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ABSTRACT

India's Trade Policy For Sale: How Much? Who Buys?*

This Paper proposes a new method to test the Grossman-Helpman model of endogenous protection and lobby formation. This method, which does not require outside data on lobbies or contributions, identifies politically organized industries for trade protection purposes and calculates equilibrium contributions directly from the model using structural parameter estimates. Its emphasis on vertical inter-industry linkages makes it also possible to trace the effects of duty drawbacks and counter-lobbying from downstream users on endogenous protection. Applied to India, it yields results that are qualitatively consistent with the model's predictions and that seem quantitatively more plausible than estimates given for the US by alternative methods. The weight on social welfare in the government's objective function is 5, and the average contribution per ISIC sector is $33 million.

JEL Classification: F10, F11 and F13
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1 Introduction

Drawing on the pioneering work of Stigler (1971), Peltzman (1976) and Becker (1983) on regulation, one strand of the political-economy literature that has gained prominence in the area of trade policy views the policymaking process as an economic exchange between politicians selling policies and lobbies willing to buy them. Grossman and Helpman (1994), who contributed to make this approach popular, treated the two-way relationship between political support and government favors as a common-agency game a la Bernheim and Whinston (1986a, b). Compared to previous modeling approaches, Grossman and Helpman's takes the theory of endogenous protection closer to 'first-principles' microeconomics and relates equilibrium trade policy to measurable variables such as import-penetration ratios, elasticities, and so on.

In spite of the progress made, a number of puzzles remain. First, Rodrik (1995) pointed out that, according to the logic of the Grossman-Helpman model (henceforth GH), if exporting sectors have larger domestic outputs than import-competing ones —as specialization according to comparative advantage would imply— they should also lobby more aggressively, leading to more export subsidies than import tariffs, a prediction that is difficult to reconcile with evidence.[1] A related point is that import-competing sectors with larger domestic outputs and hence (ceteris paribus) lower import-penetration ratios should also lobby harder and consequently get higher tariffs in equilibrium. However the evidence on this is, at best, mixed. A number of empirical studies (e.g. Marvel and Ray 1983, Baldwin 1985, or Lee and Swagel 1996) found a *positive* —instead of negative— relationship between import-penetration ratios and the level of protection.[2] The logic behind this result was straightforward: high import-penetration ratios proxy for industries where the United

[1] For a discussion of the argument and caveats, see Gawande and Krishna (2003). It is worth noting in particular that a higher domestic output always raises the return to lobbying (as a given tariff increase is spread over larger quantities). Thus, by Hotelling's lemma, any model in which lobbying intensity depends on the price derivative of the profit function will yield this prediction, whether or not based on common agency.

[2] It should be noted however that the relationship between import penetration and endogenous protection turned out to be less clearcut when the endogeneity of imports was explicitly taken into account, as in Ray (1981a) or Trefler (1993).

States has a comparative disadvantage, and those industries tend to lobby harder than others for trade protection.

Goldberg and Maggi (1999, GM henceforth) and Gawande and Bandyopadhyay (2000, GB henceforth) offered a way out of the puzzle. The starting point was to observe that the GH model predicts a different relationship between equilibrium protection and the ratio of domestic output to imports for organized sectors vs. unorganized ones. For the former, the relationship is positive (hence negative between protection and import penetration, as noted above); for the latter, it is the reverse. In order to account for this distinction in the estimation, GM and GB interacted the output/imports ratio with a binary variable equal to one when a sector was politically organized and zero otherwise. Regressing the level of protection, proxied by non-tariff barriers incidence, on this interaction term (for organized sectors) and on the non-interacted output/imports ratio (for unorganized ones and welfare effects), both divided by the elasticity of import demand, yielded parameter estimates in accordance with the model's predictions. GB also showed that GH's parsimonious specification fared well compared to a traditional endogenous-protection regression in which a wide net was cast to catch a variety of politically-related effects (employment, industry concentration, etc.).

These studies and more recent ones (Gawande, Sanguinetti and Bohara, 2001, Mitra, Thomakos and Ulubasoglu, 2002) provide forceful evidence in favor of the common-agency approach to endogenous trade policy. However they also raised, as a by-product, a second puzzle. Structural estimation yields more information than just the validation of qualitative relationships: if the model is to be taken seriously, its estimation should also yield quantitatively plausible estimates of key parameters. For instance, the weight given to welfare in the government's objective function (parameter "a" in GH's formulation) can be retrieved algebraically from regression estimates. However values of a implied by GM and GB's estimates were very high (between 100 and 3000), "enough", in Gawande and Krishna's terms, "to cast doubt on the value of viewing trade policy determination through this political economy lens" (Gawande and Krishna 2003, p. 20). Clearly, more work is needed to ascertain whether implausibly high values of a are regularly generated by the data.

A third issue has to do with the identification of sectors organized into active trade-policy lobbies. GM relied on outside information, looking at Political Action Committee (PAC) contributions and choosing a cutoff above which they considered industries as organized. There are two problems with this. First, PAC contributions are a noisy signal of trade-related influence activities. On one hand, they accounted for only half the campaign contributions in the US 1997-98 electoral cycle, the other half being so-called "soft money" (contributed to national parties rather than individual lawmakers). Influence activities take other forms as well: the turnover of lobbying firms registered under the 1995 Lobbying Disclosure Act was $1.46 billion in the same electoral cycle (CRP 2001). On the other hand, PAC contributions are not necessarily trade-related as lobbies also try to influence domestic policies. Thus, PAC contributions both understate and overstate trade-related influence activities and this may affect the ranking of sectors and hence the cutoff between organized and unorganized ones. Because the distinction between organized and unorganized sectors is so crucial in GM and GB's method, this is a potential problem. Second and perhaps more importantly, relying on PAC contribution data precludes using the method in countries other than the US where no data is available on political contributions. Confined to the US, tests of the theory would rapidly hit diminishing returns; but performing tests outside of the US requires new methods.

Two such methods have been proposed recently. The first one, in a paper by Gawande, Sanguinetti and Bohara (2001) analyzing Mercosur's trade protection, assumes that industries in which imports are above the sample mean are politically organized into protectionist lobbies. The second one, in a paper by Mitra, Thomakos and Ulubasoglu (2002) analyzing Turkey's trade protection, makes use of membership data from the Turkish Industrialist and Businessmen Association to determine which sectors are organized. The authors then statistically validate their choice of organized sectors using discriminant analysis methods. We propose a third method and apply it on India, a country that has, for a variety of reasons, enjoyed a large degree of independence in the determination of its trade policy.

