Gutenberg School of Management and Economics

Discussion Paper Series

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August 2013

Discussion paper number 1306

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Endogenous Trade Policy with Heterogeneous Firms

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This version: August 2013

Abstract

The present paper modifies the "Protection for Sale" model of Grossman and Helpman (1994) to account for heterogeneous firms lobbying for non-tariff barriers to trade, such as technical standards or certification requirements. They raise the fixed costs of market access for both domestic producers and foreign exporters, force the least efficient firms to exit and shift profits to the most efficient firms. Non-tariff barriers to trade shift profits both within and across countries, but not necessarily to the country in which firms are more productive on average. They decrease social welfare as they reduce competition and product variety, but may nevertheless be implemented if only the largest domestic firms lobby the government. When variable trade costs fall or foreign firms become relatively more competitive, the potential for profit shifting and hence non-tariff barriers to trade decrease. The paper also analyzes the case of international trade negotiations, and it addresses the issue of endogenous lobby formation.

Keywords: Endogenous trade policy, non-tariff barriers to trade, heterogeneous firms, lobbying

JEL Classification: F12, F13, D70

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1 Introduction

There is by now a broad consensus among trade economists as well as political scientists that trade policies are set by politicians who are subject to pressures applied by special interest groups. In fact, lobbying for trade policy is a widely spread phenomenon. Between 1998 and 2008, 84 % of all U. S. sectors at the 4-digit SIC level were engaged in lobbying for trade policy (Bombardini and Trebbi, 2012). The theoretical benchmark in this line of literature is the "Protection for Sale" model of Grossman and Helpman (1994), in which some organized sectors make political contributions to sway the government's trade policy choice in their favor. The incumbent government trades off social welfare against these political contributions, and thus makes a trade policy choice that is biased toward the interest of the lobbying sectors.

Even though the "Protection for Sale" model has found general empirical support,[1] it remains silent on a couple of interesting issues. Most importantly, the model abstracts from the role of individual firms in the political process. Yet, firms within a sector differ in their political activity, a fact predominantly discussed by political scientists. Larger firms, as measured by sales, make higher contributions to political action committees in the U.S. (Bombardini, 2008; Drope and Hansen, 2006; Sadrieh and Annavarjula, 2005, and others). In the European Union, they are more likely to have an office in Brussels and to be accredited to lobby the European Parliament (Bernhagen and Mitchell, 2006). Smaller enterprises, in contrast, are more reluctant to engage in the process of trade policy formation due to financial constraints and lack of expertise (Fliess and Busquets, 2006). These results are consistent with recent evidence by Kerr et al. (2011), who show that both the extensive and intensive margins of lobbying are strongly related to firm size.[2] To the extent that large and small firms differ in their preferences regarding trade policy, a purely sectoral analysis may miss important determinants of the strength and the objective of lobbying activities.

Furthermore, like most of the theoretical contributions on the political economy of trade policy, Grossman and Helpman (1994) concentrate on import tariffs and export subsidies as the relevant trade policy instruments. However, during decades of multilateral trade negotiations, tariffs on manufacturing goods have fallen sub-

[1] For a critical survey of the empirical evidence on the "Protection for Sale" model, see Imai et al. (2009).

[2] Using official data on U.S. companies' lobbying expenditures from 1998-2006, Kerr et al. (2011) find that the average firm that lobbies sells roughly four times more, has three-and-a-half times more employees and disposes of two times more assets than the average firm that does not lobby. For firms that lobby, there is a positive correlation between lobbying expenditures and sales of 28%.

stantially. In 2010, the unweighted average applied tariff rate in high income OECD countries was below 3% (World Bank, 2013). At the same time, non-tariff barriers to trade such as technical barriers or customs procedures and administrative practices have gained importance. From 1994 to 2004, the percentage of tariff lines affected by technical barriers has risen from 32% to 59% (UNCTAD, 2005). Empirical work by Chen and Novy (2011) suggests that technical barriers have a significantly negative impact on trade integration within the European Union. Explaining around 3% of the variation in bilateral, industry-specific trade frictions, technical barriers are the most important policy-related trade barrier. Together with undue administrative complications, technical barriers are perceived by exporters around the world to be relevant obstacles to foreign market access (OECD, 2005). After all, it has been argued that non-tariff barriers to trade are easier to manipulate unilaterally and therefore more appropriate for a political economy setup (Bombardini, 2008).

The present paper accounts for these facts and modifies the theoretical framework of Grossman and Helpman (1994) to study the endogenous determination of non-tariff barriers in a lobbying model with heterogeneous firms and intra-industry trade between two asymmetric countries. The model resorts to Chaney (2008) in assuming that in each country, there is a given mass of firms producing varieties of a differentiated good with heterogeneous marginal costs. In order to access the market and sell their products, both domestic producers and foreign exporters have to incur some fixed costs. These costs are potentially different for domestic producers and foreign exporters and may be interpreted as the costs of adapting the product to local standards, of testing and certifying the product, of complying with legal requirements or of passing customs and administrative procedures.

Non-tariff barriers to trade are modelled as additional regulations which raise these fixed costs of gaining market access. I assume that they affect both foreign exporters and domestic producers, in compliance with the national treatment principle of the World Trade Organization. It requires that once imported goods have crossed the border, they must be treated like locally produced goods. Hence all technical standards, testing or certification procedures, labeling or packaging requirements that are imposed on foreign exporters must apply to domestic producers as well. Such regulations are also called behind-the-border measures (Staiger, 2012).[3]

When a country introduces behind-the-border measures, domestic firms and foreign exporters with high marginal costs cannot generate enough revenues to cover

[3]Customs procedures or shipping inspections, in contrast, affect foreign exporters only, and thus raise the ratio of market acces costs for foreign exporters to market access costs for domestic producers. Such regulations are also called border measures. Unlike behind-the-border measures, however, they do not create any conflict of interest between domestic firms and emerge independently of whether firms are heterogeneous in their political activities. Therefore, in the present paper, I will focus on behind-the-border measures, and discuss border measures only briefly.

the increased fixed costs of market access anymore and exit. This reduces competition, and increases the market shares and profits of those domestic and foreign firms with low marginal costs. In addition to this profit shifting effect within countries, there is also a profit shifting effect across countries. In particular, profits will be shifted towards the country that imposes such additional regulations whenever it has a more dispersed firm size distribution and hence a higher ratio of very efficient to very inefficient firms than its trading partner. However, despite their potentially positive effect on aggregate profits, behind-the-border measures decrease social welfare, because they reduce the variety available to domestic consumers. They will nevertheless be implemented if only the largest and thus the most efficient domestic firms lobby their government, as the empirical evidence suggests, and if the government is sufficiently susceptiple to the influence of special interest groups. The equilibrium level of technical standards or labeling requirements will be the larger, the lower the government's concern about social welfare, and the stronger the profit shifting effect between domestic firms. Most interestingly, when variable trade costs such as tariffs and transport costs decline and foreign firms become more competitive, the potential for profit shifting between domestic firms decreases, which lowers the incentives of large domestic firms to lobby for behind-the-border measures. Thus, as in Grossman and Helpman (1994), protection is inversely related to the import penetration ratio, although for very different reasons.

In an extension of the model, I endogenize the composition of the lobby that bribes the government to implement technical barriers to trade. Following Zudenkova (2011), each domestic firm which benefits from the policy that the lobby achieves will also be a member of the lobby and bear a certain share of the lobby's contribution to the government. Under certain assumptions on the sharing rule, a unique equilibrium can be shown to exist. The comparative statics of the equilibrium trade policy turn out to be robust to this extension.

Although the literature on firm heterogeneity in international trade is growing fast, it has so far paid little attention to the issue of endogenous trade policy. Four recent contributions stand out. Bombardini (2008) extends the traditional Grossman and Helpman (1994) setup by assuming that each sector is composed of several firms which differ in their endowments with a sector specific factor of production. Firms with a larger endowment produce more, sell more and thus have a stronger incentive to lobby for either import tariffs or export subsidies. Yet, there are no conflicts of interest within sectors. This is different in Chang and Willmann (2006), who introduce lobbying into a Melitz (2003) type model of intra-industry trade in which firms are heterogeneous in their productivities. The most productive firms operate on the export market and oppose a reciprocal import tariff since it would

reduce their profits made abroad, while the least productive ones sell on the domestic market only and favor an import tariff since it would shield their market from foreign competition. Neither Bombardini (2008) nor Chang and Willmann (2006) consider non-tariff barriers to trade as the relevant policy variables. Do and Levchenko (2009) analyze the determination of the fixed costs of producing for the domestic market, which they interpret as the quality of institutions, in a modified median voter model. The political mechanism is thus different from the one considered here. Also, the fixed costs of producing for the export market are exogenous in their model. The work most closely related to the present paper deals with the endogenous determination of an entry tax in a model with heterogeneous firms and product differentiation. Rebeyrol and Vauday (2009) however focus on a closed economy. They argue informally that in a small open economy a tax on the fixed costs for both foreign exporters and domestic producers would shift profits toward domestic firms if these were more productive on average and that it would thus be optimal to introduce a positive entry tax even in the absence of lobbying. The formal analysis provided in the present paper qualifies their intuition, for a large as well as for a small open economy, and addresses the issue of endogenous lobby formation.

In emphasizing the role of variable trade costs for the profit shifting effect of behind-the-border measures between firms which differ in both their economic efficiency and their political activity, the present paper also adds a new argument to the debate on whether tariffs and non-tariff barriers to trade are complements or substitutes. Although at first sight, it might seem that tariffs have gradually been replaced by non-tariff barriers to trade, this question is far from being settled.[4] In fact, some empirical studies have found a positive correlation between tariffs and non-tariff barriers to trade, in line with the predictions of the present paper.[5]

The paper is organized as follows. Section 2 lays out the basic model. Section 3 analyzes the effects of non-tariff barriers to trade on individual firms' and aggregate profits and social welfare. Section 4 presents the lobbying game and analyzes the equilibrium trade policies. Section 5 deals with possible extensions of the model, including endogenous lobby formation, and section 6 concludes.

[4]See World Trade Organization (2012) for a summary of the debate.

[5]See Goldberg and Pavcnik (2005) and Gourdon and Nicita (2012), for instance. Clearly, much more empirical research is needed to make robust inference about the relationship between variable trade costs and different types of non-tariff-barriers to trade.

