. I then use the aggregate FDI outflows data of the World Bank as well as GDP, tax and FDI data from 2006. This part provides a broader picture and takes into account countries with very high restrictions such as emerging economies (China, Russia, Indonesia, India, Brazil, etc). I get similar results on the impact of repatriation. Second I focus on the complementary between the tax Index and the growth Index. The set of countries is more heterogenous. I add an interaction term between the two proxies and compute the marginal effect of the tax Index

Table 1.2: Impact of repatriation on services restrictions (STRI) for OECD countries using Partner country data

| | | Sector dummy | Country dummy | The two dummies |
|---------------|--------------------------|--------------------------|-------------------------|-------------------------|
| TaxIndex | 0.00420*** [0.000986] | 0.00250*** [0.000617] | 0.00638*** [0.00109] | 0.00487*** [0.00100] |
| GrowthInd | | -0.0122* [0.00652] | -0.0280** [0.0109] | -0.0162* [0.00932] |
| lnGdpCap | -0.0944*** [0.0306] | -0.00458 [0.0191] | -0.148*** [0.0316] | -0.0785*** [0.0256] |
| lnGdp | 0.0196 [0.0119] | -0.00456 [0.00837] | 0.0441*** [0.0133] | 0.0175 [0.0117] |
| Striur | 0.533*** [0.0562] | 0.535*** [0.0506] | 0.442*** [0.0233] | 0.533*** [0.0562] |
| VA_serv | 0.0222*** [0.00408] | 0.0225*** [0.00392] | 0.0314*** [0.00697] | 0.0213*** [0.00595] |
| VA_manuf | 0.0212*** [0.00349] | 0.0239*** [0.00350] | 0.0387*** [0.00388] | 0.0217*** [0.00344] |
| Observations | 244 | 244 | 244 | 244 |
| Country Dummy | Yes | No | Yes | Yes |
| Sector Dummy | Yes | Yes | No | Yes |
| R-sq | 0.911 | 0.883 | 0.824 | 0.911 |

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

on FDI restrictions for different Growth Index. The marginal effect in Table 1.8 is:

$$\frac{\partial STRI_{c,s}}{\partial Tax_c} = \delta_g + \gamma Growth_c$$

Figure 1.8 shows that the marginal effect of the tax index for different levels of the growth Index. It shows that high tax rates on profits increase foreign restrictions only for positive relative growth rates. This means that the two indexes are complementary. Multinationals decide whether to shift profits for tax reasons only if there are growth opportunities in the host country. Without growth opportunities, multinationals repatriate their profits for any tax rate. The decision to repatriate is based on both the corporate tax rates and the growth opportunities of a country. This implies that my mechanism particularly applies for fast-growing emerging economies for which the level of tax rates determines

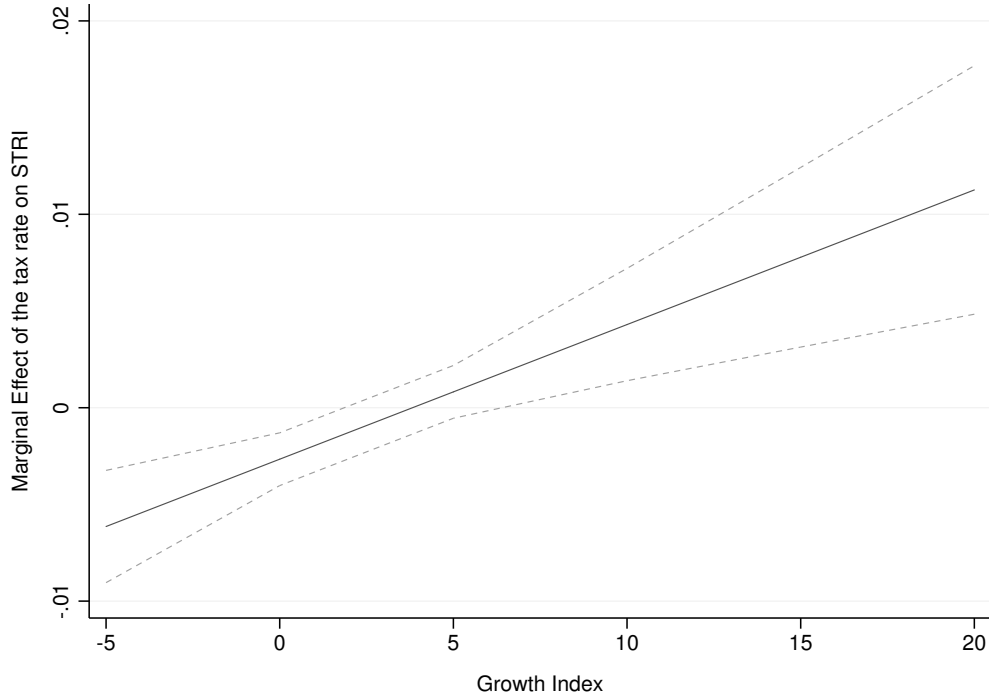


Figure 1.8: Complementarity between the tax and the growth indexes.

the levels of restrictions.

1.6.4 Discussion

Whether this result shows causality can be discussed. The primary objective of this past is to show that the data go in the direction of the mechanism explained in the paper. However a limited access to the data at stake in the paper restricts our empirical analysis. The role of the repatriation of profits as the channel at stake behind this result can also be discussed. Other channels could be candidates for explaining this positive result. For example increasing taxes creates a disadvantage for domestic firms that should then be protected against foreign competition through higher restrictions. This channel is relevant for trade through exports across borders but is not in this model of horizontal FDI. Foreign affiliates and domestic firms face the same conditions to sell and produce. An increase in tax rates affect both domestic and foreign firms. However increasing corporate tax rates does not create a disadvantage for the domestic firms compared to their foreign competitors. Another candidate is the quality of political institutions that can act as a third factor and explain both lower tax rates and lower restrictions. This applies to countries with weak institutional levels. In certain cases, an improvement in

the political institutions or in the quality of politicians can lead to less "expropriation" through corporate taxes²⁷ and at the same time more opening to foreign investment. The profit shifting channel is not needed. The addition of country dummies or year-country dummies is however supposed to capture these political differences across countries.

A drawback of this empirical work is due to the data used for the tax rates index. Special tax provisions as an incentive to promote a policy are difficult to take into account. It is particularly relevant for FDI given the increasing number of special economic zones in emerging or developing economies. These zones provide better economic conditions (administrative simplifications, low tax rates, etc) to attract FDIs. There exist studies that have tried to measure multinationals' effective tax rates. They use backward-looking approaches and firm-level data. However these effective rates take into account both statutory provisions to provide certain incentives and aggressive tax planning strategies. It is difficult to determine which factor explains most of the lower effective tax rates. Using tax rates that already reflect tax planning strategies is counterproductive for this work. They also cannot be used as a proxy for profit shifting for the reason that they encompass governments' incentives to attract FDI. OECD (2013) reports that the use of different methodologies to calculate these effective tax rates result in divergent conclusions about the level of taxation imposed on multinationals. Using corporate tax rates from the OECD database seems to be a good approximation. In this paper it is the difference between all tax rates that matter, not the level of a tax rate in itself.

1.7 Conclusion

This paper rationalizes why few agreements to reduce FDI barriers have been signed. First I show that the possibility for multinationals to repatriate their profits is a motive for restrictions. However these profits are not taken into account by governments that non-cooperatively choose their FDI policies. Investment agreements can help countries to internalize this externality. However I show that foreign lobbying can make an agreement unnecessary if the repatriation of profits is limited and the government's valuation of foreign contributions high enough. Finally the presence of tax havens where part of the profits disappear and are not taken into account by governments always makes agreements unnecessary. Tax treaties that curb tax havens are a first step for agreements to reduce FDI barriers.

Additional work needs to be done to quantify the effects of foreign restrictions and the

²⁷This statement obviously does not apply to OECD countries in which high corporate taxes can not be called expropriation.

potential welfare gains from removing these barriers. Using the methods of Ossa (2014) I plan to build a model I could bring to the data and quantify the welfare effects of removing these barriers. The gains from services agreements that are currently negotiated could also be quantified. More empirical work should also be done to compare the influence of foreign lobbying across countries and industries. Some countries restrict foreign influence. There is no index that attempts to quantify the legal and informal barriers that restrain the capacity of foreign lobbies to exert an influence on governments. Another line of further research is the links between tax treaties and investment agreements. Taxes affect the behaviours of multinationals and their strategy in terms of profit shifting. It would be interesting to study whether current agreements that aim at reducing profit shifting towards tax havens affect the choice of FDI policies.

Chapter 2

The political economy of services trade agreements

With Matteo Fiorini

2.1 Introduction

Tariff barriers have almost completely disappeared for manufactured goods but significant restrictions remain for international services transactions. Restrictive policies are observed for professional and transportation services in both industrial and developing countries, and for most sectors in some of the fastest growing countries in Asia and the oil-rich Gulf states (Borchert et al., 2012a).¹ Due to the intangibility and non-storability of many services, their international provision requires the establishment of a commercial presence in the importing country. As a consequence, restrictions on foreign acquisitions, discrimination in licensing and other investment restrictions represent *de facto* barriers to trade in services. Liberalization in service sectors has become a key element of the international trade agenda and services trade agreements have aimed at promoting integration in the services markets. The Trade in Services Agreement (TiSA) is a recent initiative to push for multilateral negotiations. Services are also the main topic of the ‘Market Access’ chapter that is negotiated in the Transatlantic Trade and Investment Partnership (TTIP) between the United-States and the European Union.

¹According to the information provided by the World Bank Services Trade Restrictiveness database (the richest source of services trade policy outcomes in terms of country coverage) the highest barriers to services trade are observed in the high-income GCC countries, South and East Asia, the Middle East and North Africa. Latin America, Eastern Europe and OECD countries are relatively more open while Sub-Saharan Africa shows an intermediate level of services trade openness.

A key stylized fact here is that international agreements have done very little to establish a higher access to service markets.² Why the current framework of services trade agreements is not conducive to the desired policy outcomes is a question that deserves careful consideration and, above all, calls for a deeper understanding of the motives behind commitment to services trade liberalization through an international agreement. While there is little in the way of theoretical investigation on the rationales/motives behind services trade agreements, several hypothesis have been advanced regarding the applicability to services of the main explanations for the existence of international trade agreements.

First, it has been argued that the predominance of foreign direct investment (FDI) in international services transactions weakens the ‘terms-of-trade’ rationale for most services sectors (Hoekman, 2008 and Francois and Hoekman, 2010). The terms-of-trade motive is a prominent argument to explain the existence of a trade agreement as a way out of a prisoner dilemma where each government imposes high barriers in order to improve its terms of trade at the expense of others (Johnson, 1954 and Bagwell and Staiger, 1999). With FDI, protectionist measures that affect world prices benefit both national firms and foreign affiliates which all produce in the same country and sell at the same price.³ Second, the commitment motive developed by Maggi and Rodriguez-Clare (1998) rests on assumptions (perfect competition, trade in final goods) and mechanisms (protectionism as a source of misallocation given countries’ comparative advantages) that do not fit the specificities of services. In their paper, an international agreement serves as a commitment device for the government to distance itself from domestic political pressures which would induce inefficient investment in the sector without comparative advantage. Protectionism in services sectors does not primarily reduce the gains from a comparative advantage mechanism (as it happens in that paper), but mostly reduces the benefits from more competition in sectors where monopolies, large entry costs or state-owned firms are predominant. Moreover, these authors only consider final goods whereas services are major inputs for downstream producers (Francois, 1990a). The lack of a theory that matches the specificities of services calls for further work. The present paper constitutes a first attempt in rationalizing the motives behind services trade agreements accounting for the characteristics of services production and trade.

²In practice, unilateral policy reforms remain the prime channel through which the major (though incomplete) steps toward liberalization have been made so far. This key stylized fact is discussed in details in Francois and Hoekman (2010).

³An additional argument revisiting the terms-of-trade motive is given in Blanchard (2010a) where the terms-of-trade motive is weakened by the rise of international ownership. Governments have less incentives to set high tariffs given that some domestic firms make profits from importing goods and suffer from high tariffs. In the case of services, international ownership mostly aims at accessing a market when cross border exports are not possible or not optimal.

We build a new model whose assumptions fit some key stylized facts about services. First, services are important inputs that are often complementary to other factors; second, trade in services often requires commercial presence; third, services sectors are characterized by significant market imperfections. These premises are shown to be empirically important for trade in services as well as less relevant for trade in goods. A new model that relies on these three features is required to understand the political economy of trade in services. Our framework features an open economy in which a perfectly competitive downstream sector produces a final consumption good using service and non-service intermediates as complementary inputs. Service inputs can be imported by allowing foreign multinationals to establish a commercial presence (engage in FDI) and operate domestically. National services providers and foreign firms' affiliates operate under a regime of oligopolistic competition. The government chooses the number of foreign providers allowed to contest the services market, with free entry representing the welfare-maximizing policy option. Firms can form lobbies and give contributions in order to have an impact on the government's choice.

We show the existence of a commitment motive for services agreements. The government uses trade policies as a substitute for domestic reforms in order to attract foreign multinationals. Imperfect competition in the services sector leads national providers to exert political pressures and lobby for protection against foreign entry. However higher services prices due to protectionist policies leads to underinvestment in the complementary non-services inputs and a lower production of the consumption good. Similarly to Maggi and Rodriguez-Clare (1998), we reveal a time inconsistency problem for the government given that the 'long run' losses due to the protection of the services sector - which triggers an inefficient scale of the final good industry - are not compensated by the political rents. As a consequence, the government can end up worse off when subject to political pressures than under free entry. In this case there is scope for commitment via an international agreement as a tool for the government to credibly distance itself from the special interest groups and to prevent their lobbying activity. Our first contribution is to extend their argument to the case of trade in services and show which characteristics of services production and trade are necessary to reach similar conclusions.

The literature on services trade policies (Hoekman, 2008 and Francois and Hoekman, 2010) supports the existence of such a commitment motive in which agreements act as a commitment device to avoid domestic political pressures even in the absence of reciprocity channels. One of our contributions is to show that the complementarity between services and non-services inputs in downstream production is the key assumption to support the existence of a commitment motive for services.

An additional contribution of our paper is to consider the political influence of foreign firms on the choice of trade policies. We allow foreign providers to coalesce into a lobby and to offer contributions directly to the government. However we assume that governments tend to value a unit of foreign contributions less than the same unit of domestic contributions (Gawande et al., 2006). Two interesting results emerge. First we show that the foreign lobby's optimal policy is not free-entry. The foreign lobby supports lower barriers, i.e. more entry, till the gains from an additional entry are less than the losses due to lower individual profits for all affiliates. We show that whether the foreign lobby pushes for higher or lower market access depends on the number of national services providers. We find that the foreign lobby supports more entry when the number of national firms is large. The economic intuition is simple. With a high number of national firms, the contribution base of the national lobby is large and high barriers tend to be chosen. The gains from an additional foreign firm are higher than the sum of the losses for all foreign firms. In that case foreign lobbying is welfare improving as it counteracts the effect of national lobbying. Second we find that the government's valuation of contributions from foreign firms compared to those from national firms shapes the commitment choice of the government in a non trivial way. In our new framework, we study how the bargaining power of the government, its valuation of foreign contributions and the number of national services providers all interact to explain commitment.

The paper relates to the literature in several respects. First, we provide the existing debate on the motives behind services trade agreements (Hoekman, 2008 and Francois and Hoekman, 2010) with a formal analysis of the commitment rationale for the specific case of trade in services through commercial presence. In doing so, we add to the theoretical work on liberalization in producer services (see for instance Francois, 1990b, Francois, 1990a and Markusen et al., 2005). From these models, we keep the assumptions on the role of services as intermediate inputs and the relevance of investment barriers for services trade. We add a political economy dimension to analyze the trade policy outcomes and the role of agreements in case of political pressures.⁴ Our contribution is to develop a model that relies on these assumptions. Some papers have focused on the effect of the rise of trade in intermediate inputs for commercial policy and the design of trade agreement for goods (Antràs and Staiger, 2012 and Blanchard, 2015). In our paper we go further by focusing on the complementarity between services and other inputs and studying how this affects the willingness of the government to commit to an agreement.

We also contribute to the theoretical literature on the motives behind international

⁴A similar political economy framework can be found in Fung and Siu (2008). These authors however look at the role of political economy forces only for the contingent trade policy outcome while our focus is on the decision to commit via an international agreement.

agreements. We draw from the seminal work on the commitment motive (Maggi and Rodriguez-Clare, 1998) making it compelling for the case of trade in services. One of our contributions is to translate their argument into a model more suitable for services. We do this by departing from a comparative advantage model of trade in final goods, by introducing imperfect competition and, most importantly, by focusing on entry barriers instead of tariffs as the relevant policy instruments. We consider a model with intermediate services that are used for downstream production. Whereas the time inconsistency problem in Maggi and Rodriguez-Clare (1998) relies on firms' choice of sectors in which to initially invest, our time inconsistency mechanism relies on firms' initial investment in non-services inputs that are complementary to services inputs. Under-investment in complement non-services inputs becomes a constraint for the government's action as inefficient investments in sectors with a comparative disadvantage was in their paper. The mechanism is similar but the economic story differs in the case of services and relies on the complementarity assumption of services inputs.

Furthermore, the present paper speaks to existing analysis of foreign lobbying as a determinant of trade policy outcomes (see for instance Gawande et al., 2006). Compared to the existing studies, we consider that the foreign lobby acts as a third agent in the bargaining game. His objective differs from the objectives of both the government and the lobby of national firms. In line with Antràs and Padró i Miquel (2011b), we study how foreign lobbying affects the willingness of governments to commit.

Finally, our framework has implications for the empirical study of commitment to services trade liberalization through international agreements (Egger and Lanz, 2008). It suggests that the degree of services input intensity, the complementarity between intermediate services and other factors of production as well as the impact of foreign lobbying and the size of the national services sector should be considered as determinants of participation into services trade and investment agreements.

The rest of the paper is organized as follows. Section 2.2 discusses some key empirical facts that capture the specificities of services production and trade. Section 2.3 presents our baseline theoretical model and Section 2.4 extends it to allow for foreign lobbying. Section 2.5 offers conclusions.

2.2 Stylized facts

In this part we detail the specificities of services on which we base our modeling assumptions to study the role of services trade agreements. These specificities are shown to be

empirically relevant for trade in services whereas they are often less important for trade in goods.

First services are special inputs into modern production processes, from a quantitative as well as a qualitative perspective. Producer services (transportation, communication, accounting, consulting, financial, computer design services, etc) are important suppliers to the rest of the whole economy.⁵ Good financial and transportation services are necessary to expand the production and trade of final goods. As a consequence, improving the access and the quality of producer services is a crucial step for the rest of the economy to expand. This is supported by the empirical studies that analyze the effect of reforms in the services sector on downstream manufacturing industries (Arnold et al., 2011, Fernandes and Paunov, 2011). The main result of those studies is that higher services productivity, better access to producer services and pro-competitive reforms targeting the service industry have a positive impact on the economic performance of sectors downstream the supply chain, notably manufacturing. What is interesting for our paper is that the entry of multinationals in the services sectors is key to get a positive effect.⁶ Services inputs are therefore key to improve the productivity of the whole economy. However the qualitative difference between services inputs and other types of inputs is that services are often complement inputs in the production function. Overall, services help to coordinate and control specialized operations involving the other factors of production (Francois, 1990a and Markusen et al., 2005). This is modeled in Francois (1990a) as a complementarity relationship between producer services and other inputs in the production function of the final good.⁷ This assumption of complementarity (Leontief production function) is widely used in CGE models which assume that firms' production function exhibits fixed proportions among its inputs (Burfisher, 2011 and UK.GOV, 2014). More recently Jones (2011), Boehm et al. (2015), and Krishna and Levchenko (2013) have been working with the Leontief assumption to discuss the role of input linkages in the propagation of shocks.

⁵Averaging across the 63 countries covered by the OECD Inter Country Input Output (ICIO) database, 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. Additionally, there is often an increasing trend in the evolution of services input intensity from 1995 to 2011: this is the case especially for ICT services, whose cost as intermediate inputs relative to one dollar of total output goes from 0.43 cents in 1995 to 0.86 cents in 2011. OECD 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.

⁶These empirical works include a number of country case studies with firm-level data (such as Arnold et al., 2011, Fernandes and Paunov, 2011, Duggan et al., 2013 and Arnold et al., 2016) as well as few cross-country analysis, often with data at the sector-level (see for instance Arnold et al., 2008, Barone and Cingano, 2011, Bourlès et al., 2013, Hoekman and Shepherd, forthcoming and Beverelli et al., 2015).

⁷More precisely, given that the only factor of production in Francois (1990a) is labor, the complementarity is defined between the labor directly employed for specialized production operations and the labor employed in producer services.

Harrigan et al. (2016) also uses the complementary assumption between ICT services and skilled workers to study the impact of technology on job polarization. In our model, the assumption of complementarity is going to be central to understand the motives for commitments in the case of trade in services. An additional difference between services inputs and goods inputs pertains to their relative role in total trade. For the case of developed OECD countries analyzed by Miroudot et al. (2009) across the ten years from 1995 to 2005, trade in intermediate goods inputs represents 56% of overall trade in goods. The same figure increases by some 30% for services trade, where the flows in intermediate services inputs account for 73% of total services trade.

Moreover, trade in services mainly happens through horizontal FDI, as opposed to cross-border trade. This is a main difference between trade in goods and trade in services which comes from the nature of services. Services are typically intangible and non-storable (Jensen, 2011), such that production and consumption must occur at the same place and time. In order to cover all the possible ways to exchange services, the GATS negotiators have defined four mode of services provision: Mode 1 for cross-border trade; Mode 2 when customers move in the exporter's country; Mode 3 for commercial presence (also called horizontal FDI); finally Mode 4 when the exporter's personnel move to the customer's country. In this paper we only focus on horizontal FDI or Mode 3. This is relevant because a large share of trade in service, especially trade in producer services, happens through horizontal FDI (mode 3).

Figure 2.1 shows the evolution of trade in services through commercial presence (Mode 3 trade) for US exports and imports respectively. Data on trade in services through commercial presence is not captured in the Balance of Payment Statistics. A good measure of mode 3 services trade is given by the Foreign Affiliates in Trade in Services (FATS) data. Mode 3 exports of a national economy are measured as the sales (abroad) of foreign affiliates of national firms. Specularly, mode 3 imports by a reference country are given by the the sales of those services providers that, while located in the country, are foreign affiliates of non national firms. From the beginning of the nineties when both mode 3 imports and exports had a value of approximately 100 billion USD, these trade figures have increased to 800 billion USD for the case of imports and almost to 1300 billion USD - which corresponds to approximately one twelfth of total US GDP - for the case of exports in 2012. This cannot be explained just by a decrease in barriers to FDI: indeed, a large part of services that have increasingly been traded are intangible and can be provided through FDI only.

⁸Foreign Affiliate Trade in Services data used in Figure 2.1 come from the US Bureau of Economic Analysis.