While being close in spirit to the recent literature, our approach differs in three key respects. First, instead of using outside information on industry organization, we endogenously derive from the model a classification of industries into organized vs. unorganized ones through an iterative procedure. In the first stage, we estimate a standard GH equation without differentiating between organized and unorganized sectors. This regression determines endogenous tariffs as functions of, inter alia, import penetration rates. In the second stage, we use the first equation's residuals to rank industries, those with high residuals being, in some sense, more likely to be organized than others. On the basis of this ranking, we set a cutoff value above which industries are considered to be organized. Next, we run a "GM/GB" equation, which generates a new vector of residuals. We repeat the procedure until the sum of squared residuals is minimized, and then choose the cutoff value yielding the *minimum-minimorum*.

Second, we use Mitra's (1999) approach to solve for equilibrium contributions. Mitra modelled lobby formation as the first stage of a two-stage game, the second of which is the determination of tariffs a la GH. In the first stage, special interests decide whether or not to incur the fixed costs of organization given the equilibrium return from being organized. Based on Mitra's approach, we retrieve monetary amounts for equilibrium contributions from parameter estimates. Thus, our empirical methodology puts the Grossman-Helpman model on its head, using information on tariff protection and its determinants as predicted by the model to infer which lobbies are organized for trade protection purposes and how much they contribute.

Third, we refine on GB's modeling of input-output linkages. Treating those linkages explicitly is important both conceptually and empirically. Conceptually, the gist of the common-agency approach is that good policies (small departures from free trade in a trade-policy context) result not just from governments being impervious to influence activities, but also from the balance of conflicting lobbying pressures. Counter-lobbying against protection of an industry by its downstream users is one such countervailing force and is likely to be more effective when those downstream users are industrial rather than final. Recognizing this leads to sharper predictions and hence more powerful tests of the theory. We depart from GB in our use of input-output data to determine jointly the protection of final and intermediate goods. We also draw from Cadot, de Melo and Olarreaga (2003) to include the effect of duty-drawbacks on lobbying incentives.

The results provide strong evidence in favor of the common-agency approach and are encouraging for further applications of the method. Direct producer lobbying has the effect predicted by the theory and is significant at the 1% level. Based on parameter estimates, the weight given to social welfare relative to contributions in the government's objective function is 5.1, well below the problematic 100-3000 estimates found for the US in earlier studies. Out of 81 ISIC sectors, we identify 17 as organized and the mean equilibrium contribution is $33 million per sector after exclusion of three outliers (petroleum refineries, synthetic resins and industrial chemicals).

2 India's Trade Policy

In his review of the World Trade Organization's Trade Policy Review of India in 1998, Panagariya (1999) warned that "a reader unfamiliar with India's past is bound to wonder how a trade-policy regime such as the one about to be described can be characterized as having undergone serious reforms".[3] Indeed, the average tariff was around 35 percent in 1997-1998. The average for manufacturing in our sample is around 40 percent. This compares badly with the average for developing countries in the late 1990s (around 14 percent overall and for manufacturing). For instance, Sub-Saharan Africa's average tariff is 18 percent, South Asia (including India) 24 percent, Latin America and East Asia 10 and 11 percent respectively.

India has a total of 22 tariff bands at the eight-digit level of the Harmonized System, much more than the 4 or 5-band tariff structure common in developing countries. For manufacturing's 81 four-digit ISIC industries, average tariffs vary between 4 percent for Tanneries and leather finishing (ISIC 3231) and 164 percent for Soft drinks and carbonated

[3]For a review of the extensive Indian reforms in the early 1990s, see Pursell (1996) or Srinivasan (2001). As an indication, the average tariff in 1990-1991 was around 128 percent, with an import-weighted average of 87 percent.

waters (ISIC 3134).[4] As noted by the WTO in its 1998 Trade Policy Review of India (WTO, 1998), there is a significant amount of tariff escalation as well. Tariffs on unprocessed goods average 25 percent, against 35 percent for semi-processed goods and 37 percent for fully processed ones. Escalation is particularly high in some industries. For example, the tariff on unprocessed Food, beverages and tobacco (ISIC 311) is around 16 percent, against 30 percent for semi-processed ones and 45 percent on fully processed ones.

The structure of tariffs is further complicated by numerous and spreading exemptions (Panagariya, 1999 and Srinivasan, 2001). These fall into two categories: i) those targeting exporters and ii) those providing exemptions for commodities used for specific purposes (i.e., end-use provisions). The latter only exempt a portion of the tariff line and are fairly discretionary in practice. We abstract from these partial exemptions in the empirical analysis.[5] Exemptions for exporters include a Duty Drawback scheme which compensates exporters for tariffs paid on imported inputs upon export of the finished product; the Duty Exemption scheme, which offers large exporters duty exemption on imported inputs prior to export of the finished product, and the Export Promotion Capital Goods scheme, which provides exporters with access to foreign capital goods at reduced tariff rates.[6] Use of these exporter exemptions schemes has tended to grow significantly since the early 1990s (Panagariya, 1999).

Non-tariff barriers (NTBs) have always been an important part of India's trade policy.[7] Although by April 2001, import licensing had been completely abolished (see Panagariya, 2000 and 2001), over 30 percent of all tariff lines were still subject to some type of non-tariff barrier in 1997-1998. These are broadly divided into three categories: a) *prohibited products* to address religious and cultural concerns. This category only affects 59 tariff lines at the eight-digit level of the Harmonized System and its impact on protection is minimal. b) *canalized imports* to be imported only by designated states agencies. This category

[4]See Table 1 for a description of the basic data used in this paper.

[5]See Table AIII.2 in WTO (1998) for a description of these end-use exemptions, which include, inter alia, wine for the Church, educational movies, medical material, some inputs to the sports goods industry, UNICEF greeting cards, and inputs into the manufacture of fertilisers and the power industry.

[6]For a complete description of these sechemes, see Table III.4 in WTO (1998).

[7]Because NTBs are generally not allowed to GATT members, they have been traditionally justified under the balance-of-payments provisions of GATT Article XVIII:B.

concerns 1.3 percent of all tariff lines in 1997 but more than 19 percent of imports. Of this, 80 percent are petroleum products, 12 percent edible oils, and other food products the rest. c) *restricted items* subject to import licensing. Almost all consumer goods are included, although the incidence is much higher for agriculture than for manufacturing where only 30 percent of value added is subject to a license compared to 84 percent for agriculture (Pursell, 1996). The key document for access to restricted imports is the tradable *Special Import License* issued to large established exporters, exporters of selected items and exporters deemed to achieve certain quality standards.

3 Protection and lobbying: A basic framework

In this section, we present the basic model guiding our empirical estimation exercise. As in Mitra (1999), the political set-up is a two-stage game where owners of specific factors in import-competing industries first decide whether to organize into lobbies or not, after which trade policy is determined by a Grossman-Helpman (1994) common-agency game.[8] The second stage uses a model with $n+1$ goods serving to highlight the role of input-output linkages and duty-drawback schemes.