2 Model setup

There are two countries, Home and Foreign. Whenever necessary, variables are indexed by H or F. In both countries there is a continuum of consumers with mass L_H and L_F, respectively, who share identical preferences over a composite numéraire good C_A and a continuum of varieties of a manufacturing good C_M described by a quasilinear utility function of the form

$$U = C_A + \mu \ln C_M, \qquad C_M = \left(\int_{i \in \Omega} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where Ω is the set of available varieties and $\sigma > 1$ is the elasticity of substitution between any two varieties of the differentiated good. Thus, consumers display love of variety.[6]

Assuming that the income of each consumer is larger than the expenditures for the manufacturing good, which are constant and equal to μ, the individual demand for any imported or locally produced variety i is

$$c_i = \frac{\mu \, p_i^{-\sigma}}{P^{1-\sigma}} \tag{2}$$

where p_i is the consumer price and $P = \left(\int_{i \in \Omega} p_i^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$ is the ideal price index over all consumed varieties. As more varieties become available, the ideal price index decreases, and the demand for any single variety falls.

Each consumer inelastically supplies one unit of labor, which is the only factor of production. The numéraire good is produced under perfectly competitive conditions with constant returns to scale in both countries and is freely traded. One unit of output requires one unit of input, which fixes the wage rate at one. The differentiated good is produced with increasing returns to scale under monopolistically competitive conditions, implying that each variety is produced at most by one firm and no firm produces more than one variety. Firms differ in their marginal costs. A firm i producing variety i for its domestic market incurs marginal costs a_i. Trade in the differentiated good is subject to iceberg trade costs. A firm in Home has to ship $\tau_F > 1$ units in order for one unit to arrive in Foreign, implying that its marginal costs of producing for the Foreign market are $\tau_F a_i$. Similarly, a firm in Foreign has to ship $\tau_H > 1$ units in order to sell one unit on the Home market. Profit maximization implies that a firm charges a constant markup $\frac{\sigma}{\sigma-1}$ over its marginal

[6] The model can easily be extended to more than one manufacturing sector by using an additively separable utility function as in Grossman and Helpman (1994), with the outside good entering linearly as shown above. Such preferences would rule out cross-price and income effects and allow for a sector-by-sector analysis as shown below.

costs. Accordingly, the consumer price for a locally produced variety is $p_i = \frac{\sigma}{\sigma-1} a_i$, while it is $p_i = \frac{\sigma}{\sigma-1} \tau_H a_i$ for an imported variety in Home and $p_i = \frac{\sigma}{\sigma-1} \tau_F a_i$ for an imported variety in Foreign.

If a firm wants to sell its variety in its country of origin, it has to comply with domestic product market regulations such as technical standards, testing and certification procedures, or legal requirements. This creates fixed costs, which are denoted by f_{HD} for a Home firm and by f_{FD} for a Foreign firm. If a firm wants to export its product, it has to comply with the product market regulations in the target country. In addition, it has to pass certain customs and administrative routines at the border. Altogether, exporting creates fixed costs, which are denoted by f_{HE} for a Home firm, and by f_{FE} for a Foreign firm.

Using profit maximizing consumer prices and the corresponding aggregate demands, the profits of a Home firm with marginal costs a_i from selling on its domestic market are

$$\pi_{HD}(a_i) = \frac{\mu}{\sigma} \left(\frac{\sigma}{\sigma - 1} \right)^{1-\sigma} L_H P_H^{\sigma-1} a_i^{1-\sigma} - f_{HD} \tag{3}$$

while its profits from exporting are

$$\pi_{HE}(a_i) = \frac{\mu}{\sigma} \left(\frac{\sigma}{\sigma - 1} \right)^{1-\sigma} L_F P_F^{\sigma-1} \left(\tau_F a_i \right)^{1-\sigma} - f_{HE} \tag{4}$$

where P_H denotes the ideal price index in Home, and P_F denotes the ideal price index in Foreign. Analogous expressions follow for a Foreign firm. The higher a Home firm's marginal cost, the less it sells on its domestic market. If a firm's marginal costs are too high, the net revenues from being active on the domestic market are too small to cover the associated fixed costs, and the firm will exit. Thus, there is a cutoff level of marginal costs a_{HD}, implicitly defined by $\pi_{HD}(a_{HD}) = 0$, such that only Home firms with $a_i \leq a_{HD}$ are active on their domestic market. Similarly, only Home firms with $a_i \leq a_{HE}$ export their products and make non-negative profits on the Foreign market, where a_{HE} is given by $\pi_{HE}(a_{HE}) = 0$. The corresponding cutoff values for Foreign firms are denoted by a_{FD} and a_{FE}, respectively.

To make the model suitable for a political economy setup, I assume that there is a fixed mass of potential firms M_H in Home and M_F in Foreign.[7] Potential firms

[7]The assumption of a fixed mass of potential entrepreneurs has also been used by Chaney (2008), Arkolakis (2010), and Do and Levchenko (2009), amongst others.

in Home draw their marginal costs $a \in (0, \bar{a}_H]$ from the cumulative distribution function

$$H(a) = \left(\frac{a}{\bar{a}_H}\right)^{\kappa_H} \tag{5}$$

while firms in Foreign draw their marginal costs $a \in (0, \bar{a}_F]$ from the cumulative distribution function

$$F(a) = \left(\frac{a}{\bar{a}_F}\right)^{\kappa_F} \tag{6}$$

with $\kappa_H + 1 - \sigma > 0$ and $\kappa_F + 1 - \sigma > 0$, which are standard regularity conditions. The distribution of marginal costs a is equivalent to a Pareto distribution of marginal productivities $1/a$ with shape parameters κ_H or κ_F and scale parameters $\bar{a}_H$ or $\bar{a}_F$, respectively. Using a Pareto distribution for marginal productivities is now quite common in the literature on heterogeneous firms, since it is in line with the empirical evidence on firm sales and ensures analytical tractability.[8]

Given the cutoff values a_{HD} and a_{FE} and the marginal cost distributions $H(a)$ and $F(a)$, the equilibrium price index P_H can be determined as an implicit function of the population size L_H, the mass of potential firms in both countries, M_H and M_F, the fixed costs f_{HD} and f_{FE}, the variable trade costs τ_H, the preference parameters μ and σ, and the distribution parameters κ_H, κ_F, $\bar{a}_H$, and $\bar{a}_F$. Aggregate profits of all Home firms from selling on the domestic market and from exporting are $\pi_{HD}^{agg} = M_H \int_0^{a_{HD}} \pi_{HD}(a) dH(a)$ and $\pi_{HE}^{agg} = M_H \int_0^{a_{HE}} \pi_{HE}(a) dH(a)$, respectively, and can be calculated as a function of the equilibrium price index.[9]

I assume that firms do not have sources of income other than profits, and that they spend all of their profits on the numéraire good. This ensures that their interest in lobbying comes solely from their role as producers and not from their role as consumers. Thus, they do not care about prices in sectors other than their own. A comparable assumption to simplify the traditional Grossman and Helpman (1994) setup has been advocated by Bombardini (2008) and Baldwin and Robert-Nicoud (2007), for instance. Social welfare in the Home country is then given by the sum of the aggregate profits of Home firms from selling on their domestic market and from exporting, aggregate labor income, and total consumer surplus,

$$W = \pi_{HD}^{agg} + \pi_{HE}^{agg} + L_H + L_H \left(\mu \ln \frac{\mu}{P_H} - \mu\right). \tag{7}$$

[8] Examples for papers that use a Pareto distribution for marginal productivities include Chaney (2008), Arkolakis (2010), Baldwin and Forslid (2010), Ghironi and Melitz (2005), and Helpman et al. (2004). For the empirical evidence, see Axtell (2001) and Corcos et al. (2012).

[9] All solutions are given in the appendix.

3 Effects of non-tariff measures

Following the national treatment principle of the World Trade Organization, I model non-tariff barriers to trade such as technical standards, testing and certification procedures, or labeling and packaging requirements as regulations which increase the fixed costs of accessing the Home market for both Home and Foreign firms, f_{HD} and f_{FE}, by a factor $\alpha \in [1, \infty)$.[10] Such regulations have an anti-competitive effect in that they force the least efficient Home producers and Foreign exporters to withdraw from the Home market. Their marginal costs are too high and hence their sales too low to cover the increased fixed costs. The more comprehensive these additional regulations, the more firms have to exit. The benchmark case in which $\alpha = 1$ characterizes a situation in which the Home government does not implement any undue regulations at all.

Proposition 1 *For any values of κ_H and κ_F, behind-the-border measures force the least efficient Home and Foreign firms that have been active on the Home market to exit, $\frac{\partial a_{HD}(\alpha)}{\partial \alpha} < 0$ and $\frac{\partial a_{FE}(\alpha)}{\partial \alpha} < 0$.*

For a proof, see the appendix. As the least efficient firms exit the Home market, the available product variety shrinks and the price index in Home increases, $\frac{\partial P_H(\alpha)}{\partial \alpha} > 0$. Equation (3) for Home firms and the analogue of equation (4) for Foreign firms show that this increase in the price index P_H benefits the remaining firms the more the smaller their marginal costs. For the most efficient Home and Foreign firms, the gain in market share due to reduced competition more than compensates the increase in fixed costs, and their profits rise at the expense of the profits of the least efficient Home and Foreign firms. This profit shifting effect is illustrated in figure 1 for Home firms, with a similar picture applying to Foreign firms. Thus, behind-the-border measures shift profits from the least efficient Home firms to the most efficient Home firms, and from the least efficient Foreign exporters to the most efficient Foreign exporters.

[10] The assumption of multiplicative behind-the-border measures is mainly made for reasons of analytical tractability. If accessing the Home market is more difficult for Foreign exporters than for Home firms, $f_{FE} > f_{HD}$, which is quite plausible due to informational disadvantages, cultural differences, or language barriers, this assumption implies that the absolute costs of complying with a new technical standard are higher for Foreign exporters. Hence, in absolute terms, behind-the-border measures have a discriminatory effect against Foreign firms, and in this respect may be seen as a protectionist trade policy. An alternative way would be to model behind-the-border measures as regulations which impose the same absolute cost on both Foreign exporters and Home firms. Additive behind-the-border measures would generally create the same conflict of interest between large and small firms. However, if $f_{FE} > f_{HD}$, they would unintentionally increase the relative competitiveness of Foreign exporters and thus would hurt rather than protect Home firms.

