

Firm Heterogeneity and Lobby Participation

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Abstract

The structure of protection across sectors has been interpreted as the result of competition among lobbies to influence politicians, but lobbies have been treated as unitary decision makers and little attention has been devoted to the importance of individual firms in this process. This paper builds a model where individual firms determine the amount of resources to allocate to political contributions and shows that, in the presence of a fixed cost of channeling political contributions, it is efficient for a lobby to be formed by the largest firms in a sector. Therefore the size distribution of firms plays an important role: sectors with a higher share of firms above a given size exhibit higher intensity of political activity. This prediction is borne out by the data: industries characterized by higher firm size dispersion obtain a higher level of protection. The model is also tested against the leading ‘Protection for Sale’ paradigm, employing a newly matched data set on firm-level political contributions. The empirical evidence shows that, accounting for individual firm behavior, the model explains a larger fraction of the variation of protection across sectors.

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1 Introduction

Why do some industries receive more protection than others? This question has been the subject of a large body of theoretical and empirical literature. The idea that the structure of trade policy is mainly the result of interest groups lobbying the government to be shielded from foreign competition has gathered large consensus among economists, but little attention has been devoted to the role played by individual firms in shaping the structure of protection across sectors. In this paper I start from the observation that sectors with a higher degree of firm heterogeneity exhibit a higher level of protection (this is similar to the result that protection is positively correlated with industry concentration, which is reported, among others, by Finger et al. (1982)). While models of endogenous trade policy such as Grossman and Helpman (1994) (henceforth GH) concentrate on the comparison across sectors and cannot account for this pattern, I show that from a theoretical point of view this evidence can be reconciled with the “Protection for Sale” paradigm, provided that we shift the focus to the behavior of individual firms.

Most contributions in the literature on the political economy of trade policy can be summarized by a common scheme: interest groups attempt to influence the government’s choice of trade policy through the promise of votes, monetary donations, and general campaign support; the government grants protection from foreign competition to a sector by comparing the benefits that it receives from the industry’s lobby and the social welfare loss brought about by protection measures. Nevertheless, these studies have failed to investigate the behavior of the individual members (firms) that form interest groups, thus potentially disregarding important aspects of interest groups’ aggregate behavior. In particular, I show that, controlling for all the variables employed in previous empirical studies of the GH framework, the dispersion of the size distribution of firms within a sector is positively correlated with the level of protection granted to an industry. According to the GH model, the distribution of firms within a sector should not matter for the determination of trade policy, so the evidence I bring forth calls for a model that incorporates the behavior of individual firms and for further empirical investigation.

In this paper I embed firm heterogeneity in a menu auction set-up à la Grossman and Helpman (1994). Differently from GH where the unit of analysis is the sector, in this framework the decision of whether to lobby

and how much to contribute is made by individual firms.¹ Once the firm decides to participate in political activity, it presents the government with a contribution schedule that associates a monetary contribution to each potential degree of protection. The government chooses the level of protection by trading off contributions and loss of aggregate welfare, like in GH. The empirical prediction that the model delivers is that what matters for the strength of the lobby (and therefore for the equilibrium level of protection) is not the size of the sector per se (like in GH), but the share of the total industry output produced by firms that make positive contributions. Because this type of game entails a multiplicity of equilibria in the level of contributions and in the set of firms that make positive contributions, I impose a specific selection criterion. I select the equilibrium set of lobbying firms that maximizes the lobby's total return from political activity. A key assumption in this regard is the presence of a fixed cost of making political contributions which I interpret as the initial expenses necessary to play an active role in the sector lobby. The lump-sum nature of these set-up costs is such that, from the point of view of the interest group, it is efficient that only the largest firms participate in the lobby. The mechanism is the following: the sector lobby considers the entry of a marginal firm into the lobby, which is going to increase the sector tariff proportionally to the firm size; if the net return from this addition to the interest group is smaller than the fixed cost, then the firm will optimally be excluded from the sector's lobby. The feature that only large firms lobby in equilibrium is suggested (but not empirically verified) in the work of Masters and Keim (1985) on the motivation behind a corporation's choice to set up Political Action Committees:² controlling for other determinants of political participation, "the economic size of the firm should also be positively related to the probability of having a PAC. This is because the initial fixed costs of organizing for political activity may be spread over a larger asset base". The relationship between size and participation implies that the share of industry output produced by firms participating in the lobby depends on the size distribution of firms in the sector. In particular, the model predicts that, under certain conditions (that I find verified in the data), industrial sectors where the distribution of firm size is more dispersed are more likely to have a larger fraction of the sector output produced by firms large enough to incur the fixed cost of contributing and participate in

¹In this paper I use interchangeably the expressions 'lobbying' and 'giving political contributions'. It is worth clarifying the issue because the former term can also refer to "informational lobbying", which is the focus of another strand of literature investigating the strategic interaction between interest groups and the government in the presence of asymmetric information.

²Commonly referred to as PAC's. I will describe in the empirical section what PAC's are and how they work. For now I simply take the choice of setting up a PAC as the decision of entering into the political game.

the lobby. Therefore, a larger firm dispersion will result in a larger participation share and in a higher level of protection.

The empirical section of this paper tests the predictions of the model. It is worth emphasizing that, differently from this paper, previous empirical studies of the “Protection for Sale” model, like Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000), have made use of sector-level aggregate political contributions data. By matching firm-level contributions data, obtained from records of the Federal Election Commission to individual company information available on COMPUSTAT, I am able to test a number of predictions about individual firms’ lobbying behavior. The first part of the analysis provides reduced form evidence that the characteristics of the size distribution of firms are important in explaining the pattern of protection across industries while the second part tests the structural predictions of the model. First, I verify that, both at the industry level and over all sectors, larger firms are more likely to participate in the political game and make larger contributions. Second, using firm-level data on output and political contributions, I measure the share of total output in a sector produced by firms that lobby and I show that this share is an increasing function of the average firm size and the firm size dispersion within the sector, as predicted by the model. Third, I show that accounting for differences in participation shares across sectors in the way predicted by the model gives sensible parameter estimates. The data supports a specification of the tariff equation that accounts for participation shares as well as the total size of the sector. Finally I test the model presented in this paper against the “Protection for Sale” benchmark and I show that the Heterogeneity model helps explain a larger fraction of the variation of protection levels across sectors.

This paper builds on the strand of literature that has explored the interaction between the government and interest groups in the context of trade policy. The literature is so vast that I do not attempt at being exhaustive and simply refer to the survey by Rodrik (1995), where the various approaches are analyzed and linked to one another. Rodrik offers a clear perspective on the work in this area going from the Political Support Function introduced by Hillman (1989) to the Tariff Formation Function approach proposed by Findlay and Wellisz (1982) to the Campaign Contribution approach explored by Magee et al. (1989) and more recently by Grossman and Helpman (1994). While previous approaches had provided a reduced form link between the characteristics of a sector and the benefit to the government of granting protection, the GH model provides a micro-foundation of

the interaction between lobbies and the government.

This paper is also related to a more recent but fast-growing area of international trade concerned with the importance of relaxing the assumption of identical firms within sectors. This literature (to cite only a few of the important papers, Melitz (2003), Bernard et al. (2003), Bernard and Jensen (1999), Helpman et al. (2004), Antras and Helpman (2004)) has emphasized, from both a theoretical and an empirical point of view, that allowing for differences in firm productivity and size within a sector helps explain a number of facts that the representative firm approach cannot account for.

An account of where this contribution stands in the literature would be incomplete without mentioning previous work on the provision of public goods and lobby formation. In his seminal contribution Mancur Olson (1965) informally advanced the idea that “in groups of members of unequal ‘size’...there is the greatest likelihood that a collective good will be provided”. The motivation for this statement relies on the presumption that larger members will find it economically viable to participate in lobbying activities and that groups with a few large members will be more effective than groups with a large number of small members. In this paper I intend to revisit Olson’s insightful contribution and provide a rigorous micro-foundation of firms behavior.³

Finally, the most thorough analysis of lobby formation in the framework of the Grossman and Helpman model is due to Mitra (1999). In his paper lobby formation is a discrete process: either a sector organizes into a lobby or it is unorganized⁴. Therefore while Mitra’s paper helps explain the presence or the absence of a sector’s lobby, this paper rationalizes a continuous measure of the “intensity” of lobbying.

³Two papers, one by Pecorino (1998) and one by Magee (2002), tackle the issue of free-riding in the interaction between firms in a lobby. While they offer an interesting insight into the issue of how the number of identical firms in a sector affect the likelihood of free-riding, these models do not analyze the decision of the firm to enter the lobby and do not apply to the case where firms are heterogeneous. Pecorino (2001) shows how incorporating heterogeneity does not yield trivially unambiguous results. Gawande (1997) adopts the reduced form model of private provision of public goods, first introduced by Bergstrom et al. (1986), and presents empirical evidence that the concentration of firms in a sector increases the level of protection. These papers do not micro-found the decision of the firm to participation in the lobby and still adopt the tariff function approach without having an explicit mechanism of interaction between the government and individual firms.

⁴In this sense sectors are again treated as black boxes where firms do not play any role: lobby formation realizes on the sole condition that total surplus is greater than the set up cost. This seems a reasonable assumption for lobby formation if we consider, as Mitra does, sectors where firms are all identical and symmetry arguments can justify a coordination outcome. This characterization seems less innocuous if there are large differences among firms within a sector, which is what we observe in the data.

The remainder of the paper is divided into two main sections: a theoretical model and empirical methods and results. Section 2 presents the structure of the economy, Section 3 describes the political game and Section 4 finds the equilibrium set of firms lobbying. Section 5.1 describes the data used in this study and presents reduced form evidence. Section 5.2 tests specific predictions of the model. Section 6 concludes.

2 Structure of the economy

Consider a small open economy. The numeraire good, x_0 , is not taxable, but all the other m goods can potentially bear an import tax or export subsidy. Denote ad valorem tariff on good x_i by τ_i and set international prices $p_i^* = 1$ so that the domestic price for good i is $p_i = 1 + \tau_i$.

The population is of size one and its preferences are represented by the following quasi-linear utility function:

$$U(c_0, c_i) = c_0 + \sum_{i=1}^m u_i(c_i) \quad (1)$$

where c_0 is consumption of good x_0 and c_i is consumption of good x_i . The function $u_i(\cdot)$ is differentiable, increasing, and strictly concave. Quasi-linear preferences allow the demand for each good x_i to depend only on its domestic price p_i : $c_i = d_i(p_i)$

The numeraire good is produced one-to-one with labor only. Free trade in the numeraire good and the production technology for x_0 assures that the wage is equal to one, assuming that the production of the numeraire good is positive. Each good x_i is produced, using labor and a specific factor, by a set S_i of firms that are endowed with different amounts of the specific factor. Firm j in sector i produces output x_{ij} according to an increasing and concave production function, employing K_{ij} , the firm endowment of the specific factor, and labor. The return to firm j specific factor, Π_{ij} , depends on the domestic price for the good produced and the amount of specific factor owned. By Hotelling's lemma, as the domestic price p_i increases the rent increases by the amount of output produced:

$$\frac{\partial \Pi_{ij}}{\partial p_i} = x_{ij} \quad (2)$$

Equation (2) simply states that size matters, i.e. the gain from protection increases with size. This is going to play a key role in determining the greater incentive for a larger firm to be included in the lobby.