Figure 2.1: Mode 3 Services Trade in the US.⁸



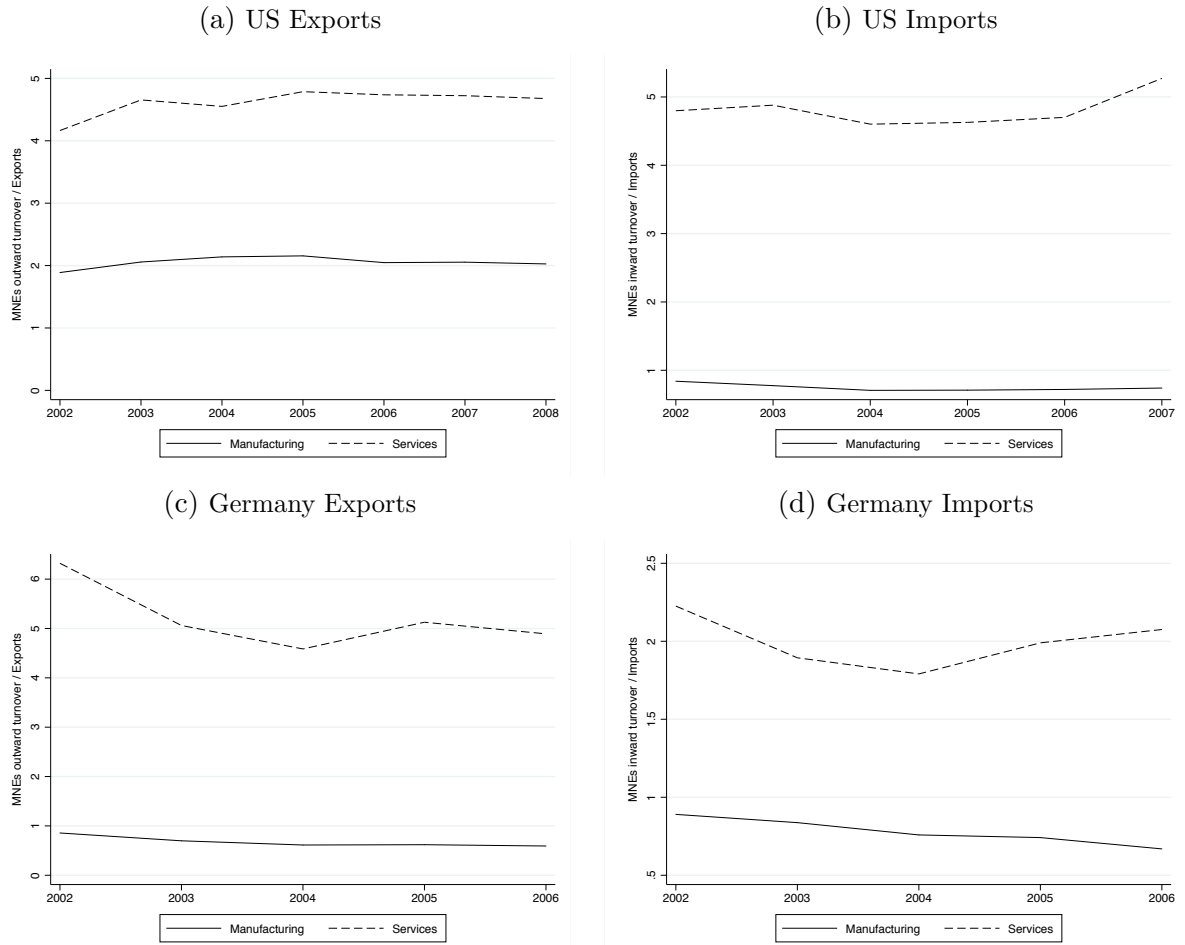
Figure 2.2 compares the figures of trade through commercial presence with those of the trade through cross border exchange for both goods and services in two major trade economies, the US and Germany. Panel 2.2a (2.2c) plots the ratio between mode 3 trade as measured by turnover of US (German) multi-national enterprises in the rest of the World over the value of US (German) gross-exports. For the case of the US (panel 2.2a), the solid line shows that the ratio is quite stable around a value of 2 from 2002 to 2008 for manufacturing goods. For services instead the same ratio is always above 4 and remains pretty close to 5 from 2005 to 2008. When looking at German export this pattern is even more pronounced: in the case of goods, the value of cross border exports (at the denominator of the ratio) is always higher than that of mode 3 exports (the numerator) making the manufacturing ratio (solid line) always below 1. The same ratio for services is instead often above a value of 5 showing that mode 3 exports as opposed to cross border ones are significantly more relevant for services rather than merchandise trade. Analogous conclusions about the importance of mode 3 flows - for services more than for goods - can be drawn from the patterns of mode 3 and cross border imports represented in panels 2.2b and 2.2d.

Mode 3 trade is relevant for services not only quantitatively. An important finding from the empirical trade literature is that the presence of foreign firms is the key channel for successful liberalization reforms (Arnold et al., 2011 and Fernandes and Paunov, 2011).¹⁰

⁹Figure 2.2 combines different sources: data on turnover of foreign affiliates is from the OECD FATS Database; data on cross border (mode 1 and mode 2) services trade is from OECD Trade in Services, EBOP Statistics 2002. Data on manufacturing trade is taken from WITS.

¹⁰Arnold et al. (2011) highlight that foreign entry in services sectors is the key channel to improve performance in the manufacturing sectors. Foreign firms bring know-how and knowledge about new products. Their presence may also lead domestic providers to improve the quality of their products. The positive role of foreign entrants was also shown by Javorcik et al. (2008). They focus on the

Figure 2.2: Mode 3 VS Cross border trade (Goods VS Services).⁹



There are two explanatory channels: foreign firms bring know-how and knowledge about new products, and foreign firms increase competition in sectors where monopolies and high entry costs are predominant. We focus on the last explanation which is particularly relevant in services sectors.

Indeed services sectors are often characterized by a strong degree of market concentration. In their analysis of competition across US industries, Epifani and Gancia (2011) show that services sectors have mark-ups which are from two to three times bigger than the average mark-up in the manufacturing industry. In the same paper the authors argue that the degree of market imperfection is linked to the tradability of an industry's output, highlighting the linkages between market structure and trade policy. Analogously, domestic market imperfections have been identified as key determinants for trade policy action (Hoekman, 2008 and Francois and Hoekman, 2010). In many cases, more lib-

Mexican detergent industry and find that the entry of Walmart reduced the distribution cost for detergent manufacturers. Finally Fernandes and Paunov (2011) studies the impact of FDI inflows in producer service sectors on the productivity of Chilean manufacturing firms.

eral trade policies act as substitutes for domestic reforms to make services sectors more competitive and to improve the provision of intermediate services.

The three facts presented in this section have important implications for the political economy of services trade policy. First, protectionist measures that restrict foreign entry in services sectors directly affect downstream producers. Therefore lobbying from services firms to protect their interests affect the behavior of all producers that use intermediate services and thus create inefficiencies in the provision of consumption goods. We study here how the government reacts to political pressures and chooses trade policies by weighting the interests of consumers and of all producers. Second, horizontal FDI is the main mode of services provision which means that the relevant trade policies here are barriers that restrict the entry of multinationals. Examples of such policy instruments are foreign equity quotas, limit on the number of licenses available, nationality requirements for key personnel and discriminatory licensing criteria.¹¹ Moreover, the market power of services firms suggests that national providers are willing to buy protection for their oligopolistic profits against the entry of foreign providers. Given that the role of foreign firms is crucial in improving domestic services sectors, foreign firms should also be considered as important players in the political game between the government and services firms. Foreign firms will also lobby in order to affect the choice of the domestic government. In the next section we develop a theoretical framework that accounts for the role of services as complementary inputs, the role of FDI in trade in services and the market power of services providers. Our positive analysis of services trade policy embeds the political economy forces described above.

2.3 Theoretical Model

2.3.1 The set up

We consider one Home country (H), and the rest of the world. The economic structure in H consists of 2 sectors: a downstream sector (D) and an intermediary services sector (S). We assume a representative consumer receiving utility from the final good domestically-produced by the downstream sector and from a numeraire that represents the rest of

¹¹For a comprehensive discussion on the relationship between modes of provision and policy instruments see Francois and Hoekman (2010).

production.¹² Formally, utility is given by:

$$\mathbb{U}(x_0, x^D) = x_0 + u(x^D) \quad \text{st. } x_0 + P^D x^D \leq R \quad (2.3.1)$$

with x_0 and x^D being the consumption respectively of the numeraire and the final good, and R the consumer's income. The demand is a function of price and is assumed to be strictly decreasing and twice continuously differentiable. The function 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 its price, not on the consumer's income.

The downstream sector (or final-good sector) consists of a unit measure continuum of small firms, operating under perfect competition. The firms produce a final good using services and other inputs. We model all non-services inputs as an input bundle denoted by k and owned by consumers. Consistently with the coordination role of services inputs, we assume a complementarity relationship between services and k . Downstream producers operate through the following production function:

$$F(k, d^S) = f(\min\{k, d^S\}) \quad (2.3.2)$$

with the usual assumptions on f being increasing and strictly concave. k and d^S are the demands for the input bundle and services from each individual downstream producer.¹³ We focus here on a partial equilibrium model neglecting the impact of services trade policy for non-services upstream markets. The supply of k is assumed unlimited and its price is fixed and denoted by τ . The profit of a downstream producer is given by

$$\pi^D(k, d^S) = P^D F(k, d^S) - P^S d^S - \tau k \quad (2.3.3)$$

with P^D the price of the final good and P^S the price of services inputs. All downstream firms are identical so that the aggregate profit function is given by $\Pi^D = \int_0^1 \pi^D dj = \pi^D$. Similarly, the aggregate demand for the input bundle is $K = k$ and the aggregate demand of services inputs is $D^S = d^S$.

The services sector is characterised by a finite number n of firms that operate under a regime of oligopolistic competition à la Cournot. We assume that services are non tradable through cross-border exports. Foreign services can only be provided through

¹²The numeraire is produced with constant returns to scale with a cost per unit of one which implies that its price is equal to one.

¹³Notice that our assumption on the competitive structure of sector D implies that final-goods producers take inputs and output prices as given. By doing so we prevent any strategic behaviour among downstream firms.

commercial presence (FDI / Mode 3).¹⁴ In order to access the H market, foreign firms have to establish a commercial presence (open an affiliate) in the country and employ domestic (H) specific factors. We assume no cost for opening an affiliate. The revenues from specific factor ownership is given by the profits of the services sector.¹⁵ Once foreign firms are allowed to contest the H market, there is no difference between a Home firm and a Foreign firm any more. Services can therefore be provided by either Home national firms or by affiliates of foreign services providers. We denote by n_d the number of national providers and we take it as an exogenous parameter.¹⁶ The remaining $n - n_d$ services firms operating within the domestic market are affiliates of a foreign firm.

Notice that the owners of the specific factor used by the affiliates of foreign providers own claims on the services sector's profits in the same way as those agents whose specific factor is used by the national services firms. All the n services providers are identical in terms of production capacity and they all take the price of the final good P^D as given. The profits of a services firm are given by:

$$\pi^S(q^S) = q^S P^S(Q_-^S + q^S) \quad (2.3.4)$$

with $P^S(\cdot)$ the price of services 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 individual supply of the firm q^S plus the aggregate supply of all the others, Q_-^S .

We now turn to the political structure of the economy. We assume a national government in country H that can choose the level of market access in the services sector. More precisely, the government takes as given the number of national firms n_d and sets a value for n which directly determines the number of foreign suppliers allowed to operate in the country.

Firms in the services sector are able to coalesce into lobbies that can offer contributions to the government. The rationale behind the lobbying activity comes from oligopolistic competition in the services sector. Indeed, services providers make positive profits depending on the their total number n . Importantly, two lobbies can be formed: the 'national lobby' that represents national services providers and the 'foreign lobby' that aggregates the interests of foreign firms. Denoting with c and c^f the contributions of the

¹⁴We do not model trade in downstream production.

¹⁵We assume that the production of services requires only the use of a sector-specific factor that is available in inelastic supply and non-tradable. The sector-specific model has been used in the literature as exemplified by Grossman and Helpman (1994) or Buzard (2014).

¹⁶This implies that our model has a short-term perspective that does not consider the impact of new national firms.

national and the foreign lobby respectively, their objective function are given by:

$$L(n, c) = n_d \pi^S(n) - c \quad (2.3.5)$$

and

$$L^f(n, c) = (n - n_d) \pi^S(n) - c^f \quad (2.3.6)$$

In case of inactive lobbies the government maximises the welfare given by the sum of the consumer's surplus, the services and downstream producers' surplus and the rents from the input bundle.¹⁷ 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 maximised by the government is given by:

$$W(n) = H(n) + \Pi^D(n) + \Pi^S(n) + \tau K \quad (2.3.7)$$

where $H(n)$ is the consumer surplus that only depends on the price $P^D(n)$,¹⁸ and

$$\Pi^S(n) = \underbrace{n_d \pi^S(n)}_{\text{national firms}} + \underbrace{(n - n_d) \pi^S(n)}_{\text{foreign affiliates}} \quad (2.3.8)$$

When instead special interest groups are active, each lobby pays a contribution to the government in order to have an influence on the trade policy n . The government's objective is the weighted sum of the social welfare and contributions:

$$G(n, c) = aW(n) + c + \gamma c^f \quad (2.3.9)$$

where a is the weight on the social welfare. The parameter γ varies between 0 and 1 and measures to which extent foreign contributions are valued with respect to national ones. Following Gawande et al. (2006), we assume imperfect foreign lobbying: the government will never value one dollar of foreign contributions strictly more than one dollar of national ones.¹⁹ 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.

The timing of the economy is the following. At $t = 0$ there are n_d domestic firms and no

¹⁷This 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.

¹⁸The consumer surplus is $H(P^D) = \frac{(v - P^D)^2}{2}$.

¹⁹The rationale behind $\gamma \leq 1$ is linked to the risks run by policymakers when accepting contributions from foreign entities, this being potentially considered as non consistent with national interests and therefore punished by the voters.

foreign services providers. At the first stage, $t = 1$, the downstream producers buy the non-services input bundle K . No production takes place. In the second stage, $t = 2$, the government chooses its trade policy by fixing n , the total number of services firms allowed to operate in the market. We call this the *trade policy stage*. Notice that this timing reflects the idea that both the government and the lobbies lack commitment with respect to the downstream producers. Relevant downstream economic decisions, exemplified by the purchase of the input bundle K , have to be taken as given in the political game. Finally, at $t = 3$, production in the services sector takes place. The price of services P^S is determined and the downstream firms buy services inputs. Production and consumption of the final goods take place.

We are now ready to solve for the equilibrium of the model. We start deriving a benchmark solution from the simplest case of national lobbying only. Section 2.4 extends the discussion to foreign lobbying.

2.3.2 The equilibrium with national lobbying

We proceed by backward induction. We start describing the incentives of the producers and consumers in the final stage ($t = 3$), given the level of K and the trade policy decided in the previous periods. Then we move to the trade policy stage where, for a given K , a political game between the government and the active lobby determines the number of foreign firms to enter the domestic services sector. Finally, we solve for the optimal aggregate level of the input bundle purchased by downstream producers at $t = 1$. In this section we assume no foreign lobbying ($\gamma = 0$).

The final stage ($t = 3$)

Optimal demand for services inputs. At $t = 3$, downstream producers have already bought the input bundle k and its cost τ is therefore sunk.²⁰ With k given, the demand for services of an individual downstream producer solves the following maximisation problem

$$\max_{d^S} P^D f(d^S) - P^S d^S - \tau k \quad \text{subject to} \quad d^S \leq k \quad (2.3.10)$$

²⁰If the two decisions on k and services inputs had taken place simultaneously, the maximisation problem of a representative downstream firm would have been given by

$$\max_{\{k, d^S\}} P^D f(\min\{k, d^S\}) - P^S d^S - \tau k$$

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

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

$$D^S(P^S, P^D) = \begin{cases} (f')^{-1}(\frac{P^S}{P^D}) & \text{if } (f')^{-1}(\frac{P^S}{P^D}) \leq K \\ K & \text{otherwise} \end{cases} \quad (2.3.11)$$

Optimal behaviour of the services firms. The problem of a services firm is as follows:

$$\max_{q^S} q^S P^S (Q_-^S + q^S) \quad (2.3.12)$$

with $P^S(Q_-^S + q^S) = P^D f'(Q_-^S + q^S)$ given the oligopolistic framework. We use the aggregate demand in services goods (2.3.11) considering a non binding constraint.²¹ In addition, we impose the functional form $f(x) = 1 - e^{-\frac{x}{A}}$ with A positive constant.²² The aggregate services supply is given by:

$$Q^S(P^D) = nA \quad (2.3.13)$$

Optimal behaviour of the representative consumer The consumer only consumes the final good. The demand function is

$$D^D(P^D) = v - P^D \quad (2.3.14)$$

Market clearing First, the aggregate supply Q^S of services has to match the demand from all downstream producers

$$Q^S(P^D) = D^S(P^S, P^D) \quad (2.3.15)$$

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

$$f(K, D^S(P^S, P^D)) = D^D(P^D) \quad (2.3.16)$$

²¹The focus on the case where $(f')^{-1}(\frac{P^S}{P^D}) \leq K$ will be rationalised below when setting the value for τ .

²²This functional form is chosen for tractability reasons. It results in a constant optimal individual supply function $q^S(P^D) = A$.

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

Downstream firms use services and the complementary input bundle 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 k is low enough so that the complementarity of inputs implies that only the relative price of the services affects the final firms' decision. Therefore the initial aggregate purchase of the input bundle is not binding - $K \geq D^S$ - and the demand function for the service input is simply given by $D^S(P^S, P^D) = (f')^{-1}(\frac{P^S}{P^D})$. This imply the following price equations

$$P^D(K, n) = v - f(nA) \quad (2.3.17)$$

$$P^S(K, n) = [v - f(nA)]f'(nA) \quad (2.3.18)$$

Finally, standard comparative statics analysis shows that an increase in the total number of services firms n (i) decreases the price of services inputs P^S , (ii) decreases the final price P^D , and (iii) decreases the profit made by each services firm.²³

The trade policy stage ($t = 2$)

Trade policy n and contributions c are determined through a cooperative bargaining game between the government and the lobby (Maggi and Rodriguez-Clare, 1998). The threat point is given by the trade policy n_0 , chosen by the government in case of no political distortions, and zero contributions. n_0 coincides with free entry for foreign services providers.²⁴ 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), which implies heterogeneity in bargaining power. We denote the bargaining weights σ and $1 - \sigma$, for the government and the lobby respectively. The solution (n^N, c^N)

²³In order to keep these comparative statics results straightforward we assume $v > f(\cdot)$. This allows the derivative of π^S with respect to n to be negative for any positive value of A . For analogous technical reasons, pertaining to subsequent derivations, we further assume v to be smaller than 1.

²⁴Technically this is given by setting the individual profits of services firms equal to 0: $\pi^S(n) = 0$.

maximises the Nash product:²⁵

$$(n^N, c^N) = \arg \max_{(c,n) \in \mathbb{R} \times \mathbb{R}^+} \left[aW(n|K) + c - aW(n_0|K) \right]^\sigma \times \left[n_d \pi^S(n|K) - c - n_d \pi^S(n_0|K) \right]^{1-\sigma} \quad (2.3.19)$$

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

$$\mathbb{J}^N(n) = aW(n|K) + n_d \pi^S(n|K) \quad (2.3.20)$$

A detailed derivation of this result is given in Appendix B.1.

Finally, it is important to highlight that the threat point gives the government a utility $W(n_0|K)$ which differs from the one in a game with no active lobbies. If the political distortions associated with special interest groups are removed, downstream producers do not expect any form of protectionism to increase the price of services inputs. On the contrary, in the political game with lobbying, the aggregate purchase of the input bundle (K) is made given the expectations of political frictions over the trade policy decision.

The initial stage ($t = 1$)

Downstream firms are assumed to be small and, as a consequence, unable to individually affect the aggregate demand for the input bundle. Given the complementarity between services and k , the optimal demand for services determined in the final stage ($t = 3$) represents an upper threshold for k 's demand. We can write the initial stage maximisation program of downstream producers using the expected services demand from the final stage $d^S = (f')^{-1}(\frac{P^S}{P^D})$.

$$\max_k P^D f(k) - P^S d^S - \tau k \quad \text{subject to} \quad k \leq (f')^{-1}\left(\frac{P^S}{P^D}\right) \quad (2.3.21)$$

When the constraint is not binding the solution is given by the first order condition $P^D f'(k) = \tau$, otherwise k is equal to the optimal unconstrained services demand. This defines the aggregate demand for k :

$$K(P^S, P^D) = \min \left\{ (f')^{-1}\left(\frac{\tau}{P^D}\right), (f')^{-1}\left(\frac{P^S}{P^D}\right) \right\} \quad (2.3.22)$$

²⁵The superscript N denotes the solution of the political game when only the national lobby is active.

The assumption on τ (low enough to guarantee that $K \geq (f')^{-1}(\frac{P^S}{P^D})$ in the final stage) reduces the aggregate demand for k to

$$K(P^S, P^D) = (f')^{-1}\left(\frac{P^S}{P^D}\right) \quad (2.3.23)$$

Given our assumption of an unlimited supply of k , aggregate demand is always met. Importantly, our simple framework implies that the aggregate demand for k is decreasing in the relative price of services. Therefore, if services become more expensive, the downstream producers will demand less of the other inputs.

Equilibrium

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

Definition 2.1 (Equilibrium under national lobbying) *The equilibrium of the model with inactive foreign lobbying is defined by the vector*

$$E^N := \{n^N, c^N, K^N, (P^S)^N, (P^D)^N\} \quad (2.3.24)$$

that satisfies the optimal behaviour of the representative consumer in (2.3.14); the optimal demand of services and k from downstream firms given by equations (2.3.11) and (2.3.23); the optimal supply from services firms in (2.3.13); the optimal trade policy (2.3.19); and all market clearing conditions, (2.3.15) and (2.3.16).

The equilibrium reflects coming from the economic as well as political structure of our setting. 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 rent owners 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 equilibrium trade policy results in a number of domestically active foreign providers that is non zero (closed economy) but lower than the free-entry level (fully open economy).

Technically, the equilibrium trade policy n^N and contributions c^N are derived from the

first order conditions of the Nash product - equation (2.3.19) - after having expressed all other relevant quantities as a function of n . In particular, the complementarity assumption between services and k and the market clearing condition for services imply that $K = D^S = Q^S = nA$.

The key properties of the equilibrium are given in the following

Proposition 2.1 *The equilibrium E^N exists and is unique. The equilibrium trade policy n^N is given by*

$$n^N = -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right) \quad (2.3.25)$$

which is increasing in the government's social valuation (a) and decreasing in the number of national services providers (n_d).

Proof. See Appendix B.1.

The equilibrium number of services firms n^N increases in the government's valuation of social welfare (the a parameter). Intuitively, given that setting no entry restrictions is the welfare maximising trade policy, if the government puts less weight on political rents (contributions), it will reduce the barriers to foreign entry by choosing a higher value of n . Instead, the total number of services providers decreases in the exogenous number of national services firms, n_d . A larger national services sector makes it more rewarding for the government to decrease the number of foreign entries.

2.3.3 The political game versus unilateral commitment

Similarly to Maggi and Rodriguez-Clare (1998), we allow the government to commit to its optimal trade policy at $t = 0$, i.e. before any economic decision is taken by the downstream producers. We assume that government commitment at $t = 0$ is perfectly enforceable. As a consequence, if the government commits at the beginning, the subsequent trade policy stage does not take place and there is no political game between the government and the lobby. The welfare maximising trade policy n_0 is associated with no entry restrictions for foreign services firms. It is given by the following zero-profit condition in the services sector

$$\pi^S(n_0) = 0 \iff v - f(n_0A) = 0 \iff n_0 = -\ln(1-v) \quad (2.3.26)$$

Notice that positive contributions in the equilibrium with the political game assure that $n^N < n_0$: indeed, the national lobby is willing to offer contributions with the precise

objective to increase protection beyond the welfare maximising policy n_0 .²⁶

Importantly, the aggregate demand for the input bundle under commitment is given by $K_0 = n_0 A$. This quantity is strictly bigger than K^N , the aggregate demand for k in the equilibrium without commitment. Downstream producers anticipate the distorted equilibrium trade policy when the government chooses not to commit. This implies a higher services price than under commitment. Given the complementarity of services input and k , a higher price for services leads to a smaller demand for the input bundle. Formally

$$K_0 - K^N = A \ln \left(\frac{a - n_d}{a - 2n_d} \right) > 0 \quad (2.3.27)$$

The difference in the equilibrium aggregate input bundle is decreasing in governments valuation of social welfare and increasing in the number of national services firms n_d . Formally

$$\frac{\partial(K_0 - K^N)}{\partial a} \leq 0 \quad \text{and} \quad \frac{\partial(K_0 - K^N)}{\partial n_d} \geq 0 \quad (2.3.28)$$

The intuition behind this result is simple. First, a government that cares more about social welfare (higher value of a) is less influenced by contributions from services firms. The policy chosen in the political game is then closer to its optimal when there is no lobbying. Therefore, downstream producers expect the price of services to be closer to the free-entry benchmark. This will allow them to buy more services at $t = 3$. Anticipating this higher demand for services and given the complementarity of services and k , downstream producers buy more input bundle at $t = 1$. 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 higher restrictions (lower value of n), which in turns imply a higher services price. Downstream producers will then buy less services at $t = 3$. The services- k complementarity in production and the anticipation of a lower demand for services in the final stage, lead the final good firms to buy less of k at $t = 1$.