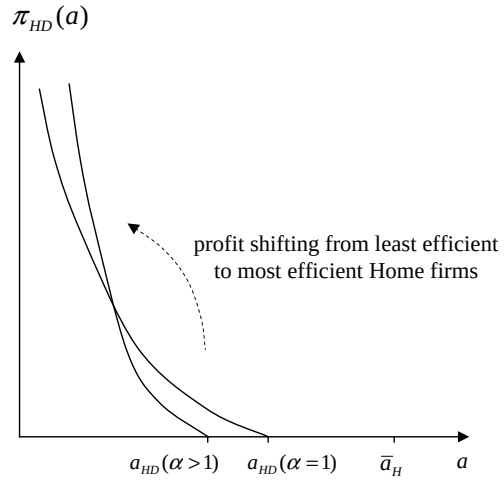

Figure 1: Effect of behind-the-border measures on the profits of Home firms

Besides the profit-shifting effect within countries, there is also a profit-shifting effect across countries, at least if countries are characterized by cost distributions with different shape parameters κ_H and κ_F.

Proposition 2 *Behind-the-border measures shift aggregate profits from selling on the Home market from Foreign to Home firms if and only firm productivity is more dispersed in Home than in Foreign, that is* $\frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} > 0$ *and* $\frac{\partial \pi_{FE}^{agg}(\alpha)}{\partial \alpha} < 0$ *if and only if* $\kappa_H < \kappa_F$.

For a proof, see the appendix. Interestingly, whether profits from selling on the Home market are shifted from Foreign to Home firms depends only on the shape parameters κ_H and κ_F, and not on the scale parameters $\bar{a}_H$ and $\bar{a}_F$ of the marginal cost distribution. This is because the scale parameters $\bar{a}_H$ and $\bar{a}_F$ affect the relevant cutoff values in Home and Foreign in the same way, and thus lead to the same ratio of winners to losers in Home and Foreign. However, different shape parameters κ_H and κ_F give winners and losers a different weight. If $\kappa_H < \kappa_F$, the ratio of very efficient firms to rather inefficient firms and hence the ratio of winners to losers from behind-the-border measures is higher in Home than in Foreign, implying that in the aggregate, profits are shifted from Foreign to Home firms.

An interesting implication of this result is that the average of marginal costs of Home and Foreign firms, given by $\int_0^{\bar{a}_H} a \; dH(a) = \frac{\kappa_H}{\kappa_H+1}\bar{a}_H$ and $\int_0^{\bar{a}_F} a \; dF(a) = \frac{\kappa_F}{\kappa_F+1}\bar{a}_F$, respectively, cannot predict the direction of the profit shifting effect of behind-the-border measures. It is quite possible that potential Foreign firms have lower marginal costs and hence are more productive on average because $\bar{a}_F$ is compa-

rably small, but profits are nevertheless shifted toward Home firms.[11] This qualifies the result of Rebeyrol and Vauday (2009) who argue by means of a rather restrictive example that behind-the-border measures would shift profits to Home firms only if these were more productive on average.[12]

Moreover, Rebeyrol and Vauday (2009) argue that if an entry tax would shift profits to Home firms, it could be optimal to introduce a positive entry tax even in the absence of lobbying. This is true because an entry tax, contrary to the behind-the-border measures considered here, generates tax revenues. In the absence of such revenues, however, the implementation of purely anti-competitive regulations like behind-the-border measures can never be social welfare maximizing.

Proposition 3 *For any values of κ_H and κ_F, the introduction of behind-the-border measures reduces social welfare in Home, $\frac{\partial W(\alpha)}{\partial \alpha} < 0$.*

See the appendix for a proof, which shows that the potentially positive effect of behind-the-border measures on the aggregate profits of Home firms is always dominated by their negative effect on consumer surplus.[13]

4 The lobbying game

To analyze the endogenous determination of non-tariff measures, I will assume that the shape parameters of the marginal cost distributions in Home and Foreign are identical, $\kappa_H = \kappa_F = \kappa$. Although this entails a certain loss of generality, it has several important advantages. First, it ensures analytical tractability as it permits

[11] This argument also holds if the average of marginal costs is conditioned on being active on the Home market. In other words, even if active Foreign exporters are more productive on average,

$$\int_0^{a_{HD}} a\, dH(a) = \frac{\kappa_H}{\kappa_H + 1} f_{HD}^{\frac{1}{1-\sigma}} > \frac{\kappa_F}{\kappa_F + 1} f_{FE}^{\frac{1}{1-\sigma}} \tau_H^{-1} = \int_0^{a_{FE}} a\, dF(a),$$

because f_{HD} is small compared to f_{FE}, it is still possible that behind-the-border measures shift aggregate profits from selling to the Home market from Foreign to Home firms.

[12] Their argument is actually made for Home being a small open economy. Yet, it carries over to Home being a large open economy, since the only difference is whether Home firms have an impact on the Foreign price index or not. The Foreign price index is however irrelevant for the profit shifting effects of behind-the-border measures. For a model of a small open economy involved in intra-industry trade, see Demidova and Rodríguez-Clare (2009).

[13] Border measures have similar effects on aggregate welfare, without creating any conflict of interest between domestic firms. They can be modelled as regulations which increase the fixed costs f_{FE} for Foreign exporters by a factor $\beta \in [1, \infty)$. Such regulations force the least efficient foreign exporters to withdraw from the Home market, $\partial a_{FE}(\beta)/\partial\beta < 0$, and induce less efficient Home firms to start producing for the Home market, $\partial a_{HD}(\beta)/\partial\beta > 0$. As the first effect dominates, the price index increases, $\partial P_H(\beta)/\partial\beta > 0$, and consumer surplus falls. All firms in Home gain, and aggregate profits of Home firms increase, $\partial \pi_{HD}^{agg}(\beta)/\partial\beta > 0$. However, this effect does not compensate the loss in consumer surplus, and hence for any values of κ_H and κ_F, the implementation of border measures decreases social welfare, $\partial W(\beta)/\partial\beta < 0$. The proofs are analogous to the ones for behind-the-border measures.

closed form solutions for the equilibrium price indices, the cutoff values, and individual as well as aggregate firm profits from selling on the domestic market and from exporting, respectively.[14] This eases exposition and fosters intuition when the political economy setup adds to the complexity of the model. More importantly, however, it implies that non-tariff measures such as technical regulations or certification requirements shift profits only within but not across countries, and thus helps to focus on the conflict of interest that arises between different firms located in the same country. In particular, since aggregate profits in either country are constant, the differentiated goods sector in the Home country would have no interest whatsoever in lobbying for non-tariff measures if it were considered as an entity as in the original Grossman and Helpman (1994) model. With identical shape parameters, any bias towards protectionist policies will solely be driven by heterogeneous lobbying activities of large versus small firms.[15] Keeping this in mind, I will now proceed to describe the lobbing game in which the equilibrium level of non-tariff measures will ultimately be determined.

4.1 Theoretical framework

Like Grossman and Helpman (1994), I model the lobbying process as a menu auction based on the theoretical framework of Bernheim and Whinston (1986). I assume that Home firms are organized exogenously into $j \in K$ lobbies. At this point, I will make no specific assumption on the composition of the lobbies. Each lobby acts as a bidder and makes a menu of offers to the Home government, one for each level of behind-the-border measures that the Home government may choose. Put differently, each lobby announces political contributions $C_j(\alpha)$ contingent on the level of behind-the-border measures $\alpha \in [1, \infty)$ that the Home government implements. The objective of each lobby is to maximize the joint welfare of its members net of contributions,

$$G_j(\alpha) = W_j(\alpha) - C_j(\alpha) = \pi^j_{HD}(\alpha) + \pi^j_{HE} - C_j(\alpha). \tag{8}$$

The Home government acts as an auctioneer. It takes the composition of the lobbies and their bids as given, and chooses behind-the-border measures $\alpha \in [1, \infty)$

[14] All solutions are given in the appendix.

[15] Intuitively, if $\kappa_H < \kappa_F$ and behind-the-border measures shift profits from Foreign to Home firms, the negative effect on social welfare in Home is moderated, while the profit shifting effect between Home firms is intensified. Both effects tend to increase the equilibrium level of behind-the-border measures, but presumably leave the comparative static results qualitatively unaffected.

to maximize a weighted sum of social welfare in Home and the lobbies' political contributions,

$$G(\alpha) = \phi W(\alpha) + \sum_{j \in K} C_j(\alpha) \tag{9}$$

The higher ϕ, the more the Home government cares about social welfare and the less it is susceptible to the pressure of lobbying firms.

The timing of the lobbying game is as follows. First, Home and Foreign firms draw their marginal costs a from the distributions $H(a)$ and $F(a)$, respectively. Second, Home firms organize exogenously into lobbies. Third, each lobby $j \in K$ offers a contribution for each possible level of α, $C_j(\alpha)$, to maximize its welfare net of contributions, $G_j(\alpha)$. The Home government takes the contribution schedules as given and chooses $\alpha \in [1, \infty)$ to maximize $G(\alpha)$. It implements the chosen trade policy and receives the corresponding contributions. Then all Home and Foreign firms produce for all markets on which they can make non-negative profits, and withdraw from markets on which they would make losses given the actual level of behind-the-border measures.

Bernheim and Whinston (1986) show that the equilibrium of the lobbying game, if set up as a menu auction, can be characterized as follows:

Proposition 4 *(Bernheim and Whinston, 1986)* $\left\{C_j^o(\alpha)_{j \in K}, \alpha^o\right\}$ *is a subgame-perfect Nash equilibrium of the lobbying game if and only if*

(a) $C_j^o(\alpha)$ *is feasible for all* $j \in K$

(b) α^o *maximizes* $\phi W(\alpha) + \sum_{j \in K} C_j^o(\alpha)$ *on* $[1, \infty)$

(c) α^o *maximizes* $\phi W(\alpha) + \sum_{j \in K} C_j^o(\alpha) + W_j(\alpha) - C_j^o(\alpha)$ *on* $[1, \infty)$ *for every* $j \in K$.