The government is not a pure welfare maximizer: its objective function G depends on aggregate welfare, W ,

and on the level of campaign contributions C that it receives from interest groups: $G = C + aW$. I restrict the set of policy tools available to the government to trade taxes and subsidies. Aggregate welfare is the sum of labor income $l = 1$, consumer surplus $SP(\mathbf{p})$, tariff revenues $r(\mathbf{p})$ (redistributed back to consumers) and rents:

$$W = 1 + r(\mathbf{p}) + \sum_{i=1}^m \Pi_i + SP(\mathbf{p}) \quad (3)$$

where tariff revenues are $r(\mathbf{p}) = \sum_{i=1}^m \tau_i m_i(p_i)$, imports are $m_i(p_i) = d_i(p_i) - X_i$, X_i is total output in sector i , $\Pi_i = \sum_{j \in S_i} \Pi_{ij}$ and consumer surplus is $SP(\mathbf{p}) = \sum_{i=1}^m u_i(d_i(p_i)) - p_i d(p_i)$.

3 Tariff setting game

The structure of the game is similar to the menu auction described by Bernheim and Whinston (1986) and adopted by Grossman and Helpman (1994). A set of principals (firms) try to induce the agent (the government) to implement a policy that might be costly for the government itself, but would benefit the firms in terms of increased specific factor rent. Differently from Grossman and Helpman (1994), where principals are sectors, in this framework each firm is an individual player that decides how much to contribute. To this framework the model adds the presence of a fixed cost F , independent of firm size, to participate in lobbying activities. When firms decide to make positive political contributions the first F dollars do not reach the hands of politicians and are spent to channel resources.⁵ The presence of this friction substantially modifies the game initially introduced by Bernheim and Whinston (1986).

The government chooses a vector of prices $\mathbf{p} \in P$ while the strategy space for firm j in sector i consists of a contribution schedule $C_{ij}(\mathbf{p})$ that associates a level of monetary contribution to each price vector. The presence of a fixed cost means that one must distinguish between gross contributions $\tilde{C}_{ij}(\mathbf{p})$ (gross of the fixed cost), which is the amount of money the firm disburses, and net contributions $C_{ij}(\mathbf{p})$ which is the amount of money that the government receives.⁶ The firm's gross payoff is $W_{ij}(\mathbf{p}) = l_{ij} + \Pi_{ij}(\mathbf{p}) + \alpha_{ij}(r(\mathbf{p}) + SP(\mathbf{p}))$ where

⁵Although the creation of a segregated campaign contribution fund within the firm (what is commonly referred to as PAC) is in itself not very costly, a firm might want to hire a lobbyist to make sure that the politician is "informed" of the contributions of such firm, or might spend resources to figure out what representatives sit on which committees and should receive the funds.

⁶In order to simplify the impact of fixed costs on the general equilibrium structure of the model, I assume they are a transfer from the owners of the firm to individuals in the economy and have therefore no impact on aggregate quantities consumed and welfare (because of quasi-linear utility). Admittedly this is not satisfactory if we think these fixed costs represent an important

α_{ij} is the share of population represented by the owner of specific factors in firm ij , l_{ij} is the labor income of the owner of firm ij specific factor. The firm's net payoff is $V_{ij} = W_{ij}(\mathbf{p}) - \tilde{C}_{ij}(\mathbf{p})$.

The extensive form of the game is the following:

- (i) In the first stage, each firm presents the government with a contribution schedule $C_{ij}(\mathbf{p}) = \max\{0, \tilde{C}_{ij}(\mathbf{p}) - F\}$.
- (ii) In the second stage, the government chooses a price vector \mathbf{p} and collects $C_{ij}(\mathbf{p})$ from each firm ij .

Denote by L_i the set (to be determined in equilibrium) of firms in sector i that contributes a positive amount in equilibrium, with $\bigcup_i L_i = L$.

The equilibrium conditions of the game are similar to those described by Bernheim and Whinston (1986) and specified in Proposition A1 in the Appendix, where a proof is also provided. Following a derivation similar to GH (detailed in the Appendix), and assuming that contribution schedules are differentiable around the equilibrium price vector, the Appendix shows that two important results of GH extend to this modified version of the game.

First, even in the presence of fixed costs, contribution schedules are locally truthful around the equilibrium point for the subsets of firms that make positive contributions:

$$\nabla W_{ij}(\mathbf{p}^o) = \nabla C_{ij}^o(\mathbf{p}^o) \quad \forall ij \in L \quad (4)$$

This condition implies that around the equilibrium price vector \mathbf{p}^o contribution schedules reflect the willingness of the firm to pay for an increase in the domestic price. In the presence of fixed costs of contributing there are firms that in equilibrium do not contribute, so obviously local truthfulness holds only for contributing firms.⁷

Second, the first order condition that characterizes the equilibrium vector \mathbf{p}^o is the following:

$$\sum_i \sum_{j \in L_i} \nabla W_{ij}(\mathbf{p}^o) + a \nabla W(\mathbf{p}^o) = 0 \quad (5)$$

The reader who is familiar with GH will notice that, similarly to GH, first order condition (5) reflects the higher weight⁸ placed by the government on the objective function of firms that make positive contributions.⁹

⁷ source of distortion, beyond the one in tariffs, but they are secondary in this paper.

⁷A contribution schedule that is flat at zero around \mathbf{p}^o is optimal for some firms because any price vector that could be induced by a positive contribution would not compensate for the initial fixed cost of contributing.

⁸Firms who make positive contributions have a weight of $1 + a$ while firms that do not contribute simply receive a weight of a .

⁹Notice also that this is the first order condition of the following program:

$$\mathbf{p}^o = \arg \max \left[\sum_i \sum_{j \in L_i} W_{ij}(\mathbf{p}) + aW(\mathbf{p}) \right]$$

in which the government maximizes a weighted sum of consumer and producers surplus with higher weight on contributing firms.

Differently from GH, this version of the first order condition shows how the government distinguishes between lobbying and non-lobbying firms *within* each sector. Having established that the equilibrium is characterized by equation (5), the Appendix shows how to derive its components and leads to the equilibrium price vector \mathbf{p}^o which is rewritten in a fashion similar to the “Protection for sale” equation in the following:

Proposition 1 *If firms’ contribution schedules are differentiable around the equilibrium price vector, for a given set of firms participating in the political game, the equilibrium domestic price of good x_i is given by the following expression:*

$$\frac{\tau_i^o}{1 + \tau_i^o} = \frac{\theta_i^o - \alpha_L}{a + \alpha_L} \left(\frac{z_i^o}{e_i^o} \right) \quad (6)$$

where $z_i^o = \frac{X_i^o}{m_i^o}$ is the inverse import penetration ratio, $e_i^o = -m_i^{lo} p_i^o / m_i^o$ is the price elasticity of imports, $\alpha_L = \sum_i \sum_{j \in L_i} \alpha_{ij}$ and θ_i^o is the equilibrium share of total output of sector i produced by firms that make positive contributions (Participation Share):

$$\theta_i^o = \frac{\left(\sum_{j \in L_i} x_{ij} \right)}{\sum_{j \in S_i} x_{ij}} \quad (7)$$

The level of protection τ_i depends on several factors (apart from a and α_L which are constant across sectors). First, the lower the import penetration, the larger is the deviation from free trade. This is a consequence of the relatively smaller distortion imposed on sectors that have low levels of imports. For sectors with a positive tariff, the size of output affects the level of protection because a larger industry will, *ceteris paribus*, receive a larger benefit from the increase in price p_i and the government can expect to receive larger contributions, therefore, protection granted will be higher. Second, sectors characterized by lower price elasticity of imports receive larger protection as the distortion created by protection is lower. The third factor is going to be the focus of the remaining part of the theoretical section and of much of the empirical section: the equilibrium share of total output produced by lobbying firms, θ_i^o , which, from now on, I will refer to as Participation Share. For a given level of output, the larger the Participation Share, the larger are the marginal contributions the government can expect, and the higher is the level of protection. There are two distinct issues regarding these Participation Shares. First, the share θ_i^o can be seen as the “intensity” of lobbying and allows sectors to be characterized by different degrees of political organization. This is conceptually different from GH (and Mitra (1999)) where lobbying is a binary choice: either the sector is politically organized or it is not and an indicator

function I_i takes the place of θ_i^o . I will show that an empirical measure of this share significantly affects the explanation of the variation of protection across sectors. Second, it is important to show how θ_i^o is determined in equilibrium, and what the factors that affect its size are. The following section will show that Participation Shares are determined by the distribution of firm size.

Equation (6) is the one referred to in the empirical section, while the remainder of the theoretical section makes use of a simplified version of this equation that allows one to identify the set of firms L_i for each sector. The following is a set of assumptions I adopt in order to obtain closed-form solutions.

Assumption 1 (Leontief Production Function): The production function for good i is Leontief. Each unit of output requires one unit of specific factor and one unit of labor. Since the firm faces a constant wage of one, this amounts to the firm producing K_{ij} if $p_i \geq 1$ and nothing otherwise. The rent earned by the owner of the firm's specific factor depends positively on the domestic price: $\Pi_{ij}(\mathbf{p}) = K_{ij}(p_i - 1)$

Assumption 2 (Linear Demand Function): The demand function for good x_i is linear in price p_i :

$$d_i(p_i) = D_i - b_i p_i.$$

Assumption 3 (Concentrated specific factor ownership): I assume that the owners of a sector's specific factor represent a negligible fraction of the voting population, that is $\alpha_{ij} = 0$. As a result there will be no "competition" among lobbies representing different sectors. In the absence of this assumption lobbies would also give contributions in order to lower the price of all the goods they consume. I therefore assume that each lobby gives contributions with the only goal of raising the price of the good it produces.

Proposition 2 *Under assumptions 1-3 the equilibrium domestic price p_i^o takes the following expression:*

$$p_i^o = \frac{\theta_i^o K_i}{ab_i} + 1 \quad (8)$$

where K_i is the total output of sector i and θ_i^o is the share of total output in sector i produced by firms making positive contributions (Participation Share): $\theta_i^o = \left(\sum_{j \in L_i} K_{ij} \right) / K_i$.

Having determined the equilibrium price for a given set of participants in the lobby, I move to discuss how to determine the set of firms that lobby in equilibrium and therefore pay the fixed cost of contributing.

4 Lobby participation

This section focuses on the determination of the set of firms that make positive contributions in equilibrium. From now on I suppress the subscript i since the equilibrium tariff in each sector is determined independently from other sectors because of Assumption 3. The sector has n firms ordered such that firm 1 is the smallest and firm n is the largest: $K_1 < \dots < K_j < \dots < K_n$.

Although differentiability implies a specific local behavior of contribution schedules and delivers a simple expression for equilibrium tariffs, the determination of contribution levels requires more restrictive assumptions about the shape of contribution schedules away from the equilibrium point (see Section IV of GH¹⁰). I therefore restrict attention to contribution schedules that are truthful, not only around the equilibrium point, but over the range of price vectors that entail positive amounts contributed.