3.1 Vertical linkages and duty-drawbacks

We start with the second stage. Consider a small open economy with $n+1$ tradable sectors, in which good zero serves as numéraire. Individuals have different endowments but identical tastes represented by a utility function:

$$U = c_0 + \sum_{j=1}^{n} u(c_j), \tag{1}$$

where c_0 is consumption of the numéraire good, c_j is the consumption of non-numéraire good j, and u satisfies the usual properties.

[8] We will use indifferently the terms "common agency" and "menu auction" to describe Grossman-Helpman's application to trade policy of the theoretical framework developed by Bernheim and Whinston (1986a, b). For our purposes, the two are mathematically equivalent.

All goods produced in the economy are potential inputs in other sectors, and all industries are perfectly competitive. In all sectors $j = 1, ..., n$ except the numeraire, technology is Leontief between intermediate consumptions and value added; thus, value added is nested in the Leontief production function and is created using a specific factor κ_j ("capital") and a mobile factor ℓ_j ("labor") under a general constant-returns to scale technology f^j. Let a_{ij} be the requirement of good i necessary to produce one unit of good j, and let x_{ij} be sector j's demand for good i as an intermediate input;

$$y_j = \min \left\{ f^j(\kappa_j, \ell_j); \frac{x_{0j}}{a_{0j}}; \ldots ; \frac{x_{nj}}{a_{nj}} \right\} , \qquad j = 1, ..., n \tag{2}$$

We will henceforth omit κ_j as an argument of production and profit functions. The numeraire good is produced using labor only under constant returns to scale, so that the wage rate w is fixed.

Let p_j^* be good j's world price and t_j an ad-valorem import tariff (subsidy if it is negative); good j's domestic price is thus $p_j = p_j^*(1 + t_j)$. Let $v_j(\mathbf{t})$ be the indirect utility function of the owners of specific capital in sector j, where $\mathbf{t}$ is the n-dimensional vector of tariffs on imported goods (all goods are tradeable). Let α_j be the share of sector j's shareowners in the population. Under quasilinear preferences, v_j is the sum of income and consumer surplus. Income is the sum of profits π_j plus α_j times economywide tariff revenue $T(\mathbf{t})$. Consumer surplus is α_j times economywide consumer surplus $S(\mathbf{t})$. Thus,

$$v_j(\mathbf{t}) = \pi_j(\mathbf{t}) + \alpha_j T(\mathbf{t}) + \alpha_j S(\mathbf{t}).$$

Let L be the set of politically organized industries (determined endogenously in the first stage) and I_j an indicator function equal to one when $j \in L$ and zero otherwise. Lobbies representing the owners of specific capital in those industries bid simultaneously for protection with 'truthful' contribution schedules $C_j(\mathbf{t}) = \max : \{0; v_j(\mathbf{t}) - b_j\}$ for some non-negative constant b_j. Faced with such contributions, the government chooses best-response tariffs that maximize

$$G(\mathbf{t}) = \sum_{j=1}^{n} I_j C_j(\mathbf{t}) + aW(\mathbf{t}), \tag{3}$$

where $W(\mathbf{p})$ is social welfare and a is the weight of social welfare. Therefore tariffs satisfy the FOC:

$$\frac{\partial G(\mathbf{t})}{\partial t_i} = \sum_{j=1}^{n} I_j \frac{\partial v_j}{\partial t_i} + a\frac{\partial W}{\partial t_i} = 0. \tag{4}$$

We now calculate the derivatives in (4) term by term. Suppose that a duty drawback (DD) scheme is in place whereby import duties paid on inputs used by sector j's firms when producing for exports are reimbursed.[9] Let λ_j be the share of good j's production that is exported. As import-competing domestic producers align their prices on the tariff-ridden price of imported goods, on the cost side it does not matter whether intermediates are imported or sourced domestically.[10] The unit cost of intermediate good i to user sector j is given by

$$\phi_{ij} = (1-\lambda_j)p_i^*(1+t_i) + \lambda_j p_i^* = p_i^*[1 + t_i\,(1-\lambda_j)].$$

Sector j's profits are

$$\pi_j(\mathbf{t}) = p_j^*(1+t_j)y_j - \sum_{i=1}^{n} \phi_{ij} a_{ij} y_j = \left[p_j^*(1+t_j) - \sum_{i=1}^{n} p_i^*[1 + t_i\,(1-\lambda_j)]\, a_{ij}\right] y_j,$$

so

$$\frac{\partial \pi_j}{\partial t_i} = \begin{cases} p_i^*\,[1-(1-\lambda_i)\,a_{ii}]\;y_i & \text{for } j = i \\ -p_i^*\,(1-\lambda_j)\,a_{ij}\,y_j & \text{otherwise.} \end{cases}$$

Let m_i be imports of good i. Aggregate tariff revenue net of duty-drawback refunds is

$$T = \sum_i p_i^* t_i \left(m_i - \sum_{j=1}^{n} \lambda_j a_{ij} y_j\right)$$

[9] See Cadot, de Melo and Olarreaga (2003) who showed in a similar setting that in equilibrium the optimal level of reimbursement is full reimbursement of import duties.

[10] Given that only imported intermediates are eligible for the DD, in equilibrium all intermediates used in the production of goods for export are imported. This implies a set of constraints of the form $\sum_j \lambda_j x_{ij} \leq m_i$ for all i. In our data set these constraints are verified for most sectors except where special regimes apply, e.g. for alcohols.

so in the absence of cross-price effects on either supply or demand sides,

$$\frac{\partial T}{\partial t_i} = p_i^* \left[m_i - \sum_{j=1}^{n} \lambda_j a_{ij} y_j + t_i \left(m_i' - \sum_{j=1}^{n} \lambda_j a_{ij} \frac{\partial y_j}{\partial \widetilde{p}_j} \frac{\partial \widetilde{p}_j}{\partial t_i} \right) \right] \tag{5}$$

where $\widetilde{p}_j = p_j^*(1+t_j) - \sum_{i=1}^{n} a_{ij} p_i^* \left[1 + t_i(1-\lambda_j)\right]$ is the "net price" of good j. Letting y_j' stand for $\partial y_j / \partial \widetilde{p}_j$ and noting that

$$\frac{\partial \widetilde{p}_j}{\partial t_i} = \begin{cases} p_i^* \left[1 - a_{ii}(1-\lambda_i)\right] & \text{if } j = i \\ -p_i^* a_{ij}(1-\lambda_j) & \text{otherwise,} \end{cases}$$

we have

$$\begin{aligned} \sum_{j=1}^{n} \lambda_j a_{ij} \frac{\partial y_j}{\partial \widetilde{p}_j} \frac{\partial \widetilde{p}_j}{\partial t_i} &= p_i^* \left\{ \lambda_i a_{ii} \left[1 - a_{ii}(1-\lambda_i)\right] y_i' - \sum_{j \neq i} \lambda_j a_{ij}^2 (1-\lambda_j) y_j' \right\} \\ &= p_i^* \left[\lambda_i a_{ii} y_i' - \sum_{j=1}^{n} a_{ij}^2 \lambda_j (1-\lambda_j) y_j' \right]. \end{aligned}$$