(d) for every $j \in K$ *there exists an* $\alpha^j \in [1, \infty)$ *that maximizes* $\phi W(\alpha) + \sum_{i \in K} C_i^o(\alpha)$ *on* $[1, \infty)$ *such that* $C_j^o(\alpha^j) = 0$

Condition (a) implies that each lobby's contribution schedule must not be negative, nor larger than the total income of the lobby's members. Condition (b) captures the fact that the Home government implements the trade policy $\alpha \in [1, \infty)$ that maximizes its own welfare, which is a weighted sum of the social welfare in Home and the political contributions. Condition (c) ensures that the equilibrium trade policy α^o maximizes the joint surplus of the government and any lobby j. If this were not the case, lobby j could modify its contribution schedule to increase the joint surplus and keep a fraction of the additional gain. And finally, condition (d) states that each lobby j contributes just enough to make the government indifferent

between the equilibrium policy α^o and the policy it would choose if lobby j did not participate in the lobbying game.

A common problem of lobbying games is the multiplicity of equilibrium contribution schedules. However, Bernheim and Whinston (1986) show that the set of a lobby's best responses to any combination of contribution schedules offered by all other lobbies always includes a truthful contribution schedule. Such a schedule reflects the true preferences of the lobby in every point $\alpha \in [1, \infty)$ and stipulates a payment to the government which equals the excess welfare of the lobby at α relative to some basic level B_j. Formally, a truthful contribution schedule of lobby j is given by

$$C_j^T(\alpha, B_j) = \max[0, W_j(\alpha) - B_j]. \tag{10}$$

It is differentiable everywhere, except where it becomes nil, as long as the lobby's total profits are differentiable. Further, Bernheim and Whinston (1986) show that all truthful Nash equilibria, that is all equilibria which are supported by truthful contribution schedules, and only these equilibria, are coalition-proof, which makes them focal among the set of all Nash equilibria. Truthful Nash equilibria have the compelling property that the equilibrium policy α^o satisfies

$$\alpha^o = \arg\max_{\alpha \in [1,\infty)} \left[\phi W(\alpha) + \sum_{j \in K} W_j(\alpha) \right]. \tag{11}$$

Effectively, the Home government maximizes a social welfare function in which organized Home firms are weighted with $1 + \phi$, while non-organized firms and consumers are only weighted with ϕ. Given their useful properties, I will concentrate on truthful Nash equilibria in the following. Note, however, that the necessary condition for an equilibrium policy in the interior of $[1, \infty)$,

$$\phi \frac{\partial W(\alpha^o)}{\partial \alpha} + \sum_{j \in K} \frac{\partial W_j(\alpha^o)}{\partial \alpha} = 0, \tag{12}$$

applies even if contributions schedules are not globally truthful, as long as they are differentiable around the equilibrium point α^o. This follows from combining equilibrium conditions (b) and (c).

4.2 Lobby composition and welfare

In line with the empirical evidence on the relationship between firm size and lobbying activities, I assume that only the largest, and hence the most efficient firms will

lobby jointly for behind-the-border measures. This seems plausible, as they have an aligned interest in restricting market access through technical barriers or certification requirements, and gain most from their introduction. Small firms, on the contrary, will not engage in the policy formation process.

Assumption 1 *In the differentiated goods sector, all Home firms with $a \in (0, a_L]$ are organized into a single lobby L, with $a_L < a_{HD}(1)$. All Home firms with $a > a_L$ do not engage in lobbying.*

Thus, I assume that there is only one lobby, and that its composition is given exogenously. I will rationalize this assumption and discuss the possibility of endogenizing the composition of the lobby in section 5.3.

The lobby's welfare is the joint welfare of its members and given by $W_L(\alpha) = \pi^L_{HD}(\alpha) + \pi^L_{HE}$. The lobby's profits from exporting are independent of α, while the lobby's profits from selling on the domestic market are given by

$$\pi^L_{HD}(\alpha) = \begin{cases} M_H \left(\frac{a_L}{\bar{a}_H}\right)^{\kappa} \left(\frac{\mu}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} P_H(\alpha)^{\sigma-1} L_H a_L^{1-\sigma} \frac{\kappa}{\kappa+1-\sigma} - \alpha f_{HD}\right) & \text{if } \alpha < \tilde{\alpha} \\ \pi^{agg}_{HD} & \text{if } \alpha \geq \tilde{\alpha} \end{cases} \tag{13}$$

For all $\alpha < \tilde{\alpha}$, the lobby's profits from selling on the Home market are increasing and concave in α. As α increases, however, the cutoff value $a_{HD}(\alpha)$ declines. At $\tilde{\alpha}$, the cutoff value coincides with the marginal costs of the least efficient lobby member, $a_{HD}(\tilde{\alpha}) = a_L$, and the lobby consist of all Home firms which are active on the domestic market. Consequently, for all $\alpha \geq \tilde{\alpha}$, the lobby's profits coincide with the aggregate profits of Home firms from selling on the domestic market. Since the gains of the largest firms in the lobby exactly offset the losses of the smallest members of the lobby, the lobby's total profits do not depend on α anymore.

4.3 Equilibrium policy and contributions

With only the largest firms participating in the lobbying game, the following result regarding the equilibrium level of behind-the-border measures holds:

Proposition 5 *Suppose that assumption 1 is satisfied and contribution schedules are truthful. Further, suppose that one of the following conditions is satisfied at $\alpha = 1$:*

(i) $\phi \frac{\partial W(\alpha)}{\partial \alpha} + \frac{\partial \pi^L_{HD}(\alpha)}{\partial \alpha} > 0$

(ii) $\phi \frac{\partial W(\alpha)}{\partial \alpha} + \frac{\partial \pi^L_{HD}(\alpha)}{\partial \alpha} = 0$ *and* $\phi \frac{\partial^2 W(\alpha)}{\partial \alpha^2} + \frac{\partial^2 \pi^L_{HD}(\alpha)}{\partial \alpha^2} > 0$

Then there exists a unique equilibrium level of behind-the-border measures α^o in the interior of $[1, \tilde{\alpha}]$ which is characterized by $\phi\frac{\partial W(\alpha^o)}{\partial \alpha} + \frac{\partial \pi^L_{HD}(\alpha^o)}{\partial \alpha} = 0$.

For a proof, see the appendix. If $\phi\frac{\partial W(\alpha)}{\partial \alpha} + \frac{\partial \pi^L_{HD}(\alpha)}{\partial \alpha} > 0$ at $\alpha = 1$, the lobby's marginal gain in profits and hence the Home governments marginal gain in political contributions is higher than the weighted marginal loss in social welfare from introducing behind-the-border measures, and the Home government has an incentive to deviate from the socially optimal policy. This is always the case if the price index in Home is sufficiently high, since Foreign firms are rather inefficient or variable trade costs are high, for instance, or if the weight on social welfare ϕ is sufficiently low. As α increases, however, the marginal gain in political contributions declines, and at some point becomes smaller than the weighted marginal loss in social welfare. This point characterizes the unique interior equilibrium level of behind-the-border measures. If $\phi\frac{\partial W(\alpha)}{\partial \alpha} + \frac{\partial \pi^L_{HD}(\alpha)}{\partial \alpha} = 0$ and $\phi\frac{\partial^2 W(\alpha)}{\partial \alpha^2} + \frac{\partial^2 \pi^L_{HD}(\alpha)}{\partial \alpha^2} > 0$ at $\alpha = 1$, the socially optimal policy is even a local minimum of the Home government's objective function.

Using the derivative of social welfare (7) and of the lobby's profits (13) with respect to α, and taking into account that the elasticity of the price index with respect to α, $\epsilon_{P_H,\alpha}$, is equal to $\frac{\kappa+1-\sigma}{(\sigma-1)\kappa}$, the first order condition $\phi\frac{\partial W(\alpha^o)}{\partial \alpha} + \frac{\partial \pi^L_{HD}(\alpha^o)}{\partial \alpha} = 0$ can be rewritten as

$$-\phi\mu\frac{L_H}{\alpha^o}\frac{\kappa+1-\sigma}{(\sigma-1)\kappa} + M_H\left(\frac{a_L}{\bar{a}_H}\right)^{\kappa}\left(\frac{\mu}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}P_H(\alpha^o)^{\sigma-1}\frac{L_H}{\alpha^o}a_L^{1-\sigma} - f_{HD}\right) = 0. \qquad (14)$$

Applying the implicit function theorem and using the first and second order condition for an interior maximum gives the following comparative static result:

Proposition 6 *The equilibrium level of behind-the-border measures which results from the lobbying game in Home, α^o, is increasing in the fixed costs of gaining access to the Home market for Foreign firms, f_{FE}, the variable trade costs from Foreign to Home, τ_H, and the scale parameter of the distribution of marginal costs in Foreign, $\bar{a}_F$. It is decreasing in the mass of Foreign firms, M_F, the fixed costs of gaining acces to the Home market for Home firms, f_{HD}, the marginal costs of the least efficient lobby member, a_L, and the weight the Home government puts on social welfare, ϕ.*

The larger f_{FE}, τ_H and $\bar{a}_F$ and the smaller M_F, the fewer Foreign firms are active on the Home market, and the higher is the ideal price index in Home. A higher ideal price index in Home implies that the marginal gains of the most efficient Home firms from the introduction of behind-the-border measures are larger, and hence their willingness to make political contributions that convince the government to implement such measures is higher. Put differently, when Foreign firms become more competitive relative to Home firms, because trade costs fall or productivity improves,

the import penetration ratio increases[16] and the profit-shifting effect of behind-the-border measures gets weaker. Hence, liberalizing trade and fostering competition from abroad will actually reduce the incentives of Home firms to lobby for market entry barriers, and thus lower undue technical regulations or administrative burdens. In that sense, tariffs and non-tariff measures are complements rather than substitutes. The smaller f_{HD}, the smaller the leverage of α, and the more behind-the-border measures are needed to shift the same amount of profits to the large and efficient firms. Higher marginal costs of the least efficient lobby member, a_L, imply that the lobby represents a larger fraction of Home firms in the differentiated goods sector, and thus has a higher weight in the government objective function. However, higher marginal costs also imply that the least efficient lobby member and hence the average productivity of the firms represented by the lobby is lower, meaning that the lobby benefits less from additional regulations. This diluting effect on policy preferences dominates and leads to a lower level of behind-the-border measures. Not surprisingly, the weight the Home government puts on social welfare, ϕ, has a negative impact on the equilibrium level of behind-the-border measures, while all other model parameters have an ambiguous effect.