Assumption 4: Contribution schedules are truthful:

$$C_j(\mathbf{p}) = \max[0, W_j(\mathbf{p}) - B_j - F] \quad (9)$$

where B_j indicates a level of welfare of firm j to be determined in equilibrium.¹¹

Similarly to the case of $\alpha_L = 0$ in GH, here there is no competition among lobbies and since the firms move first, they lower their contribution schedules (increase B_j) until the government is indifferent between the equilibrium level of protection and the free trade price.¹² Although the assumption of global truthfulness helps in narrowing the possible outcomes, the game admits multiple equilibria. The multiplicity is both in terms of contribution levels that support the equilibrium price and in terms of the set of firms that make positive contributions in equilibrium. The first type of multiplicity is not of concern to us because, for a given set of firms

¹⁰The determination of contribution levels is a somewhat overlooked part of their paper. See the working paper version for more details Grossman and Helpman (1992).

¹¹Notice that the presence of a fixed cost does not allow me to automatically extend to this framework all the results derived by Bernheim and Whinston (1986). In the absence of fixed costs, Bernheim and Whinston (1986) have shown that Truthful Nash Equilibria (equilibria supported by truthful contribution schedules) may be focal among a set of possible equilibria because, first, firms' best-response sets always include a truthful strategy so firms cannot lose from choosing a truthful contribution schedule; and second, Truthful Nash Equilibria are Pareto optimal, robust to communication among players and are therefore coalition-proof. In this paper I assume truthfulness (although local truthfulness is proved to hold) because it allows me to describe the behavior of contribution schedules away from the equilibrium price, which is essential in order to determine the level of contributions.

¹²See Example 3 p. 846 of GH.

L the equilibrium price in the sector is determined by equation (8), regardless of the different combinations of contributions patterns by individual firms within L . The second type of multiplicity is important, because the identity of firms in L determines the level of protection. Therefore I propose a criterion to choose among possible equilibrium sets of firms lobbying. I argue that there is an optimal set of contributing firms in equilibrium and that it is reasonable to expect the selection of such equilibrium if firms are allowed to communicate.¹³ I label this criterion as Optimal Lobby Criterion.

Optimal Lobby Criterion: Consider firm h of size K_h and an arbitrary set of contributing firms L . In order to determine whether it is optimal for firm h to “join the lobby” (to be one of the firms making positive contributions in equilibrium¹⁴) consider the joint surplus of prospective member firm h and the lobby L . If the joint surplus is higher under firm h participation, then it is optimal for firm h to contribute in equilibrium, otherwise it is optimal for firm h to be excluded from the lobby (and therefore save the fixed cost F).¹⁵

The criterion proposed leads, through a derivation reported in the Appendix, to the following proposition.

Proposition 3 *In the Optimal Lobby equilibrium:*

(i) *If firm h enters the political game then all firms j , with $j \geq h$, enter the political game.*

(ii) *Let h^* be the smallest firm participating in the lobby. Then:*

$$\begin{aligned} \frac{K_{h^*}^2}{2ab} &\geq F \\ \frac{K_{h^*-1}^2}{2ab} &< F. \end{aligned}$$

(iii) *The equilibrium Participation Share θ^o is:*

$$\theta^o = \frac{\sum_{j \geq h^*} K_j}{\sum_{j \in S} K_j}.$$

¹³It is worth emphasizing that we are “choosing” among self-enforcing Nash equilibria and we do not admit cooperation among individual firms, but only coordination.

¹⁴In conveying the intuition I describe the mechanism as dynamic, but one should keep in mind that this is purely a selection among static equilibria.

¹⁵Another criterion could involve considering the surplus of all firms in the sector under firm h participation and under its exclusion. This criterion seems less appealing because firms that are not contributing in equilibrium would like as many of the other firms as possible to contribute and free-ride on their participation. It seems more plausible that the decision to include a possible candidate h should be taken jointly by the candidate lobby member and other firms in the lobby.

4.1 Size distribution and the level of protection

This section investigates whether this model can explain the impact on protection levels of characteristics of the size distribution of firms. In particular, this section shows that basic moments of the distribution, such as mean and standard deviation of firm size, affect the equilibrium level of protection.

The intuition is straightforward: in a sector where, holding the mean constant, the size distribution of firms has a larger standard deviation, we can find a greater number of firms that are large enough to participate in the lobby. Although this result is intuitive, it does not hold for any mean-preserving spread, so, in order to obtain simple comparative statics, the distribution of firm size is approximated using a continuous Pareto distribution.¹⁶ Take a continuum of firms of size K_j and let K_j be distributed over the support $[K_M, \infty]$ according to the following probability density function:

$$K_j \sim \varepsilon \frac{K_M^\varepsilon}{K_j^{\varepsilon+1}} \quad (10)$$

where $\varepsilon > 2$ is a parameter. Indicating the threshold lobbying firm as h^* , construct θ^o as the share of output produced by firms lobbying in equilibrium:

$$\theta^o = \left(\frac{K_{h^*}}{K_M} \right)^{1-\varepsilon} \quad (11)$$

We are interested in the effect on θ^o of a mean-preserving spread in the size distribution of firms. As ε decreases, dispersion increases and to keep the mean constant the lower bound K_M has to decrease.¹⁷ Then the Participation Share can be written as:

$$\theta^o = \left(\frac{K_{h^*} \varepsilon}{\mu (\varepsilon - 1)} \right)^{1-\varepsilon} \quad (12)$$

We can now evaluate the impact of a mean-preserving spread in the size distribution of firms on θ^o and therefore on the domestic price level.

¹⁶The model so far has dealt with firms of discrete size: it is fundamental to the structure of the model that the firm perceives its impact on the tariff level as it decides to lobby. Nevertheless employing a continuous density function in this section does not affect the results about the impact of dispersion on protection and simplifies considerably the relevant expressions. The choice of density function is dictated by evidence that the distribution of firm size is well approximated by a Pareto distribution as reported by Axtell (2001) and Helpman et al. (2004).

¹⁷Indicate μ as the average size of the firm. In order to keep the average size constant the lower bound K_M is lowered according to the following expression: $K_M = \mu \frac{\varepsilon-1}{\varepsilon}$.

Proposition 4 *If the following condition is satisfied:*

$$\ln \frac{K_{h^*}}{\mu} + \ln \frac{\varepsilon}{\varepsilon - 1} > \frac{1}{\varepsilon} \quad (13)$$

then a decrease in ε (an increase in dispersion), holding the mean constant, brings about an increase in the domestic price p .

Condition (13) is always satisfied if $K_{h^*} > \mu$. As described in the following section, I can identify the threshold participating firm and I verify that for all 226 sectors used in this study, with the exception of one, the threshold contributing firm is larger than the average firm.

5 Empirical strategy and data description

The empirical section is organized as follows. First, I provide reduced form evidence of the motivating fact of this paper: controlling for average firm size differences, sectors characterized by a higher dispersion in firm size present higher levels of protection.

Second, the model predicts that larger firms are more likely to take part in the lobby. Making use of firm-level data, I show that this prediction is confirmed. Third, employing the same firm-level data, I build the share of total output in each sector produced by firms that are part of the lobby. The model predicts that these participation shares are increasing in the level of firm size dispersion. I show that this is confirmed by the data. Fourth, I test the prediction that the level of protection depends not simply on the sector's total output, but on the participation shares. Fifth, I test the model developed in this paper against the benchmark "Protection for sale" model and show that it explains a significantly larger fraction of the variation in protection levels across sectors.

5.1 Reduced form evidence: the effect of firm size dispersion on protection

The empirical section of this paper makes use of several data sources: the data used in previous empirical studies to test the original GH model from Gawande and Bandyopadhyay (2000); the data on sector-level firm size distribution is from the 1987 US Census of Manufactures; the data on firms political contributions is taken from Federal Election Commission records for electoral cycle 1986-88 and individually matched to COMPUSTAT

firm information about sales, employment and industry classification.

5.1.1 The benchmark model and data description

I will use the model presented by Gawande and Bandyopadhyay (2000) (from now on GB) as benchmark test of the original “Protection for Sale” model and the data set employed here is the same.¹⁸ Their specification is a system of three equations, of which I will emphasize only one as it is relevant to this study:¹⁹

$$\frac{t_i}{1+t_i} = \gamma_0 + \gamma_1 I_i \frac{z_i}{e_i} + \gamma_2 \frac{z_i}{e_i} + Z_{1i} + \varepsilon_i \quad (14)$$

where i is a sector, which throughout the empirical section is a four-digit SIC category, t_i is the protection measure for industry i , z_i is the inverse of the import penetration ratio, e_i is the price elasticity of imports and I_i is a dummy that describes whether the sector is politically organized, while Z_{1i} includes tariffs on intermediate goods as controls as in GB.

The equation:

$$\frac{1}{z_i} = \phi \frac{t_i}{1+t_i} + \xi_i \quad (15)$$

accounts for the fundamental simultaneity problem first raised by Trefler (1993): we can expect higher tariffs to reduce import penetration as this equation illustrates. This system accounts for the fact that import penetration and tariff levels are determined simultaneously.

As a measure of protection t_i , the literature has widely adopted the use of coverage ratios for non-tariff barriers (NTB),²⁰ which represent the share of products in an industry covered by one or more quantitative or qualitative restrictions to trade.²¹ Import penetration ratios z_i measure the share of imports to total production

¹⁸The data set was kindly provided by Kishore Gawande. Part of the industry-level data employed in GB was collected by Trefler, who cleaned up the NTB data from an early version of the TRAINS data base (UNCTAD data base on trade control measures) and merged it with trade data (import penetration, etc.). See Trefler (1993) for details.

¹⁹This is the specification used to test the main “Protection for sale” equation:

$$\frac{t_i}{1+t_i} = \frac{I_i - \alpha_L}{a + \alpha_L} \frac{z_i}{e_i}$$

(Grossman and Helpman (1994) p.842)

²⁰Data on Non-Tariff Barriers, originally from UNCTAD, is relative to year 1983 and initially employed in Trefler (1993).

²¹Although the model deals with tariffs, there are two reasons to use NTB’s in the empirical analysis. First, tariffs are low and the use of instruments such as anti-dumping, countervailing duties and tariff rate quotas are on the rise. Second, interest groups are aware that NTBs are easier for a country to manipulate unilaterally, as opposed to tariffs, which are set through multilateral rounds of negotiations.

in sector i . As for e_i , I employ estimate of sector-level price elasticity of imports from Shiells et al. (1986). I_i is a dummy variable that indicates whether the sector is politically organized and represented by a lobby. In this study I use the dummy constructed by GB²², but I show alternative results under a dummy that I construct using other data sources. The data on political contributions used by GB to construct I_i are originally from the Federal Election Commission.²³ Following GB I employ the instruments used by Trefler (1993) to correct for the simultaneity bias intrinsic to the system of equations (14) and (15). The variables employed as instruments are sector-level capital-labor ratios interacted with industry dummies, and the fractions of managers, scientists and unskilled labor per industry as measures of comparative advantage that determine import penetration independently of the level of protection.