Let $\xi_i = p_i^* \left[\lambda_i a_{ii} y_i' - \sum_{j=1}^{n} a_{ij}^2 \lambda_j (1-\lambda_j) y_j' \right]$. Substituting this into (5) gives

$$\frac{\partial T}{\partial t_i} = p_i^* \left[m_i - \sum_{j=1}^{n} \lambda_j a_{ij} y_j + t_i \left(m_i' - \xi_i \right) \right].$$

Consumer surplus is $S = \sum_i u(c_i) - p_i^*(1+t_i) c_i$, so

$$\frac{\partial S}{\partial t_i} = u'(c_i) c_i' - p_i^* c_i - p_i^*(1+t_i) c_i' = -p_i^* c_i.$$

Combining these gives

$$\frac{\partial v_i}{\partial t_i} = p_i^* \left\{ \alpha_i \left[m_i - \sum_{j=1}^{n} \lambda_j a_{ij} y_j + t_i \left(m_i' - \xi_i \right) - c_i \right] + \left[1 - (1-\lambda_i)\, a_{ii}\right] y_i \right\}.$$

Noting that $m_i - c_i = \sum_j a_{ij} y_j - y_i$,

$$\frac{\partial v_i}{\partial t_i} = p_i^* \left\{ \alpha_i \left[t_i \left(m_i' - \xi_i \right) + \sum_{j=1}^{n} (1 - \lambda_j) a_{ij} y_j - y_i \right] + [1 - (1 - \lambda_i) \, a_{ii}] y_i \right\} \tag{6}$$

and

$$\frac{\partial v_j}{\partial t_i} = p_i^* \left\{ \alpha_j \left(t_i \left(m_i' - \xi_i \right) + \sum_{j=1}^{n} (1 - \lambda_j) a_{ij} y_j - y_i \right) - (1 - \lambda_j) \, a_{ij} \, y_j \right\} \tag{7}$$

Adding up (6) and (7) and aggregating gives

$$\begin{aligned} \sum_{j=1}^{n} I_j \frac{\partial v_j}{\partial t_i} &= I_i p_i^* \left\{ \alpha_i \left[t_i \left(m_i' - \xi_i \right) + \sum_{j=1}^{n} (1 - \lambda_j) a_{ij} y_j - y_i \right] + [1 - (1 - \lambda_i) \, a_{ii}] y_i \right\} \\ &\quad + p_i^* \sum_{j \neq i} I_j \left\{ \alpha_j \left(t_i \left(m_i' - \xi_i \right) + \sum_{j=1}^{n} (1 - \lambda_j) a_{ij} y_j - y_i \right) - (1 - \lambda_j) \, a_{ij} \, y_j \right\} \\ &= p_i^* \left\{ \left[t_i \left(m_i' - \xi_i \right) + \sum_{j=1}^{n} (1 - \lambda_j) a_{ij} y_j - y_i \right] \sum_{j=1}^{n} I_j \alpha_j + I_i [1 - (1 - \lambda_i) \, a_{ii}] y_i \right. \\ &\quad \left. - \sum_{j \neq i} I_j \left(1 - \lambda_j \right) a_{ij} \, y_j \right\}. \end{aligned}$$

Letting $\alpha_L = \sum_{j=1}^{n} I_j \alpha_j$ be the proportion of the population belonging to organized lobbies, this becomes

$$\sum_{j=1}^{n} I_j \frac{\partial v_j}{\partial t_i} = p_i^* \left\{ \alpha_L \left[t_i \left(m_i' - \xi_i \right) + \sum_{j=1}^{n} (1 - \lambda_j) a_{ij} y_j \right] + \left(I_i - \alpha_L \right) y_i - \sum_{j=1}^{n} I_j \left(1 - \lambda_j \right) a_{ij} \, y_j \right\}.$$

Similar calculations for aggregate welfare give

$$\frac{\partial W}{\partial t_i} = \frac{\partial T}{\partial t_i} + \frac{\partial S}{\partial t_i} + \sum_{j=1}^{n} \frac{\partial \pi_j}{\partial t_i} = p_i^* t_i \left(m_i' - \xi_i \right). \tag{8}$$

Combining these, simplifying and rearranging gives the following FOC:

$$\frac{1}{p_i^*} \frac{\partial G(\mathbf{t})}{\partial t_i} = (a + \alpha_L) t_i \left(m_i' - \xi_i \right) + \left(I_i - \alpha_L \right) y_i - \sum_{j=1}^{n} \left(I_j - \alpha_L \right) (1 - \lambda_j) a_{ij} \, y_j = 0,$$

or, after isolating t_i on the LHS and simplifying,

$$t_i = \frac{(I_i - \alpha_L)\, y_i}{-(a+\alpha_L)(m_i' - \xi_i)} - \sum_{j=1}^{n} \frac{(I_j - \alpha_L)\,(1-\lambda_j) a_{ij} y_j}{-(a+\alpha_L)(m_i' - \xi_i)}. \tag{9}$$

In order to convert this expression into elasticities, let ε_i be the own-price elasticity of good i's import demand (in algebraic, not absolute value; i.e. $\varepsilon_i < 0$). In order to limit the demands on data, we will suppose that 'net-price' supply elasticities are all zero.[11] Letting $\widetilde{t}_i = t_i/[p_i^*(1+t_i)]$ and $z_j = y_j/m_i$, (9) can be converted into elasticities:

$$\widetilde{t}_i = \frac{I_i - \alpha_L}{a+\alpha_L} \frac{z_i}{|\varepsilon_i|} - \sum_{j=1}^{n} \frac{I_j - \alpha_L}{a+\alpha_L} (1-\lambda_j) \frac{a_{ij} z_j}{|\varepsilon_i|}. \tag{10}$$

As in GB and GM, the first term in (10) shows that equilibrium tariffs are an increasing function of the output/import ratio for politically organized sectors (and the reverse for unorganized ones). The second term reduces tariffs due to counter-lobbying pressure by organized downstream sectors. However, due to the duty drawback scheme, this counter-lobbying effect is weaker the larger is the exported share of the downstream sector's output.