How about the equilibrium level of political contributions? With truthful contribution schedules $C_L^T(\alpha, B_L)$, the only thing that is left to be determined is the basic level of welfare B_L. In principle, B_L indicates how the surplus of the lobby's political relationship with the Home government is shared. The lobby wishes to make B_L as large as possible and hence contributions as small as possible. However, as Grossman and Helpman (1994) show, if the lobby raised B_L beyond a certain point, the Home government would neglect the lobby's interest and contributions entirely and, since there are no other lobbies participating in the lobbying game, implement the socially optimal policy. Hence, the lobby will make contributions just large enough and set B_L just small enough to make the Home government indifferent between the socially optimal policy and the equilibrium policy α^o. That is,

$$\phi W(\alpha^o) + C_L^T(\alpha^o, B_L) = \phi W(1). \tag{15}$$

[16]The import penetration ratio relates expenditures on imported varieties to total expenditure on the differentiated good and is given by

$$\frac{1}{\mu}\int_{i\in\Omega_{imp}} p_i c_i = \frac{M_F\left(\frac{f_{FE}}{L_H}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}} (\tau_H \bar{a}_F)^{-\kappa}}{M_H\left(\frac{f_{HD}}{L_H}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}} \bar{a}_H^{-\kappa} + M_F\left(\frac{f_{FE}}{L_H}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}} (\tau_H \bar{a}_F)^{-\kappa}}$$

where Ω_{imp} is the set of all imported varieties.

If there is only one active lobby, it captures all of the surplus, and merely compensates the Home government for the weighted loss in social welfare that arises if α^o is implemented. Given that the aggregate profits of Home firms from selling on the domestic and the export market remain unaffected by changes in α, the loss in social welfare is simply the loss in consumer surplus that arises from an increase in the price index, and hence $C_L^T(\alpha^o, B_L) = \phi W(1) - \phi W(\alpha^o) = \phi L_H \mu \ln \frac{P_H(\alpha^o)}{P_H(1)} = \phi L_H \mu \frac{\kappa+1-\sigma}{(\sigma-1)\kappa} \ln \alpha^o$.

5 Extensions

The basic model as well as the lobbying game lend themselves to several extensions, including social welfare enhancing behind-the-border measures, interactions between national governments, and endogenous lobby formation. I will discuss each of these possibilities in the following.

5.1 Welfare enhancing measures

Contrary to what I assumed so far, some behind-the-border regulations such as food safety requirements or environmental standards may have a beneficial effect on consumer welfare. In fact, recognizing this potentially positive effect, the WTO explicitly allows for measures that serve to protect human, animal or plant life and health, but may not put foreign exporters at a disadvantage in comparison to domestic producers, in article 20 of the General Agreement of Tariffs and Trade and tries to distinguish them from hidden protectionist measures in its Agreements on Sanitary and Phytosanitary Measures and on Technical Barriers to Trade.

Allowing for such positive effects of behind-the-border measures to compensate for the loss in welfare due to less variety does not alter the preceding analysis that much, however. The only difference is that even in the absence of lobbying, it may be beneficial to introduce behind-the-border measures, depending on whether the positive effect on consumer health, for instance, outweighs the negative effect on product variety. With lobbying, a beneficial effect of technical standards and regulations simply shifts the equilibrium policy upwards.

5.2 Interactions between national governments

The preceding analysis focuses on unilateral trade policies which are implemented by the national government of one country in response to the pressure applied by a domestic interest group. However, there is reason to believe that a national government cannot determine its trade policy in isolation. Rather, it may provoke

retaliatory sanctions by the other country, possibly triggering a trade war, or it may enter into trade negotiations, eventually ending up in a multilateral agreement on non-tariff barriers to trade. The issue of interaction between national governments, either noncooperative as in the case of trade wars, or cooperative, as in the case of trade negotiations, has been addressed in the traditional Grossman and Helpman (1994) framework by Bagwell and Staiger (1999) and Grossman and Helpman (1995), for instance.

What are the implications of such interactions at the international level for the equilibrium trade policy outcomes in the present model? Formally, they add another stage to the game, which occurs after the lobbies in Home and Foreign have announced their contribution schedules to their national governments. At this stage, with the contribution schedules of their domestic lobbies in mind, the Home and the Foreign government either set their trade policies simultaneously and noncooperatively, or they bargain over the levels of behind-the-border measures to be implemented in Home and Foreign.

Interestingly, when the Home and the Foreign government set their levels of behind-the-border measures simultaneously and noncooperatively, the equilibrium trade policy in Home will be exactly the same as the one described in the previous section. This is because the markets in Home and Foreign are separated and the profits of Home firms from selling to the domestic market and from exporting are independent of each other. The level of behind-the-border measures set in Foreign influences Home firms' exporting profits, but affects neither Home firms' profits from selling to their domestic market nor consumer surplus in Home. However, it is Home firms' profits from selling to their domestic market and consumer surplus in Home that matter for behind-the-border measures in Home. Thus, the Home government's best response is independent of the Foreign government's trade policy choice, and vice versa. This means that the analysis in the preceding section is robust to noncooperative interaction between the Home and the Foreign government.

Yet, when the levels of behind-the-border measures to be implemented in Home and Foreign are determined cooperatively in a bargaining situation, they are most likely different from the levels that would obtain in a situation without international interactions. Grossman and Helpman (1995) point out that if both the Home and the Foreign government enter into trade negotiations with the aim of maximizing their respective objective functions, G and G_F, the Nash bargaining solution implies that the equilibrium levels of behind-the-border measures in Home and Foreign, α^o and α_F^o, are efficient in the sense that the Home government cannot be made better

of without making the Foreign government worse off. This means that α^o and α_F^o must maximize the weighted sum

$$\bar{G}(\alpha, \alpha_F) = \phi_F G(\alpha, \alpha_F) + \phi G_F(\alpha, \alpha_F) \tag{16}$$

where ϕ_F is the weight the Foreign government puts on national social welfare. Once this weighted sum has been maximized, any combination of G and G_F on the straight line defined by (16) can be achieved by international transfers. Assuming that only the largest firms in Foreign are organized into a single lobby, and substituting in the respective objective functions yields

$$\begin{aligned}\bar{G}(\alpha, \alpha_F) = \phi_F \phi \left(\pi_{HD}^{agg}(\alpha) + \pi_{HE}^{agg}(\alpha_F) + L_H \left(\mu \ln \frac{\mu}{P_H(\alpha)} - \mu \right) \right) + \phi_F C^L(\alpha, \alpha_F) \\ + \ \phi \ \phi_F \left(\pi_{FD}^{agg}(\alpha_F) + \pi_{FE}^{agg}(\alpha) + L_F \left(\mu \ln \frac{\mu}{P_F(\alpha_F)} - \mu \right) \right) + \phi \ C_F^L(\alpha, \alpha_F)\end{aligned} \tag{17}$$

The structure of the problem is then equivalent to the one described in section 4, with lobbies setting their contribution schedules noncooperatively in the first stage, and an imaginary world government which chooses α and $\alpha_F \in [1, \infty)$ to maximize $\bar{G}$ in the second stage. The results of Bernheim and Whinston (1986) thus apply, and with truthful contribution schedules amount to the following first order condition for the equilibrium level of behind-the-border measures α^o in Home:

$$\begin{aligned}\phi_F \phi \left(\frac{\partial \pi_{HD}^{agg}(\alpha^o)}{\partial \alpha} - L_H \frac{\mu}{P_H(\alpha^o)} \frac{\partial P_H(\alpha^o)}{\partial \alpha} \right) + \phi_F \frac{\partial \pi_{HD}^{L}(\alpha^o)}{\partial \alpha} \\ + \phi \ \phi_F \frac{\partial \pi_{FE}^{agg}(\alpha^o)}{\partial \alpha} + \phi \frac{\partial \pi_{FE}^{L}(\alpha^o)}{\partial \alpha} = 0\end{aligned} \tag{18}$$

When the shape parameters of the productivity distributions in Home and Foreign are identical, the effects on aggregate profits vanish, and the first order condition boils down to

$$-\phi \mu \frac{L_H}{\alpha^o} \frac{\kappa + 1 - \sigma}{(\sigma - 1)\kappa} + \frac{\partial \pi_{HD}^{L}(\alpha^o)}{\partial \alpha} + \frac{\phi}{\phi_F} \frac{\partial \pi_{FE}^{L}(\alpha^o)}{\partial \alpha} = 0 \tag{19}$$

The first two terms reflect the marginal loss in consumer surplus in Home and the marginal gain in the Home lobby's profits and hence in contributions. These effects are well known from the noncooperative case. The third term captures the political pressure which the Foreign lobby exerts on the Foreign government to make it plead for non-tariff measures in their favor at the negotiating table. The most efficient Foreign firms may actually prefer a positive level of protection, as it allows them to grab the market shares of the less efficient Foreign exporters. Thus, if the Foreign

government is responsive to the political pressure of special interest groups, the equilibrium level of non-tariff measures which restrict market access for small firms will be higher in the cooperative than in the noncooperative case, simply because the lobby of large Foreign firms also has a say when policies are set in international negotiations.

When the shape parameters of the productivity distribution differ and firm size is more dispersed in Home than in Foreign, behind-the-border measures implemented in the Home country reduce the aggregate profits from exporting of Foreign firms and hence social welfare in Foreign, as shown in proposition 2. In a noncooperative setting, the Home government would not take this effect into account, and thus choose an inefficiently high level of behind-the-border measures from a global welfare perspective. In a cooperative setting, this negative externality on the differentiated goods sector in Foreign is taken into account and will, all else equal, lead to a lower level of behind-the-border measures.

5.3 Endogenous lobby formation

Until now, the composition of the lobby that bribes the Home government to implement non-tariff measures was taken as exogenous. All Home firms with marginal costs lower or equal to some threshold value a_L were part of the lobby, while all others were not. This seems a reasonable assumption, as it is in line with the empirical evidence on the relationship between firm size and lobbying status, and gives very clear results on the equilibrium trade policy. To analyze the robustness of these results, however, it is desirable to endogenize the lobby formation process and let individual firms choose whether they want to join the lobby and exert political pressure.