5.1.2 Introducing characteristics of the size distribution of firms

This section shows that sectors characterized by higher firm size dispersion receive higher protection. I present here reduced form evidence, that suggests that relevant variables are omitted in previous empirical studies of the GH model. This is the basic specification:

$$\frac{t_i}{1+t_i} = \gamma_0 + \gamma_1 I_i \frac{z_i}{e_i} + \gamma_2 \frac{z_i}{e_i} + \gamma_3 \sigma_i + \gamma_4 \mu_i + \gamma_5 I_i + Z_{1i} + \varepsilon_i \quad (16)$$

where μ_i and σ_i are, respectively, the mean and the standard deviation of firm size within sector i . Notice that GH would imply that γ_3 and γ_4 are both zero. The source of data employed to measure μ_i and σ_i is the 1987 US Census of Manufactures.²⁴ The Industry Series of the Census of Manufactures include data on 4-digit SIC industry firm size distribution.²⁵ The first panel of Table 1 reports summary statistics for size distribution

²²See Gawande and Bandyopadhyay (2000) for detailed explanation of the derivation of I_i .

²³The data provided by Kishore Gawande reports sector-level aggregate contributions by Political Activity Committees (PAC's) for the 1981-82 and 1983-84 election cycles.

²⁴1987 Census of Manufactures Volume 1E - Industry Series MC87-I. Industry statistics by employment size of establishment MC87I4.

²⁵I approximate firm size using total annual shipments. The average size and size dispersion are respectively the mean μ_i and the standard deviation σ_i of the firm shipments distribution. Publicly available US Census data sets do not report individual firm information, but they report ten size brackets according to employment size. For each bracket total shipments and the number of establishments is reported. As a result of this data limitation the method employed is to calculate the average size per employment bracket and then derive the weighted average and standard deviation across the ten available employment bins. Details in the Appendix.

variables for 226 4-digit SIC categories.²⁶

To correct for the possibility of reverse causality in the relationship between firm size distribution and the level of protection, I instrument for the mean and standard deviation of firm size using their European analogs.²⁷ In principle, the instrumenting strategy should also correct for the fact that σ_i and μ_i are estimates of the true moments of the sector-level distribution of firm size.

5.1.3 Results

All results in Table 2 are obtained from two-stage least square regressions and the methodology is the same (including the instruments employed) as in GB so that results are readily comparable.²⁸ Column GB in Table 2 reports the results for specification (14).²⁹ As predicted by the general GH model, for politically unorganized sectors a larger size of the industry output relative to imports and a smaller price elasticity of imports decreases the tariff level ($\gamma_2 = -1.73$). For politically organized sectors this relationship has the opposite sign ($\gamma_1 = 1.83$).³⁰ The results from specification (16) appear in column I of Table 2. While the coefficients on $I_i(z_i/e_i)$ and z_i/e_i remain of the same sign and magnitude (suggesting that the GH model is robust), the standard deviation of firm size presents a positive and very significant impact on protection levels, controlling for the average size of the firms in the sector. The point estimate of γ_3 is 0.44 (precisely estimated with a robust standard error of 0.063). The coefficient on average firm size is 0.04 (not statistically significant). The centered R^2 for column I is 33 percent larger than in the benchmark GB column which suggests that including measures of firm

²⁶As reported in GB, implausible import elasticity estimates allow the authors to include only 242 of the 448 4-digit SIC industries (see p.152 of Appendix in GB for details). My sample size is further reduced to 226 because, while GB use the 1972 SIC classification, I could only access the Census of Manufactures data for 1987, which employs the 1987 SIC classification. Observations that had a poor match between the two classifications were dropped from the sample.

²⁷The data on firm size distribution for European firms (the mean and the standard deviation of sales) are from Helpman et al. (2004). Data are originally from Amadeus (1997).

²⁸GB employ a method proposed by Kelejian (1971) for the estimation of systems where the endogenous variables enter the first stage equation in a non-linear fashion.

²⁹The results are consistent with, although not identical to, the coefficients reported in the paper by Gawande and Bandyopadhyay (2000) (the set of interactions used as instruments is slightly different) and qualitatively similar to the values obtained by Goldberg and Maggi (1999).

³⁰Although the prediction that the sign of γ_1 is positive is confirmed by the data, the positive sign of $\gamma_1 + \gamma_2$ is not statistically significant. It is important to stress that this prediction is confirmed when considering the specification that is closest to the model presented in this paper, as emphasized in the following section.

size distribution explains a larger fraction of the variation of protection levels across sectors. In other columns of Table 2 I control for other variables that could be affecting the structure of protection across industries. I control for Total Sales in the sector, accounting for the fact that the data used for import penetration might not be the same as the Sales data used to calculate firm size dispersion. I also control for Total Value Added per sector and for more partial measures of firm distribution as the Herfindahl index and the Concentration4 index.³¹ When included in the same regression, the measure of dispersion presented here remains the only significant distribution variable affecting the structure of protection.

5.2 Testing the model

This section employs data on firm-level contributions and firm characteristics to test more structural predictions of the model.

Firm-level campaign contributions are from a collection of records of the Federal Election Commission. I refer to the Appendix for more details about these data. The FEC holds a record of all Political Action Committees formed. PAC's are a channel through which corporations, among other entities, make contributions to politicians (mostly to incumbent politicians).³² This data set though, originally lacks a standard identifier for the company sponsor of the PAC, which is required to individually match each PAC to a firm. Therefore each PAC was matched to a firm in COMPUSTAT using the PAC name, as explained in detail in the Appendix. Firm characteristics are from COMPUSTAT North America Industrial Annual 1987.³³

As described in the Appendix, data on PAC contributions and COMPUSTAT data on firm size allow me to find the threshold participating firm for each SIC 4 industry, which is the smallest (in terms of sales) firm with positive campaign contributions. Once the threshold firm is identified, the True Participation Share θ_i ³⁴ can be calculated as the share of total industry output produced by firms above the threshold.³⁵ Because I only

³¹Concentration4 reports the share of total sales accounted for by the top four firms in the sector.

³²I thank Jim Snyder for kindly sharing these data. In order to make the data on contributions compatible with 1987 US Census of Manufactures data I consider the political cycles 1986 and 1988.

³³This data set provides information on company's employment size, annual net sales and 4-digit SIC.

³⁴I define this as the True Participation Share as opposed to the Constructed Participation Share, which I will describe later.

³⁵In using COMPUSTAT to identify firms that are lobbying we disregard the rather large number of private firms that have a PAC. By counting all firms above the smallest firm contributing I implicitly conjecture that the Participation Share will include also those large private firms.

have access to publicly available Census of Manufactures data, this reduces to computing the share of output produced by firms in employment bins above and including the one containing the threshold firm. The second and third panels of Table 1 report firm-level summary statistics of PAC contributions, sales and employment levels, while the fourth panel reports summary statistics for the Participation Shares. The number of firms for which data are available in 1988 is 3089, of which 478 make positive contributions (15.47% of the available sample). Among the contributing firms the average contribution is 62,241 dollars.³⁶

5.2.1 Firm size and the likelihood of participating in the political game

A prediction of the model is that larger firms are more likely to participate in the political game. This section shows that participation is positively correlated with size and that (although this is not strictly speaking a prediction of the model because of the indeterminacy of contributions) larger firms make larger contributions.

According to the first panel in Table 3, the amount of contributions by each firm increases as a function of firm size (measured as the logarithm of sales) both in a linear (column I) and quadratic specification (column II). The effect of size is admittedly small: a doubling of size of the average firm in the sample increase contributions by less than a dollar. The coefficients of the sector-by-sector regressions are too many to report, so columns III to VII provide summary statistics. Generally the pooled regression results are confirmed (contributions increase with size).³⁷ The model also predicts that contributions should be zero up to the industry participation threshold and then be positive. Graph 1 shows that, as predicted by the model, small firms do not contribute, but it also shows that, although participation is correlated with size, some large firms do not contribute. More work is needed to determine whether these large firms participate in political activity through channels other than PAC contributions or they do not participate at all (and why).

The second panel in Table 3 also shows that the probability that a firm participates in the lobby is increasing

³⁶The fact that political contributions are small relative to the size of contributing firms has been documented by Ansolabehere et al. (2003). The small size of political contributions is not necessarily surprising and what should matter is the leverage that a given amount of money obtains. Furthermore it is plausible that political contributions are not the only channel through which lobbying takes place. In particular many corporations decide to hire lobbyists whose task is to promote legislation that is favorable to a specific industry. Although this paper does not show evidence of this channel, the logic of the model should apply as long as this form of lobbying also involves an initial fixed cost independent of firm size.

³⁷Since contributions are censored at zero, the first panel of Table 3 reports Tobit regressions results.

in the size of the firm (this is confirmed both in the pooled and the sector-by-sector regressions).³⁸ The marginal effect in the Probit model calculated at the average firm size means that a marginal increase in size at that level increases the probability of participating by 3.2%.

Finally, the third panel in Table 3 takes as unit of observation the Census of Manufactures employment bin for each 4-digit SIC industry and shows that the ratio of participating firms to non-participating firms is increasing as we consider larger employment bins³⁹ (again both in the pooled and the sector-by-sector regression).⁴⁰ In particular a typical firm that goes from one employment bin to the next contributes less than an extra dollar.⁴¹

5.2.2 The relationship between θ_i and size distribution parameters

The model predicts that the Participation Share increases as the average size and standard deviation of the size distribution of firms increase: $\frac{\partial \theta_i}{\partial \sigma_i} \geq 0$ and $\frac{\partial \theta_i}{\partial \mu_i} \geq 0$. Identifying the threshold participating firm allows me to check that condition (13), under which a mean-preserving spread of the firm size distribution induces an increase in θ_i , is satisfied. In a the sample of 226 sectors, the condition that the threshold participating firm is larger than the average firm is satisfied for 225 of these industries and is not satisfied for 1.

Table 4 reports that the Participation Share is positively correlated with both the mean (correlation 0.39) and the standard deviation (correlation 0.47) of the firm size distribution. Both correlations are significant at the 1 percent confidence level, consistently with what is predicted by the model.

5.2.3 The Heterogeneity specification

The model predicts that the correct specification that describes the equilibrium level of protection of an industry should account for different Participation Shares θ_i . The model predicts exactly how it should enter the protection equation:⁴²

³⁸I employ a Probit model for the pooled regression, but this methodology is not feasible in some of the sector-by-sector regressions since all firms above a given threshold contribute. I therefore switch to a Linear Probability model.

³⁹The right-hand side variable is a discrete number between 1 and 10, where 10 is the largest bin.

⁴⁰The estimation for the third panel of Table 3 is by OLS both in the pooled and sector-by-sector regressions.

⁴¹In pondering the small effect of size of contributions one should keep in mind that the model here does not predict contribution levels for each firm, but only makes predictions about participation.

⁴²The specification still includes I_i to account for the fact that some sectors cannot be considered politically organized for the purpose of lobbying for trade policy even though they make some small political contributions. GB devote considerable effort to isolate the sectors that lobby for trade policy and I follow their definition.

$$\frac{t_i}{1+t_i} = \gamma_0 + \gamma_1 I_i \frac{z_i}{e_i} \theta_i(\sigma_i, \mu_i) + \gamma_2 \frac{z_i}{e_i} + Z_{1i} + \varepsilon_i \quad (17)$$

where $\theta_i(\sigma_i, \mu_i)$ is an increasing function of both σ_i and μ_i (as shown in the previous section).