3.2 Rent sharing and the formation of lobbies

How the rents created by protection at the expense of society as a whole are shared between the government and organized lobbies is determined by the vector of constants $\mathbf{b} = (b_1, ..., b_n)$. Let L be the set of organized lobbies, $C_i(\mathbf{t}, L)$ sector j's contribution function, and $C(\mathbf{t}, L) = [C_1(\mathbf{t}, L), ..., \; C_n(\mathbf{t}, L)]$. We define $C_i(\mathbf{t}, L)$ by

$$C_i(\mathbf{t}, L) = \begin{cases} \max\{0;\, v_i(\mathbf{t}) - b_i\} & \text{if } i \in L, \\ 0 & \text{otherwise.} \end{cases} \tag{11}$$

We will henceforth assume that the constraint $v_i(\mathbf{t}) - b_i \geq 0$ is never binding, so the max expression in (11) can be dispensed of. Let also $F(x_i)$ be the cost of organizing into a lobby

[11] Attempts to estimate supply elasticities from the data proved unconvincing.

for sector i, itself a function of a vector of sector-specific variables x_i.[12] In the following two subsections, we will derive expressions for the sharing of protection rents between lobbies and the government under common agency (CA) and Nash bargaining solution (NBS) approaches.

3.2.1 A common-agency approach

Let stars designate equilibrium values and $\{\mathbf{t}^*, L^*, C^*(\mathbf{t}, L)\}$ be a CA equilibrium. That is,

$$\begin{aligned}
&\mathbf{t}^* = \arg\max\, G\left[\mathbf{t}, C^*(\mathbf{t}, L^*)\right], \\
&\mathbf{t}^* = \arg\max\, G\left[\mathbf{t}, C^*(\mathbf{t}, L^*)\right] + v_i(\mathbf{t}) - C_i^*(\mathbf{t}, L^*) \qquad \forall i \in L^*, \\
&v_i(\mathbf{t}^*) - C_i^*(\mathbf{t}^*, L^*) - F(x_i) \geq v_i(\mathbf{t}) \qquad \forall \mathbf{t}, \forall i \in L^*.
\end{aligned}$$

The first equation states that $\mathbf{t}^*$ is a best response for the government given equilibrium contribution functions. The second states that $\mathbf{t}^*$ is jointly optimal for each pair of one organized lobby and the government. The third states that every organized lobby finds it worthwhile to get organized and contribute rather than stay unorganized. Let

$$\mathbf{t}_{-i} = \arg\max\, G\left[\mathbf{t}, C^*(\mathbf{t}, L^* \backslash i)\right],$$

where $L^* \backslash i$ is the set of industries organized in lobbies in equilibrium minus industry i. Each element b_i of $\mathbf{b}$ is set so as to leave the government just indifferent between (a) adopting the equilibrium tariff $\mathbf{t}^*$ and collecting equilibrium contributions $C^*(\mathbf{t}, L^*)$, and (b) adopting tariff $\mathbf{t}_{-i}$ and collecting contributions from all lobbies in L^* except i (i.e. ignoring lobby i altogether). This thought experiment holds contribution *functions* (the lobbies' strategies) constant but affects the *value* of contributions because $\mathbf{t}_{-i} \neq \mathbf{t}^*$. We also assume, for tractability, that each lobby is small enough that setting its contribution to zero does not affect the equilibrium decision by other sectors to get organized or not. This ensures that

[12] Goldberg and Maggi (1999) include, inter alia, geographic concentration, the proportion of skilled and non-skilled labor, and proxies for entry barriers such as the minimum efficient scale and capital stock as determinants of the likelihood of an industry organizing into a lobby.

the set L^* can be taken as fixed in this thought experiment. Let

$$\begin{aligned}
\Delta G &= G\left[\mathbf{t}^*, C^*(\mathbf{t}^*, L^*)\right] - G\left[\mathbf{t}_{-i}, C^*(\mathbf{t}_{-i}, L^*\backslash i)\right], \\
\Delta W &= W(\mathbf{t}^*) - W(\mathbf{t}_{-i}), \\
\Delta v_j &= v_j(\mathbf{t}^*) - v_j(\mathbf{t}_{-i}).
\end{aligned}$$

The indifference condition can be written as

$$\Delta G = \sum_{j \in L^*} v_j(\mathbf{t}^*) - b_j^* - \left[\sum_{j \in L^*\backslash i} v_j(\mathbf{t}_{-i}) - b_j^*\right] + a\Delta W = 0. \tag{12}$$

As noted above, contribution functions are held constant so the value of the constants b_j^* is the same in the first and second terms of the RHS of (12). Thus, (12) can be rewritten as

$$v_i(\mathbf{t}^*) - b_i^* + \sum_{j \in L^*\backslash i} \Delta v_j + a\Delta W = 0,$$

which implies that the retained share of the protection rents is

$$b_i(L^*) = v_i(\mathbf{t}^*) + a\Delta W + \sum_{j \in L^*\backslash i} \Delta v_j \tag{13}$$

and that equilibrium contributions are

$$C_i^*(\mathbf{t}^*, L^*) = v_i(\mathbf{t}^*) - b_i(L^*) = -a\Delta W - \sum_{j \in L^*\backslash i} \Delta v_j. \tag{14}$$

Thus, positive contributions imply that $a\Delta W + \sum_{j \in L^*\backslash i} \Delta v_j < 0$. Sector i finds it worthwhile to get organized if and only if

$$b_i(L^*) - F(x_i) \geq v_i(\mathbf{t}_{-i}).$$

or, using (13),

$$\begin{aligned}F(x_i) &\leq b_i(L^*) - v_i(\mathbf{t}_{-i}) = v_i(\mathbf{t}^*) + a\Delta W + \sum_{j\in L^*\backslash i} \Delta v_j - v_i(\mathbf{t}_{-i}) \qquad (15)\\ &= a\Delta W + \sum_{j\in L^*} \Delta v_j. \qquad (16)\end{aligned}$$

Note that in the last RHS expression, unlike in the previous one the summation is taken over all sectors in L^*, including i, which is why this expression can be positive. Thus, in equilibrium, for i to contribute and get protection, it must be the case that

$$\Delta v_i > -a\Delta W - \sum_{j\in L^*\backslash i} \Delta v_j = C_i^*(\mathbf{t}^*, L^*), \qquad (17)$$

since otherwise the RHS of (15) could not be positive.