In endogenizing the lobby formation process, I will follow Zudenkova (2011) who suggests a *temptation-free lobbying* approach to solve the coordination problem between individual firms who decide about being part of the lobby. The idea is that firms which benefit from the activities of the lobby but are not members and do not contribute to the expenses of the lobby have to bear a very high cost that exceeds their benefits. This can be interpreted as a form of punishment of free riders. In fact, experimental evidence shows that individuals who cooperate are willing to punish free riders even if this is costly for them (see Fehr and Gächter, 2000, for example) and that large groups contribute at rates no lower than small

groups because punishment does not fall appreciably in large groups (Carpenter, 2007).[17]

This implies that in equilibrium, no Home firm which is a member of the lobby prefers the lobby to stop existing. Formally, a Home firm with marginal cost a is a member of the lobby and prefers the lobby to exist if

$$\Delta\pi_{HD}(a, \alpha^o) > c_L(a, \alpha^o) \tag{20}$$

where $\Delta\pi_{HD}(a, \alpha^o) = \pi_{HD}(a, \alpha^o) - \pi_{HD}(a, 1)$ reflects the firm's gains from having a lobby that bribes the Home government to implement α^o rather than the social welfare maximizing policy, and $c_L(a, \alpha^o)$ reflects the firm's contributions to the lobby. When deciding whether to join the lobby, the Home firm takes α^o and $c_L(a, \alpha^o)$ as given.

To keep things as simple as possible, I assume that a firm's contributions to the lobby are proportional to its gains from the lobby's activities, that is

$$c_L(a, \alpha^o) = \gamma\Delta\pi_{HD}(a, \alpha^o) \tag{21}$$

where $\gamma \in (0, 1)$ is pinned down by the condition that the individual contributions of all lobby members must add up to $C_L^T(\alpha^o, B_L)$, the bribe that the lobby needs to make to induce the government to implement α^o.[18] With this sharing rule, a Home firm with marginal costs a will be a member of the lobby and prefer the lobby to exist if

$$(1 - \gamma)\Delta\pi_{HD}(a, \alpha^o) > 0 \tag{22}$$

Since the gains from behind-the-border measures are positive if marginal costs a are low, decreasing in a, $\partial\Delta\pi_{HD}(a, \alpha^o)/\partial a < 0$, and negative if marginal costs a are high, there exists a critical level of marginal costs a_L for which a Home firm is just indifferent between having a lobby and being a member of it or having no lobby at all. This critical level a_L characterizes the least efficient lobby member. It is determined as an implicit function of α^o, given by

$$(1 - \gamma)\Delta\pi_{HD}(a_L, \alpha^o) = 0. \tag{23}$$

[17] Alternatively, one could allow firms to derive some private benefit from being part of the lobby (see Zhang and Zhu, 2011, and the literature cited therein) or postulate social norms which prevent firms from free riding.

[18] The explicit solution for γ is derived in the appendix.

All firms with $a \leq a_L$ will gain from the policy achieved by the lobby and make positive contributions, with large firms contributing more than small firms. This is consistent with the positive correlation between firm size and lobbying expenditure found in the data. All firms with $a > a_L$ prefer the lobby not to exist and hence will make no contributions.

The level of behind-the-border measures α^o is in turn a function of a_L, as can be seen from the first order condition (14) for a truthful interior equilibrium. With endogenous lobby formation, I thus have two equations, (23) and (14), in two unknowns, a_L and α^o. Solving (23) for a_L, using the expression for a Home firm's domestic profits, yields

$$a_L = \left(\frac{(\alpha - 1) f_{HD}}{\left({\alpha^o}^{\frac{\kappa+1-\sigma}{\kappa}} - 1 \right) \left(\frac{\mu}{\sigma} \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} P_H(1)^{\sigma-1} L_H \right)} \right)^{\frac{1}{1-\sigma}} \tag{24}$$

Inserting a_L into equation (14) gives

$$\begin{aligned} &\left({\alpha^o}^{\frac{\kappa+1-\sigma}{\kappa}} \left(\frac{\alpha - 1}{{\alpha^o}^{\frac{\kappa+1-\sigma}{\kappa}} - 1} \right) - \alpha \right) \left(\frac{\alpha - 1}{{\alpha^o}^{\frac{\kappa+1-\sigma}{\kappa}} - 1} \right)^{\frac{\kappa}{1-\sigma}} \\ &\quad - \phi \frac{\sigma}{\sigma - 1} \left(1 + \frac{M_F}{M_H} \left(\frac{f_{FE}}{f_{HD}} \right)^{\frac{\kappa+1-\sigma}{1-\sigma}} \left(\frac{\tau_H \bar{a}_F}{\bar{a}_H} \right)^{-\kappa} \right) = 0 \end{aligned} \tag{25}$$

If this equation has a solution, it characterizes the equilibrium level of behind-the-border measures that arises with endogenous lobby formation.[19] Numerical simulations show that the derivative of this implicit function with respect to α^o is negative for basically all parameter values. Applying the implicit function theorem then shows that the equilibrium level of behind-the-border measures α^o is increasing in the fixed costs of gaining access to the Home market for Foreign firms, f_{FE}, the variable trade costs from Foreign to Home, τ_H, and the scale parameter of the distribution of marginal costs in Foreign, $\bar{a}_F$. It is decreasing in the mass of Foreign firms, M_F, the fixed costs of gaining access to the Home market for Home firms, f_{HD}, and the weight the Home government puts on social welfare, ϕ. This is exactly what I found when the composition of the lobby is exogenously given. In addition, when the lobby is formed endogenously, the equilibrium level of behind-the-border measures is increasing in the mass of Home firms, M_H, and is independent of the size of the country, L_H, or the differentiated goods sector, μ.

[19] A combination of parameter values for which the conditions given in proposition 5 are satisfied, $0 < \gamma < 1$, and a unique solution to equation (25) exists is, for instance, $\mu = 0.8$, $\sigma = 2$, $\kappa = 7$, $\bar{a}_H = \bar{a}_F = 1$, $\tau = 1.2$, $L_H = M_H = M_F = 20$, and $f_{HD} = f_{FE} = 1$. This would yield $\gamma = 0.93$, $a_L = 0.65$ and $\alpha^o = 2.66$.

Trade liberalization and foreign competition reduce the price index and hence variable profits, and thus make a given level of non-tariff measures less attractive especially for smaller firms. As they leave the lobby, the interests of the remaining members get more focused, and they will lobby for even higher market entry barriers. This indirect effect is however dominated by the direct effect of trade liberalization and foreign competition on the level of behind-the-border measures. As more foreign firms enter the market, the potential for profit shifting between domestic firms shrinks, and lowers the incentives of the lobby to bribe the government. Thus, eventually, trade liberalization and foreign competition will lead to lower levels of behind-the-border measures, as before.

6 Conclusion

Taking the seminal contribution of Grossman and Helpman (1994) as a starting point, the present paper develops a political economy model that allows for heterogeneous lobbying activities of large and small firms engaged in intra-industry trade, and considers non-tariff barriers to trade such as technical standards or customs and administrative procedures as the relevant policy instruments.

Technical standards, which are applied to both domestic firms and foreign exporters and are thus called behind-the-border measures, shift profits within countries, from the least efficient to the most efficient firms. Behind-the-border measures may also shift profits across countries, but not necessarily in the direction of the country that is more productive on average. In any case, from a pure social welfare perspective, it is never optimal to introduce such measures. With only the largest firms lobbying, they may nevertheless be an equilibrium outcome, and the model suggests that the level of such anti-competitive regulations will be the larger, the more restricted trade already is, and the less the government cares about social welfare.

Possible extensions of the model include positive welfare effects of behind-the-border measures, interactions between national governments, and endogenous lobby formation. For a simple form of coordination between firms that rules out free riding on the lobbying efforts of others, it is shown that the results derived under the assumption of an exogenously given lobby are robust.

A possible avenue for further research is to allow for the possibility of foreign lobbying, or to allow firms to invest in research and development to boost their productivity instead of lobbying for protection. And finally, the model derives a set of predictions which are, in principle, empirically testable, given appropriate data

on firm productivities, lobbying expenditures and the level of non-tariff barriers to trade.

Appendices

A Implicit solutions for price indices, cutoff values, and profits for $\kappa_H \neq \kappa_F$

Setting the profit functions of Home firms given in equations (3) and (4) and the corresponding expressions for Foreign firms equal to zero gives rise to the following cutoff values:

$$a_{HD} = \left(\frac{f_{HD}}{L_H}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma}{\mu}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right) P_H \tag{A.1}$$

$$a_{HE} = \left(\frac{f_{HE}}{L_F}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma}{\mu}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right) \frac{1}{\tau_F} P_F \tag{A.2}$$

$$a_{FD} = \left(\frac{f_{FD}}{L_F}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma}{\mu}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right) P_F \tag{A.3}$$

$$a_{FE} = \left(\frac{f_{FE}}{L_H}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma}{\mu}\right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right) \frac{1}{\tau_H} P_H \tag{A.4}$$

which are functions of the equilibrium price indices P_H and P_F, repsectively.
The price index in Home is given by

$$P_H = \left(M_H \int_0^{a_{HD}} \left(\frac{\sigma}{\sigma-1}\, a\right)^{1-\sigma} dH(a) + M_F \int_0^{a_{FE}} \left(\frac{\sigma}{\sigma-1}\, \tau_H a\right)^{1-\sigma} dF(a) \right)^{\frac{1}{1-\sigma}} \tag{A.5}$$

which, using the expressions for the cutoff values a_{HD} and a_{FE} derived above and the marginal cost distributions given by (5) and (6), amounts to the following implicit solution for the price index in Home:

$$0 = \frac{\sigma}{\mu} \left(A \left(\frac{f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H} + B \left(\frac{f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F} \right) - 1. \tag{A.6}$$

with $A = \frac{M_H}{\bar{a}_H^{\kappa_H}} \frac{\kappa_H}{\kappa_H+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_H}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_H}$ and $B = \frac{M_F}{\bar{a}_F^{\kappa_F}} \frac{\kappa_F}{\kappa_F+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_F}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_F} \tau_H^{-\kappa_F}$.
Similarly, the price index in Foreign is given by