I show in the following section the results for this specification using: (i) the True Participation Shares, described in the previous sections, and (ii) the Constructed Participation Shares, functions of parameters that, according to the model, determine θ_i 's: $\theta_i(\sigma_i, \mu_i)$

The model predicts that $\gamma_1 > 0$: in sectors where firms make political contributions the level of protection is higher the higher the output, the lower the imports, the lower the price elasticity of imports and the higher participation share θ_i . The model also predicts $\gamma_2 < 0$: in sectors that are not politically organized the level of protection is lower the higher the output, the lower the imports, the lower the price elasticity of imports.

The third prediction is that $\gamma_1 \theta_i + \gamma_2 > 0$. In principle the sign of $\gamma_1 \theta_i + \gamma_2$ should depend on whether $(\theta_i - \alpha_L)$ is smaller or greater than zero, but if we maintain the assumption that ownership is very concentrated, α_L will be relatively small and the sign of $\gamma_1 \theta_i + \gamma_2$ should be positive. In other words, it seems reasonable to expect the political effort to lower a product's price on the part of consumers of the good to be weaker than the political effort to increase it by its producers.

5.2.4 The heterogeneity specification with True Participation Shares

I here estimate equation (17) using True Participation Shares. In Table 5 (and Table 6, 7, and 8) the estimation method is different from Table 2. Since I am no longer concerned about immediate comparability with GB, I adopt a GMM (generalized method of moments) procedure which is not only efficient, but also has consistent diagnostic tests in presence of heteroskedasticity of unknown form.⁴³ As Table 5 reports, both coefficients γ_1 and γ_2 have the predicted sign. The point estimate for γ_1 is 13.78 (s.e. 3.24) and the coefficient γ_2 is -0.28 (s.e. 0.11).⁴⁴ The implication of the results of this specifications is that, *ceteris paribus*, an increase of one standard deviation (see Table 1 for summary statistics) in the Participation Share⁴⁵, induces an increase of 0.02

⁴³See Baum et al. (2003). The set of instruments is still the same as in Table 2 and the same as in GB.

⁴⁴The results exhibit some degree of sensitivity to the exclusion of some data points, a sensitivity they inherit from the original GB data set.

⁴⁵The increase is evaluated at the mean of $I_i \frac{z_i}{e_i}$ (0.0057).

in the coverage ratio, which is one tenth of its standard deviation⁴⁶. Moreover, this specification supports the hypothesis that $\gamma_1\theta_i + \gamma_2 > 0$: calculated at the average $\bar{\theta}$, $\gamma_1\bar{\theta} + \gamma_2 = 3.34$ and the 95 percent confidence interval is [2.88, 3.80].⁴⁷ Estimates of γ_1 and γ_2 also yield a quantification of the weight that the government places on aggregate welfare relative to contributions.⁴⁸ The estimates of γ_1 and γ_2 imply that $a = 725$ and that the government places an equal weight on net welfare and contributions.⁴⁹

Another implication of this regression is that the value for α_L is around 0.02,⁵⁰ which implies that a low fraction of the population is represented by interest groups. This value for α_L is much lower than the values obtained by Gawande and Bandyopadhyay (2000), who find $\alpha_L \approx 1$, and Goldberg and Maggi (1999), who find values of α_L between 0.84 and 0.88. These values of α_L have been recognized as unrealistically high for the US and are commonly indicated as a failure of the empirical tests of the “Protection for sale” model. The more reasonable estimate of α_L obtained under the Heterogeneity specification offers further support to the need to account for different participation shares (θ_i 's) across sectors.

5.2.5 The heterogeneity specification with Constructed Participation Shares

I here estimate equation (17) using Constructed θ_i 's. Participation Shares are predicted to depend positively on both the mean and the standard deviation of the firm size distribution in the sector. I choose the simplest functional form for $\theta_i(\sigma_i, \mu_i)$: $\tilde{\theta}_i = \rho\mu_{iF} + (1 - \rho)\sigma_{iF}$ with $\rho \in (0, 1)$, where $\mu_{iF} = F_\mu(\mu_i)$ ⁵¹ and $\sigma_{iF} = F_\sigma(\sigma_i)$ ⁵²

⁴⁶The average coverage ratio is 0.1 with a standard deviation of 0.2.

⁴⁷Notice that the equivalent prediction in the GH model is not supported by the results obtained by GB, although it is supported by the empirical estimates in Facchini et al. (2006).

⁴⁸We can rewrite the government's utility as $G = C + a(W^N + C)$ where W^N is the aggregate welfare net of contributions. Therefore the weight on net aggregate welfare is a while the weight on contributions is $(1 + a)$.

⁴⁹This is a very high coefficient and in this sense the results do not improve on the puzzling result also found in GB and Goldberg and Maggi (1999). More recently Gawande and Krishna (2005) have made progress in solving this puzzle by introducing competition among interest groups, in particular among upstream producers, who lobby in favor of protection, and downstream producers, who lobby to reduce the tariff on the goods they use as intermediates. Their approach rationalizes the low level of trade barriers as a result of opposing lobbying efforts and not as a result of a high weight placed on welfare. Although Facchini et al. (2006) also find a high estimated value for the weight placed on welfare, their framework, allowing for imperfect capturing of rents from non-tariff barriers, could also provide an explanation for the low level of protection observed. They are the first to admit though that ‘rent leakage of 25% to 28% is unlikely to be a significant deterrent to protectionism’.

⁵⁰The model implies that $\alpha_L = -\frac{\gamma_2}{\gamma_1}$.

⁵¹Empirical cumulative distribution function of μ_i

⁵²Empirical cumulative distribution function of σ_i

are normalized⁵³ values of σ_i, μ_i .⁵⁴

Results in Table 6 show that different weights (ρ 's) do not substantially affect the coefficients γ_1 and γ_2 in specification (17). The coefficients have the predicted sign with γ_1 positive and significant and γ_2 negative and significant. Moreover the prediction that $\gamma_1\theta_i + \gamma_2 > 0$ is supported by the data. I also check that results are robust to the estimation method (I report 2SLS and Censored 2SLS).

5.2.6 Comparing the “Heterogeneity” model and the “Protection for sale” model

It is difficult to draw any sharp conclusions from comparing results from specifications (14) and (17) because the two models are such that model (17) is not nested into model (14). I adopt a methodology introduced by Davidson and MacKinnon (1981) and employed by Eicher and Osang (2002) to compare the two models' power in explaining the pattern of protection across sectors. The goal is to test whether the model proposed in this paper explains significantly more of the variation in observed NTB's than the original GH model does.

The procedure introduced by Davidson and MacKinnon (1981) consists in non-nested J-tests where two types of tests are performed. Table 7 reports results for these two tests under True Participation Shares. In Test I the null hypothesis is that the GH model is the correct one and the alternative hypothesis is that the model proposed in this paper, which I call “Heterogeneity” model, does not add any explanatory power. I reject the null hypothesis that the GH model is the correct one as I find that the Heterogeneity model adds explanatory power. In Test II the “Heterogeneity” is correct under the null hypothesis and the GH model is correct under the alternative hypothesis. This test finds that one cannot reject the null hypothesis that the Heterogeneity model is the correct one at the 1 percent confidence level (one can reject that the Heterogeneity model is the most informative at the 5 percent confidence level, which suggests that there might be some information in the GH model that is not encompassed by the Heterogeneity model).

Table 8 reports results for the same two tests under Constructed Participation Shares. In this case both tests strongly support the “Heterogeneity” model as having stronger explanatory power than the original GH model. In particular, Test II in this case cannot reject the null hypothesis that the Heterogeneity model is the

⁵³ μ_{iF} and σ_{iF} are both between 0 and 1 since they are cumulative density functions therefore their weighted average is between 0 and 1.

⁵⁴ Although the choice of a weighted average as an aggregating function is atheoretical, I evaluate the robustness of this choice by assigning ρ several values.

correct one at all confidence levels.⁵⁵

6 Conclusions

This paper provides a micro-foundation of individual firms' lobbying behavior and develops a model that helps explain a number of empirical features shown in the data. In particular the model explains why larger firms are more likely to lobby and to contribute more and offers a channel through which the size distribution of firms affects lobby participation shares and therefore the level of protection in a sector. It also shows that accounting for individual firm behavior and differences in participation shares across sectors helps explain a larger fraction of the variation of protection across sectors and, therefore, improves on existing theoretical and empirical studies of endogenous protection that employ the "Protection for sale" framework. Nevertheless this paper constitutes a partial attempt to study individual firm lobbying behavior and focuses on a specific game structure and equilibrium selection criterion. It might be interesting to explore different game structures that might explain participation decisions through different mechanisms than the method proposed here.

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⁵⁵These results are particularly relevant if one believes that the True Participation Shares might be measured with error and the Constructed Participation Shares can be considered a theoretically justified instrument.

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Appendices

A Proofs

A.1 Proof of Proposition 1

This Appendix follows Bernheim and Whinston (1986) in describing equilibrium conditions and proofs of Proposition A1. Denote by C_{-ij} (and \tilde{C}_{-ij}) the sum of contributions of all firms except firm j in sector i . I will first prove necessity and then sufficiency.

Proposition A.1 *A configuration $\left(\{C_{ij}^o\}, \{\tilde{C}_{ij}^o\}, \mathbf{p}^o\right)$ is a subgame-perfect equilibrium of the tariff setting game if and only if:*

(i) C_{ij}^o is feasible $\forall ij$;

(ii) $\mathbf{p}^o \in \arg \max \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}) + aW(\mathbf{p})$;

(iii) $W_{ij}(\mathbf{p}^o) - \tilde{C}_{ij}^o(\mathbf{p}^o) + \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^o) + aW(\mathbf{p}^o) \geq W_{ij}(\mathbf{p}) - \tilde{C}_{ij}^o(\mathbf{p}) + \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}) + aW(\mathbf{p})$

$\forall \mathbf{p}, \forall ij \in L$;

(iv) $\exists \mathbf{p}^{-ij} \forall ij \in L$ such that $\mathbf{p}^{-ij} \in \arg \max \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}) + aW(\mathbf{p})$ and $C_{ij}^o(\mathbf{p}^{-ij}) = \tilde{C}_{ij}^o(\mathbf{p}^{-ij}) = 0$.

Proof.

Necessity - Condition (i) states that contributions cannot be larger than total income of firm ij and cannot be negative. Condition (ii) states that the government chooses \mathbf{p} to maximize its objective function, given the equilibrium contribution schedules presented by each firm. Condition (iii) states that the joint surplus of the government and firm ij is maximized at \mathbf{p}^o (otherwise the firm could modify its contribution schedule to induce the choice of a different policy, increase the joint surplus and would retain a fraction of this increased surplus). Condition (iv) states that, due to the timing of the game, firm ij contributes just enough to maintain the government at the same level of welfare that it would achieve if firm ij were not participating in the political game. If condition (iv) were not satisfied then firm ij could lower its contribution schedule by a constant amount and not affect the outcome policy, while strictly gaining.