We can now describe the optimal decision of the government at $t = 0$, whether to commit to n_0 or to do nothing, waiting to play the political game with the lobby during the subsequent trade policy stage. 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 opt for the political game. Indeed, when playing the political game at $t = 2$, the government is constrained by the choice of the downstream producers

²⁶See the proof of Proposition 2.1 for the technical restrictions on the parameters implied by a well defined equilibrium with national lobbying.

from $t = 1$. The optimal allocation gives the government his outside option plus a share of the surplus. However the outside option is not the first-best any more. Indeed, the lower aggregate purchase of k by downstream firms prevents the government to get $W(n_0)$. The government gets its constrained first-best $W(n_0|K)$ plus a share of the surplus that depends on its bargaining power and therefore it be worse off with respect to the benchmark case where it obtains $W(n_0)$. Under commitment instead, the government has the opportunity to set its trade policy at $t = 0$ before any relevant economic decision by the downstream producers. The enforcement is perfect such that the policy chosen cannot be renegotiated. In other words, 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 lower input bundle purchase by the downstream firms (cost of the political game) pins down the value of commitment, defined as the difference between the objective of the government under commitment - G_0 - and the one under the political game, G^N :

$$\Omega = G_0 - G^N = aW(n_0, K_0) - aW(n^N, K^N) - c^N \quad (2.3.29)$$

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

Proposition 2.2 *(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 B.1.

Proposition 2.2 shows that, when the government has a low bargaining power, the rents it can extract from the lobby above its reservation utility are small.²⁷ Therefore the cost of commitment (foregone contributions) is smaller than the cost of playing the political game (lower purchase of k) and the government optimally chooses to initially commit to a unilateral trade policy. On the contrary, a strong government can extract big political rents (above its reservation utility) and therefore chooses not to commit at $t = 0$. Under technical restriction on the parameter v , there always exists a level of bargaining power

²⁷The 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).

above which the cost of commitment is larger than the cost of playing the political game.

Crucial for the decision to commit is the assumption of complementarity between services and other intermediate inputs represented by k . While the time inconsistency setting is not new to the literature on the commitment motive, the inefficiency coming from input complementarity is, to the best of our knowledge, an original contribution of our framework. To further clarify the relevance of our complementarity assumption, let us take the opposite stance and assume perfect substitutability between services and k in downstream production. In that case the government never commits at $t = 0$.

Under perfect substitutability, downstream firms buy either only k if $\tau \leq P^S$ or only services if $\tau \geq P^S$. If k is cheaper, there is no production in the services sectors. Interestingly, when services are expected to be cheaper, downstream firms optimally choose not to buy any other intermediate input. When the government chooses its trade policy at a later stage, no purchase of k has been made and the government can get as an outside option its unconstrained first-best $W(n_0, K_0)$. In any case, the government never wants to commit as he always gets compensated by the lobbies in the bargaining game. This shows that unilateral commitment as an outcome depends on the complementarity assumption between services and non-services inputs.²⁸

We have described the commitment motive that explains why governments might want to unilaterally commit to a trade agreement when services are inputs for downstream productions and are provided by foreign affiliates in the host country. Such commitment motive arises when lobbying by national firms leads to entry restrictions. Downstream producers underbuy non-services inputs anticipating a higher price for services inputs. This creates a time-inconsistency problem that might lead the government to choose to initially commit.

2.4 The role of foreign lobbying

So far we have assumed that only national firms can coalesce into a lobby. In this section we relax this assumption and study the outcome of a game where foreign multinationals can form a lobby and offer contributions to the domestic government (foreign lobbying). Foreign firms' interests differ from those of national firms'. Do foreign firms always lobby

²⁸While here we only discuss the two extreme cases of perfect complementarity and perfect substitutability, further work can be done on the link between the elasticity of substitution between inputs and commitment to liberalization in the services sectors. The analysis in this paper suggests that more liberal commitments should be observed in sectors that are characterized by a lower elasticity of substitution with other types of inputs.

for more entry? What is the outcome when both national and foreign firms can lobby? What happens when governments undervalue foreign contributions?

The objective function of the lobby of foreign multinationals ('foreign lobby') differs from the one of the lobby of national firms ('national lobby'). It is given by $L^f(n, c^f) = (n - n_d)\pi^f(n) - c^f$ with c^f the contribution that is given to the government. Whereas the national lobby's objective is maximized under no foreign entry ($n = n_d$), the optimal policy of the foreign lobby is neither no entry ($n = n_d$) nor free-entry ($n = n_0$), and is given by:

$$\tilde{n} = \arg \max_n (n - n_d)\pi^f(n) \quad \text{with} \quad n_d \leq \tilde{n} \leq n_0 \quad \wedge \quad \pi^f(\tilde{n}) = -(\tilde{n} - n_d)\pi^{f'}(\tilde{n}) \quad (2.4.1)$$

The lobby of foreign firms maximizes the sum of all affiliates' profits and pushes for more entry till the gain from an additional entry ($\pi^f(n)$) is lower than the aggregate losses from all decreasing profits ($-(n - n_d)\pi^{f'}(n)$). Free-entry increases the number of foreign firms that benefit from entering the domestic market but individual profits are decreasing in the number of total producers ($\pi^{f'}(n) < 0$). We therefore 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 affiliate. 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).

In this part we assume that both the national and the foreign lobby can offer contributions to the Home 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. Compared to this work, we model the game between the government and the two lobbies as a bargaining game. 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's objective function is:

$$G(n, c, c^f) = aW(n) + \mathbb{I}c + \gamma c^f \quad (2.4.2)$$

The dummy \mathbb{I} is used to study the case where only foreign lobbying takes place ($\mathbb{I} = 0$).

The bargaining game solutions are given by the maximization of the Nash product

$$(n^\gamma, c^\gamma, c^{f,\gamma}) = \arg \max [G(\cdot) - G_0]^{\sigma_G} [L^N(\cdot) - L_0^N]^{\sigma_N} [L^F(\cdot) - L_0^F]^{\sigma_F} \quad (2.4.3)$$

The threat point is given here by full liberalization ($n = n_0$), and no political contributions ($c = c^f = 0$). At the stage of the game when the government sets its trade policy the level of investment by the downstream firms is already chosen and its cost sunk. Therefore the threat point is constrained by the optimal decision of the downstream firms that, anticipating future political frictions, underinvested at the beginning: $G_0 = aW(n_0|K)$, $L_0^N = \Pi(n_0|K)$ and $L_0^F = \Pi^D(n_0|K)$. The FOCs of the Nash product maximization imply that the new trade policy n^γ maximizes $aW(n) + n_d\pi(n) + \gamma(n - n_d)\pi(n)$ where the aggregate profits of the foreign affiliates are less valued than the profits of the national firms. The equilibrium is defined in the following

Definition 2.2 *The equilibrium of the model with foreign lobbying is defined by the vector*

$$E^\gamma := \{n^\gamma, c^\gamma, c^{f,\gamma}, K^\gamma, (P^S)^\gamma, (P^D)^\gamma\} \quad (2.4.4)$$

that satisfies the optimal behaviour of the representative consumer in (2.3.14); the optimal demand of services and non-services inputs k from downstream firms given by equations (2.3.11) and (2.3.23); the optimal supply from services firms in (2.3.13); the optimal trade policy, national and foreign contributions (2.4.3); and all market clearing conditions, (2.3.15) and (2.3.16).

For simplicity the policy when only foreign firms lobby ($\mathbb{I} = 0$) is denoted by n^F . The next proposition presents the main properties of the equilibrium.

Proposition 2.3 *The equilibrium exists and is unique. The equilibrium policy is given by:*

$$n^\gamma = -\ln \left(\frac{(1-v)(a + \gamma - \gamma n^\gamma - (\mathbb{I} - \gamma)n_d)}{(a + \gamma - 2\gamma n^\gamma - 2(\mathbb{I} - \gamma)n_d)} \right) \quad (2.4.5)$$

Moreover

1. *if only perfect foreign lobbying takes place, i.e. if $\mathbb{I} = 0$ and $\gamma = 1$, there exists a threshold n_d^- in the number of domestic firms such that*

$$\begin{cases} n_d \leq n_d^- & \Rightarrow & n^\gamma(\mathbb{I} = 0) = n^F \leq n^N \\ n_d \geq n_d^- & \Rightarrow & n^\gamma(\mathbb{I} = 0) = n^F \geq n^N \end{cases} \quad (2.4.6)$$

Compared to national lobbying, foreign lobbying only is welfare improving when the

number of domestic firms is large enough ($n_d \geq n_d^-$).

2. if both national and imperfect foreign lobbying take place, i.e. if $\mathbb{I} = 1$ and $0 \leq \gamma \leq 1$, there exists a threshold \hat{n}_d in the number of domestic firms such that

$$\begin{cases} n_d \leq \hat{n}_d & \Rightarrow & \frac{\partial n^\gamma}{\partial \gamma} \leq 0 & \wedge & n^\gamma \leq n^N \\ n_d \geq \hat{n}_d & \Rightarrow & \frac{\partial n^\gamma}{\partial \gamma} \geq 0 & \wedge & n^\gamma \geq n^N \end{cases} \quad (2.4.7)$$

A higher valuation of foreign contributions by the government leads to a higher level of entry, i.e. lower restrictions, only when the number of domestic firms is large enough ($n_d \geq \hat{n}_d$). Compared to national lobbying only, foreign lobbying is here welfare improving only when the number of domestic firms is small enough ($n_d \leq \hat{n}_d$).

Proof. See Appendix B.1.

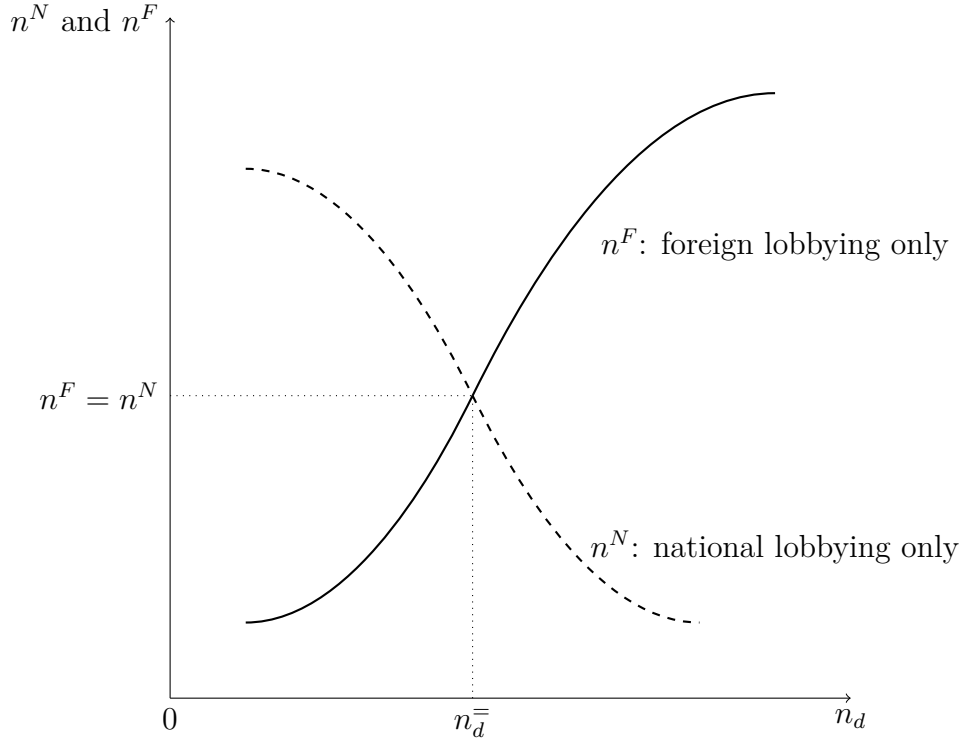
Proposition 2.3 presents two cases: foreign lobbying only (point 1) and both national and foreign lobbying (point 2). It is interesting to detail the case of foreign lobbying only in order to understand the role of foreign firms in the more complex scenario when both national and foreign providers can offer contributions. Figure 2.3 offers a qualitative illustration of the result discussed in point 1.

When the number of national firms is large enough ($n_d \geq n_d^-$), the result is intuitive. The policy is higher when only foreign affiliates can lobby rather than only national firms. A high number of national firms implies that they have a relatively high influence on the government. The policy is therefore a low number of foreign affiliates. From the perspective of foreign firms, there are already a lot of national producers in the market so it is more likely that the gain from one additional entry remains larger than the losses from the decreasing profits.²⁹ The lobby of foreign firms therefore pushes for more entry. In that case foreign lobbying is welfare improving because it leads to a higher number of total producers in the services market.

When the number of national firms is small ($n_d \leq n_d^-$), the result might seem counter-intuitive. The policy chosen when only foreign firms lobby is lower than the one when only national firms lobby. A low number of national firms means that the national lobby is rather weak and the policy that is chosen in case of national lobbying is not too restrictive. This implies a potentially high number of foreign affiliates. The latter are numerous enough to push for more restrictions in order to increase their individual

²⁹This is due to the concavity of individual profits with respect to the number of producers. The marginal loss from an additional producer decreases.

Figure 2.3: The case of one lobby: the national lobby versus the foreign lobby.

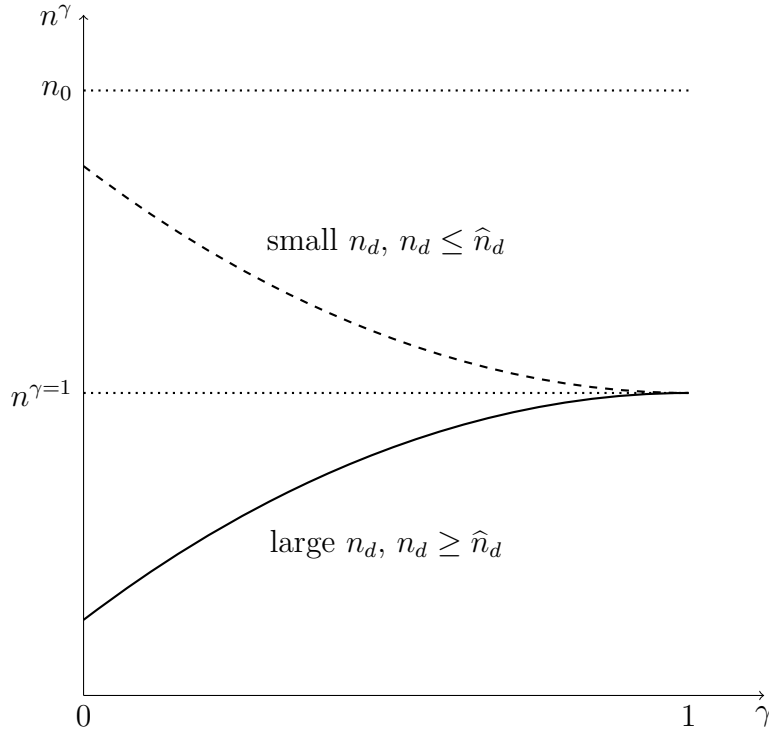


profits. The intensive margin exceeds the extensive margin. In that case foreign lobbying is not welfare improving because it leads to a lower number of total producers in the services market.

Let us move to the second part of Proposition 2.3 where both national and foreign firms can offer contributions. The interesting parameter here is the government's valuation of a unit of foreign contributions with respect to a unit of national ones. Figure 2.4 provides a qualitative representation of point 2 in Proposition 2.3.

There are two cases that emerge when all firms can lobby. The number of national firms determines how the parameter γ affects the policy outcome and whether foreign lobbying is welfare improving or not compared to national lobbying only. When the number of national firms is small ($n_d \leq \hat{n}_d$), the policy decreases in the valuation of foreign contributions or, in other words, the more foreign contributions are valued by the government, the more restrictive the policy is. To understand this result, it is useful to remember the previous description of the role of foreign lobbying in point 1. Figure 2.3 showed that for a small number of national firms, the policy chosen with foreign lobbying only was lower than the policy chosen under national lobbying alone. Therefore, a higher influence of foreign contributions in point 2 is expected to move the policy closer to the

Figure 2.4: Trade policy n^γ under imperfect foreign lobbying $0 \leq \gamma \leq 1$



outcome of perfect foreign lobbying. This explains why a higher value of γ leads to a lower policy outcome, i.e. a more restrictive policy.

The opposite happens when the number of national firms is large enough. Figure 2.3 showed that the foreign lobbying policy was higher than the national lobbying one. A higher valuation of foreign contributions in point 2 then increases the policy outcome, i.e. it leads to a less restrictive policy. Finally the impact of the number of national firms disappears when the government equally values both types of contributions. To conclude, a higher valuation of foreign contributions is welfare improving only when the number of national firms is large enough. This is interesting because it shows whether and the extent to which allowing foreign firms to lobby the domestic government can be welfare improving.

2.4.1 Foreign lobbying and commitment

In this last part we study the government's decision to commit when foreign firms can lobby. We need first to define the commitment value Ω when both national and foreign firms can lobby and when foreign contributions can be undervalued. The commitment

function of the government defined by $\Omega = G_0 - G^\gamma$ is given by

$$\begin{aligned}\Omega = & aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - \frac{\sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F}[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\ & - [\frac{\gamma\sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F}][\Pi^D(n^\gamma) - \Pi^D(n_0|K^\gamma)]\end{aligned}$$

Result 2.1 *We can define a bargaining power threshold by $\bar{\sigma}_G$ such that $\Omega(\bar{\sigma}_G) = 0$. $\bar{\sigma}_G$ is given by the following equation:*

$$\bar{\sigma}_G = \frac{[1 + (\gamma - 1)\sigma_F][aW(n_0|K_0) - aW(n^\gamma|K^\gamma)]}{[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] + \gamma[\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]} \quad \wedge \quad 0 \leq \bar{\sigma}_G \leq 1 \quad (2.4.8)$$

Proof. See Appendix B.1.

Given the complexity of the commitment expression, 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.³⁰ Panels (a), (c) and (e) of Figure 2.5 show the policy outcome of the bargaining game for different values of the number of national firms n_d . First, we notice that a low value of n_d leads to a policy which is decreasing in the valuation of foreign contributions γ , whereas a high value of n_d leads to a policy increasing in γ (as illustrated in point 2 of Proposition 2.3). For each case we plot the value of the commitment function Ω at three different values of the government's bargaining power ($\sigma_G = 0.3/0.6/0.9$). The government chooses to commit when $\Omega \geq 0$.

The panels (b), (d) and (f) of Figure 2.5 suggest that the government's decision to sign a trade agreement depends on three parameters: the number of national firms, the bargaining power of the government and the valuation of foreign contributions.

Let us start from the case of a large initial number of national firms (high value of n_d) in panel (f). As discussed above, trade policy n^γ is increasing in the government's valuation γ (panel (e) in Figure 2.5). 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 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 (decreasing curves in panel (f) of Figure 2.5). Similarly to the classic

³⁰We present the results for the following values of the parameters: $A = 1$, $v = 0.7$, $a = 0.99$. We add similar results in Appendix B.2 to show that the key qualitative patterns illustrated in this section are robust.

analysis in Maggi and Rodriguez-Clare (1998), a low bargaining power increases the preference of the government for commitment whereas a large bargaining power increases his preference for the lobbying game.

In the case of a small (or very small) initial number of national firms (panels (d) and (b) of Figure 2.5), foreign lobbying has two countervailing 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 (panels (c), (a) of Figure 2.5): the foreign lobby pushes for higher restrictions in the same way as the national lobby does. 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 .

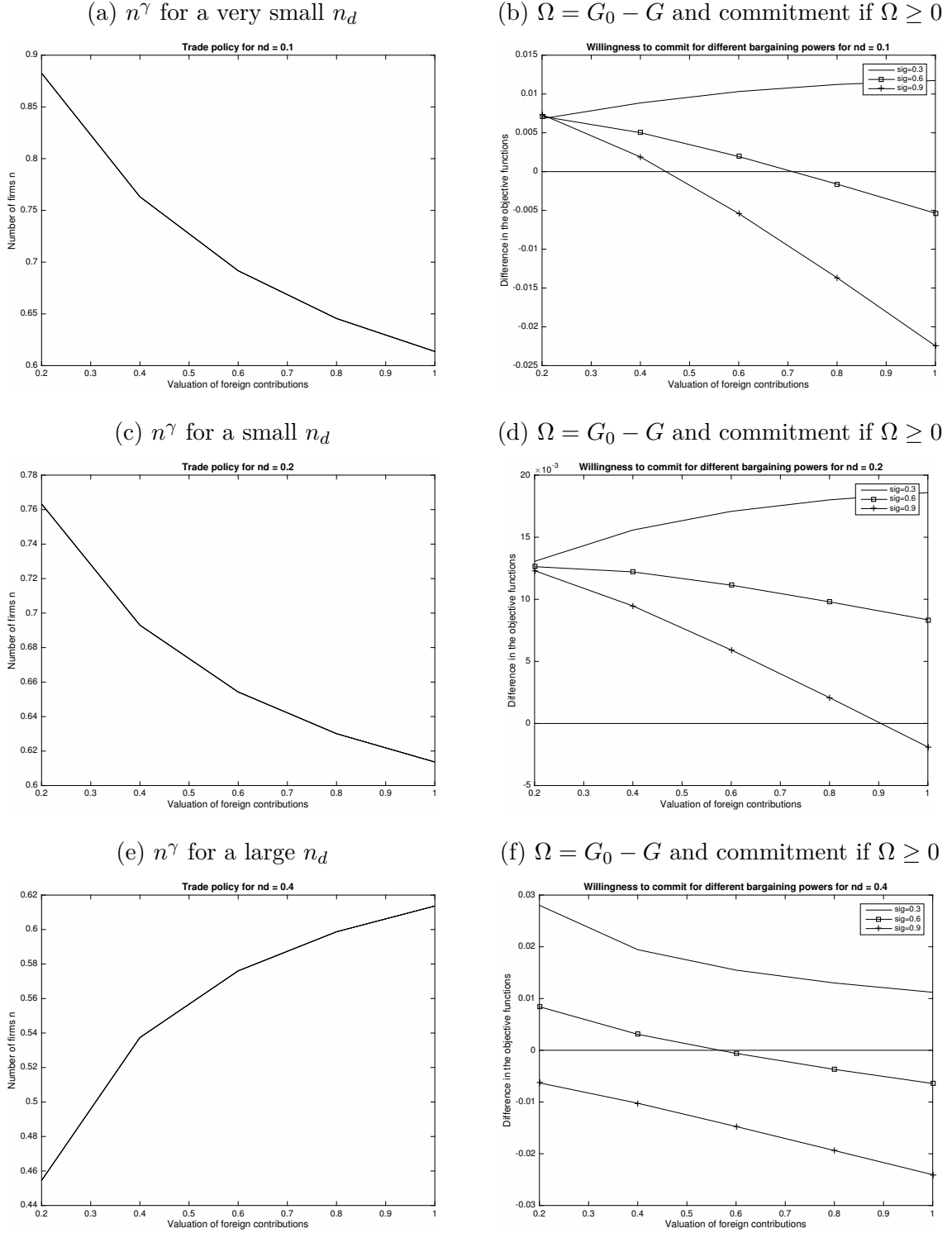
Which one of the two effects prevails depends on the bargaining power of the government. High values of the bargaining power allow the government to extract bigger political rents and therefore make the direct effect of γ on the value of contribution units relatively more important than its indirect effect. In this case the value of commitment is a decreasing function of γ (this case is represented by the curve corresponding to $\sigma_G = .9$ in panels (d) and (b) of Figure 2.5). 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 curve at $\sigma_G = .1$ in panels (d) and (b) of Figure 2.5).

Compared to Maggi and Rodriguez-Clare (1998), we have extended the set of relevant determinants of government's commitment to the impact of the valuation of foreign contributions and the number of national services providers.