3.2.2 A Nash bargaining approach

Let each sector $i \in L^*$ bargain separately with the government over how the rents from protection are split. The Nash bargaining solution (NBS) maximizes, subject to a feasibility constraint, the product of the bargainers' utilities net of their threat-point utilities, the threat point being the outcome when they fail to agree. We will maintain throughout the analysis the assumption that contributions are truthful, i.e. follow (11). For now, take $\mathbf{t}_{-i}$ as a given mathematical object. We will turn to its construction later on. Let also

$$\begin{aligned}G &= aW(\mathbf{t}) + \sum_{j\in L^*\backslash i} C_j(\mathbf{t}) + C_i\\ G_0 &= aW(\mathbf{t}_{-i}) + \sum_{j\in L^*\backslash i} C_j(\mathbf{t}_{-i})\\ \widetilde{v}_i &= v_i(\mathbf{t}) - C_i\\ \widetilde{v}_{i0} &= v_i(\mathbf{t}_{-i})\end{aligned}$$

for some $\mathbf{t}$. Using these, the NBS solves the following problem:

$$\max_{C_i,\mathbf{t}} \phi_i = (G - G_0)(\widetilde{v}_i - \widetilde{v}_{i0}) \, \forall \, i \in L^* \tag{18}$$

$$\text{s.t. } 0 \leq C_i \leq \Delta v_i. \tag{19}$$

The formulation in (18) subsumes the feasibility constraint in the fact that the variable C_i is the same in the expressions for G and for $\widetilde{v}_i$, so the problem is one of sharing a pie whose size is determined by $\mathbf{t}$. Assume that the constraint on C_i is non-binding. It will turn out to be. The FOC are

$$\frac{\partial \phi_i}{\partial t_j} = \frac{\partial G}{\partial t_j}(\widetilde{v}_i - \widetilde{v}_{i0}) + (G - G_0)\left(\frac{\partial v_i}{\partial t_j} - \frac{\partial C_i}{\partial t_j}\right) = 0 \, \forall \, i \in L^*, \forall \, j = 1, ..., n; \tag{20}$$

$$\frac{\partial \phi_i}{\partial C_i} = \widetilde{v}_i - \widetilde{v}_{i0} - (G - G_0) = 0 \, \forall \, i \in L^*. \tag{21}$$

By truthfulness, the second term in (20) vanishes; so either $\widetilde{v}_i = \widetilde{v}_{i0}$ or $\partial G/\partial t_j = 0$, or both. The first case ($\widetilde{v}_i = \widetilde{v}_{i0}$) implies that $C_i = \Delta v_i$. It will become clear later on that generically (i.e. except for a particular value of relevant parameters) it violates FOC (21) so that case can be discarded. It follows that t_j maximizes the government's objective function, as in the common-agency setup. This is of course not a surprise since the pie to be shared must itself be of maximal size. Thus from now on, in equilibrium $\mathbf{t} = \mathbf{t}^*$. However in the threat point of the bargaining game between i and the government, $\mathbf{t} = \mathbf{t}_{-i}$. How is the latter constructed?

Suppose that sector i retreats altogether from the lobbying process. By the argument above, the government would then choose the optimal value of $\mathbf{t}$ given that the set of organized sectors is now $L^* \backslash i$. This is $\mathbf{t}_{-i}$, which is consequently defined in the same way as in the previous subsection.

Turning now to the second FOC, we have, after substituting the relevant expressions into (21),

$$\Delta v_i - C_i = a\Delta W + \sum_{j \in L^* \backslash i} \Delta v_j + C_i,$$

which means that equilibrium contributions are now

$$C_i^N(\mathbf{t}^*, L^*) = \frac{1}{2}\left(\Delta v_i - a\Delta W - \sum_{j\in L^*\setminus i} \Delta v_j\right) = \frac{1}{2}\left[\Delta v_i + C_i^*(\mathbf{t}^*, L^*)\right].$$

Comparing equilibrium contributions under the NBS and CA approaches gives thus

$$C_i^N(\mathbf{t}^*, L^*) - C_i^*(\mathbf{t}^*, L^*) = \frac{1}{2}\left[\Delta v_i - C_i^*(\mathbf{t}^*, L^*)\right] > 0$$

where $C_i^*(\mathbf{t}^*, L^*)$ is defined in (14) and the last inequality follows from (17) which applies both under CA and NBS. The retained part of the rents is

$$b_i^N = v_i(\mathbf{t}^*) - C_i^N(\mathbf{t}^*, L^*) = v_i(\mathbf{t}_{-i}) + \frac{1}{2}\left(a\Delta W + \sum_{j\in L^*} \Delta v_j\right).$$

The decision to organize then follows the same logic as in the previous subsection.

To sum up, an industry's decision to organize in a lobby results, in Mitra's approach, from a comparison between the costs and benefits of organization. The latter depend on the particular form of the distribution of bargaining power between lobbies and the government. The former are industry specific factors left outside of the model, whereas the latter is the policy rent net of the transfer payment needed to make the government agree to implement the policy (itself a function, inter alia, of its welfare costs). This brief theoretical overview provides a guide for the calculation of contributions and highlights the fact that the decision to organize is endogenous and should be treated as such.[13]

4 Empirical methodology

As explained in the introduction, we base the estimation of equilibrium import tariffs on a careful distinction between organized and unorganized sectors, using an approach that

[13] Two aspects are left outside of this formulation: first, to what extent the policy rent is appropriable by the agents who make the organization decision (residual claimants and beneficiaries of quasi-rents such as skilled workers).On the appropriability issue, see Baldwin and Robert-Nicoud (2001). Second, what is the reservation utility of those agents, itself a function of their mobility.

derives the classification of sectors into organized vs. unorganized ones from the data and the model itself. Before describing the empirical methodology, let us rewrite equation (10) as

$$\frac{|\varepsilon_i|\,\widetilde{t}_i}{z_i} = \frac{I_i - \alpha_L}{a + \alpha_L} - \sum_{j=1}^{n} \frac{I_j - \alpha_L}{a + \alpha_L}(1 - \lambda_j)\frac{a_{ij} y_j}{y_i}. \tag{22}$$

The advantage of rewriting (10) as (22) is twofold. First, sending z_i and ε_i to the left-hand side (LHS) eliminates the need to correct for measurement errors in ε_i and to instrument for z_i and ε_i which are both potentially endogenous. Second, the theoretical equation to be estimated now has a constant, which facilitates the interpretation of some results and avoids biasing the estimates in the presence of missing variables.

4.1 Estimating structural parameters

Our empirical methodology is based on a stochastic version of (22). It has four steps.

Step 1. A stochastic version of (22) is estimated where all I_i are set equal to zero (no information):[14]

$$\frac{|\varepsilon_i|\,\widetilde{t}_i}{z_i} = \gamma_0 + \gamma_1 \sum_{j=1}^{n} a_{ij}\frac{y_j}{y_i} + \gamma_2 \sum_{j=1}^{n} \lambda_j a_{ij}\frac{y_j}{y_i} + \mu_i \tag{23}$$

where μ_i is the error term. Although the algebra implies that $\gamma_1 = -\gamma_0 = -\gamma_2 = \alpha_L/(a + \alpha_L) > 0$, no constraint is imposed at this stage other than $I_i = 0 \ \forall\ i$.