Sufficiency - By contradiction, suppose $(\{C_{ij}^o\}, \{\tilde{C}_{ij}^o\}, \mathbf{p}^o)$ is not an equilibrium. Then, firm ij could choose a gross contribution schedule \tilde{C}_{ij}^* (with a net contribution schedule C_{ij}^*) that induces the government to choose \mathbf{p}^* and makes the firm better off. That is:

$$C_{ij}^*(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) \geq C_{ij}^*(\mathbf{p}) + C_{-ij}^o(\mathbf{p}) + aW(\mathbf{p}) \quad \forall \mathbf{p}; \quad (\text{A-1})$$

$$W_{ij}(\mathbf{p}^*) - \tilde{C}_{ij}^*(\mathbf{p}^*) > W_{ij}(\mathbf{p}^o) - \tilde{C}_{ij}^o(\mathbf{p}^o). \quad (\text{A-2})$$

By rearranging condition (iii) (applied to \mathbf{p}^*) one obtains the following inequality for $W_{ij}(\mathbf{p}^*) - W_{ij}(\mathbf{p}^o)$:

$$W_{ij}(\mathbf{p}^*) - W_{ij}(\mathbf{p}^o) \leq \tilde{C}_{ij}^o(\mathbf{p}^*) - \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^*) - aW(\mathbf{p}^*) - \tilde{C}_{ij}^o(\mathbf{p}^o) + \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^o) + aW(\mathbf{p}^o),$$

which, combined with (A-2), implies:

$$\tilde{C}_{ij}^*(\mathbf{p}^*) < \left[\sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^o) + aW(\mathbf{p}^o) \right] - \left[\sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) - \tilde{C}_{ij}^o(\mathbf{p}^*) \right],$$

and using (iv), results in:

$$\tilde{C}_{ij}^*(\mathbf{p}^*) < [0 + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij})] - \left[\sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) - \tilde{C}_{ij}^o(\mathbf{p}^*) \right].$$

Since C_{ij}^* is feasible (i.e. non-negative):

$$\tilde{C}_{ij}^*(\mathbf{p}^*) < [C_{ij}^*(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij})] - \left[\sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) - \tilde{C}_{ij}^o(\mathbf{p}^*) \right]$$

or

$$\tilde{C}_{ij}^*(\mathbf{p}^*) + \sum_i \sum_{j \in S_i} C_{ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) - \tilde{C}_{ij}^o(\mathbf{p}^*) < C_{ij}^*(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}). \quad (\text{A-3})$$

We need to distinguish three cases and show that all of them lead to a contradiction thus proving that Proposition 1 does indeed describe the Nash equilibrium of this game.

Case 1: $\tilde{C}_{ij}^*(\mathbf{p}^*) > 0$ and $\tilde{C}_{ij}^o(\mathbf{p}^*) > 0$ or $\tilde{C}_{ij}^*(\mathbf{p}^*) = \tilde{C}_{ij}^o(\mathbf{p}^*) = 0$.

In both instances (A-3) can be re-written as:

$$C_{ij}^*(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) < C_{ij}^*(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}),$$

which violates (A-1) for $\mathbf{p} = \mathbf{p}^{-ij}$.

Case 2: $\tilde{C}_{ij}^*(\mathbf{p}^*) > 0$ and $\tilde{C}_{ij}^o(\mathbf{p}^*) = 0$.

In this case (A-3) can be re-written as:

$$C_{ij}^*(\mathbf{p}^*) + F + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) < C_{ij}^*(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}),$$

which implies that:

$$C_{ij}^*(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) < C_{ij}^*(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}),$$

which violates (A-1) for $\mathbf{p} = \mathbf{p}^{-ij}$.

Case 3: $\tilde{C}_{ij}^*(\mathbf{p}^*) = 0$ and $\tilde{C}_{ij}^o(\mathbf{p}^*) > 0$.

In this case there is no need to use (A-3) to find a contradiction. Faced with the schedules $\{C_{ij}^o\}$, price vector \mathbf{p}^{-ij} maximizes the government objective function (by condition iv). In particular \mathbf{p}^{-ij} is weakly preferred to \mathbf{p}^* :

$$C_{ij}^o(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}) \geq C_{ij}^o(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*). \quad (\text{A-4})$$

Since $\tilde{C}_{ij}^*(\mathbf{p}^*) = 0$ (which implies that $C_{ij}^*(\mathbf{p}^*) = 0$) and $\tilde{C}_{ij}^o(\mathbf{p}^*) > 0$ (which implies that $C_{ij}^o(\mathbf{p}^*) > 0$):

$$C_{ij}^o(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*) > C_{ij}^*(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*). \quad (\text{A-5})$$

Combining (A-4) and (A-5) the following inequality follows:

$$C_{ij}^o(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}) > C_{ij}^*(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*).$$

By definition $C_{ij}^o(\mathbf{p}^{-ij}) = 0$ and knowing that C_{ij}^* is feasible (i.e. $C_{ij}^* > 0$) we can conclude that:

$$C_{ij}^*(\mathbf{p}^{-ij}) + C_{-ij}^o(\mathbf{p}^{-ij}) + aW(\mathbf{p}^{-ij}) > C_{ij}^*(\mathbf{p}^*) + C_{-ij}^o(\mathbf{p}^*) + aW(\mathbf{p}^*),$$

which contradicts (A-1) for $\mathbf{p} = \mathbf{p}^{-ij}$. ■

A.2 Derivation of Proposition 2

This section of the Appendix presents the derivation of Proposition 1 starting from Proposition A1.

Assumption A1: Assume that all firms use contribution schedules that are differentiable around the equilibrium price vector.

This assumption is made by Grossman and Helpman (1994) and is reasonable if we want to prevent mistakes in the calculations of the individual firm from resulting in large swings in the contributions offered. Also, notice that, where differentiable, $\nabla C_{ij}(\mathbf{p}) = \nabla \tilde{C}_{ij}(\mathbf{p})$ because the two differ, at any given point, by a constant.

Condition (ii) implies that:

$$\sum_i \sum_{j \in S_i} \nabla C_{ij}^o(\mathbf{p}^o) + a \nabla W(\mathbf{p}^o) = 0. \quad (\text{A-6})$$

Condition (iii) implies that:

$$\nabla W_{ij}(\mathbf{p}^o) - \nabla C_{ij}^o(\mathbf{p}^o) + \sum_i \sum_{j \in S_i} \nabla C_{ij}^o(\mathbf{p}^o) + a \nabla W(\mathbf{p}^o) = 0 \quad \forall ij \in L. \quad (\text{A-7})$$

Combining (A-6) and (A-7) delivers equation (4) in the main text, which is reported here for convenience:

$$\nabla W_{ij}(\mathbf{p}^o) = \nabla C_{ij}^o(\mathbf{p}^o) \quad \forall ij \in L. \quad (\text{A-8})$$

Summing (A-8) across all lobbying firms and all sectors and substituting the resulting equation into (A-6) delivers the equation (5), also reported here for convenience:

$$\sum_i \sum_{j \in L_i} \nabla W_{ij}(\mathbf{p}^o) + a \nabla W(\mathbf{p}^o) = 0. \quad (\text{A-9})$$

Starting from this first order condition, one has to derive the components of $\nabla W_{ij}(\mathbf{p}^o)$ and $\nabla W(\mathbf{p}^o)$ in order to find the equilibrium price. Consider the impact of the increase in price p_k of good x_k on the welfare of firm ij owner:

$$\frac{\partial W_{ij}}{\partial p_k} = (\delta_{ik} \theta_{ij} - \alpha_{ij}) X_k + \alpha_{ij} (p_k - 1) m'_k,$$

where $\delta_{ik} = 1$ if $i = k$ and $\delta_{ik} = 0$ otherwise, $x_{ij} = \theta_{ij}X_i$ and θ_{ij} is the share of total output in sector i produced by firm j :

$$\theta_{ij} = \frac{x_{ij}}{\sum_{j \in S_i} x_{ij}}.$$

Therefore aggregating over all firms in sector i that make positive contributions, I obtain the impact of an increase of price p_k on the welfare of the set of firms L_i , call it W_{L_i} :

$$\sum_{j \in L_i} \frac{\partial W_{ij}}{\partial p_k} = \frac{\partial W_{L_i}}{\partial p_k} = (\delta_{ik}\theta_i - \alpha_{L_i}) X_k + \alpha_i (p_k - 1) m'_k, \quad (\text{A-10})$$

where $\alpha_{L_i} = \sum_{j \in L_i} \alpha_{ij}$ and $\theta_i = \sum_{j \in L_i} \theta_{ij}$. θ_i is the share of total output in sector i produced by firms that make positive contributions. Now aggregating (A-10) over all sectors we obtain the impact of the change in price p_k on welfare of firms lobbying:

$$\sum_i \frac{\partial W_{L_i}}{\partial p_k} = (\theta_k - \alpha_L) X_k + \alpha_L (p_k - 1) m'_k, \quad (\text{A-11})$$

where $\alpha_L = \sum_i \alpha_{L_i}$ is the share of the population in the economy that owns some specific factor and participates in the political game and $\theta_k = \sum_i \delta_{ik}\theta_i$.

Aggregate welfare is affected by an increase of the price of good x_k according to the following expression:

$$\frac{\partial W}{\partial p_k} = (p_k - 1) m'_k + m_k - d(p_k) + X_k = (p_k - 1) m'_k. \quad (\text{A-12})$$

Notice that in the absence of lobbying the welfare-maximizing domestic price is the international price $p_k = 1$. Now substitute expressions (A-12) and (A-11) into the first-order condition (A-9) and rearrange to obtain the following expression for the domestic price of good x_k :

$$p_k^o - 1 = -\frac{\theta_k^o - \alpha_L}{a + \alpha_L} \frac{X_k^o}{m_k^{l'o}},$$

which, expressed in terms of the tariff yield the equilibrium described in Proposition 2.

A.3 Proof of Proposition 3

This section shows the derivation for Proposition 3.