To sum up, except when the government's bargaining power is very low, the commitment value Ω decreases in the valuation of foreign contributions. The explanation differs depending on the number of national services providers (whether we are in the first or second case of point 2 in Proposition 2.3). In the case of a decreasing policy outcome (low number of national firms in panels (a) and (c)), the welfare W decreases with a lower policy outcome but the government values more foreign contributions that increase its utility when playing the political game. This can explain why the government is less

and less willing to commit for higher valuations of foreign contributions. In the case of an increasing policy outcome (high number of national firms in panel (e)), the welfare increases because of a higher policy outcome. This can explain why the government less and less needs to commit. Foreign lobbying reduces the time-inconsistency problem. Panel (e) indeed shows that the government is less likely to commit when foreign lobbying leads to higher policy outcome, i.e. to a less restrictive trade policy. The willingness to commit is even lower when the government's bargaining power is high.

Figure 2.5: Foreign lobbying and commitment



2.5 Conclusions

This paper contributes to the trade policy literature proposing a theory that rationalizes services trade agreements as a commitment device to implement domestic reforms in the services market. Our framework fits to the specificities of services better: their role of complementary inputs, the importance of commercial presence (FDI) and of entry barriers, and the role of trade policies in case of imperfect competition. By extending the basic setting to allow for foreign lobbying that is imperfectly valued by the government, we identify a set of parameters which determine the government's choice to commit. For instance, our model explains the observed low commitment through international services agreements as the consequence of a large national services sector combined with a high valuation of foreign contributions.

Our analysis leaves several interesting implications open to future empirical research. In particular, it suggests that two new sets of variables should be considered when explaining services trade policies and commitments in services agreements. First, variables capturing the quantitative and qualitative extent of services input intensity to downstream production. The results in the present paper imply that a higher use of services inputs and a more pronounced complementarity between services inputs and other factors of production can trigger a more open trade policy with respect to services transactions as well as higher commitment to services trade liberalization via international agreements. A second set of variables consists of proxies for the size or political influence of domestic services industries on the one hand and for foreign lobbying activities on the other. Our model suggests that the role of the latter for commitment to services trade liberalization depends on the value of the former and on the government's bargaining power.

Beyond the case of services trade policy, the role of foreign lobbying has been theoretically and empirically understudied. There is no quantitative cross-country index to reflect the possibility for foreign firms to lobby. Foreign lobbying is even more relevant when firms use foreign investment rather than cross-border exports to sell in international markets.

Chapter 3

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

With Matteo Fiorini and Alberto Osnago

3.1 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 Treffer (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.

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

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.

The outline of the paper is as follows. In Section 3.2 we describe some stylized facts on the linkages between trade and productivity. Section 3.3 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 3.4 concludes.

3.2 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.

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.

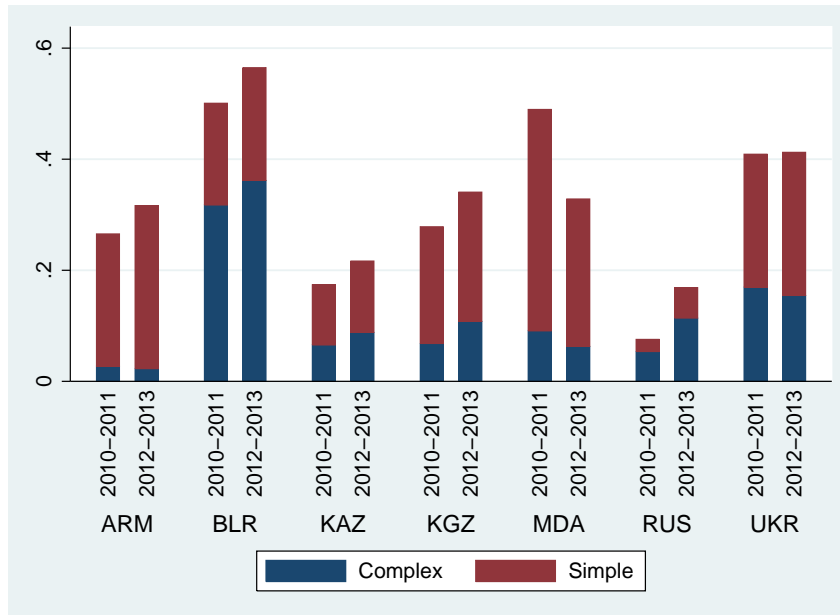
A recent liberalization episode among Commonwealth of Independent States (CIS) countries represents a good example of how institutional quality affects the gains from trade liberalization. The idea of a free trade area among CIS the emerged already right after the break up of the Soviet Union in 1991. 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 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 3.1 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 3.1 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.

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.

Figure 3.1: 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 3.1 shows the quality of contract enforcement in the countries 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

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. 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

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.

Table 3.1: 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.

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 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.

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).

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.

3.3 The model

3.3.1 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:

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

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.

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 .

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 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:

$$l := \int_{u \in \mathbb{Y}(\varphi)} \frac{1}{\varphi} du + \frac{1}{\varphi} \quad (3.3.1)$$

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

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

$f > 0$. 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 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

$$\mathbb{I}(supply) = \begin{cases} 1 & \text{with probability } e^{-\frac{1}{\theta}} \\ 0 & \text{with probability } 1 - e^{-\frac{1}{\theta}} \end{cases} \quad (3.3.2)$$

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

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 founded application in Appendix.

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.

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.

3.3.2 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,

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.

consumption across varieties is given by the following equations:

$$c(\omega) = \begin{cases} \mathbf{S}[p(\omega)/P^S]^{-\sigma} & \text{if } \omega \in \Omega^S \\ \mathbf{A}[p(\omega)/P^A]^{-\sigma} & \text{if } \omega \in \Omega^A \end{cases} \quad (3.3.3)$$

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:

$$y(\varphi) = \mathbb{P}(\mathbb{I} = 1)^{N(\varphi)} \int_{u \in \mathbb{Y}(\varphi)} du \quad (3.3.4)$$

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 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

$$\max_N pe^{-\frac{N}{\theta}} \frac{\varphi}{z^i} S \left(h - \frac{z^i}{\varphi N} \right) - w(S + f) \quad (3.3.5)$$

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

Proposition 3.1 (*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*

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 $\left(h - \frac{z^i}{\varphi N} \right)$ the number of hours left for production for each supplier after the learning process.

is:

$$N^*(\varphi, z, \theta) = \frac{z}{2h\varphi} \left(1 + \sqrt{1 + \frac{4\theta h\varphi}{z}} \right) \quad (3.3.6)$$

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 3.1 (*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 directly 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 3.2 and 3.3.¹⁸

¹⁸The general patterns shown in Figure 3.2 hold for any level of institutions. The general patterns in figure 3.3 hold for any level of complexity.

Figure 3.2: The degree of fragmentation N^* for the two sectors S and A in one country

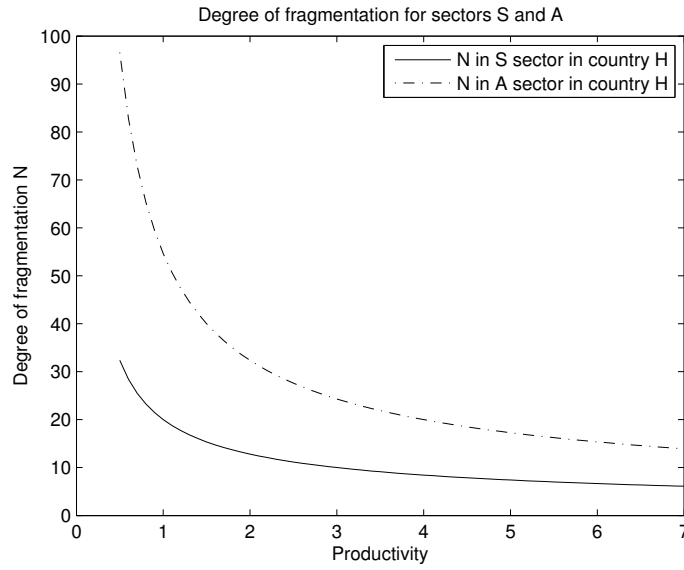
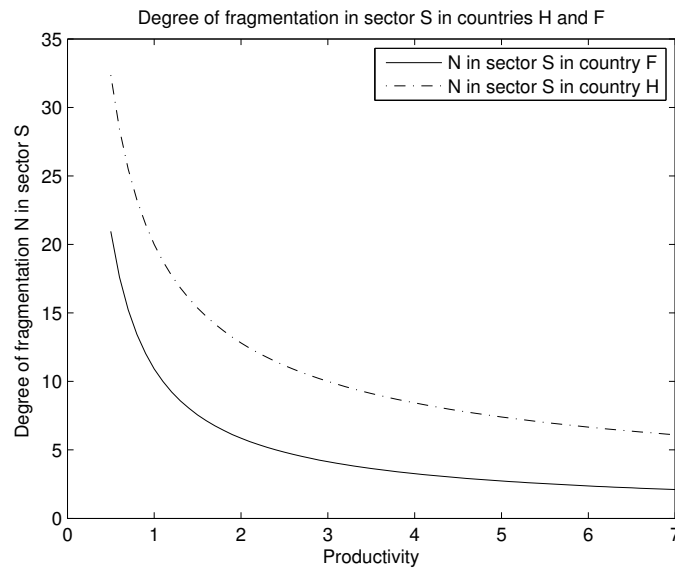


Figure 3.3: The degree of fragmentation N^* for two countries with different qualities of institutions θ^H and θ^F in one sector



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:

$$S^i(y) = \frac{z^i}{\varphi} e^{\frac{N^i(\varphi)}{\theta}} \left(h - \frac{z^i}{\varphi N^i(\varphi)} \right)^{-1} y \quad (3.3.7)$$

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

$$\beta^i(\varphi) := \frac{\partial S^i(y)}{\partial y} = e^{\frac{N^i(\varphi)}{\theta}} \left[\frac{h\varphi}{z^i} - \frac{1}{N^i(\varphi)} \right]^{-1} \quad (3.3.8)$$

The maximization problem of the final firm can be written as

$$\max_y p^i(y)y - w \left[S^i(y) + f \right] \quad (3.3.9)$$

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 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:

$$\epsilon^i(\varphi) = \epsilon = \frac{1}{1 - \rho} \quad \text{where} \quad \rho = \frac{\sigma - 1}{\sigma} \quad (3.3.10)$$

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.

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

$$p^i(\varphi) = \frac{\beta^i(\varphi)}{\rho} \quad (3.3.11)$$

The profit function is given by

$$\pi^i(\varphi) = \frac{R}{2\sigma} \left[\frac{P^i \rho}{\beta^i(\varphi)} \right]^{\sigma-1} - f \quad (3.3.12)$$

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

Observation 3.2 (*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

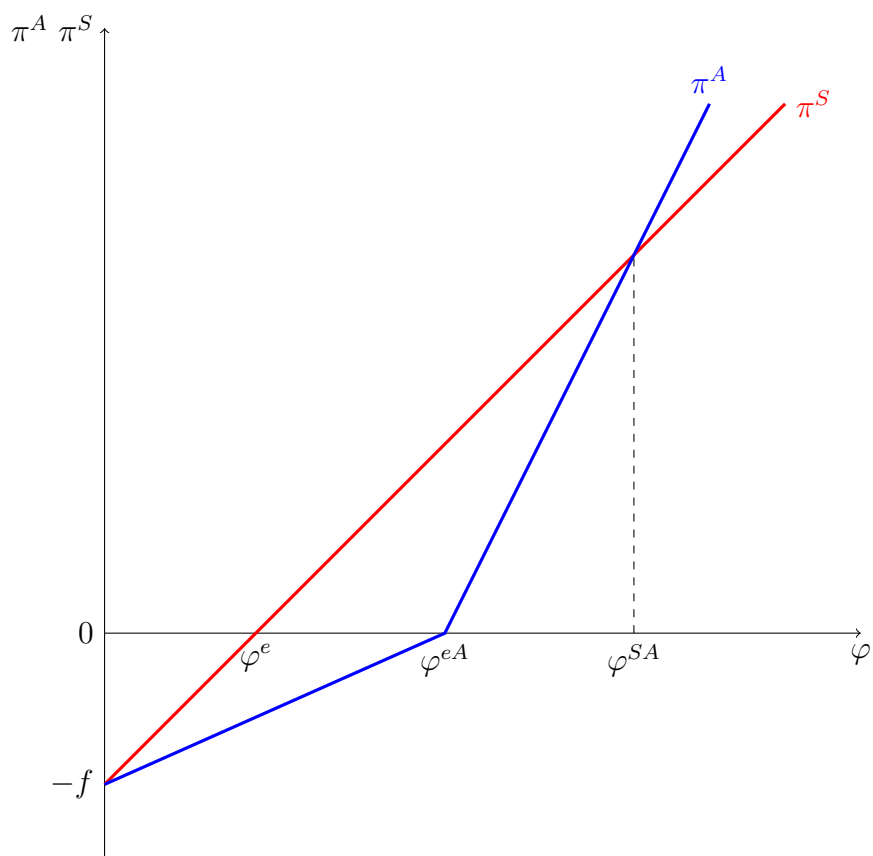
Proposition 3.2 (*Production and sector decision*) If the autarky equilibrium (properly defined later) exists, (i) there exists one productivity threshold φ^{SA} such that $\pi^S(\varphi^{SA}) = \pi^A(\varphi^{SA}) > 0$; (ii) there exist two productivity thresholds φ^{eS} and φ^{eA} such that $\pi^S(\varphi^{eS}) = \pi^A(\varphi^{eA}) = 0$ 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.

Proposition 3.2 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 3.4 where we rely on a simplified representation of the profit functions for the two sectors.

Figure 3.4: Profits as function of productivity



Proposition 3.2 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 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:

$$V = \frac{[1 - G(\varphi^e)]}{\delta} \bar{\pi} = f_e \quad (3.3.13)$$

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:

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

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.

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 3.3 (*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.

All the equilibrium endogenous variables can be pinned down from the vector of thresholds $(\varphi^{e*}, \varphi^{SA*})$. See Appendix (Proof of Proposition 3.3) for a detailed derivation of the equilibrium under autarky.

Observation 3.3 (*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:

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

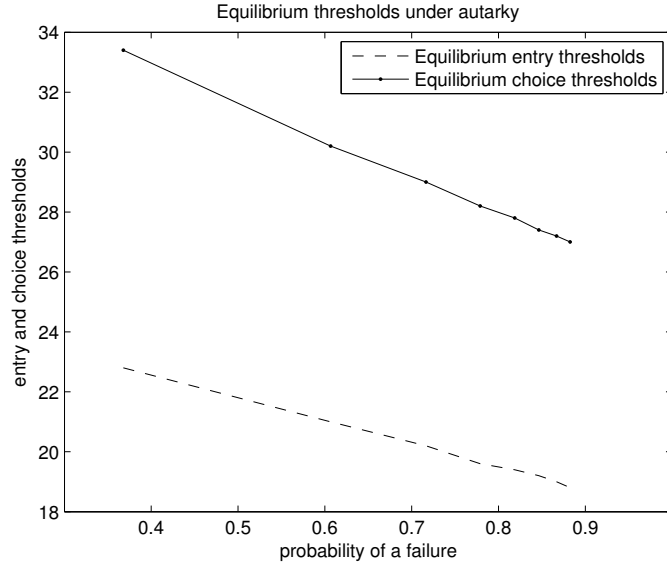
and

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

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 3.5, 3.6 and 3.7 provide a graphical representation of Observation 3.3 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 as functions of the probability of successful provision $\mathbb{P}(\mathbb{I} = 1) = e^{\frac{-1}{\theta}}$.

Figure 3.5: Entry and choice thresholds φ^{e*} and φ^{SA*} as functions of institutions $\mathbb{P}(\mathbb{I} = 1)$



3.3.3 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 3.3.4. 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

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 $z^A = 40$.

Figure 3.6: Marginal costs at the productivity thresholds ($\beta^S(\varphi^{e*}), \beta^A(\varphi^{SA*})$) as functions of institutions $\mathbb{P}(\mathbb{I} = 1)$

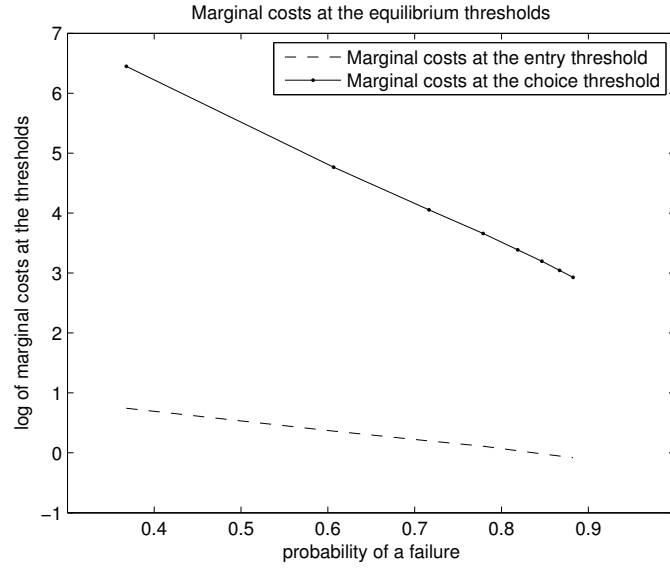
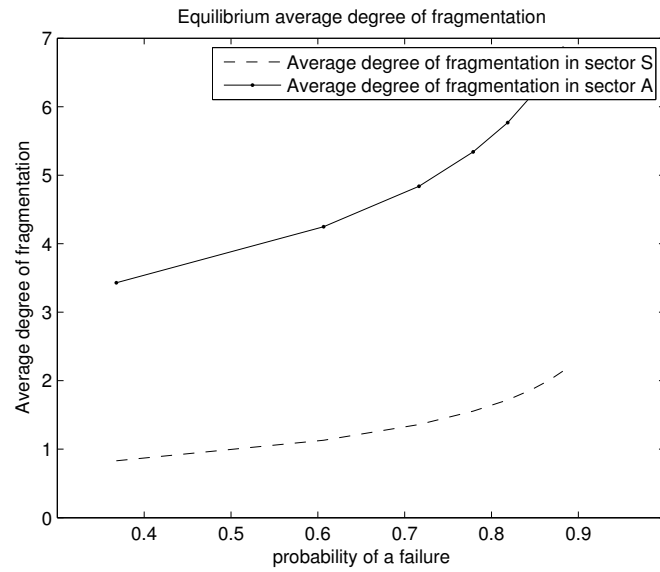


Figure 3.7: Average degrees of fragmentation (\tilde{N}^S, \tilde{N}^A) as a function of institutions $\mathbb{P}(\mathbb{I} = 1)$



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 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 3.2 still holds under free trade. Firms' sector-

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

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

$$M_k^S = \frac{[G(\varphi_k^{SA}) - G(\varphi_k^e)]}{[1 - G(\varphi_k^e)]} M_k \quad \text{and} \quad M_k^A = \frac{[1 - G(\varphi_k^{SA})]}{[1 - G(\varphi_k^e)]} M_k \quad (3.3.14)$$

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

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi_k^{SA}) - G(\varphi_k^e)] \left\{ \left[\frac{\tilde{\beta}_k^S(\varphi_k^e, \varphi_k^{SA})}{\tilde{\beta}_k^S(\varphi_k^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi_k^{SA})] \left\{ \left[\frac{\tilde{\beta}_k^A(\varphi_k^{SA})}{\tilde{\beta}_k^A(\varphi_k^{SA})} \frac{\tilde{\beta}_k^S(\varphi_k^{SA})}{\tilde{\beta}_k^S(\varphi_k^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \end{aligned} \quad (3.3.15)$$

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

$$\{\varphi_k^{e,FT}, \varphi_k^{SA,FT}, P_k^{S,FT}, P_k^{A,FT}, M_k^{FT}, p_k^{S,FT}(\varphi), p_k^{A,FT}(\varphi)\} \quad \text{for } k \in \{H, F\} \quad (3.3.16)$$

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.

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 3.5 (*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.

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

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.

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 3.6 (*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.

We provide a graphical representation of Proposition 3.6 in Figure 3.8 and Figure 3.9.

Figure 3.8: Change in thresholds for the country with good institutions



Figure 3.9: Change in thresholds for the country with poor institutions



The result from Proposition 3.6 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 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 3.6 reveals a mechanism that will guide our economic intuition.

Consider country H with good institutions. 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 mechanism 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 3.1 *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 3.10 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 3.10 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 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.

Aggregate productivity

Proposition 3.6 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 3.11 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 3.2 *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*

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

Figure 3.10: Relative price P^S/P^A

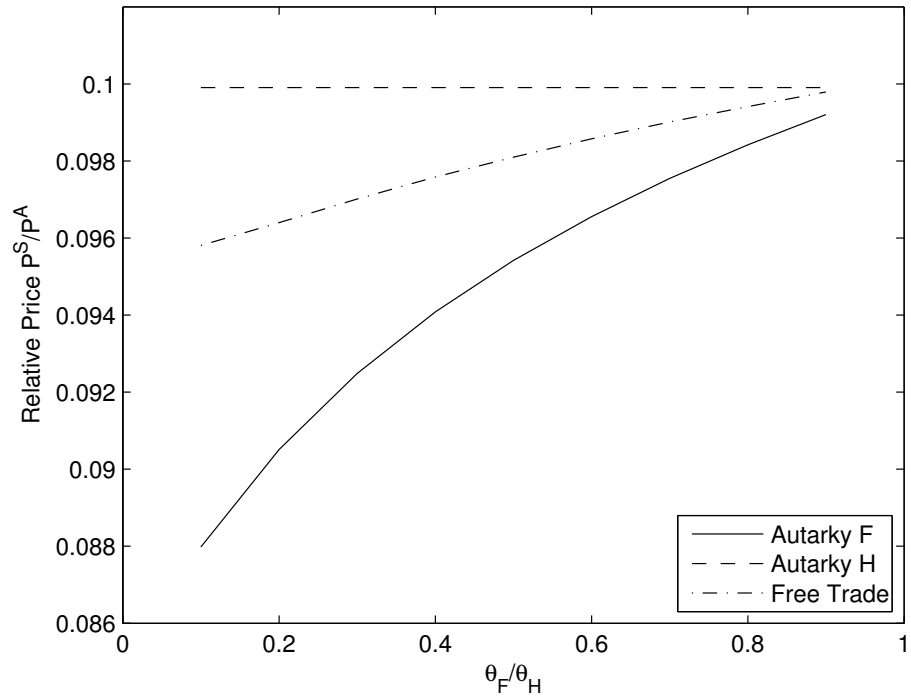


Figure 3.11: Entry and choice ratio

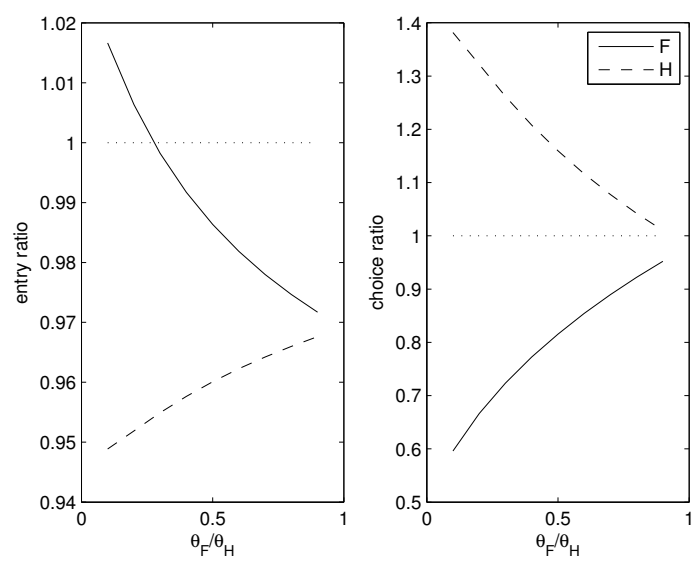
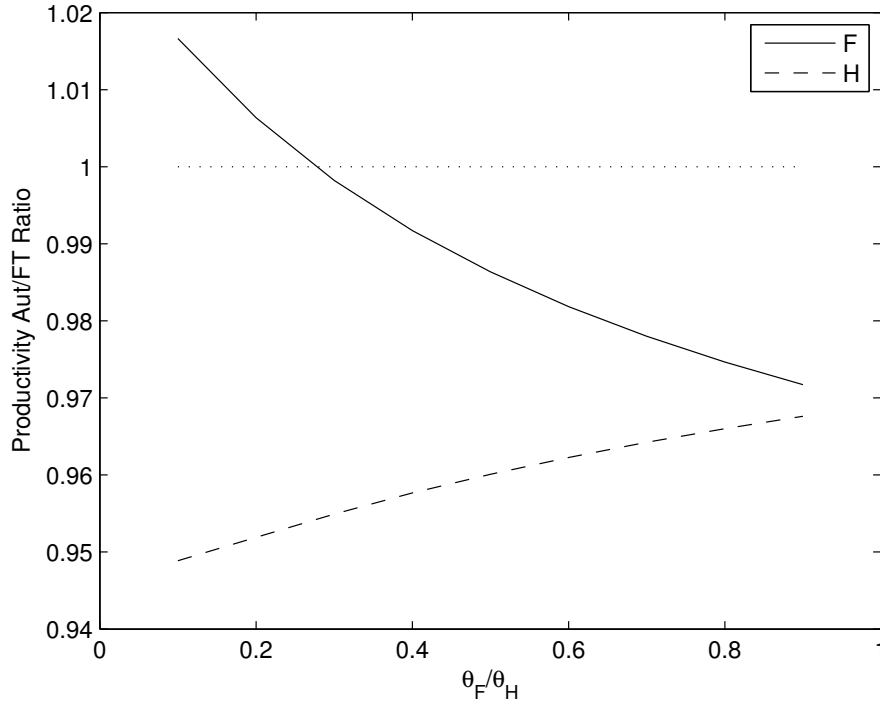