$$P_F = \left(M_F \int_0^{a_{FD}} \left(\frac{\sigma}{\sigma-1}\, a\right)^{1-\sigma} dF(a) + M_H \int_0^{a_{HE}} \left(\frac{\sigma}{\sigma-1}\, \tau_F a\right)^{1-\sigma} dH(a) \right)^{\frac{1}{1-\sigma}} \tag{A.7}$$

which, using the expressions for the cutoff values a_{FD} and a_{HE} derived above and the marginal cost distributions given by (5) and (6), amounts to the following implicit solution for the price index in Foreign:

$$0 = \frac{\sigma}{\mu} \left(C \left(\frac{f_{FD}}{L_F}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_F^{\kappa_F} + D \left(\frac{f_{HE}}{L_F}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_F^{\kappa_H} \right) - 1. \tag{A.8}$$

with $C = \frac{M_F}{\bar{a}_F^{\kappa_F}} \frac{\kappa_F}{\kappa_F+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_F}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_F}$ and $D = \frac{M_H}{\bar{a}_H^{\kappa_H}} \frac{\kappa_H}{\kappa_H+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_H}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_H} \tau_F^{-\kappa_H}$. Integrating individual profits of Home firms from selling on the domestic market and from exporting, given by (3) and (4), and the corresponding expressions for Foreign firms, using the respective cutoff values and the marginal cost distributions given by (5) and (6), gives aggregate profits of Home and Foreign firms from selling to the domestic market and exporting, respectively, as a function of the equilibrium price indices P_H and P_F:

$$\pi_{HD}^{agg} = M_H \int_0^{a_{HD}} \pi_{HD}(a) dH(a) = L_H \frac{M_H}{\bar{a}_H^{\kappa_H}} \frac{\sigma-1}{\kappa_H+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_H}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_H} \left(\frac{f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H} \tag{A.9}$$

$$\pi_{HE}^{agg} = M_H \int_0^{a_{HE}} \pi_{HE}(a) dH(a) = L_F \frac{M_H}{\bar{a}_H^{\kappa_H}} \frac{\sigma-1}{\kappa_H+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_H}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_H} \left(\frac{f_{HE}}{L_F}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_F^{\kappa_H} \tau_F^{-\kappa_H} \tag{A.10}$$

$$\pi_{FD}^{agg} = M_F \int_0^{a_{FD}} \pi_{FD}(a) dF(a) = L_F \frac{M_F}{\bar{a}_F^{\kappa_F}} \frac{\sigma-1}{\kappa_F+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_F}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_F} \left(\frac{f_{FD}}{L_F}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_F^{\kappa_F} \tag{A.11}$$

$$\pi_{FE}^{agg} = M_F \int_0^{a_{FE}} \pi_{FE}(a) dF(a) = L_H \frac{M_F}{\bar{a}_F^{\kappa_F}} \frac{\sigma-1}{\kappa_F+1-\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_F}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_F} \left(\frac{f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F} \tau_H^{-\kappa_F} \tag{A.12}$$

B Proof of propostion 1

Multiplying the fixed costs f_{HD} in the cutoff value a_{HD} given in equation (A.1) by α and then differentiating with respect to α, taking into account that P_H also depends on α yields

$$\frac{\partial a_{HD}(\alpha)}{\partial \alpha} = -\frac{1}{\sigma} \left(\frac{\sigma}{\mu}\right)^{\frac{1}{1-\sigma}} \left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{1}{1-\sigma}} \frac{P_H}{\alpha} \left(1 - (\sigma-1)\, \epsilon_{P_H,\alpha}\right) \tag{B.1}$$

where $\epsilon_{P_H,\alpha} = \frac{\partial P_H(\alpha)}{\partial \alpha} \frac{\alpha}{P_H(\alpha)}$ is the elasticity of the price index P_H with respect to α. It can be calculated by multiplying the fixed costs f_{HD} and f_{FE} in equation (A.6) by α and then applying the implicit function theorem,

$$\epsilon_{P_H,\alpha} = \frac{\frac{\kappa_H+1-\sigma}{\sigma-1} A \left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H} + \frac{\kappa_F+1-\sigma}{\sigma-1} B \left(\frac{\alpha f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F}}{\kappa_H A \left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H} + \kappa_F B \left(\frac{\alpha f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F}}. \tag{B.2}$$

It is straightforward to verify that $0 < (\sigma-1)\epsilon_{P_H,\alpha} < 1$ and hence $\frac{\partial a_{HD}(\alpha)}{\partial \alpha} < 0$. The proof for $\frac{\partial a_{FE}(\alpha)}{\partial \alpha}$ follows analogously. ■

C Proof of propostion 2

Multiplying the fixed costs f_{HD} in π_{HD}^{agg} given in equation (A.9) by α and then differentiating with respect to α, taking into account that P_H also depends on α, and rearranging yields

$$\frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} = L_H \, \frac{M_H}{\bar{a}_H^{\kappa_H}} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_H}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_H} \left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} \, \frac{P_H^{\kappa_H}}{\alpha} \left(\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} - 1\right) \tag{C.1}$$

Hence,

$$\frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} \begin{cases} > 0 & \text{if } \frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} > 1 \\ = 0 & \text{if } \frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} = 1 \\ < 0 & \text{if } \frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} < 1 \end{cases} \tag{C.2}$$

Multiplying the elasticity given in (B.2) by $\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma}$ gives

$$\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} = \frac{A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}\kappa_H + B\left(\frac{\alpha f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F} \, \frac{\kappa_F+1-\sigma}{\kappa_H+1-\sigma}\kappa_H}{A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}\kappa_H + B\left(\frac{\alpha f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F} \, \kappa_F}. \tag{C.3}$$

Thus, $\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} > 1$ and $\frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} > 0$ if $\frac{\kappa_F+1-\sigma}{\kappa_H+1-\sigma}\kappa_H > \kappa_F$, or, equivalently, if $\kappa_H < \kappa_F$. Further, $\frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} < 0$ if $\kappa_H > \kappa_F$ and $\frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} = 0$ if $\kappa_H = \kappa_F$. The proof for $\frac{\partial \pi_{FE}^{agg}(\alpha)}{\partial \alpha}$ follows analogously. ■

D Proof of propostion 3

Differentiating (7) with respect to α using (C.1) gives

$$\begin{aligned} \frac{\partial W(\alpha)}{\partial \alpha} &= \frac{\partial \pi_{HD}^{agg}(\alpha)}{\partial \alpha} - L_H \mu \frac{1}{P_H(\alpha)} \frac{\partial P_H(\alpha)}{\partial \alpha} \\ &= \frac{L_H}{\alpha} \, \frac{M_H}{\bar{a}_H^{\kappa_H}} \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa_H}{1-\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\kappa_H} \left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H} \left(\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} - 1\right) \\ &\quad - \frac{L_H}{\alpha} \mu \, \epsilon_{P_H,\alpha} \\ &= \frac{L_H}{\alpha} \frac{\kappa_H+1-\sigma}{\kappa_H} A \left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H} \left(\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma} \, \epsilon_{P_H,\alpha} - 1\right) - \frac{L_H}{\alpha} \mu \, \epsilon_{P_H,\alpha}. \end{aligned} \tag{D.1}$$

Substituting μ in the second summand of equation (D.1) using the implicit solution (A.6) for the price index in Home gives

$$
\begin{aligned}
\frac{\partial W(\alpha)}{\partial \alpha} &= \frac{L_H}{\alpha}\frac{\kappa_H+1-\sigma}{\kappa_H}A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}\left(\frac{(\sigma-1)\kappa_H}{\kappa_H+1-\sigma}\,\epsilon_{P_H,\alpha}-1\right) \\
&\quad -\frac{L_H}{\alpha}\sigma\left(A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}+B\left(\frac{\alpha f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F}\right)\epsilon_{P_H,\alpha} \\
&= \frac{L_H}{\alpha}(\sigma-1)A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}\epsilon_{P_H,\alpha}-\frac{L_H}{\alpha}\sigma A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}\epsilon_{P_H,\alpha} \\
&\quad -\frac{L_H}{\alpha}\frac{\kappa_H+1-\sigma}{\kappa_H}A\left(\frac{\alpha f_{HD}}{L_H}\right)^{\frac{\kappa_H+1-\sigma}{1-\sigma}} P_H^{\kappa_H}-\frac{L_H}{\alpha}\sigma B\left(\frac{\alpha f_{FE}}{L_H}\right)^{\frac{\kappa_F+1-\sigma}{1-\sigma}} P_H^{\kappa_F}\epsilon_{P_H,\alpha} \\
&< 0
\end{aligned}
\tag{D.2}
$$

since $\epsilon_{P_H,\alpha} > 0$. ■

E Explicit solutions for price indices, cutoff values and profits for $\kappa_H = \kappa_F$

If the marginal cost distributions given by (5) and (6) have identical shape parameters, i.e. $\kappa_H = \kappa_F = \kappa$, the price index in Home can be calculated as

$$
P_H = E\left(M_H\left(\frac{f_{HD}}{L_H}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}}\bar{a}_H^{-\kappa}+M_F\left(\frac{f_{FE}}{L_H}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}}(\tau_H\bar{a}_F)^{-\kappa}\right)^{-\frac{1}{\kappa}}. \tag{E.1}
$$