Firms contribute just enough to compensate the government for the welfare loss relative to free trade. So the necessary contributions at p° are:⁵⁶

$$a(W(1) - W(p^\circ)) = \frac{ab}{2}(p^\circ - 1)^2 \quad (\text{A-13})$$

Let us then calculate the joint surplus of lobby L and candidate participant firm h under firm h participation and firm h exclusion from the lobby, which we denote respectively as Γ° and Γ^{-h} . Denote by p° the equilibrium domestic price resulting from the interaction of the set of firms L (including h) and the government:

$$p^\circ = \frac{\sum_{j \in L} K_j}{ab} + 1 \quad (\text{A-14})$$

The joint surplus Γ° is the difference between the gross profits and the necessary contributions, including the fixed cost of contributing for each firm: $\Gamma^\circ = \sum_{j \in L} (\Pi_j(p^\circ) - F) - a(W(1) - W(p^\circ))$. After substitution Γ° can be rewritten as follows:

$$\Gamma^\circ = \sum_{j \in L} \left(K_j \left(\frac{\sum_{j \in L} K_j}{ab} \right) - F \right) - \frac{\left(\sum_{j \in L} K_j \right)^2}{2ab}. \quad (\text{A-15})$$

Now consider the price that would prevail if firm h did not make positive contributions in equilibrium, p^{-h} :

$$p^{-h} = \frac{\sum_{j \in L, j \neq h} K_j}{ab} + 1 \quad (\text{A-16})$$

The joint surplus for the lobby L and firm h when firm h does not contribute in equilibrium Γ^{-h} depends on the gross profits for both the lobby and firm h and the necessary contributions at the lower price p^{-h} . With firm h exclusion there is also a benefit in terms of reduced resources spent on fixed costs of contributing:

$\Gamma^{-h} = \sum_{j \in L, j \neq h} (\Pi_j(p^{-h}) - F) + \Pi_h - a(W(1) - W(p^{-h}))$. After substitution Γ^{-h} can be rewritten as follows:

$$\Gamma^{-h} = \sum_{j \in L, j \neq h} \left(K_j \left(\frac{\sum_{j \in L, j \neq h} K_j}{ab} \right) - F \right) + K_h \frac{\sum_{j \in L, j \neq h} K_j}{ab} - \frac{\left(\sum_{j \in L, j \neq h} K_j \right)^2}{2ab}. \quad (\text{A-17})$$

It is optimal to include firm h in the lobby if and only if $\Gamma^\circ \geq \Gamma^{-h}$ and this inequality is satisfied if and only if:

$$\frac{K_h^2}{2ab} \geq F. \quad (\text{A-18})$$

⁵⁶For simplicity and since utility is additively separable, imagine there is only one non-numeraire sector: $U = x_0 - \frac{1}{2b}x^2 + \frac{D}{b}x$. Demand of the two goods is $x = D - bp$ and $x_0 = I - x$, where $I = 1 + K(p - 1) + (D - bp - K)(p - 1)$. Substituting into utility, one obtains the indirect utility function $W(p) = 1 + (D - bp) \left(\frac{1}{2}p + \frac{D}{2b} - 1 \right)$

This condition tells us that there is an optimal threshold for the inclusion of firms in the lobby: large firms induce the government to grant higher protection, which brings about a higher benefit for the sector and therefore are efficiently (from the point of view of the lobby) bearing the fixed cost of contributing. Notice that in the absence of a fixed cost it is optimal for the lobby to include all firms in a sector.

B Data

B.1 Federal Election Commission contributions data and COMPUSTAT individual company information

The data set used to identify the firms that participate in the political game was provided by Jim Snyder and is taken from the Federal Election Commission (FEC). The FEC collects information about all Political Action Committees formed: it provides the PAC's name and the sponsor's name, along with data on contributions for all electoral cycles from 1978 to 1998. The FEC identifier does not correspond to any standard company classification so it is necessary to use the name of the PAC sponsor to individually match each PAC to a company listed in COMPUSTAT. In this process I made use of a publication by Congressional Quarterly (CQ) that describes the sponsors of most corporate PAC's. I was unable to match all the PAC's to an individual firm using COMPUSTAT company information, but a reasonable effort was made to look for links between PAC's and companies through company affiliations and subsidiaries (this information was taken from the each company's website). The PAC data set included 3700 entries of which 2040 were matched to individual companies available on COMPUSTAT. Disregarding the banking, insurance, utilities and health sectors, that are not relevant to this study, I can assess the number of unmatched firms to below 500. This number includes several PAC's that I could not classify in any other sector and I therefore reported as potentially relevant to my study (i.e. manufacturing sectors). It is plausible to have introduced some selection bias using this matching procedure: COMPUSTAT covers publicly traded companies, which are plausibly the largest in the industry. In identifying the industry participation threshold with the smallest contributing firm matched, I am potentially overestimating the participation threshold and underestimating the share of total industry output represented by contributing firms. Nevertheless companies that contribute in manufacturing industries are predominantly publicly traded

and, among the PAC's I was unable to match, a large number is private and large (according to CQ PAC's Directory).

B.2 Construction of the characteristics of the size distribution of firms

This section describes the construction of sector-level size dispersion measure. The 1987 US Census of Manufacturing (henceforth USCM) reports the value of total shipments by SIC 4 and provides a breakdown of the total shipments by employment size of the establishment according to ten brackets reported below. The variable *Emplsize* indicates the employment bracket and associated to it is a range that describes the number of employees per establishment in that size category. Below I will describe the implications for my study of the choice of establishment as the unit of observation and I will report the adjustments that I was able to make.

US Census of Manufacturing 1987

Employment brackets

Emplsize	Number of Employees*
1	0 – 4
2	5 – 9
3	10 – 19
4	20 – 49
5	50 – 99
6	100 – 249
7	250 – 499
8	500 – 999
9	1000 – 2499
10	> 2500

*per establishment

The USCM reports the total value of shipments S_i and the total number of establishments n_i for each employment size category i , $i = 1, \dots, 10$. The average and the standard deviation of shipments are calculated

as follows:

$$\mu = \frac{\sum_{i=1}^{10} S_i}{\sum_{i=1}^{10} n_i}$$

$$\sigma = \left(\frac{\sum_{i=1}^{10} n_i \left(\frac{S_i}{n_i} - \mu \right)^2}{\sum_{i=1}^{10} n_i} \right)^{\frac{1}{2}}$$

B.3 Determination of the participation threshold

The FEC reports data on individual firm contributions and therefore cannot be matched to the Census of Manufacturing data directly as firms are generally composed by several establishments. An establishment is defined by the USCM as the "A single physical location where business is conducted or where services or industrial operations are performed", whereas a firm is defined as "A firm is a business organization consisting of one or more domestic establishments in the same state and industry that were specified under common ownership or control". We therefore need to know how many establishments belong on average to each firm of a given size in a given sector. The method used to impute a firm to one of the ten employment categories in the 1987 Census of Manufacturing requires the use of the 1992 Statistics of US Businesses (henceforth SUSB) data on industry (SIC 4) employment. The 1992 SUSB classifies enterprises⁵⁷ in each industry according to the number of employees and reports for each of the six employment categories (which are different from the USCM employment breakdown) the total number of firms and the total number of establishments. It is possible to derive the average number of establishments per firm for a company of a certain size (in terms of employees). After assigning each individual company to an industry and employment bracket (using COMPUSTAT data on employment and SIC category), I divide the number of employees of each firm by the corresponding number of average establishment per firm. I finally used this average number of employees per establishment to assign the firm to the USCM employment category. Identifying the smallest firm contributing in each sector then allows one to find the participation threshold, which is the USCM employment bin where the threshold firm is classified.

⁵⁷The SUSB distinguishes between firms and enterprise using the following criterion. An enterprise is a company that operates in more than one industry and therefore controls several firms across different industries (SIC 4). For my scope I do not make a distinction between the two entities.

Table 1 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>SIC 4 sample - US Census of Manufactures 1987</i>					
Coverage Ratio	226	0.13	0.25	0	1
Total Shipments	226	6,247	13,640	92.9	133,346
Average Shipments	226	23.3	59.8	0.53	639
Shipments St. Dev.	226	43.0	88.8	0.82	797
<i>Firm full sample - COMPUSTAT</i>					
PAC Contributions	3089	8,668	40,518	0	526,956
Total sales	3089	1,525	8,111	0	121,817
Employees	2893	9,389	46,777	1	765,700
<i>Contributing firm sample - COMPUSTAT</i>					
PAC Contributions	478	62,241	88,590	100	526,956
Total sales	374	7,172	18,988	3.5	121,817
Employees	368	43,508	110,162	60	765,700
<i>SIC 4 Sample</i>					
Participation Share	226	0.26	0.25	0	0.95

Notes: Coverage Ratios from UNCTAD 1983. Shipments in million USD. Compustat sample refers to North America Industrial Annual for year 1988. Net annual sales (Compustat series DATA12) in millions USD. PAC contributions in USD. Firm full sample refers to Compustat firms with available total sales data. Contributing firm sample includes only firms contributing to respective PACs. Participation Share is share of output produced by firms of size above the smallest contributing firm.

Table 2 - Size distribution characteristics- Reduced form

Dependent Variable: NTB_i	Regression using Gawande Organization Dummy						Organization Dummy FEC data	
	GB*	I	II	III	IV	V	VI	VII
$I_i(z_i/e_i)$	1.83 (0.74)	1.97 (0.87)	1.47 (0.75)	1.56 (1.04)	1.53 (0.77)	1.58 (0.81)	2.3 (1.16)	1.55 (0.6)
z_i/e_i	-1.73 (0.70)	-1.82 (0.85)	-1.38 (0.73)	-1.46 (1.022)	-1.43 (0.75)	-1.44 (0.79)	-2.21 (1.15)	-1.62 (0.58)
$\sigma_i(/1000)$		0.44 (0.063)	0.37 (0.12)	0.04 (0.018)	0.39 (0.08)	0.48 (0.06)	0.42 (0.06)	
$\mu_i(/1000)$		0.04 (0.04)	0.04 (0.05)	0.01 (0.08)	0.05 (0.05)	0.037 (0.047)	0.033 (0.049)	
I_i			0.01 (0.02)	0 (0.00)	0.01 (0.02)	0.008 (0.019)	0.021 (0.022)	0.024 (0.006)
Total Sales (/10M)			5.6 (7.61)	0.015 (0.007)				
Total Value Added (/1M)					1.5 (1.69)			
Concentration4						-0.015 (0.37)		
Herfindahl						-0.01 (0.009)		
$I_i\sigma_i(/1000)$								0.42 (0.02)
$I_i\mu_i(/1000)$								0.031 (0.008)
$N_i\sigma_i(/1000)$								-1.93 (0.92)
$N_i\mu_i(/1000)$								6.77 (2.1)
F-test joint $\sigma_i \mu_i^{**}$		0.00	0.00	0.04	0.00	0.00	0.00	0.00
F-test model**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J-test overidentification**	0.33	0.2	0.26	0.47	0.23	0.19	0.35	0.37
Centered R^2	0.24	0.32	0.33	0.3	0.32	0.33	0.32	0.33
No. of Observations	226	226	226	226	226	226	226	226
Estimator	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS

Notes: *Gawande and Bandyopadhyay (2000) benchmark. **p-value reported. Robust s.e. in parentheses. All specifications include a constant and controls for intermediate goods tariffs and intermediate goods ntb's, not reported. I_i is a dummy variable taking value 1 if the sector is politically organized (from Gawande and Bandyopadhyay (2000)); z_i is the inverse import penetration ratio divided by 10000 (the import penetration ratio is the ratio of imports to domestic production); e_i is the price elasticity of imports; μ_i is the average of per firm shipments in sector i ; σ_i is the standard deviation of per firm shipments in sector i ; N_i is defined as $(1-I_i)$. In column III the average and the standard deviation of $\log(\text{shipments})$ are reported. Instrument set defined in Appendix Table A1.