Figure 3.12: Aggregate productivity (Autarky/Free Trade ratio)



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 liberalization 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 3.6). 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 3.3 *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 3.11 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 3.6). 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

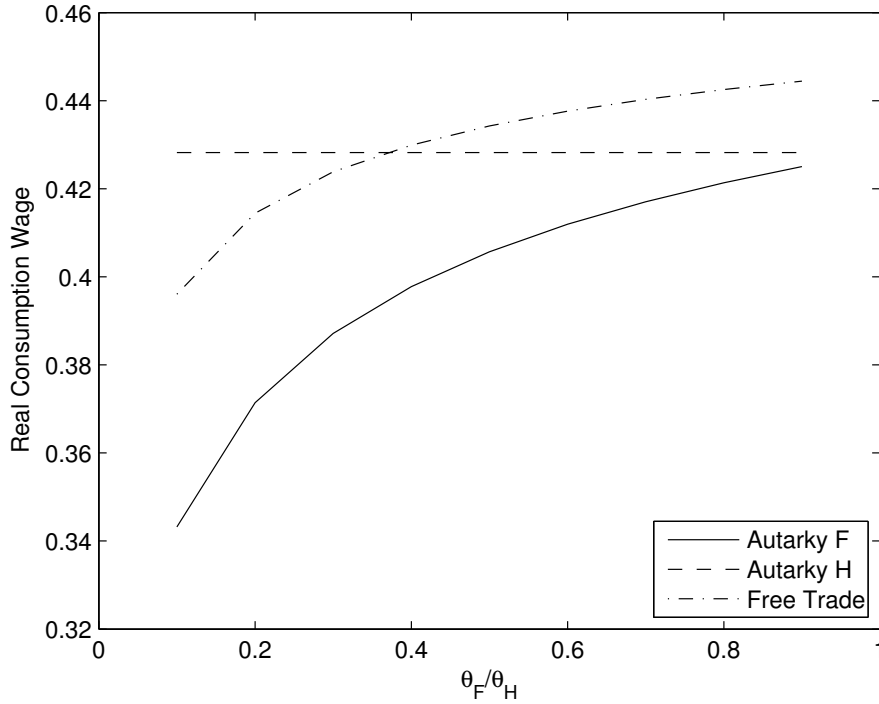
In a simple Ricardian framework, trade and the comparative advantage dynamics benefit both countries. Adding heterogeneous firms and reallocations of firms across sectors challenges this result, and creates cases for which welfare, measured here as the real consumption wage, decreases in free-trade compared to autarky.²⁶

Result 3.4 *(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 3.13 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

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

Figure 3.13: Real Consumption Wage



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.

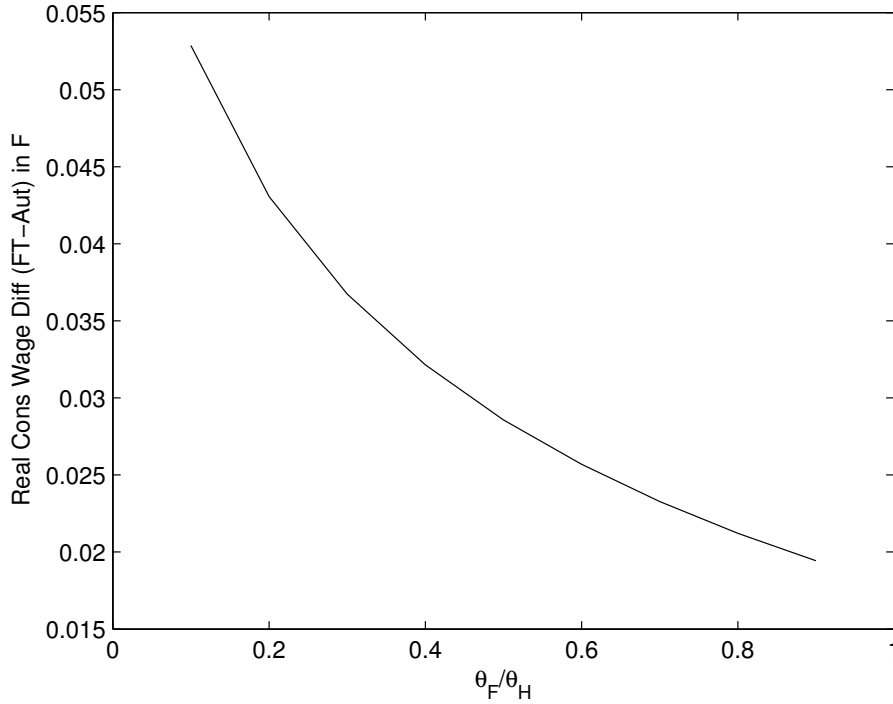
Result 3.5 *In the country with the worst institutions, the welfare gains in terms of real wages are always positive but decrease in the institutional proximity.*

Figure 3.14 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

Figure 3.14: Free Trade Welfare effect in country H



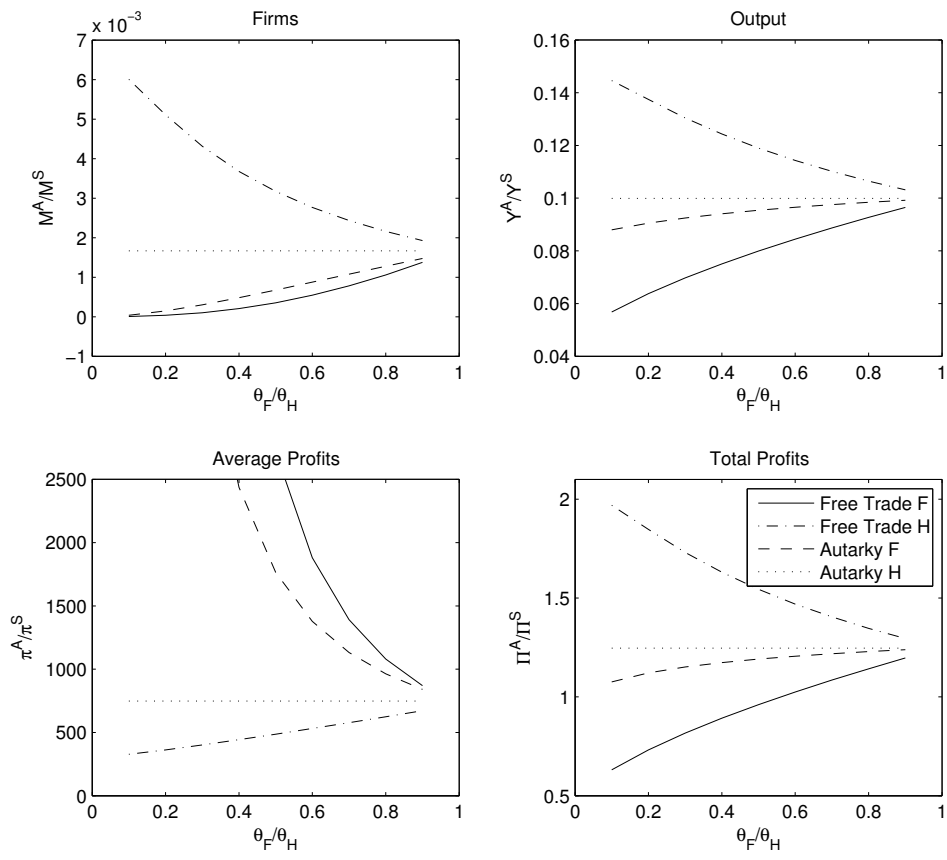
A nice feature of our model with institutional heterogeneity and endogenous production choices is that we can study the impact of institutional convergence on the production structure of both countries in autarky and free-trade. Figure 3.15 presents the results of this comparative statics exercise.

Result 3.6 *In the country with the best institutions, (i) the relative mass of firms in the 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 3.7 *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 3.15 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

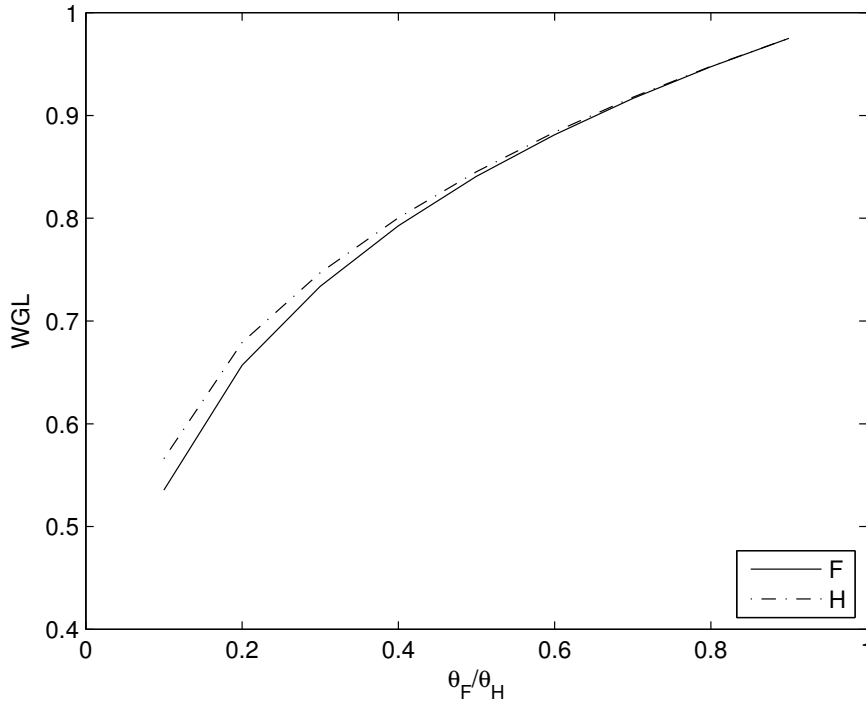
Figure 3.15: Industrial composition



follows from Proposition 3.6 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 3.16 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.

Figure 3.16: Intra-industry trade



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 $\frac{Y_k^i}{Y_k}$.

3.3.4 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 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.

3.4 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 international 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

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.

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.

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Appendix A

Appendix to Chapter 1

A.1 Appendix

A.1.1 Data

The FDI Regulatory Restrictiveness Index (OECD) This index measures restrictions on FDI in 58 countries, covers 22 sectors and is available for 8 years: 1997, 2003, 2006-2014. The OECD lists the main types of restrictions that the index covers: foreign equity limitations, screening or approval mechanisms, restrictions on the employment of foreigners and operational restrictions. The index is between 0 and 1 with high values for high restrictions. Figure shows a high variance across sectors and across countries. The following figure A.2 focuses on barriers to FDI across services industries and across countries using the OECD FDI restriction Index. Several sectors are very restricted (real estate investment, media, maritime) whereas others are mostly not restricted (hotels and restaurants, wholesale, architectural). In addition restrictions vary across countries. Canada, the USA and Germany have on average low restrictions to foreign entry whereas China, India and Indonesia still have restrictive policies in most of the services sectors.

The Services Trade Restrictiveness Index (World Bank) It covers 103 countries that represent all regions and income groups of the world. For each country, five major services sectors are covered: financial services (retail banking and insurance), telecommunications, retail distribution, transportation, professional services (accounting, auditing, and legal services). The four modes of supplying services are covered. In the rest of the paper I only keep the data for mode 3, which is trade through commercial presence. Policies are categorized with associated scores: completely open (0), virtually open but

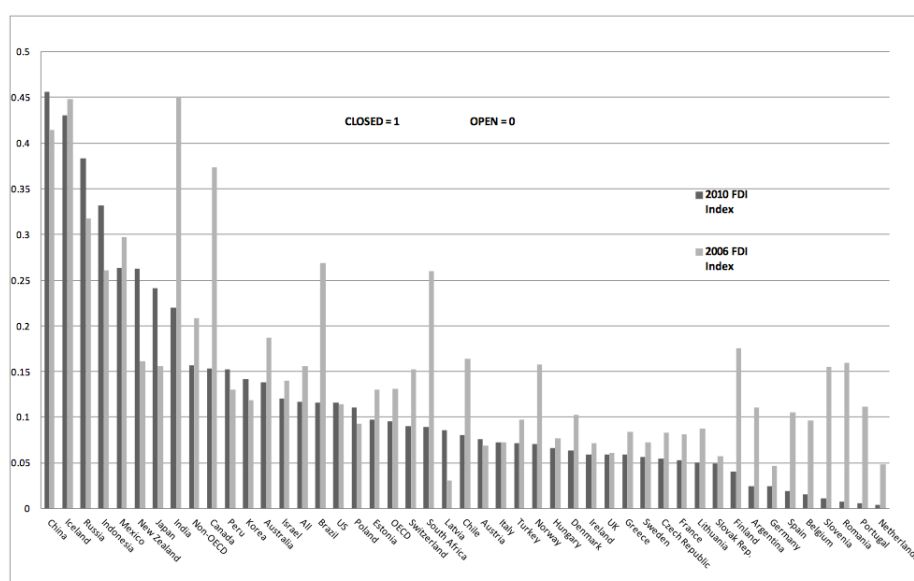


Figure A.1: FDI restrictions' variations across countries and years (Source: OECD).

with minor restrictions (25), major restrictions (50), virtually closed with limited opportunities to enter and operate (75), and completely closed (100). Figure A.3 shows the difference in FDI barriers across countries.

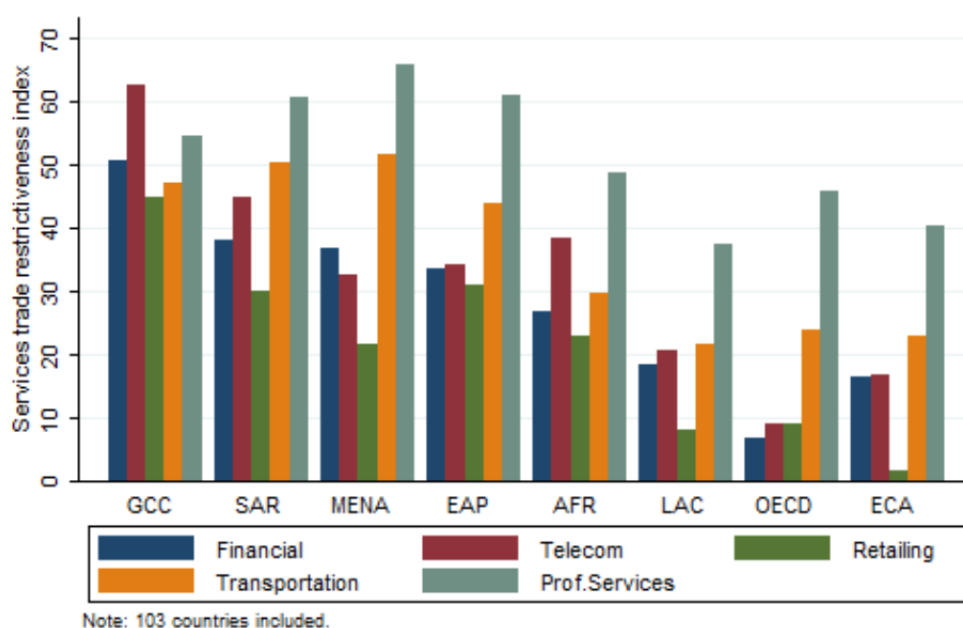


Figure A.3: Services trade restrictiveness index by sector and region. Source: Borchert et al. (2012b)

Services sectors Figures A.4 and A.5 show that horizontal FDI is the main mode of trade for services. Many services can only be provided in the host country through

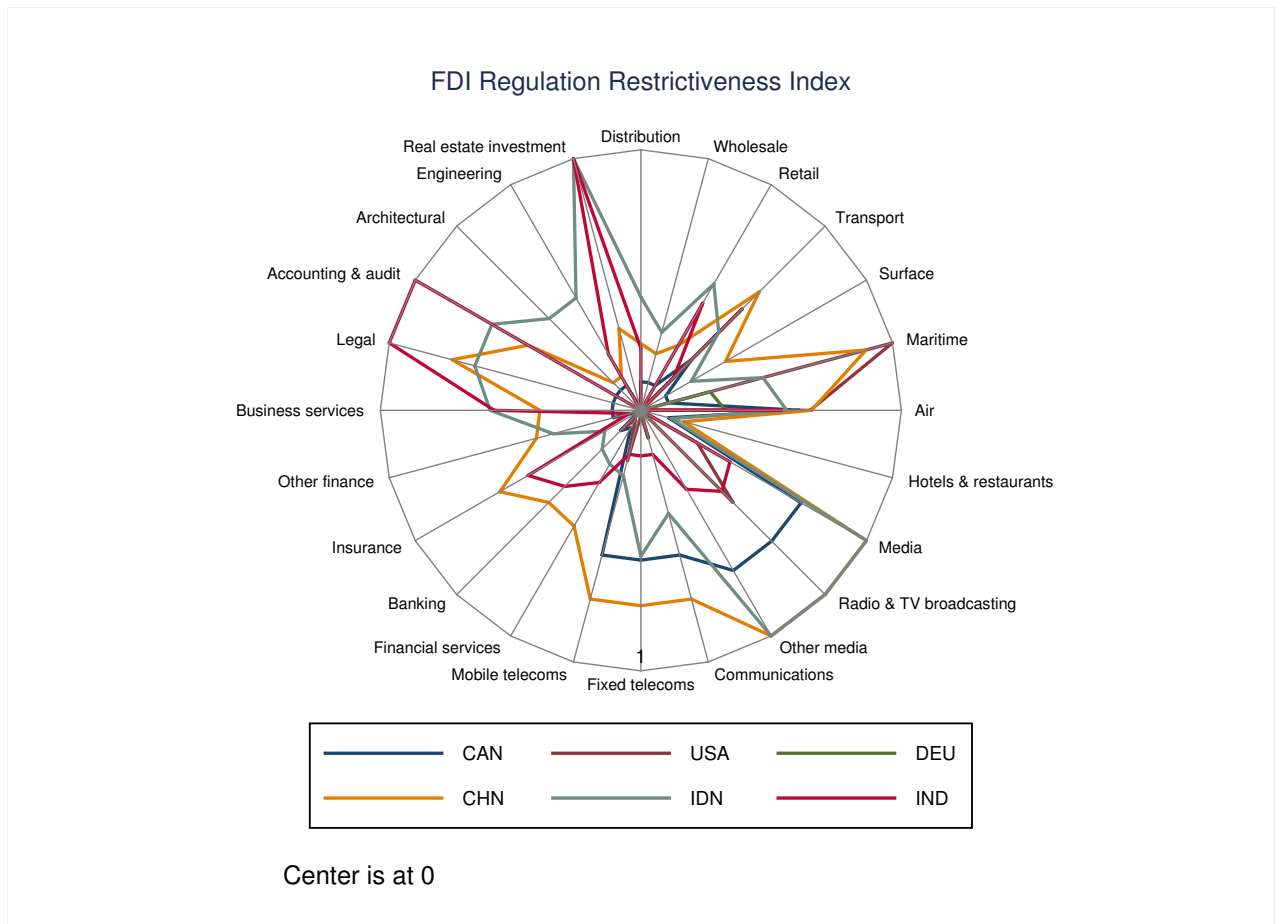


Figure A.2: Barriers to FDI per services industries and per country. Source of the data: OECD

commercial presence and cannot be exported. The first figure shows that commercial presence is the main mode of services exports and imports. In addition commercial presence in services sector has been growing over the last years. 2

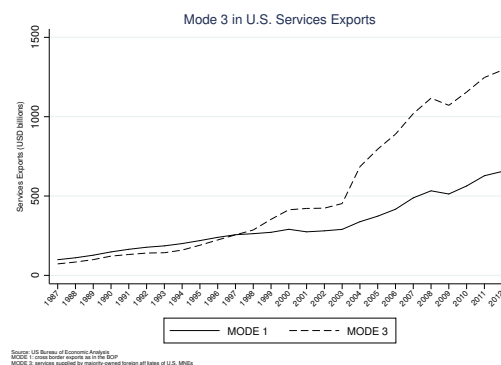


Figure A.4: Commercial presence (mode 3) is the major mode of services exports and imports in the US.

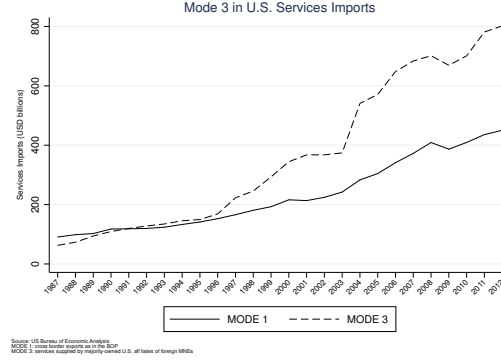


Figure A.5: Commercial presence (mode 3) is the major mode of services exports and imports in the US.

A.1.2 Additional empirical analysis

Restrictions in services sectors I provide results for the two types of tax index I describe: the tax index per industry with outflows data in the following Table and the tax index per country with partner data in Table 1.2. Similar results are obtained.

Table A.1: Impact of repatriation on services restrictions (STRI) using outflows at the industry level

| | est1 | est2 | est3 | est4 | est5 | est6 |
|----------------|------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|
| TaxIndex | 0.0299*** [0.00650] | 0.00224** [0.00112] | | | 0.00222** [0.00112] | 0.0299*** [0.00650] |
| GrowthInd | | | -0.0117** [0.00482] | -0.00675** [0.00335] | -0.00753 [0.00500] | -0.0138** [0.00680] |
| lnGdp | -0.416*** [0.101] | 0.00193 [0.0118] | 0.00510 [0.0144] | 0.0116* [0.00605] | 0.00668 [0.0122] | 0.0675** [0.0292] |
| lnGdpCap | 0.770*** [0.197] | 0.0266 [0.0279] | 0.0207 [0.0400] | 0.0206 [0.0183] | 0.0298 [0.0278] | -0.231*** [0.0769] |
| Striur | 0.362*** [0.0330] | 0.580*** [0.0839] | 0.390*** [0.0227] | 0.672*** [0.0512] | 0.597*** [0.0843] | 0.362*** [0.0330] |
| Observations | 123 | 123 | 291 | 291 | 123 | 123 |
| Country Dummy | Yes | No | Yes | No | No | Yes |
| Industry Dummy | No | Yes | No | Yes | Yes | No |
| R-sq | 0.649 | 0.712 | 0.560 | 0.706 | 0.718 | 0.649 |

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.1.3 Appendix - Figures from the Model section

I here provide simulations to see the effect on FDI policies and joint surpluses of three variables: the government's valuation of foreign contributions, the repatriation of profits, and the number of national firms. This is useful to characterize cases when bargaining in the grand coalition has no solution such that a sub-coalition is formed.