Similarly, the price index in Foreign can be calculated as

$$
P_F = E\left(M_F\left(\frac{f_{FD}}{L_F}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}}\bar{a}_F^{-\kappa}+M_H\left(\frac{f_{HE}}{L_F}\right)^{\frac{\kappa+1-\sigma}{1-\sigma}}(\tau_F\bar{a}_H)^{-\kappa}\right)^{-\frac{1}{\kappa}} \tag{E.2}
$$

with $E = \left(\frac{\sigma}{\mu}\right)^{\frac{\kappa+1-\sigma}{\kappa(\sigma-1)}}\left(\frac{\sigma}{\sigma-1}\right)\left(\frac{\kappa}{\kappa+1-\sigma}\right)^{-\frac{1}{\kappa}}$. The corresponding cutoff values are

$$
a_{HD} = F\left(\frac{M_H}{L_H}f_{HD}\bar{a}_H^{-\kappa}+\frac{M_F}{L_H}f_{FE}^{\frac{\kappa+1-\sigma}{1-\sigma}}f_{HD}^{-\frac{\kappa}{1-\sigma}}(\tau_H\bar{a}_F)^{-\kappa}\right)^{-\frac{1}{\kappa}} \tag{E.3}
$$

$$
a_{HE} = F\left(\frac{M_H}{L_F}f_{HE}\bar{a}_H^{-\kappa}+\frac{M_F}{L_F}f_{HE}^{-\frac{\kappa}{1-\sigma}}f_{FD}^{\frac{\kappa+1-\sigma}{1-\sigma}}\tau_F^{\kappa}\bar{a}_F^{-\kappa}\right)^{-\frac{1}{\kappa}} \tag{E.4}
$$

$$
a_{FD} = F\left(\frac{M_F}{L_F}f_{FD}\bar{a}_F^{-\kappa}+\frac{M_H}{L_F}f_{HE}^{\frac{\kappa+1-\sigma}{1-\sigma}}f_{FD}^{-\frac{\kappa}{1-\sigma}}(\tau_F\bar{a}_H)^{-\kappa}\right)^{-\frac{1}{\kappa}} \tag{E.5}
$$

$$
a_{FE} = F\left(\frac{M_F}{L_H}f_{FE}\bar{a}_F^{-\kappa}+\frac{M_H}{L_H}f_{FE}^{-\frac{\kappa}{1-\sigma}}f_{HD}^{\frac{\kappa+1-\sigma}{1-\sigma}}\tau_H^{\kappa}\bar{a}_H^{-\kappa}\right)^{-\frac{1}{\kappa}} \tag{E.6}
$$

with $F = \left(\frac{\sigma}{\mu}\right)^{-\frac{1}{\kappa}}\left(\frac{\kappa}{\kappa+1-\sigma}\right)^{-\frac{1}{\kappa}}$. Given P_H and P_F, the profits of a firm with marginal costs a can be calculated as

$$\pi_{HD}(a) = G\left(\frac{M_H}{L_H} f_{HD}^{\frac{\kappa+1-\sigma}{1-\sigma}} \bar{a}_H^{-\kappa} + \frac{M_F}{L_H} f_{FE}^{\frac{\kappa+1-\sigma}{1-\sigma}} (\tau_H \bar{a}_F)^{-\kappa}\right)^{\frac{1-\sigma}{\kappa}} a^{1-\sigma} - f_{HD} \text{ if } a \leq a_{HD} \quad \text{(E.7)}$$

$$\pi_{HE}(a) = G\left(\frac{M_F}{L_F} f_{FD}^{\frac{\kappa+1-\sigma}{1-\sigma}} \tau_F^{\kappa} \bar{a}_F^{-\kappa} + \frac{M_H}{L_F} f_{HE}^{\frac{\kappa+1-\sigma}{1-\sigma}} \bar{a}_H^{-\kappa}\right)^{\frac{1-\sigma}{\kappa}} a^{1-\sigma} - f_{HE} \text{ if } a \leq a_{HE} \quad \text{(E.8)}$$

$$\pi_{FD}(a) = G\left(\frac{M_F}{L_F} f_{FD}^{\frac{\kappa+1-\sigma}{1-\sigma}} \bar{a}_F^{-\kappa} + \frac{M_H}{L_F} f_{HE}^{\frac{\kappa+1-\sigma}{1-\sigma}} (\tau_F \bar{a}_H)^{-\kappa}\right)^{\frac{1-\sigma}{\kappa}} a^{1-\sigma} - f_{FD} \text{ if } a \leq a_{FD} \quad \text{(E.9)}$$

$$\pi_{FE}(a) = G\left(\frac{M_H}{L_H} f_{HD}^{\frac{\kappa+1-\sigma}{1-\sigma}} \tau_H^{\kappa} \bar{a}_H^{-\kappa} + \frac{M_F}{L_H} f_{FE}^{\frac{\kappa+1-\sigma}{1-\sigma}} \bar{a}_F^{-\kappa}\right)^{\frac{1-\sigma}{\kappa}} a^{1-\sigma} - f_{FE} \text{ if } a \leq a_{FE} \quad \text{(E.10)}$$

and zero otherwise, with $G = \left(\frac{\sigma}{\mu}\right)^{\frac{1-\sigma}{\kappa}} \left(\frac{\kappa}{\kappa+1-\sigma}\right)^{\frac{1-\sigma}{\kappa}}$.

F Proof of proposition 5

With truthful contribution schedules and differentiable profit functions, any equilibrium policy that lies in the interior of $[1, \tilde{\alpha}]$ must satisfy $\phi\frac{\partial W(\alpha^o)}{\partial \alpha} + \frac{\partial W_L(\alpha^o)}{\partial \alpha} = 0$, which is equivalent to $\phi\frac{\partial W(\alpha^o)}{\partial \alpha} + \frac{\partial \pi_{HD}^L(\alpha^o)}{\partial \alpha} = 0$. Taking the first, second and third derivative of (13) with respect to α, using $\epsilon_{P_H,\alpha} = \frac{\kappa+1-\sigma}{(\sigma-1)\kappa}$, shows that the marginal gain in contributions, $\frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha}$, is positive, decreasing and convex in α until it reaches zero at $\alpha = \tilde{\alpha}$. Taking the first, second and third derivative of equation (7) with respect to α, taking into account $\frac{\partial \pi_{HD}^{agg}}{\partial \alpha} = \frac{\partial \pi_{HE}^{agg}}{\partial \alpha} = 0$ and $\epsilon_{P_H,\alpha} = \frac{\kappa+1-\sigma}{(\sigma-1)\kappa}$, shows that the marginal loss in social welfare, $-\phi\frac{\partial W(\alpha)}{\partial \alpha}$, is positive, decreasing, convex, and converges to zero as α goes to infinity. Restricting parameters such that $\phi\frac{\partial W(\alpha)}{\partial \alpha} + \frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha} > 0 \Leftrightarrow -\phi\frac{\partial W(\alpha)}{\partial \alpha} < \frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha}$ at $\alpha = 1$ ensures that $-\phi\frac{\partial W(\alpha)}{\partial \alpha}$ and $\frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha}$ cross exactly once, and this will be in the interior of the interval $[1, \tilde{\alpha})$. Hence $-\phi\frac{\partial W(\alpha^o)}{\partial \alpha} = \frac{\partial \pi_{HD}^L(\alpha^o)}{\partial \alpha} \Leftrightarrow \phi\frac{\partial W(\alpha^o)}{\partial \alpha} + \frac{\partial \pi_{HD}^L(\alpha^o)}{\partial \alpha} = 0$ characterizes α^o as the unique equilibrium level of behind-the-border measures resulting from the lobbying game. If $\phi\frac{\partial W(\alpha)}{\partial \alpha} + \frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha} = 0 \Leftrightarrow -\phi\frac{\partial W(\alpha)}{\partial \alpha} = \frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha}$ at $\alpha = 1$ but parameters are restricted such that $\phi\frac{\partial^2 W(\alpha)}{\partial \alpha^2} + \frac{\partial^2 \pi_{HD}^L(\alpha)}{\partial \alpha^2} > 0$ at $\alpha = 1$, the government objective function has a local minimum at $\alpha = 1$. $-\phi\frac{\partial W(\alpha)}{\partial \alpha}$ and $\frac{\partial \pi_{HD}^L(\alpha)}{\partial \alpha}$ will cross once more, and this will be again in the interior of the interval $[1, \tilde{\alpha}]$. Thus, $-\phi\frac{\partial W(\alpha^o)}{\partial \alpha} = \frac{\partial \pi_{HD}^L(\alpha^o)}{\partial \alpha} \Leftrightarrow \phi\frac{\partial W(\alpha^o)}{\partial \alpha} + \frac{\partial \pi_{HD}^L(\alpha^o)}{\partial \alpha} = 0$ again characterizes α^o as the unique level of behind-the-border measures that maximizes the government objective function. ■

G Derivation of γ

To ensure that the individual contributions of all firms which are members of the lobby cover the lobby's expenses for bribing the Home government, γ must be chosen such that

$$M_H \int_0^{a_L} c_L(a, \alpha^o) dH(a) = C_L^T(\alpha^o, B_L) \tag{G.1}$$

$$\Leftrightarrow M_H \int_0^{a_L} \gamma \Delta\pi(a, \alpha^o) dH(a) = \phi L_H \mu \frac{\kappa + 1 - \sigma}{(\sigma - 1)\kappa} \ln \alpha^o \tag{G.2}$$

Plugging in the profit functions, integrating over a, and solving for γ yields

$$\gamma = \frac{\frac{\phi \mu L_H \frac{\kappa+1-\sigma}{(\sigma-1)\kappa}}{M_H \left(\frac{a_L}{\bar{a}_H}\right)^{\kappa}}}{\left(\alpha^{o\,\frac{\kappa+1-\sigma}{\kappa}} - 1\right) \frac{\mu}{\sigma} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} P_H(1)^{\sigma-1} L_H a_L^{1-\sigma} \frac{\kappa}{\kappa+1-\sigma} - (\alpha^o - 1) f_{HD}}$$

Clearly, γ depends on the composition of the lobby a_L and the level of behind-the-border measures α^o, which are determined in equilibrium. To ensure consistency, parameters must be chosen such that for the equilibrium values of a_L and α^o, γ is indeed $\in (0, 1)$.

Acknowledgements

I am grateful to Eckhard Janeba, Volker Nocke, Daniel Bernhofen, Ron Davies, Maurizio Zanardi, Vincent Rebeyrol, Xenia Matschke, Benjamin Jung, and Klaus Wälde for inspiring discussions and helpful comments. I would also like to thank seminar participants at ECARES, the University of Tübingen, the 2009 Annual Meeting of the European Trade Study Group, the 3rd FIW Research Conference, the 2010 International Economics Workshop in Göttingen, the 2010 Spring Meeting of Young Economists, as well as my former colleagues at the Chair for Economic Policy at the University of Mannheim. All errors are mine. This paper is a substantially revised and extended version of the CDSE Discussion Paper No. 93.

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