Step 2. Residuals are retrieved from the estimation of (23) and their magnitude is taken to indicate how successful each lobby was in obtaining protection. Let σ_μ be the standard deviation of the error term. The political-organization variable I_i is determined by the following rule:

$$I_i = \begin{cases} 1 & \text{if } \mu_i > \rho\sigma_\mu, \\ 0 & \text{otherwise.} \end{cases} \tag{24}$$

where ρ is a parameter to be estimated by search grid. In words, whenever the error term for observation i is algebraically higher than ρ times the standard deviation, sector i is deemed organized and I_i is set equal to one.

[14] Note that setting all initial I_i to one yields the same equation; only the initial parameters interpretation would be different.

Step 3. The vector $\mathbf{I} = (I_1, ..., I_n)$ constructed according to (24) is introduced into a stochastic, unconstrained version of (22) which is then re-run. Because I_i appears in (22)'s first term while other elements of $\mathbf{I}$ (the I_js) appear in its third term, all terms involving counter-lobbying (terms in a_{ij}) need to be recalculated, since in equilibrium they depend on whether sectors $j = 1, ..., n$ are organized or not.[15] In order to facilitate the interpretation of parameter estimates, we separate them from terms involving counter-lobbying dilution through duty drawbacks (terms involving a_{ij} and λ_j). Before introducing constraints on the parameters, the equation to be estimated is then:

$$\begin{aligned} \frac{|\varepsilon_i| \widetilde{t}_i}{z_i} &= \beta_0 + \beta_1 I_i + \beta_2 \sum_{j=1}^{n} \frac{a_{ij} y_j}{y_i} + \beta_3 \sum_{j=1}^{n} \frac{\lambda_j a_{ij} y_j}{y_i} + \beta_4 \sum_{j=1}^{n} \frac{I_j a_{ij} y_j}{y_i} \\ &+ \beta_5 \sum_{j=1}^{n} \frac{I_j \lambda_j a_{ij} y_j}{y_i} + \mu_i. \end{aligned} \tag{25}$$

The algebra implies that $\beta_2 = \alpha_L/(a + \alpha_L) = -\beta_0 = -\beta_3 > 0$ and $\beta_5 = \beta_1 = -\beta_4 = 1/(a + \alpha_L) > 0$. Thus, the estimation of (25) yields five estimated coefficients (βs) and one supply elasticity (θ) for only two unknown structural parameters: a and α_L. In order to later be able to retrieve these, we also proceed with the estimation of a constrained version of (25) using again (23) as a first step :

$$\frac{|\varepsilon_i| \widetilde{t}_i}{z_i} = \beta_0 \left[1 - \sum_{j=1}^{n} (1 - \lambda_j) \frac{a_{ij} y_j}{y_i} \right] + \beta_1 \left[I_i - \sum_{j=1}^{n} I_j (1 - \lambda_j) \frac{a_{ij} y_j}{y_i} \right] + \mu_i \tag{26}$$

where $\beta_0 = -\alpha_L/(a + \alpha_L) < 0$ and $\beta_1 = 1/(a + \alpha_L) > 0$.

Step 4. The procedure is re-started at the second step until the system either converges or minimizes the sum of squared residuals (this second criterion is used if the system enters a cyclical loop where the same regressions are run in cycles) for each level of ρ. Then a grid search is used to find the ρ that minimizes the sum of squared residuals. The final $\mathbf{I}^*$ vector can then be retrieved. Together, these four steps provide a theoretically consistent

[15] For the same reason instrumenting for I using a polynomial and non-linear method to estimate the tariff equation is not possible as we would run out of degrees of freedom. A panel dataset would allow for this alternative method.

method to determine which sectors are politically organized to influence trade policy when data on political contributions is not available.

We also control for the potential endogeneity of the **I** vector: Sectors finding it profitable to organize are those that can get high protection in equilibrium (see section 3.2 supra). Because **I** appears in the variables associated with β_4 and β_5 in (25), the equation cannot be estimated with 2SLS and two further stages are needed. First, using the determinants of **I** in GM and GB's studies of the US (also to be found in the political economy literature, see Rodrik, 1994), a probit "lobby equation" is estimated. Second, fitted values from that equation are retrieved and used to recalculate the variables in front of β_4 and β_5 in (25), which is then re-run, giving final estimates.

After these four steps, the model's structural parameters can be retrieved from the estimates of β_0 and β_1. Solving for a and α_L gives

$$\begin{aligned} a &= \frac{1+\beta_0}{\beta_1} \qquad (27) \\ \alpha_L &= -\beta_0/\beta_1. \qquad (28) \end{aligned}$$

4.2 Estimating contributions

Estimates of a and α_L can now be used to provide derived estimates of lobbying contributions and an upper bound on the fixed cost of organization incurred by organized import-competing lobbies. We have

$$C_i = \begin{cases} -a\Delta W - \sum_{j\in L^*\backslash i} \Delta v_j & \text{under CA,} \\ \left(\Delta v_i - a\Delta W - \sum_{j\in L^*\backslash i} \Delta v_j\right)/2 & \text{under NBS.} \end{cases}$$

In order to estimate changes in aggregate welfare and in the utility of individual lobbies, we need to calculate the n hypothetical tariff vectors $\mathbf{t_{-i}}$, $i = 1, ..., n$, used in expression (12). This is done by retrieving fitted values of $\widetilde{t}_i$ from a constrained estimation (26) in which I_i is set equal to 0 and repeating the procedure for all $i = 1, ..., n$. We then calculate the percentage difference between this fitted value and the one obtained from the conventional estimation of (26) and apply that percentage change to *actual* tariffs. The resulting values are our estimate of $\mathbf{t_{-i}}$. Estimated import demand elasticities, given in the data appendix, and available data are then used to estimate welfare changes using a discrete version of marginal welfare effects provided in (8).

Because contribution estimates turned out to be fairly high under common agency, we refrained from calculating their NBS values which would be even higher. Those may however be interesting to calculate when CA estimates are on the low side.

5 Empirical Results

Data sources and variable construction are discussed in the data appendix. Table 1 gives the average tariff (t_i), the ratio of output over imports (z_i), intermediate sales of a sector relative to that sector's domestic output ($\sum_j a_{ij}y_j/y_i$), and the number of tariff lines for the sample's 81 ISIC sectors. Note that the variable $\sum_j a_{ij}y_j/y_i$ is not the share of a sector's intermediate sales in its output but the ratio of total purchases of that sector's goods by industrial users relative to its domestic output. As the numerator includes imports, the ratio can be below or above unity. Even when the ratio is above unity, it remains a correct measure of counterlobbying, since when a sector obtains trade protection, downstream users pay more irrespective of whether they source domestically or abroad. The large number of ISIC sectors having the same value of that variable is due to the fact that the a_{ij} coefficients come from an input-output matrix that is more aggregated than the trade data.