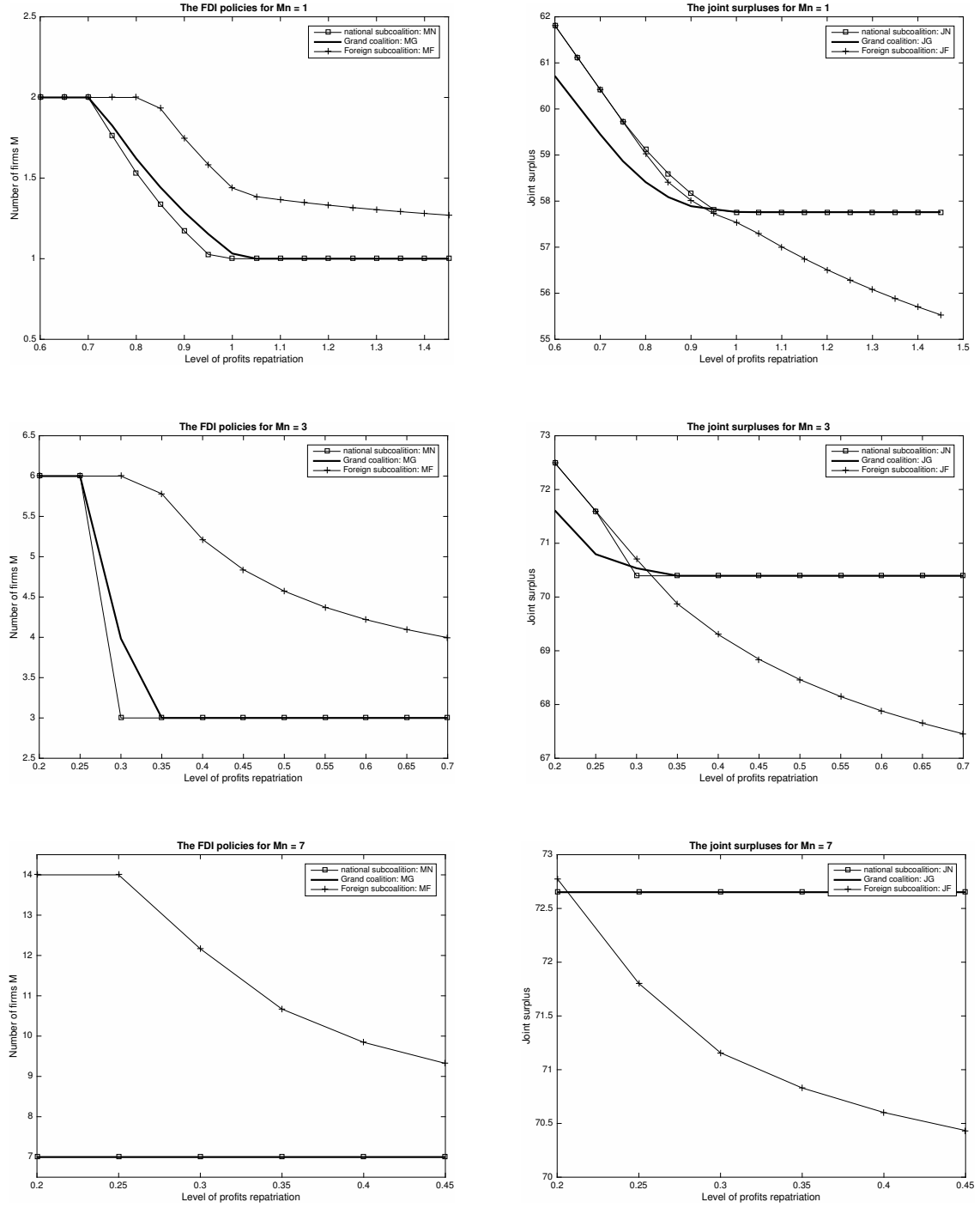


Figure A.6: Effect of repatriation on FDI policies $\{M^N, M^G, M^F\}$ and joint surpluses $\{J^N + \Pi^{*f}, J^G, J^F + \Pi\}$ for different numbers of national firms M_n ($M_n \in \{1, 3, 7\}$).¹

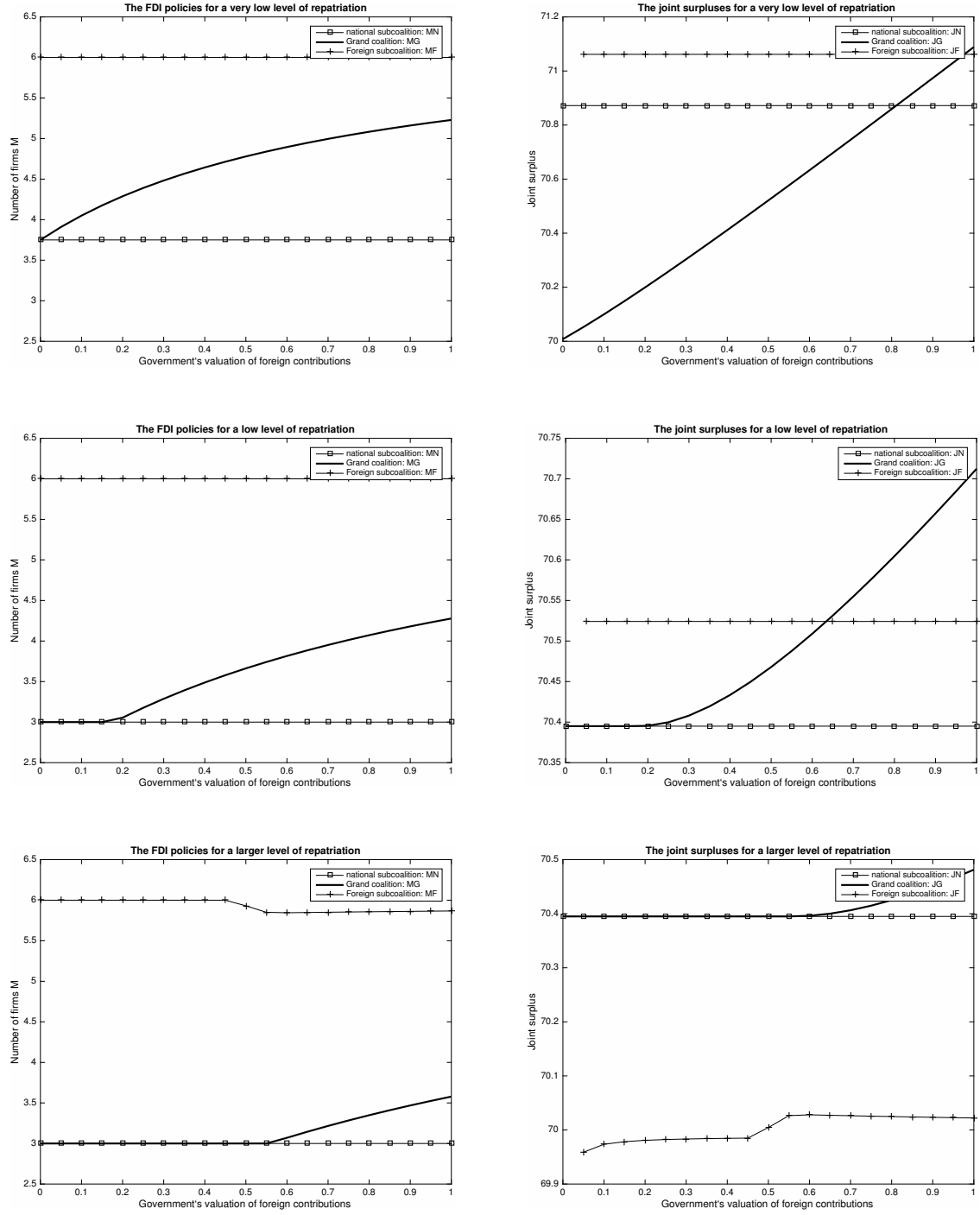


Figure A.7: Effect of undervaluation of foreign contributions $\{M^N, M^G, M^F\}$ and joint surpluses $\{J^N + \Pi^{*f}, J^G, J^F + \Pi\}$ for different levels of repatriation.

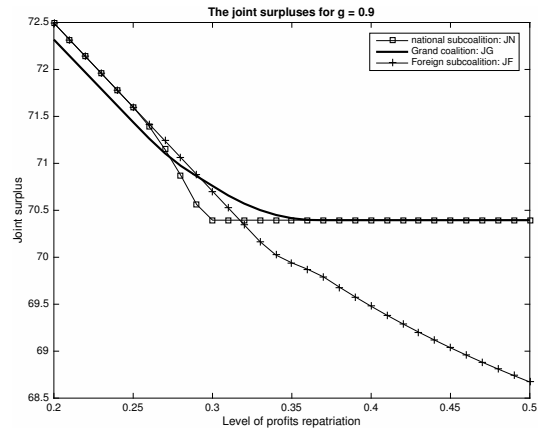
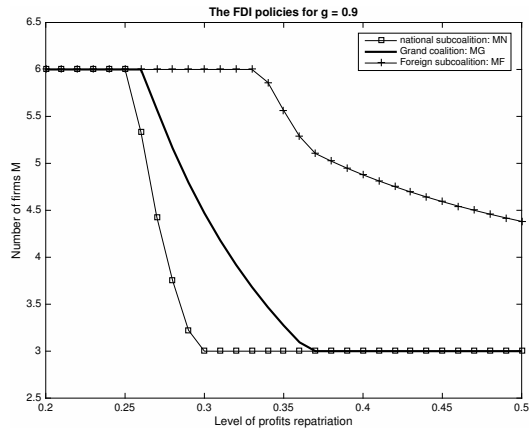
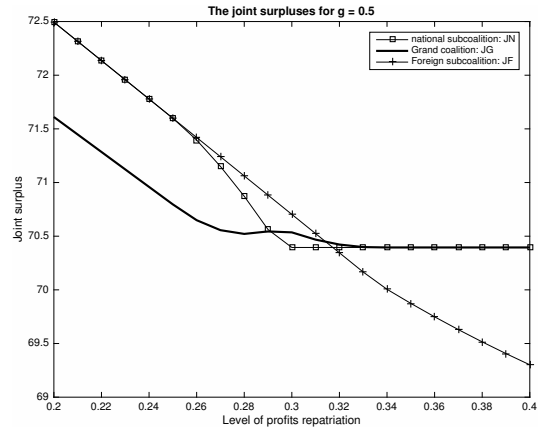
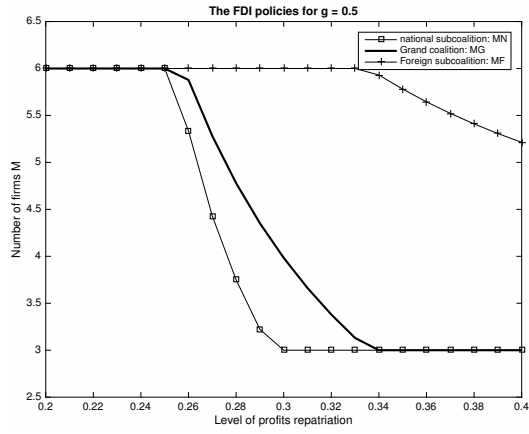
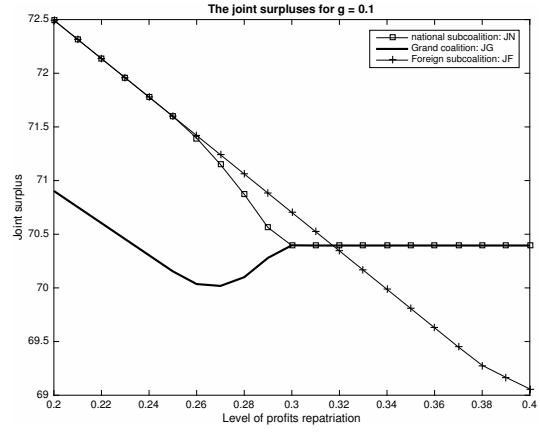
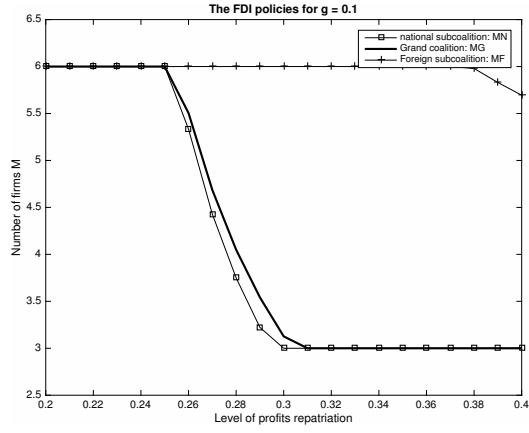


Figure A.8: Effect of repatriation on FDI policies $\{M^N, M^G, M^F\}$ and joint surpluses $\{J^N + \Pi^{*f}, J^G, J^F + \Pi\}$ for different valuations of foreign contributions $\gamma \in \{0.1, 0.5, 0.9\}$.

A.1.4 Proofs

Proofs Section 1.3

Proof of Lemma 1.1 The solution of the government's maximisation problem for any δ is

$$M_0(\delta) = -\frac{(A-z)(2-\delta)((1-\delta)(3/2-\delta)+1) + (z-\phi)(2-\delta)(2+\delta(M_n-1))}{(A-z)\delta[(\delta-3)/2 + (2-\delta)(3-2\delta)] + (z-\phi)\delta(2+\delta(M_n-1))}$$

given the constraint $M_n \leq M_0(\delta) \leq 2M_n$

Proof of Proposition 1.1 The Pareto-efficient solution is given by

$$(M_+, M_+) = \arg \max_M W(M, M^*) + W(M^*, M)$$

and $M_+ = M_+^* = 2M_n$. I can show that $M_0 < M_+$ except if $M_0 = 2M_n$. The outcome in the non-cooperative game is inefficient.

Proof of Lemma 1.3 I show here that the policies in the grand coalition all maximise the total surplus. I prove it given that the surplus now depends on the size of the foreign contributions and the allocations can be binding. I need to prove that the outcome M defined in the maximisation of the Nash product by

$$aW'(M^G, M^*) + \Pi'(M^G) + \gamma\Pi'(M^G) = 0 \quad (\text{A.1.1})$$

is the solution that maximises the joint surplus \mathbb{J}^G that is defined by:

$$\mathbb{J}^G(M) = aW(M, M^*) + (\gamma - 1)c^f + \Pi(M) + \Pi^{*f}(M) \quad (\text{A.1.2})$$

The difficulty is due to the presence of c^f in the joint surplus \mathbb{J}^G . I need to find the expression of c^f in order to state the efficiency of the Nash product maximisation. There are several cases that appear because of the additional constraints of possible deviations from each of the two lobbies.

1. The constraints that prevent deviations from the two sub-coalitions are not binding.

I show that the policies that maximize the Nash product maximize the total surplus. The policy M is defined in equation A.1.1 and the contributions are defined by the allocation of the surplus depending on each bargaining power. At the equilibrium

the allocation is given by:

$$\begin{cases} aW(M, M^*) + c + \gamma c^f - G_0 = \sigma^G[\mathbb{J}^G - G_0 - L_0 - L_0^f] \\ \Pi(M) - c - L_0 = \sigma^D[\mathbb{J}^G - G_0 - L_0 - L_0^f] \\ \Pi^{*f}(M) - c^f - L_0^f = \sigma^F[\mathbb{J}^G - G_0 - L_0 - L_0^f] \end{cases} \quad (\text{A.1.3})$$

I find the expression of c^f at the equilibrium and replace it in the joint surplus from equation A.1.2:

$$\begin{aligned} \mathbb{J}^G(M) &= aW(M, M^*) + (\gamma - 1)c^f + \Pi(M) + \Pi^{*f}(M) \\ \Rightarrow \mathbb{J}^G(M) &= \frac{1}{1 + \sigma^F(\gamma - 1)}[aW(M, M^*) + \Pi(M) + \gamma\Pi^{*f}(M)] + cte \end{aligned}$$

This shows that the policy M that maximises the Nash product in equation A.1.1 is the same as the one that maximises the joint surplus from A.1.2 given the expression of the contribution c^f in terms of M .

2. The constraint that defines the deviation of the national sub-coalition is binding.

When a constraint binds, the allocation in A.1.3 does not apply any more. The contribution of the national lobby and the policy M have to be such that the national lobby does not want to deviate. The binding constraint is given by

$$\begin{aligned} aW(M, M^*) + \gamma c^f + \Pi(M) &= \mathbb{J}^D(M^D, M^*) \\ \Rightarrow \gamma c^f &= \mathbb{J}^D(M^D, M^*) - aW(M, M^*) - \Pi(M) \end{aligned}$$

The expression of c^f is then reported in equation A.1.2:

$$\begin{aligned} \mathbb{J}^G(M) &= aW(M, M^*) + (\gamma - 1)c^f + \Pi(M) + \Pi^{*f}(M) \\ \Rightarrow \gamma \mathbb{J}^G(M) &= aW(M, M^*) + \Pi(M) + \gamma\Pi^{*f}(M) + (\gamma - 1)\mathbb{J}^D(M^D, M^*) \end{aligned}$$

Similarly to the previous case, this proof shows that the policy M that maximises the Nash product in equation A.1.1 is the same as the one that maximises the joint surplus from A.1.2.

3. The constraint that defines the deviation of the foreign sub-coalition is binding. The binding constraint is given by

$$aW(M, M^*) + c + (\gamma - 1)c^f + \Pi^{*f}(M) = \mathbb{J}^F(M^F, M^*)$$

This comes from the undervaluation of foreign contributions. The maximization

problem implies that the foreign contribution should decrease whereas the national contribution should increase till the other constraint is binding. In that case the reasoning of the previous point applies.

Proof of Proposition 1.2 : Allocations If the two sub-coalitions are binding,

$$G(M^G, M^{*C}, c^G, c^{fC}) = \mathbb{J}^D + \mathbb{J}^F - \mathbb{J}^G$$

The last case of the government's allocation being higher than the outside option happens when the two sub-coalitions are binding. The allocation is determined such that the two constraints are verified. It results in the following allocations for the three players:

$$\begin{cases} G(.) + L(.) &= \mathbb{J}^D \\ G(.) + L^f(.) &= \mathbb{J}^F \\ G(.) + L(.) + L^f(.) &= \mathbb{J}^G \end{cases} \Leftrightarrow \begin{cases} G(.) &= \mathbb{J}^D + \mathbb{J}^F - \mathbb{J}^G \\ L(.) &= \mathbb{J}^G - \mathbb{J}^F \\ L^f(.) &= \mathbb{J}^G - \mathbb{J}^D \end{cases}$$

with \mathbb{J}^D the joint surplus of the national sub-coalition, \mathbb{J}^F the joint surplus of the national sub-coalition, and \mathbb{J}^G the joint surplus of the grand coalition .

Proof of Proposition 1.7 I show here that the total surplus functions differ depending in which sub-coalition is formed. This implies that the sub-coalition policy can maximize the total surplus without being equal to the grand coalition policy. In the case of $\gamma = 1$, all surplus functions are equal and the grand coalition policy is the one that maximizes the total surplus.

The total surplus in the grand coalition is given by:

$$\mathbb{J}^G(M, M^*) = \frac{1}{1 + \sigma^F(\gamma - 1)} [aW(M, M^*) + \Pi(M) + \gamma \Pi^{*f}] + \frac{(\gamma - 1)}{1 + \sigma^F(\gamma - 1)} [-\sigma^F(G_0 + L_0) + (1 - \sigma^F)L_0^f]$$

The total surplus in the foreign-subcoalition is given by:

$$\mathbb{J}^F(M^F, M^*) + \Pi(M) = \frac{1}{\gamma(1 - \sigma_G) + \sigma_G} [aW(M^F, M^*) + \gamma \Pi^{*f}(M^F)] + \Pi(M^F) + \frac{(\gamma - 1)[(1 - \sigma_G)G_0 + \sigma_G L_0]}{\gamma(1 - \sigma_G) + \sigma_G}$$

The total surplus in the national sub-coalition is given by:

$$\mathbb{J}^D(M, M^*) + \Pi^{*f}(M) = aW(M, M^*) + \Pi(M) + \Pi^{*f}(M)$$

Proof of Proposition 1.7 : Policies The expressions of the policies for $\gamma \neq 1$ are given by

$$\begin{aligned} M^G = M^{*G} &= \min \left(2M_n, \max \left(\frac{(A-z)(\gamma-2)M_n + (z-\phi)aM_n + (A-\phi)(\gamma(1+M_n)+a)}{(A-z)\gamma + (1+M_n)(a+\gamma)(\phi-z)}, M_n \right) \right) \\ M^D = M^{*D} &= \min \left(2M_n, \max \left(\frac{a[(A-\phi) - M_n(\phi-z)] - 2M_n(A-z)}{a(1+M_n)(\phi-z)}, M_n \right) \right) \\ M^F = M^{*F} &= \min \left(2M_n, \max \left(\frac{A[\gamma(1+2M_n)+a] + M_n(a-\gamma)z - \phi(1+M_n)(a+\gamma)}{\gamma(A-z) + (1+M_n)(a+\gamma)(\phi-z)}, M_n \right) \right) \end{aligned}$$

Proof of Proposition 1.7 : Efficiency I show here that the policies in the foreign sub-coalition maximise the total surplus. I prove it given that the surplus now depends on the size of the foreign contributions and the allocations can be binding.

I define the surplus of the two players $\mathbb{J}^F(M, M^*) = aW(M, M^*) + (\gamma-1)c^f + \Pi^{*f}(M)$.

$$\begin{aligned} aW(M, M^*) + \gamma c^f - G_0 &= \sigma_G[\mathbb{J}^F(M) - G_0 - L_0^f] \\ \Pi^{*f}(M) - c^f - L_0^f &= (1 - \sigma_G)[\mathbb{J}^F(M) - G_0 - L_0^f] \end{aligned}$$

Finally I can show that the total surplus for the three players when the government and the foreign lobby play the political bargaining game is:

$$\begin{aligned} \mathbb{J}^F(M^F, M^*) + \Pi(M^F) &= \frac{1}{\gamma(1-\sigma_G) + \sigma_G} [aW(M^F, M^*) + \gamma \Pi^{*f}(M^F)] \\ &+ \Pi(M^F) + \frac{(\gamma-1)[(1-\sigma_G)G_0 + \sigma_G L_0^f]}{\gamma(1-\sigma_G) + \sigma_G} \end{aligned}$$

Proof of lemma 1.4 I show that $\frac{\partial M^G}{\partial \gamma}$ can be written as a second-degree polynomial of the variable M_n such that $\frac{\partial M^G}{\partial \gamma} = \alpha M_n^2 + \beta M_n + \delta$. Given that $\alpha = 2(A-z)(\phi-z)(a+2) > 0$, I can conclude that either $\frac{\partial M^G}{\partial \gamma} \geq 0$ for all M_n or there exists two solutions $M_{n,1}$ and $M_{n,2}$ such that $\frac{\partial M^G}{\partial \gamma} = 0$ and $\frac{\partial M^G}{\partial \gamma} \geq 0$ for $M_n \leq M_{n,1}$ and $M_n \geq M_{n,2}$. For simplicity, I only consider $M_{n,2}$ in the last case. Therefor there exists a \tilde{M}_n such that $\frac{\partial M^G}{\partial \gamma} = 0$ and such that

$$M_n \leq \tilde{M}_n \Rightarrow \frac{\partial M^G}{\partial \gamma} \leq 0 \quad \wedge \quad M_n \geq \tilde{M}_n \Rightarrow \frac{\partial M^G}{\partial \gamma} \geq 0$$

Proof of Proposition 1.4 In order to prove the second part, I need to show that the joint surplus J^G in the grand coalition is increasing in the government's valuation γ .

$$\begin{aligned}
J^G &= aW(M^G, M^*) + (\gamma - 1)c^{f,G} + \Pi(M^G) + \Pi^{*f}(M^G) \\
\Rightarrow \frac{\partial J^G}{\partial \gamma} &= \frac{\partial aW(M^G, M^*)}{\partial \gamma} + c^{f,G} + (\gamma - 1)\frac{\partial c^{f,G}}{\partial \gamma} + \frac{\partial \Pi(M^G)}{\partial \gamma} + \frac{\partial \Pi^{*f}(M^G)}{\partial \gamma} \\
&\quad \text{with } \frac{\partial c^{f,G}}{\partial \gamma} = -\sigma^F \frac{\partial J^G}{\partial \gamma} + \frac{\partial \Pi^{*f}(M^G)}{\partial M} \quad \text{from A.1.3} \\
\Rightarrow \frac{\partial J^G}{\partial \gamma} [1 + \sigma^F(\gamma - 1)] &= c^{f,G} + \underbrace{\left[\frac{\partial aW(M^G, M^*)}{\partial M} + \frac{\partial \Pi(M^G)}{\partial M} + \gamma \frac{\partial \Pi^{*f}(M^G)}{\partial M} \right]}_{=0} \frac{\partial M^G}{\partial \gamma} \\
\Rightarrow \frac{\partial J^G}{\partial \gamma} &\geq 0 \quad (\forall \gamma \in (0, 1), \quad 1 + \sigma^F(\gamma - 1) \geq 0)
\end{aligned}$$

In addition we always have $J^G(\gamma = 1) > J^D(\gamma = 1), J^D(\gamma = 1)$. Therefore $\gamma^{sub} > 0$ if $J^G(\gamma = 0) < J^D(\gamma = 1)$ or $J^G(\gamma = 0) < J^D(\gamma = 0)$ (proof of existence for some cases from simulation exercices in Annex).