Table 3 - Participation and contributions as a function of size

Unit of observation	Dependent Variable	Coefficients of 3-digit SIC level regressions								
		Pooled: All Sectors		Mean	St. Dev.	No. of 3 digit SIC sectors	No. of 3-digit SIC sectors with positive coefficient	No. of 3-digit SIC sectors with positive coefficient		
PANEL 1										
Firm	Contribution level		I	II	III	IV	V	VI	VII	
		Intercept	-0.454 (0.02)	-0.588 (0.058)	-0.54	2.02				
		log(Sales)	0.055 (0.003)	0.094 (0.015)	0.07	0.20	86	83		41
		log(Sales) squared		-0.003 (0.001)						
		No. of Firms	3027	3027						
	Estimator	Tobit	Tobit				Tobit			
PANEL 2										
Firm	Probability of participating of individual firm									
		log(Sales)	0.032 (0.003)		0.07	0.08	81	80	55	
		No. of Firms	3032							
	Estimator	Probit					Linear Probability			
PANEL 3										
SIC4 - Employment bin	Ratio of participating/non-participating firms in each industry/employment bin									
		Intercept	-0.248 (0.031)		-0.267	0.423				
		Employment bin	0.058 (0.007)		0.058	0.079	65	65	38	
		No. of Sectors * Employment bins	2100							
	Estimator	OLS					OLS			

Notes: COMPUSTAT sample. s.e. (in parenthesis) are clustered by industry in the 'Pooled: all sectors' estimations (columns 1 and 2). Sales in million USD. Panel 2: the all sectors Probit model (column 1) reports the marginal effect of log(Sales) computed at the mean. Probit estimation may not be feasible by sector: in several sectors all firms above a certain threshold participate in the political game. The linear probability model allows to estimate the slope of log(Sales) in such cases as well. The number of SIC 4 sectors for which coefficients are estimated is limited by the number of observations per sector. The minimum number allowed in this Table is 4 (qualitatively similar results obtained with higher minima).

Table 4 - Correlation between θ_i , μ_i and σ_i

	μ_i	σ_i	θ_i
μ_i	-		
σ_i	0.6849 (0.00)	-	
θ_i	0.386 (0.00)	0.4738 (0.00)	-

Notes: p-values for pairwise correlation reported in parentheses. Number of obs.: 226 (unit of observation is 4-digit SIC sector). Variable θ_i is defined as the share of total output in sector i produced by firms making positive contributions; remaining variables defined in Notes of Table 2.

Table 5 - True Participation Shares

Dependent Variable NTB _i	
$\theta_i I_i(z_i/e_i)$	13.78 (3.24)
z_i/e_i	-0.28 (0.11)
Implied $a/(1+a)$	0.9986
Implied α_L	0.0197
Estimator	GMM
F-test joint significance $\theta_i I_i(z_i/e_i)$ (z_i/e_i) p-value	0.00
F-test model p-value	0.00
J-test overidentification p-value	0.18
Shea* Partl R ² /Partl. R ²	.92/.91
Shea* Partl R ² /Partl. R ²	.86/.86
Centered R ²	0.25

Notes: *First stage Goodness of fit stats for $\theta_i I_i(z_i/e_i)$ and z_i/e_i . Two-step efficient GMM standard errors in parentheses below coefficients. All variables are defined in Notes of Table 2, except from θ_i , defined in Notes of Table 4. Instrument set defined in Appendix Table A1. All regressions include a constant and controls for intermediate goods tariffs and intermediate goods NTB's, not reported. Unit of observation is 4-digit SIC sector.

Table 6 - Constructed Participation Shares

Dependent Variable NTB _i	$\rho = 1/2$	$\rho = 1/3$	$\rho = 2/3$	$\rho = 1/2$	$\rho = 1/2$
$\theta_i I_i(z_i/e_i)$	7.52 (0.73)	7.52 (0.76)	7.51 (0.71)	6.6 (0.94)	8.82 (0.71)
z_i/e_i	-0.98 (0.11)	-0.88 (0.11)	-1.07 (0.12)	-0.82 (0.15)	-1.61 (0.79)
Implied $a/(1+a)$	1.00	1.00	1.00	1.00	1.00
Implied α_L	0.13	0.12	0.14	0.12	0.18
Estimator	GMM	GMM	GMM	2SLS	Censored 2SLS
F-test joint $\theta_i I_i(z_i/e_i)$ (z_i/e_i)	0	0	0	0	0.02
F-test model	0	0	0	0	0
J-Test overidentification*	0.26	0.3	0.24	0.26	0.26
Shea** Partl R ² /Partl. R ²	.94/.89	.94/.89	.94/.88	.94/.88	.94/.88
Shea** Partl R ² /Partl. R ²	.91/.86	.91/.86	.92/.86	.92/.86	.92/.86
Centered R ²	0.26	0.26	0.26	0.27	0.38***

Notes: Two-step efficient GMM standard errors in parentheses below coefficients. * Hansen J-Test p-value reported. **Goodness of fit stats for $\theta_i I_i(z_i/e_i)$ and z_i/e_i . ***Pseudo R² reported. Variables defined in notes to Table 2 and Table 4. Instrument set defined in Appendix Table A1. All regressions include a constant and controls for intermediate goods tariffs and intermediate goods NTB's, not reported.

Table 7 - Non-Nested Hypothesis Testing for True Theta

Null Hp.	Alternative Hp.	J-Test p-value	Interpretation	Test
GH	Heterogeneity	0.001	Reject null	I
Heterogeneity	GH	0.041	Reject null	II

Notes: Davidson and MacKinnon (1981) specification test for non nested models.

The null hypothesis tested is that the model associated to the null is the "correct model" and that the model under the alternative is uninformative.

Test I supports the Heterogeneity model. Also see Eicher and Osang (2002)

Table 8 - Non-Nested Hypothesis Testing for Constructed Theta

Null Hp.	Alternative Hp.	J-Test p-value	Interpretation	Test
GH	Heterogeneity	0	Reject null	I
Heterogeneity	GH	0.5758	Cannot reject null	II

Notes: Davidson and MacKinnon (1981) specification test for non nested models.

The null hypothesis tested is that the model associated to the null is the "correct model" and that the model under the alternative is uninformative.

Both test I and II support the Heterogeneity model. Also see Eicher and Osang (2002)

Table A1 - Instruments list

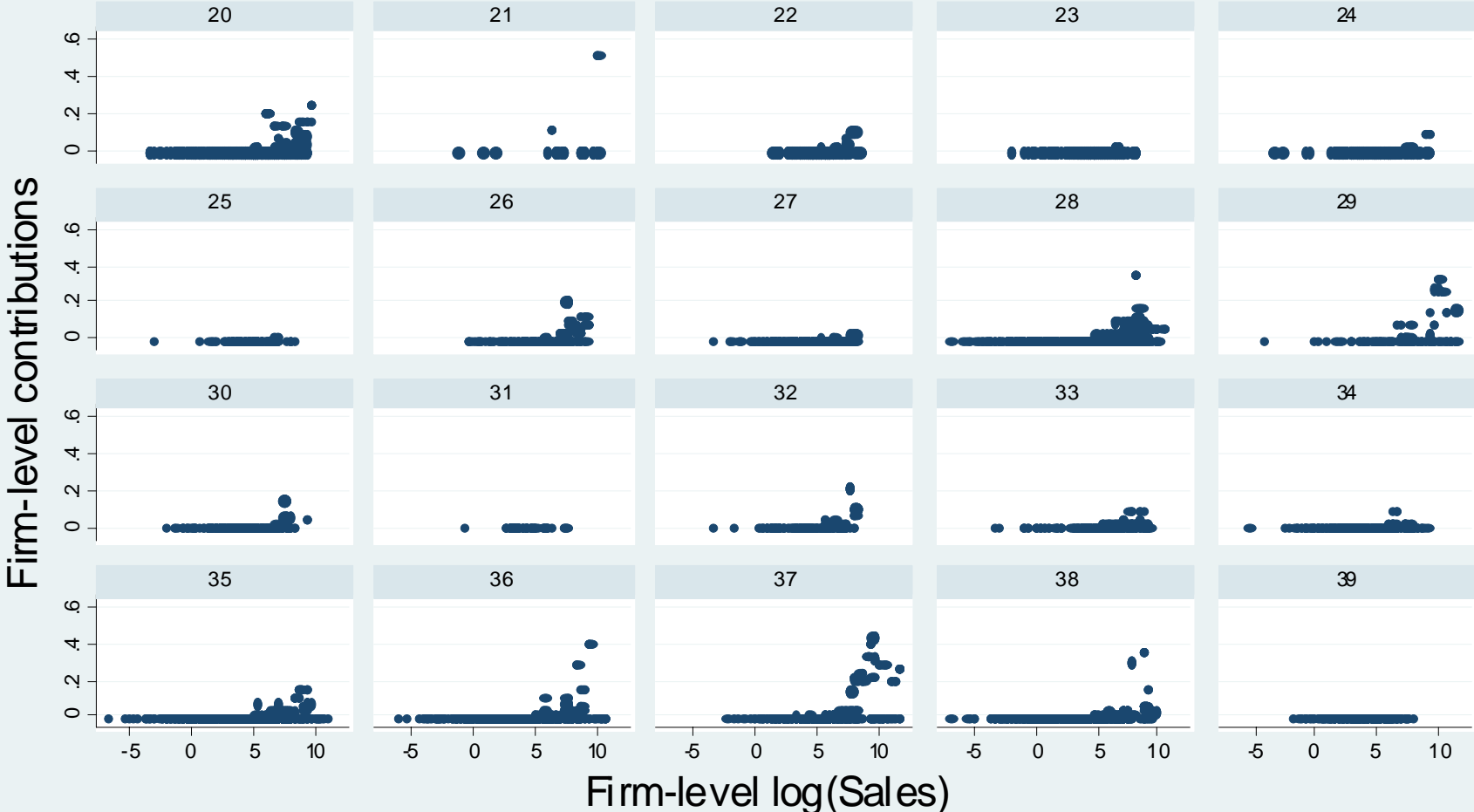
Instruments	Description
1	Average tariff on intermediate goods used in an industry
2	Average coverage ratio on intermediate goods used in an industry
3	Logarithm of the price elasticity of imports (1986)
4	Log percentage of an industry's output used as intermediate good in other sectors
5	Logarithm of the intermediate goods buyer concentration
6	Herfindahl index of the industry
7	Measure of the scale of firms in an industry (value added per firm) (1982)
8	Concentration 4 (share of output in a sector produced by the four largest producers)
9	Share of industry employees defined as Unskilled (1982)
10	Share of industry employees defined as Scientists and Engineers (1982)
11	Share of industry employees defined as Managerial (1982)
12	Real exchange rate leasiticity of imports and exports
13	Cross price elasticity between home production and imports (Shiells et al.)
14	Ad valorem tariff
15	Price elasticity of imports (1986)
16	Capital-labor ratio of the industry x Dummy for Food Processing Industry
17	Capital-labor ratio of the industry x Dummy for Resource-intensive Industry
18	Capital-labor ratio of the industry x Dummy for General Manufacturing Industry
19	Capital-labor ratio of the industry x Dummy for Capital Intensive Industry
20	Average log(sales) by industry from European data (Amadeus Dataset)*
21	Average log(sales) by industry from French data*
	Interactions between instrument 1-9 and 1-21

Notes: Instruments 1-19 are obtained from Gawande and Bandyopadhyay (2000). The set of instruments interactions was selected to optimize the fit of the first stage. *As reported in Helpman, Melitz, Yeaple (2003)

Graph 1

PAC Contributions as a function of firm size

Sector: 2-digit SIC



Graphs by sic2