Proofs Section 1.4

Proof of Proposition 1.1 This results from the restriction in Lemma 1.4 such that $\frac{\partial M^G}{\partial \gamma}$ and Result 1.5 according to which $M^D < M^G < M^F$.

Appendix B

Appendix to Chapter 2

B.1 Proofs and Derivations

Efficiency of the Nash Solution We want to show that the Nash solution of the cooperative bargaining game - given by (2.3.19) - maximises the joint surplus (2.3.20). Let's start off deriving the first order condition (FOC) from the maximisation of the joint surplus

$$\frac{dJ^N(n)}{dn} = 0 \iff \underbrace{a \frac{dW(n)}{dn}}_X = - \underbrace{n_d \frac{d\pi^S(n)}{dn}}_Y \quad (\text{A-1})$$

Instead, the FOCs for the Nash product maximisation are given by

$$\text{w. r. to } n : \quad \sigma X[n_d \pi^S(n) - c - n_d \pi^S(n_0)] + (1 - \sigma)Y[aW(n) + c - aW(n_0)] = 0 \quad (\text{A-2})$$

$$\text{w. r. to } c : \quad c = \sigma n_d[\pi^S(n) - \pi^S(n_0)] + (1 - \sigma)a[W(n_0) - W(n)] \quad (\text{A-3})$$

Plugging (A-3) into (A-2) and rearranging we get

$$\begin{aligned} & [W(n_0) - W(n)] \times \overbrace{[-(1 - \sigma)(\sigma a)Y - (1 - \sigma)(\sigma a)X]}^Z + \\ & + [\pi^S(n) - \pi^S(n_0)] \times \underbrace{[(1 - \sigma)\sigma n_d Y + (1 - \sigma)\sigma n_d X]}_V = 0 \end{aligned} \quad (\text{A-4})$$

Plugging the efficiency condition $X = -Y$ into (A-4) we get $Z = V = 0$. The unique Nash solution of the bargaining game is therefore efficient (unicity is stated in Proposition 2.1).

Proof of Proposition 2.1. Equilibrium prices - $(P^D)^N$ and $(P^S)^N$ - as well as K^N can

be uniquely determined as functions of trade policy n . In particular

$$P^D = v - f(nA) \quad (\text{A-5})$$

$$P^S = [v - f(nA)]f'(nA) \quad (\text{A-6})$$

$$K^N = nA \quad (\text{A-7})$$

Plugging those expressions into the social welfare and the profit functions we get an expression of the Nash product as a function of n and c , plus exogenous parameters. The FOC with respect to n of the Nash product maximisation problem (2.3.19) is given by

$$(a - 2n_d)e^{-2n} = (1 - v)(a - n_d)e^{-n} \quad (\text{A-8})$$

Taking logs and solving for n we get the equilibrium trade policy

$$n^N = -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right) \quad (\text{A-9})$$

For the equilibrium solution $n^N = -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right)$ to be well defined, we need to find the parameters for which n^N is smaller than the trade policy implemented in the absence of special interest groups. Indeed the domestic services firms give contributions to the government to lower the number of final firms with respect to the government optimal solution without distorting political pressures. In other words, the national lobby would not contribute for a number of firms higher than the level chosen in the case of no lobbying. The optimal value of n chosen in the absence of political pressures is given by $n_0 = -\ln(1-v)$. We can rewrite n^N as follows

$$n^N = n_0 - \ln\left(\frac{a-n_d}{a-2n_d}\right) \quad (\text{A-10})$$

The equilibrium under national lobby is well defined if $n^N < n_0$, i.e. if

$$\frac{a-n_d}{a-2n_d} > 1 \iff n_d < \frac{a}{2} \quad (\text{A-11})$$

Condition (A-11) defines the technical restrictions on the parameters which are needed to have an equilibrium solution with positive contributions.

Turning to the last equilibrium quantity, c^N , it can be uniquely determined as a function of n and exogenous parameters from the Nash product maximisation problem (2.3.19). The FOC with respect to c gives the usual weighted average of the welfare loss from

protection and the lobby's willingness to pay for protection

$$c^N = (1 - \sigma)a[W(n_0) - W(n^N)] + \sigma n_d[\pi^S(n^N) - \pi^S(n_0)] \quad (\text{A-12})$$

Equations (A-5), (A-6), (A-7), (A-9) and (A-12) uniquely define the equilibrium under national lobbying. The equilibrium is well defined under the technical restriction given in (A-11).

The comparative statics results are given by the study of the partial derivatives of n^N that completes the proof

$$\frac{\partial n^N}{\partial a} = \frac{n_d}{(a - n_d)(a - 2n_d)} \geq 0 \quad (\text{A-13})$$

$$\frac{\partial n^N}{\partial n_d} = \frac{-a}{(a - n_d)(a - 2n_d)} \leq 0 \quad (\text{A-14})$$

■

Proof of Proposition 2.2. Let us start from (i). We want to show that $\Omega(\sigma = 0) > 0$ where

$$\Omega = G_0 - G^N = aW(n_0, K_0) - aW(n^N, K^N) - c^N \quad (\text{A-15})$$

The equilibrium condition given by the FOC of the Nash product maximisation with respect to c gives

$$aW(n^N, K^N) + c^N - aW(n_0, K^N) = \frac{\sigma}{1 - \sigma} [\Pi^S(n^N, K^N) - c^N - \Pi^S(n_0, K^N)] \quad (\text{A-16})$$

which can be rearranged to get

$$c^N + aW(n^N, K^N) = \sigma [\Pi^S(n^N, K^N) - \Pi(n_0, K^N)] + a\sigma W(n^N, K^N) + a(1 - \sigma)W(n_0, K^N) \quad (\text{A-17})$$

Plugging (A-17) into (A-15) we get

$$\Omega = aW(n_0, K_0) - aW(n_0, K^N) - \sigma [\Pi^S(n^N, K^N) - \Pi(n_0, K^N)] + \sigma a [W(n_0, K^N) - W(n^N, K^N)] \quad (\text{A-18})$$

Therefore, with $\sigma = 0$ we have

$$\Omega(\sigma = 0) = aW(n_0, K_0) - aW(n_0, K^N) \quad (\text{A-19})$$

Consider the equilibrium result $D^S(n_0, K^N) = K^N$. This allows us to write $f(K^N, D^S(n_0, K^N)) =$

$f(K^N, K^N) := f(K^N)$. We can now write the welfare

$$W(n_0, K^N) = (v - f(K^N))f(K^N) + H(v - f(K^N)) \quad (\text{A-20})$$

Similarly we use the equilibrium result $D^S(n_0, K_0) = K_0$ to write $f(K_0, D^S(n_0, K_0)) = f(K_0, K_0) := f(K_0)$. Therefore

$$W(n_0, K_0) = (v - f(K_0))f(K_0) + H(v - f(K_0)) \quad (\text{A-21})$$

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 $g'(x) = f'(x)(v - f(x)) > 0$. Moreover we know that $K^N < K_0$. Therefore $W(n_0, K_0) - W(n_0, K^N) > 0$, which completes the proof of (i).

We now move to (ii). We can express Ω as a linear function of σ of the kind $\Omega(\sigma) = Y\sigma + Z$. Start from the expression for Ω given by (A-18). First we show that $W(n_0, K^N) - W(n^N, K^N) = 0$. To see this we use the result $D^S(n_0, K^N) = K^N$ that allows us to write $f(K^N, D^S(n_0, K^N)) = f(K^N, K^N) := f(K^N)$. We can now write the welfare

$$W(n_0, K^N) = (v - f(K^N))f(K^N) + H(v - f(K^N)) \quad (\text{A-22})$$

Similarly we use the equilibrium result $D^S(n^N, K^N) = K^N$ to write $f(K^N, D^S(n^N, K^N)) = f(K^N, K^N) := f(K^N)$. Therefore

$$W(n^N, K^N) = (v - f(K^N))f(K^N) + H(v - f(K^N)) \quad (\text{A-23})$$

We conclude that $W(n_0, K^N) = W(n^N, K^N)$. Given this we have $\Omega(\sigma) = Y\sigma + Z$ with

$$Y = -[\Pi^S(n^N, K^N) - \Pi^S(n_0, K^N)] \quad (\text{A-24})$$

and

$$Z = aW(n_0, K_0) - aW(n_0, K^N) (> 0) \quad (\text{A-25})$$

We show that $Y < 0$. Given the equilibrium expressions for prices we can write

$$\pi^S(n^N, K^N) = A(P^D)^N f'(K^N) \quad (\text{A-26})$$

$$\pi^S(n_0, K^N) = \frac{K^N}{n_0} P^D(n_0, K^N) f'(K^N) = \frac{K^N}{n_0} (P^D)^N f'(K^N) \quad (\text{A-27})$$

the second equality comes from the following

$$P^D(n_0, K^N) = v - f(K^N, D^S(n_0, K^N)) = v - f(K^N) = (P^D)^N \quad (\text{A-28})$$

We can now write the slope Y .

$$Y = -n_d [\pi^S(n^N, K^N) - \pi^S(n_0, K^N)] \quad (\text{A-29})$$

$$= -n_d \left[A - \frac{K^N}{n_0} \right] (P^D)^N f'(K^N) \text{ with } K^N = A n^N \quad (\text{A-30})$$

$$= -n_d A \left[1 - \frac{n^N}{n_0} \right] (P^D)^N f'(K^N) \quad (\text{A-31})$$

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

$$\tilde{\sigma} = \frac{-Z}{Y} \quad (\text{A-32})$$

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:

$$Y = (v-1) \left[n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right] + \left[n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right]^2 \quad (\text{A-33})$$

$$Z = \frac{a(v-1)^2}{2} + (v-1)a \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right] + \left[a/2 \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right]^2 \quad (\text{A-34})$$

which imply

$$\begin{aligned} \Omega = \frac{a(v-1)^2}{2} + (v-1) \left[a + \sigma n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right] + \\ + \left[a/2 + \sigma n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)} \right] \left[\frac{(1-v)(a-n_d)}{a-2n_d} \right]^2 \end{aligned} \quad (\text{A-35})$$

To simplify the expression, we write $X = \frac{(1-v)(a-n_d)}{a-2n_d}$ and $C = -n_d \frac{\ln\left(\frac{a-n_d}{a-2n_d}\right)}{\ln(1-v)}$. 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

$$\tilde{\sigma} = \frac{-Z}{Y} = \frac{\ln(1-v)}{2\ln\left(\frac{a-n_d}{a-2n_d}\right)(n_d-a)}$$

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

$$\ln(1-v) > 2\ln\left(\frac{a-n_d}{a-2n_d}\right)(n_d-a) \quad (\text{A-36})$$

Notice that the LHS of (A-36) is a monotonically decreasing function of v while the RHS of (A-36) is constant with respect to v . Therefore there exists unique a threshold value V such that $\forall v < V$ inequality (A-36) 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 Part 1 of Proposition 2.3. The proof of this part is similar to the proof of proposition 2.1. We use the expressions of optimal prices and investment in non-services inputs. Once we prove the existence and unicity of the equilibrium policy, we can easily derive the other equilibrium variables and obtain the existence and unicity of the whole equilibrium.

The policy maximizes the Nash product such that

$$\begin{aligned} & aW'(n^\gamma) + \mathbb{I}\pi'(n^\gamma) + \gamma(n^\gamma - n_d)\pi'(n^\gamma) = 0 \\ \Rightarrow & a[(v - f(n^\gamma))f'(n^\gamma)] + \mathbb{I}[v - f(n^\gamma)]f'(n^\gamma) - (n^\gamma - n_d)(f'(n^\gamma) + v - f(n^\gamma)) = 0 \\ \Rightarrow & n^\gamma = -\ln\left(\frac{(1-v)(a + \gamma - \gamma n^\gamma - (\mathbb{I} - \gamma)n_d)}{(a + \gamma - 2\gamma n^\gamma - 2(\mathbb{I} - \gamma)n_d)}\right) \end{aligned}$$

Parameters are restricted so that the solution is well defined. The necessary condition is given by:

$$a + \gamma - 2\gamma n^\gamma - 2(\mathbb{I} - \gamma)n_d > 0 \quad \Rightarrow \quad n^\gamma < \frac{a + \gamma - 2(\mathbb{I} - \gamma)n_d}{2\gamma}$$

The solution is on both sides of the equation. We need to prove that there exists a unique solution n^γ which is well-defined by the previous equation. First we define a new function

g with two variables γ with $\gamma \geq 0$ and n^γ such that

$$g(\gamma, n^\gamma) = -\ln \left(\frac{\overbrace{(1-v)(a + \gamma - \gamma n^\gamma - (\mathbb{I} - \gamma)n_d)}^N}{\underbrace{(a + \gamma - 2\gamma n^\gamma - 2(\mathbb{I} - \gamma)n_d)}_D} \right)$$

The solution n^γ to the Nash product maximization is such that $g(\gamma, n^\gamma) = n^\gamma$. We have:

$$\frac{\partial g}{\partial n^\gamma} = -\frac{D - \gamma D - N(-2\gamma)}{N} = -\frac{\gamma(a + \gamma)}{ND} \Rightarrow \frac{\partial g}{\partial n^\gamma} < 0$$

The condition $ND > 0$ is given by the previous restriction on parameters for the solution to be defined. 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. In addition for any γ , the function $g(\gamma, \cdot)$ 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 Part 2 of Proposition 2.3. We restrict our analysis to the case of foreign lobbying only ($\mathbb{I} = 0$) and perfect valuation of foreign contributions ($\gamma = 1$). We can show the existence of the threshold n_d^- and the following implications.

First we find the expression of n_d^- which is defined by the number of domestic firms n_d such that the policy n^N when there is national lobbying only (defined in 2.1) is equal to the policy $n^\gamma(\mathbb{I} = 0)$ when there is foreign lobbying only.

$$\begin{aligned} n^N = n^\gamma(\mathbb{I} = 0) &\Rightarrow -\ln \left(\frac{(1-v)(a - n_d^-)}{a - 2n_d^-} \right) = -\ln \left(\frac{(1-v)(1 + a - (n^f - n_d^-))}{(1 + a - 2(n^f - n_d^-))} \right) \\ &\Rightarrow n^\gamma(\mathbb{I} = 0) = n_d^- \frac{1 + 2a}{a} \end{aligned}$$

We plug this expression in the previous equality

$$n^\gamma(\mathbb{I} = 0) = n^N \Rightarrow n_d^- \frac{1 + 2a}{a} = -\ln \left(\frac{(1-v)(a - n_d^-)}{a - 2n_d^-} \right)$$

The threshold for which the two policies are equal exist if the equation $g(x) = -\frac{a}{1+2a} \ln \left(\frac{(1-v)(a-x)}{a-2x} \right) - x = 0$ has a solution. We use equation A-13 from the proof of proposition 2.1 to show that the function g is strictly decreasing. In addition $g(0) > 0$ and $g(+\infty) = -\infty$. This shows that there exists a unique threshold n_d^- for which $n^N = n^\gamma(\mathbb{I} = 0)$.

We have proved that n^N is strictly decreasing in n_d (equation A-13). We can show that

$n^\gamma(\mathbb{I} = 0)$ is strictly increasing in n_d . We derive the expression of $n^\gamma(\mathbb{I} = 0)$ in Proposition 2.3 with respect to n_d .

$$\begin{aligned}
& \frac{\partial n^\gamma(\mathbb{I} = 0)}{\partial n_d} + \frac{1 + a - 2(n^\gamma(\mathbb{I} = 0) - n_d)}{1 + a - n^\gamma(\mathbb{I} = 0) + n_d} \times \\
& \quad \times \frac{(-\frac{\partial n^\gamma(\mathbb{I}=0)}{\partial n_d} + 1)(1 + a - 2(n^\gamma(\mathbb{I} = 0) - n_d)) - (1 + a - n^\gamma(\mathbb{I} = 0) + n_d)(-2\frac{\partial n^\gamma(\mathbb{I}=0)}{\partial n_d} + 2)}{(1 + a - 2(n^\gamma(\mathbb{I} = 0) - n_d))^2} = 0 \\
\Rightarrow & \left[1 + \frac{1 + a}{(1 + a - 2(n^\gamma(\mathbb{I} = 0) - n_d))(1 + a - n^\gamma(\mathbb{I} = 0) + n_d)} \right] \frac{\partial n^\gamma(\mathbb{I} = 0)}{\partial n_d} \\
& = \frac{1 + a}{(1 + a - 2(n^\gamma(\mathbb{I} = 0) - n_d))(1 + a - n^\gamma(\mathbb{I} = 0) + n_d)} \\
\Rightarrow & \frac{\partial n^\gamma(\mathbb{I} = 0)}{\partial n_d} \geq 0
\end{aligned}$$

This shows that the policy $n^\gamma(\mathbb{I} = 0)$ is decreasing in the number of domestic firms n_d . Therefore We can prove the second part of Proposition 2.3. When the number of domestic firms is small ($n_d \leq n_d^-$), we have $n^N \geq n^f$ and the opposite $n^N \leq n^f$ when the number of domestic firms is large ($n_d \geq n_d^+$, $n^N \leq n^f$). ■

Proof of Part 3 of Proposition 2.3.

In this part we allow for both national and foreign contributions given that foreign contributions are less valued than national contributions ($\mathbb{I} = 1$ and $0 \leq \gamma \leq 1$). First we study how the policy n^γ varies with the responsiveness γ of the government to foreign contributions. Second we determine when the policy with both foreign and national lobbying (n^γ) is higher than the one chosen in case of no foreign lobbying (n^N).

First we study how the solution n^γ varies with the responsiveness γ of the government to foreign contributions. Let's recall the expression of the policy in the case of $\mathbb{I} = 1$ and $0 \leq \gamma \leq 1$.

$$n^\gamma = -\ln \left(\frac{\overbrace{(1-v)(a + \gamma - \gamma n^\gamma - (1-\gamma)n_d)}^N}{\underbrace{(a + \gamma - 2\gamma n^\gamma - 2(1-\gamma)n_d)}_D} \right) \quad (\text{A-37})$$

We derive the previous equation with respect to γ .

$$\begin{aligned} & \frac{\partial n^\gamma}{\partial \gamma} + \frac{D [1 - n^\gamma - \gamma \frac{\partial n^\gamma}{\partial \gamma} + n_d] D - N [1 - 2n^\gamma - 2\gamma \frac{\partial n^\gamma}{\partial \gamma} + 2n_d]}{D^2} = 0 \\ \Rightarrow & [1 + \gamma \frac{a + \gamma}{ND}] \frac{\partial n^\gamma}{\partial \gamma} = \frac{(1 + a)n_d - an^\gamma}{ND} \\ \Rightarrow & \text{Sign}\left(\frac{\partial n^\gamma}{\partial \gamma}\right) = \text{Sign}((1 + a)n_d - an^\gamma) \end{aligned}$$

given that $ND \geq 0$ for the solution to be well-defined.

There are two cases that emerge:

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 a 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 $\gamma = 0$ and the closed-form solution for $n^{\gamma=0} = n^N$ is given in Proposition 2.1. Second we infer conclusions on the monotonicity of the solution n^γ with respect to γ .

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 $V = [0, v]$ such that for all $\gamma \in V$ the solution n^γ remains inferior to $\frac{(1+a)n_d}{a}$.¹ Then $\forall n^\gamma$ that corresponds to a γ in the neighbourhood V , the policy is decreasing with respect of γ ($\frac{\partial n^\gamma}{\partial \gamma} > 0$ from the previous result). Second we show by contradiction that $\forall \gamma \geq 0, n^\gamma < \frac{(1+a)}{a}n_d$. We assume that there exists a parameter γ_2 for which $n^{\gamma_2} > \frac{(1+a)}{a}n_d$. 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 $n^{\gamma_1} = \frac{(1+a)}{a}n_d$. Therefore we have $\gamma_1 < \gamma_2$ and $n^{\gamma_2} > \frac{(1+a)}{a}n_d = n^{\gamma_1}$. This contradicts the result that $\frac{\partial n^\gamma}{\partial \gamma} < 0$ for $n^\gamma > \frac{(1+a)}{a}n_d$. To conclude, we just 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

$$n^{\gamma=0} < \frac{(1+a)}{a}n_d \quad \Rightarrow \quad -\ln\left(\frac{(1-v)(a-n_d)}{a-2n_d}\right) < \frac{(1+a)}{a}n_d$$

¹The proof of the existence of such neighbourhood is given by the continuity of n^γ .

We define a function g such that $g(n) = \frac{(1-v)(a-n)}{a-2n} - \exp(-\frac{(1+a)}{a}n)$. This function is shown to be increasing ($\forall n, f'(n) = \frac{(1-v)a}{(1-2an)^2} + (1+a)e^{-\frac{(1+a)}{a}n} \geq 0$) if $n \leq \frac{a}{2}$. The latter constraint is the regularity condition ($n_d \leq \frac{a}{2}$) that has restricted our analysis for the existence proof in Proposition 2.1. In addition $g(0) = -v < 0$ and $g(\frac{a}{2}) = \infty > 0$. We then use the theorem of intermediate values to show that there exists a $\tilde{n}_d > 0$ such that:

1. if $n_d \leq \tilde{n}_d$ then $g(n_d) \leq 0$ and $n^{\gamma=0} \geq \frac{(1+a)}{a}n_d$. This defines the interval $S^- = [0, \tilde{n}_d]$.
2. if $n_d \geq \tilde{n}_d$ then $g(n_d) \geq 0$ and $n^{\gamma=0} \leq \frac{(1+a)}{a}n_d$. This defines the interval $S^+ = [\tilde{n}_d, \frac{1}{2a}]$.

We can now conclude that:

1. when the number of domestic firms n_d is low: $n_d \in S^-$
 - (a) $n^{\gamma=0} \geq \frac{(1+a)}{a}n_d$
 - (b) $\forall \gamma > 0, n^\gamma \leq n^{\gamma=0} = n^N$
 - (c) $\frac{\partial n^\gamma}{\partial \gamma} \leq 0$
2. when the number of domestic firms n_d is large : $n_d \in S^+$
 - (a) $n^{\gamma=0} \leq \frac{(1+a)}{a}n_d$
 - (b) $\forall \gamma > 0, n^\gamma \geq n^{\gamma=0} = n^N$
 - (c) $\frac{\partial n^\gamma}{\partial \gamma} \geq 0$

■

Proof of Result 2.1 The bargaining game leads to the maximization of the Nash product from equation 2.4.3. It implies that contributions are defined in order to allocate the joint surplus according to each bargaining power. We first find the expressions of the two contributions to plug them into the utility of the government while playing the political game.

$$\begin{cases} aW(n^\gamma) + c^\gamma + \gamma c^{f,\gamma} - aW(n_0|K^\gamma) = \sigma_G \mathbb{J} \\ \Pi(n^\gamma) - c^\gamma - \Pi(n_0|K^\gamma) = \sigma_N \mathbb{J} \\ \Pi^f(n^\gamma) - c^{f,\gamma} - \Pi^f(n_0|K^\gamma) = \sigma_F \mathbb{J} \end{cases} \quad (\text{A-38})$$

with \mathbb{J} the joint surplus that is generated in the game. This allows us to get the expressions of the equilibrium contributions c^γ and $c^{f,\gamma}$,

$$\begin{aligned}
c^\gamma &= \frac{\sigma_G + \gamma\sigma_F}{\sigma_N + \sigma_G + \gamma\sigma_F} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] - \frac{\sigma_N}{\sigma_N + \sigma_G + \gamma\sigma_F} [aW(n^\gamma) - aW(n_0|K^\gamma)] \\
&\quad - \gamma \frac{\sigma_N}{\sigma_N + \sigma_G + \gamma\sigma_F} [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)] \\
c^{f,\gamma} &= \frac{-\sigma_F}{\sigma_N + \sigma_G + \gamma\sigma_F} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] - \frac{\sigma_F}{\sigma_N + \sigma_G + \gamma\sigma_F} [aW(n^\gamma) - aW(n_0|K^\gamma)] \\
&\quad + \left[\frac{\sigma_N + \sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F} \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned} \tag{A-39}$$

We can now find the expression of the Ω function.

$$\begin{aligned}
\Omega &= aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - c - \gamma c^f \\
&= aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - \frac{\sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad + \frac{\sigma_N + \gamma\sigma_F}{\sigma_N + \sigma_G + \gamma\sigma_F} [aW(n^\gamma) - aW(n_0|K^\gamma)] - \left[\frac{\gamma\sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F} \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned} \tag{A-40}$$

We previously proved that $aW(n^\gamma) = aW(n_0|K^\gamma)$ because of the assumption of perfect complementarity of the two types of inputs and the initial underinvestment in non-services inputs.

$$\begin{aligned}
\Omega &= aW(n_0|K_0) - aW(n^\gamma|K^\gamma) - \frac{\sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F} [\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] \\
&\quad - \left[\frac{\gamma\sigma_G}{\sigma_N + \sigma_G + \gamma\sigma_F} \right] [\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]
\end{aligned} \tag{A-41}$$

We define the bargaining power threshold by $\bar{\sigma}_G$ such that $\Omega(\bar{\sigma}_G) = 0$.

$$\frac{\bar{\sigma}_G}{\sigma_N + \bar{\sigma}_G + \gamma\sigma_F} = \frac{aW(n_0|K_0) - aW(n^\gamma|K^\gamma)}{[\Pi(n^\gamma) - \Pi(n_0|K^\gamma)] + \gamma[\Pi^f(n^\gamma) - \Pi^f(n_0|K^\gamma)]} \tag{A-42}$$

■

B.2 Appendix

Additional graphs to the subsection 2.4.1 As a robustness test, we conduct the same numerical simulations for two additional sets of different parameters. We set $\{A = 1, v = 0.9, a = 0.99\}$ in Figure B-1 and $\{A = 20, v = 0.7, a = 1.5\}$ in Figure B-2.

Figure B-1: Policy and commitment value for $A = 1$, $v = 0.9$, $a = 0.99$.

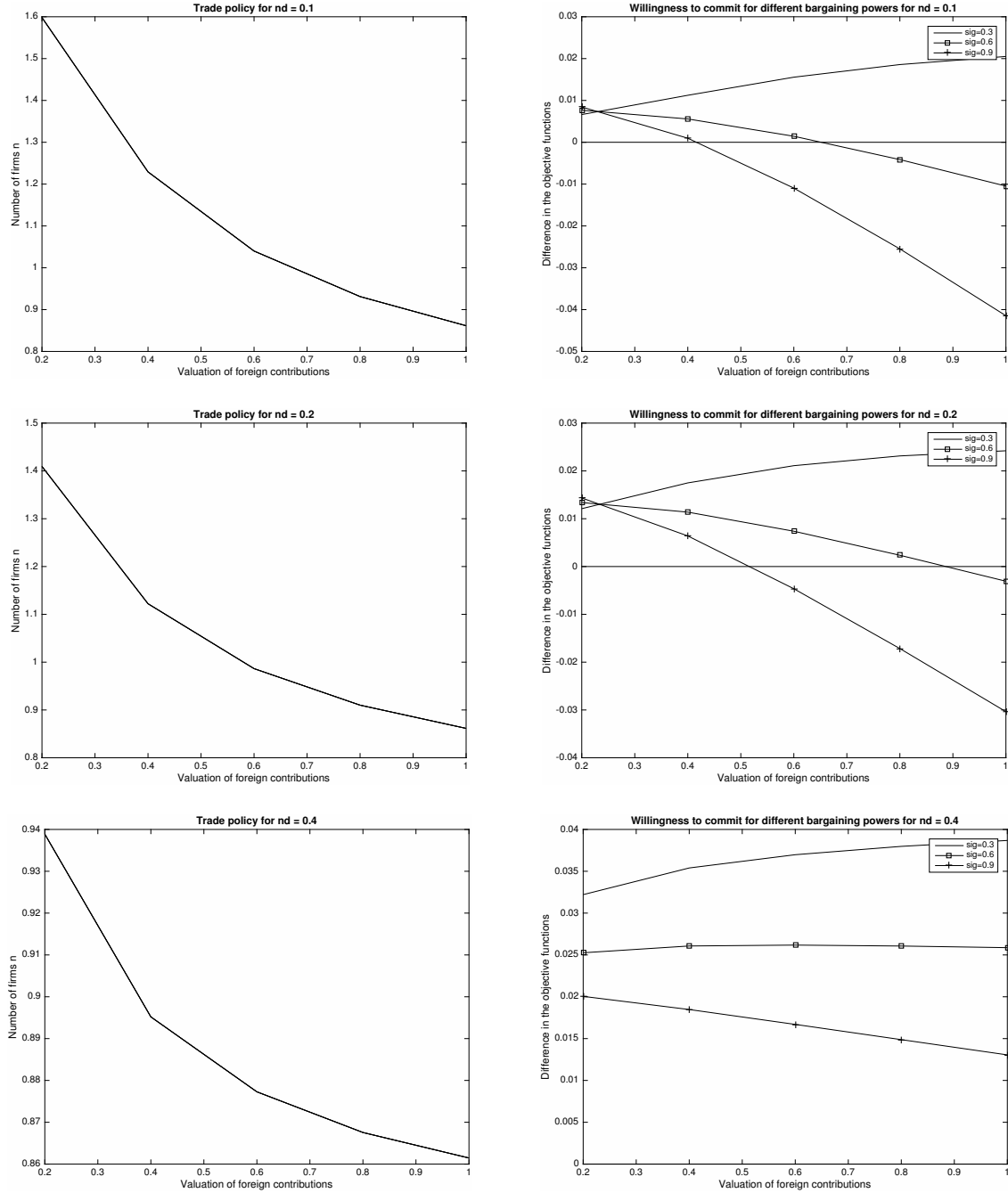
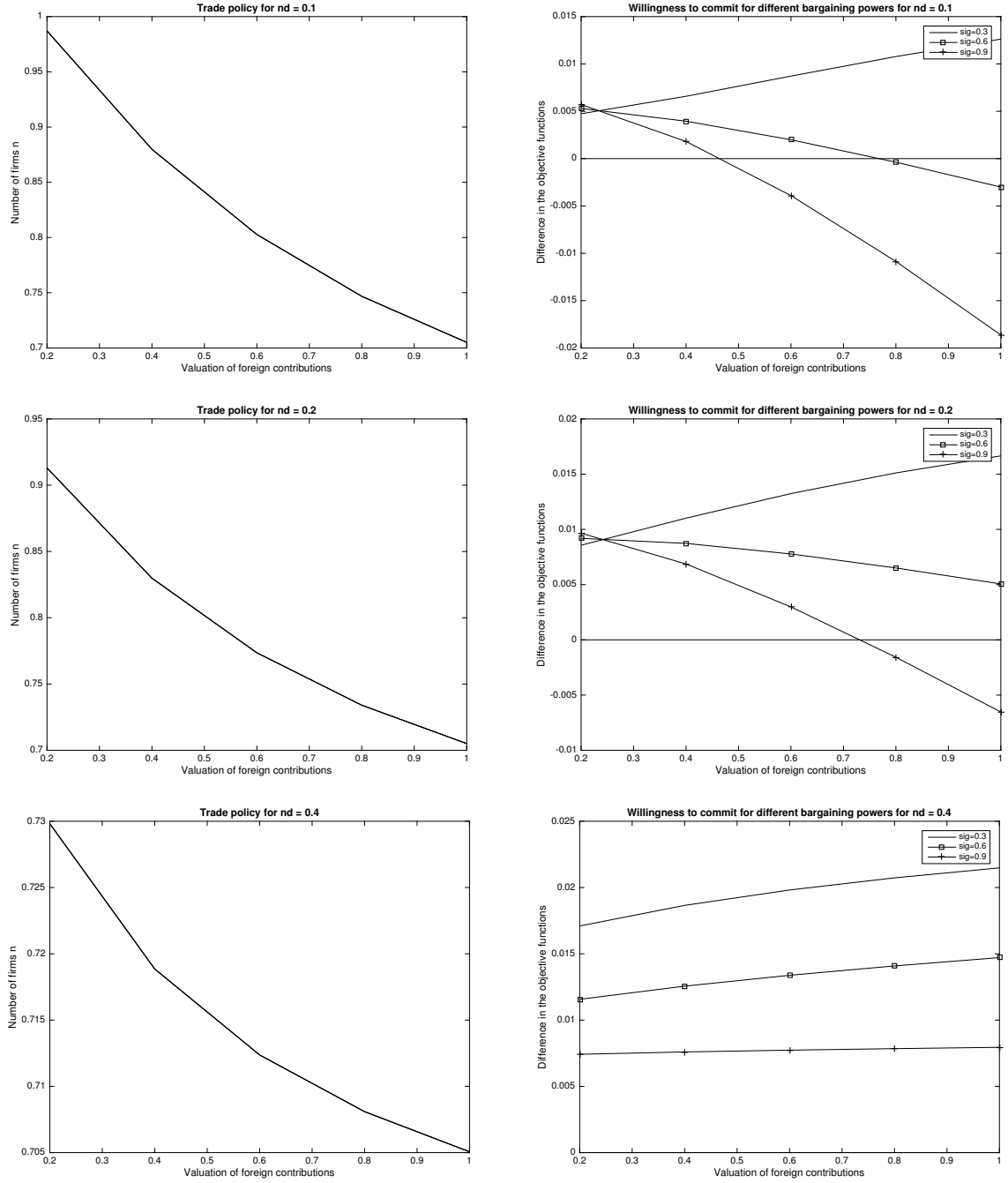


Figure B-2: Policy and commitment value for $A = 20$, $v = 0.7$, $a = 1.5$.



Appendix C

Appendix to Chapter 3

C.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

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.

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 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 |
| | | | |

C.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;

⁵We averaged the PRODY index in 2006, 2007 and 2008. The full list of 2 digit ISIC industries is available upon request.

- 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 firm designs the mapping

$$O_j^i(\cdot, \cdot) : L_j^i \times \mathbb{R}^+ \Rightarrow \{R_{1,j}^i, \dots, R_{N_j^i,j}^i, \emptyset\}$$

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

$$S_{k,j}^i(n, I, u) = \begin{cases} 1 & \text{with probability } e^{-\frac{1}{\theta_k}} \\ 0 & \text{with probability } 1 - e^{-\frac{1}{\theta_k}} \end{cases} \quad (\text{B-1})$$

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.

C.3 Proofs

Proof of Proposition 3.2 (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 3.2 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.

$$\begin{aligned}\pi'(\varphi) &= \frac{R}{2\sigma}(\sigma - 1) \left[\frac{P\rho}{w\beta(\varphi)} \right]^{\sigma-2} \times \frac{\overbrace{-w\beta'(\varphi)P\rho}^{<0}}{[w\beta(\varphi)]^2} > 0 \\ \pi''(\varphi) &= \frac{R}{2\sigma}(\sigma - 1) \left\{ (\sigma - 2) \left[\frac{P\rho}{w\beta(\varphi)} \right]^{\sigma-3} \left[\frac{-w\beta'(\varphi)P\rho}{[w\beta(\varphi)]^2} \right]^2 + \right. \\ &\quad \left. + \left[\frac{P\rho}{w\beta(\varphi)} \right]^{\sigma-2} \left[\frac{\overbrace{P\rho\{2[\beta'(\varphi)]^2 - \overbrace{\beta''(\varphi)\beta(\varphi)}^{>0}}^{>0}}{[w\beta(\varphi)]^3}} \right] \right\} > 0 \quad (\text{B-1})\end{aligned}$$

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 3.2. 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

$$\pi^S(\varphi^+) > \pi^A(\varphi^+) \iff \frac{P^S}{P^A} > \frac{\beta^S(\varphi^+)}{\beta^A(\varphi^+)} \quad (\text{B-2})$$

Analogously, $\forall \varphi^- < \varphi^{SA}$ we have that $\pi^S(\varphi^-) < \pi^A(\varphi^-)$. As before

$$\pi^S(\varphi^-) < \pi^A(\varphi^-) \iff \frac{P^S}{P^A} < \frac{\beta^S(\varphi^-)}{\beta^A(\varphi^-)} \quad (\text{B-3})$$

Combining the two conditions (B-2) and (B-3) we get

$$\frac{\beta^S(\varphi^-)}{\beta^A(\varphi^-)} > \frac{\beta^S(\varphi^+)}{\beta^A(\varphi^+)} \quad (\text{B-4})$$

Defining the function $B(\varphi) := \frac{\beta^S(\varphi)}{\beta^A(\varphi)}$ we can show that $B'(\varphi) > 0$. This contradicts condition (B-4) and completes the proof.

(iii) From (i), (ii) and profit maximisation. ■

Proof of Proposition 3.3

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:

$$\begin{aligned} \bar{\pi}^S &= \frac{\int_{\varphi^e}^{\varphi^{SA}} \pi^S(\varphi) g(\varphi) d\varphi}{[G(\varphi^{SA}) - G(\varphi^e)]} \\ \bar{\pi}^A &= \frac{\int_{\varphi^{SA}}^{\infty} \pi^A(\varphi) g(\varphi) d\varphi}{[1 - G(\varphi^{SA})]} \end{aligned}$$

We can now derive average profits as functions of the productivity cutoffs:

$$\begin{aligned} \bar{r}^S &= \underbrace{r^S(\tilde{\beta}^S(\varphi^e, \varphi^{SA}))}_{\text{or } r^S(\tilde{\beta}^S)} = \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \underbrace{r^S(\beta^S(\varphi^e))}_{\text{or } r^S(\varphi^e)} \\ \bar{r}^A &= \underbrace{r^A(\tilde{\beta}^A(\varphi^{SA}))}_{\text{or } r^A(\tilde{\beta}^A)} = \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{1-\sigma} \underbrace{r^A(\beta^A(\varphi^{SA}))}_{\text{or } r^S(\varphi^{SA})} \end{aligned} \quad (\text{B-5})$$

and

$$\begin{aligned} \bar{\pi}^S &= \pi^S(\tilde{\beta}^S) = \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \frac{r^S(\varphi^e)}{\sigma} - f \\ \bar{\pi}^A &= \pi^A(\tilde{\beta}^A) = \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{1-\sigma} \frac{r^A(\varphi^{SA})}{\sigma} - f \end{aligned}$$

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} :

$$\begin{aligned}\pi^S(\varphi^e) = 0 &\iff r^S(\varphi^e) = \sigma f \\ \pi^S(\varphi^{SA}) = \pi^A(\varphi^{SA}) &\iff r^S(\varphi^{SA}) = r^A(\varphi^{SA})\end{aligned}$$

Moreover, we notice that the revenue ratio of any two firms φ and φ' in sector i becomes

$$\frac{r^i(\varphi)}{r^i(\varphi')} = \left(\frac{\beta^i(\varphi')}{\beta^i(\varphi)} \right)^{(\sigma-1)} \quad (\text{B-6})$$

Using the revenue ratio (B-6) 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

$$\begin{aligned}\bar{\pi}^S &= f \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \\ \bar{\pi}^A &= f \left\{ \left[\frac{\tilde{\beta}^A(\varphi^{SA})}{\beta^A(\varphi^{SA})} \frac{\beta^S(\varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\}\end{aligned} \quad (\text{B-7})$$

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:

$$V = \frac{[1 - G(\varphi^e)]}{\delta} \bar{\pi} = f_e \quad (\text{B-8})$$

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:

$$\frac{1}{\delta} \left[[G(\varphi^{SA}) - G(\varphi^e)] \bar{\pi}^S + [1 - G(\varphi^{SA})] \bar{\pi}^A \right] = f_e \quad (\text{B-9})$$

Using the expressions for average profits (B-7) and (C.3) in the two sectors we have:

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi^{SA}) - G(\varphi^e)] \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi^{SA})] \left\{ \left[\frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA}) \beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \end{aligned} \quad (\text{B-10})$$

We use equation (φ^{SA}) to derive an expression for $\left\{ \frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA}) \beta^S(\varphi^e)} \right\}^{1-\sigma}$, in particular we get

$$\left\{ \frac{\tilde{\beta}^A(\varphi^{SA}) \beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA}) \beta^S(\varphi^e)} \right\}^{1-\sigma} = \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^{SA})]} \left\{ \tilde{\beta}^S(\varphi^e, \varphi^{SA}) \right\}^{1-\sigma} \quad (\text{B-11})$$

We get:

$$\begin{aligned} & \frac{f}{\delta} \left\{ [G(\varphi^{SA}) - G(\varphi^e)] \left\{ \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} + \right. \\ & \left. + [1 - G(\varphi^{SA})] \left\{ \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^{SA})]} \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} - 1 \right\} \right\} = f_e \\ & \iff \frac{f}{\delta} \left\{ 2[G(\varphi^{SA}) - G(\varphi^e)] \left[\frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})}{\beta^S(\varphi^e)} \right]^{1-\sigma} \right. \\ & \quad \left. - [G(\varphi^{SA}) - G(\varphi^e)] - [1 - G(\varphi^{SA})] \right\} = f_e \\ & \iff \frac{G(\varphi^{SA}) - G(\varphi^e)}{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}} = \frac{1}{2} \left[\delta f_e / f + 1 - G(\varphi^e) \right] \beta^S(\varphi^e)^{1-\sigma} \end{aligned} \quad (\text{FE})$$

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

$$S_x = \alpha_x \mathcal{R} = \alpha_x wL$$

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 \bar{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:

$$\left(\rho \right)^\sigma \frac{M\mathcal{R}}{[1 - G(\varphi^e)]} \left[\alpha_S \int_{\varphi^e}^{\varphi^{SA}} \frac{(P^S)^{\sigma-1}}{\beta^S(\varphi)^\sigma} g(\varphi) d(\varphi) + \right.$$

$$\left. + \alpha_A \int_{\varphi^{SA}}^{\infty} \frac{(P^A)^{\sigma-1}}{\beta^A(\varphi)^\sigma} g(\varphi) d(\varphi) \right] + Mf + M_e f_e = (1 - \alpha_x)L$$

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:

$$\left\{ \begin{array}{ll} (FE) & V(\varphi^{e*}, \varphi^{SA*}) = f_e \\ (\text{def } \varphi^{e*}) & \pi^S(\varphi^{e*}) = 0 \\ (\text{def } \varphi^{SA*}) & \pi^S(\varphi^{SA*}) = \pi^A(\varphi^{SA*}) \\ & \text{labor and good market clearing conditions} \end{array} \right. \quad (\text{B-12})$$

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 $(\varphi_*^e, \varphi_*^{SA})$

$$\left\{ \begin{array}{ll} (\varphi^{SA}) & \frac{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}}{G(\varphi^{SA}) - G(\varphi^e)} = \left[\frac{\beta^S(\varphi^{SA})}{\beta^A(\varphi^{SA})} \right]^{\sigma-1} \frac{\tilde{\beta}^A(\varphi^{SA})^{\sigma-1}}{1 - G(\varphi^{SA})} \\ (FE) & \frac{G(\varphi^{SA}) - G(\varphi^e)}{\tilde{\beta}^S(\varphi^e, \varphi^{SA})^{\sigma-1}} = \frac{1}{2} \left[\delta f_e / f + 1 - G(\varphi^e) \right] \beta^S(\varphi^e)^{1-\sigma} \end{array} \right. \quad (\text{B-13})$$

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-13) exists it has to satisfy the following equation

$$h(\varphi^{SA}) = \frac{1}{m(\varphi^e)} \quad (\text{B-14})$$

Given the strict monotonicity of h we can use (B-14) to write the equilibrium value of φ^{SA} as a function of φ^e :

$$\varphi^{SA} = h^{-1} \left(\frac{1}{m(\varphi^e)} \right) =: H(\varphi^e). \quad (\text{B-15})$$

We will now show that (B-13) 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-15)

$$k(\varphi^e) := \int_{\varphi^e}^{H(\varphi^e)} \beta^S(\varphi)^{1-\sigma} g(\varphi) d\varphi - m(\varphi^e) = 0 \quad (\text{B-16})$$

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-16) 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 3.4

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:

$$V = \frac{[1 - G(\varphi^e)]}{\delta} \bar{\pi} = f_e \quad (\text{B-17})$$

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-7) and (C.3) in the two sectors we have:

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

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

$$\bar{S}_S^p = \frac{1}{[G(\varphi^{SA}) - G(\varphi^e)]} \left[\int_{\varphi^e}^{\varphi^{SA}} \beta^s(\varphi) y^s(\varphi) g(\varphi) d\varphi + f \right]$$

$$\bar{S}_A^p = \frac{1}{[1 - G(\varphi^{SA})]} \left[\int_{\varphi^{SA}}^{\infty} \beta^A(\varphi) y^A(\varphi) g(\varphi) d\varphi + f \right]$$

Given the following expressions for supply and number of firms

$$y^i(\varphi) = \frac{r^i(\varphi)}{p^i(\varphi)} = \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^i)^{\sigma-1} [\beta^i(\varphi)]^{-\sigma}$$

$$M^S = \frac{[G(\varphi^{SA}) - G(\varphi^e)]}{[1 - G(\varphi^e)]} M \quad M^A = \frac{[1 - G(\varphi^{SA})]}{[1 - G(\varphi^e)]} M$$

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

$$S_A^p = \frac{Mf}{[1 - G(\varphi^e)]} + \frac{M}{[1 - G(\varphi^e)]} \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma (P^A)^{\sigma-1} [\tilde{\beta}^A(\varphi^{SA})]^{1-\sigma} [1 - G(\varphi^{SA})]$$

Thus

$$\begin{aligned} S_S^p + S_A^p &= \frac{2Mf}{[1 - G(\varphi^e)]} + \frac{M}{[1 - G(\varphi^e)]} \frac{R}{2} \left[1 + \frac{R_{-k}}{R} \right] \left[\frac{\rho}{w} \right]^\sigma \times \\ &\times \left\{ \left[\frac{P^S}{\tilde{\beta}^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\tilde{\beta}^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\} \end{aligned}$$

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

$$\begin{aligned} S_S^p + S_A^p &= \frac{2Mf}{[1-G(\varphi^e)]} + \frac{M}{[1-G(\varphi^e)]} \left(\frac{1-\alpha_X}{1-\alpha_X+w_k\alpha_X} \right) wL \left[\frac{\rho}{w} \right]^\sigma \times \\ &\times \left\{ \left[\frac{P^S}{\bar{\beta}^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\bar{\beta}^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\} \end{aligned}$$

Using the fact that in equilibrium $w = 1$ we have

$$\begin{aligned} S_S^p + S_A^p &= \frac{2Mf}{[1-G(\varphi^e)]} + \frac{M(1-\alpha_X)L}{[1-G(\varphi^e)]} (\rho)^\sigma \times \\ &\times \left\{ \left[\frac{P^S}{\bar{\beta}^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\bar{\beta}^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\} \end{aligned}$$

The final labor market clearing condition for country k is:

$$\begin{aligned} L - \alpha_X L - M_e f_e &= \frac{2Mf}{[1-G(\varphi^e)]} + \frac{M(1-\alpha_X)L}{[1-G(\varphi^e)]} (\rho)^\sigma \times \\ &\times \left\{ \left[\frac{P^S}{\bar{\beta}^S(\varphi^e, \varphi^{SA})} \right]^{\sigma-1} [G(\varphi^{SA}) - G(\varphi^e)] + \left[\frac{P^A}{\bar{\beta}^A(\varphi^{SA})} \right]^{\sigma-1} [1 - G(\varphi^{SA})] \right\} \end{aligned} \quad (LMC)$$

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 3.5 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

$$\iff \frac{\partial \ln \beta^S}{\partial \varphi} > \frac{\partial \ln \beta^A}{\partial \varphi} \tag{B-18}$$

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-18) 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 3.6 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 3.5 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. ■

C.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 $[1, 9]$.