Table 1 here

5.1 Estimating parameters

Table 2 provides constrained and unconstrained regression estimates. Unconstrained regression results, reported in the first column, are for $\rho = -0.2$, with the procedure stopped at the 3rd iteration (this cutoff and stopping time minimized the sum of squared residuals). As predicted by the model, producer lobbying (I_i) has a positive influence on tariffs (significant at the 1% level), and so has the share of exports in intermediate sales to organized users ($\sum_j I_j \lambda_j a_{ij} y_j / y_i$, significant at the 5% level). This suggests that duty drawbacks do dilute counterlobbying by downstream users, as argued in the case of Mercosur by Cadot, de Melo and Olarreaga (2003). The share of intermediate sales going to organized sectors ($\sum_j I_j a_{ij} y_j / y_i$), however, is not significant. This insignificance can be interpreted in two ways. It may be that we are simply asking too much information from a relatively small sample. But it may also be that counterlobbying by downstream users is weak and that the duty-drawback dilution either blurs any traceable effect or itself appears significant only fortuitously. Suppose that the second hypothesis is true. This does not imply, however, that counter-lobbying has no effect on the equilibrium outcome. Rivalry among lobbies in a menu auction has two distinct effects: first, it puts downward pressure on the equilibrium level of protection; second, as noted by Gawande and Bandyopadhyay (2000), it raises the contribution required for each lobby to get the equilibrium level of protection.[16]

Table 2 here

Constrained estimates ($\rho = 0.1$, procedure stopped at the 1st iteration) are reported in the second column. The effect of net lobbying (direct and counter-) associated with coefficient β_1 in (26) is positive and significant at the 1% level, as predicted by the model. For unorganized sectors, the effect of output net of intermediate sales on protection, associated with coefficient β_0 in (26), also has the right sign and is significant at the 5% level.

Table 3 provides a list of organized and unorganized sectors. The number of organized sectors is low (17 out of 81) and is probably underestimated.

The identity of organized vs. unorganized sectors makes sense. Sectors derived as unorganized in India include those which are typically organized for protectionist lobbying in industrial countries: practically all the textile and clothing industry, footwear, furniture, and steel. Thus, broadly speaking, the predicted pattern of political organization appears

[16] The effect of counter-lobbying on equilibrium contributions can be calculated algebraically. Let $\widehat{\varphi}_i = \sum_j \widehat{I}_j a_{ij} y_j / y_i$ be our measure of counter-lobbying. The *ceteris-paribus* effect of counter-lobbying on i's estimated contribution is

$$\frac{\partial \widehat{C}_i}{\partial \widehat{\varphi}_i} = \widehat{\beta}_1 \frac{z_i}{|\varepsilon_i|} \left[1 - (1 - \lambda_i) a_{ii}\right] y_i > 0.$$

consistent with the notion that "losers" (sectors in which a country has a comparative disadvantage) are more likely to organize themselves for political action than "winners". However these results should not be taken literally: the small number of organized sectors comes from the fact that the cutoff was set slightly above the regression line. Choosing a lower cutoff would have yielded –perhaps more plausibly– more organized sectors but at the cost of violating the rule of minimizing the sum of squared errors (although the gain was sometimes marginal between two cutoff values).

Table 3 here

Using (27)-(28) and constrained regression estimates, we retrieved numerical values for a and α_L. The implied estimate for α_L, the share of the population employed in industries organized politically for trade-related purposes, is $\widehat{\alpha}_L = (1 - 0.0176)/0.1916 = 0.10$. While still very high, this estimate is arguably more plausible than those derived in previous papers, some of which were as high as 70% on the basis of US data. As for a, the weight of welfare in the government's objective function, (27) gives $\widehat{a} = 5.1$. The value of $\widehat{a}$ that we obtain is well below estimates found for the United States, which are in the hundreds or even thousands, and arguably more plausible. For each dollar of protection-induced deadweight loss, our estimate implies that a lobby would have to contribute five dollars in order to leave the government just indifferent (this is without counting compensation for counter-lobbying, which our calculations suggest can be very large). With an $\widehat{a}$ of 300, by contrast, the lobby would have to contribute 300 dollars, a figure putting the price tag of protection very high indeed. Tests of the non-linear constraints (27)-(28) suggest that $\widehat{a}$ is significantly different from zero at the 1 percent level and fail to reject the hypothesis that α_L is zero.

5.2 Estimating contributions

Implied estimates of equilibrium contributions are provided in the second column of Table 3. Excluding three outliers (petroleum refineries, synthetic resins and industrial chemicals), the total (US$2.6 billion) is without doubt overestimated by a wide margin, albeit by much less than when $\widehat{a}$ is in the hundreds. The average contribution per ISIC sector is \$33 million (\$183 million per contributing sector) excluding the outliers. At \$1.7 billion, petroleum products is by far the wildest outlier. Interestingly, its large estimated contribution compensates for a large welfare loss, whereas chemicals' compensates for losses to downstream sectors.

6 Concluding Remarks

The objective of this paper was to provide an empirical method to identify jointly, on the basis of the Grossman-Helpman approach, what are the driving forces behind observed patterns of trade protection and which sectors find it profitable to organize themselves for trade policy influence. This endeavour is important for two reasons. First, outside of the United States, no information is available on the activity of special-interest groups and on their degree of organization. Taking Grossman-Helpman-Mitra outside of the US, in particular to emerging countries where influence via monetary contributions is most likely to be prevalent, requires an indirect method such as ours. Second, our approach bypasses the problem of disentangling the share of contributions directed at trade-policy influence from the share directed at domestic policies.

Beyond methodological issues, our approach provides further vindication of the common-agency approach to trade-policy determination, yielding plausible results on the forces that shape India's trade policy and on the pattern of political organization across tradeable sectors. We explore trade-policy determination in a formulation embodying vertical linkages through the use of an input-output matrix, so that all tariffs are determined and estimated simultaneously. We also include the effect of duty-drawback schemes whereby exporters recover duties paid on imported intermediate inputs. These schemes reduce the incentive to lobby against upstream protection. We find that the cross-industry pattern of protection relates to import penetration and price elasticities of import demands in the way predicted by the theory, and that resistance to upstream protection is diluted by duty drawbacks, although not particularly when downstream sectors are organized. The significance and robustness of the results is noteworthy given the relatively small sample size (81 observations).

Our inclusive approach makes it also possible to explore a conjecture made by Gawande and Bandyopadhyay (2000). Namely, in a menu-auction model of influence, rivalry among lobbies through vertical linkages can be expected to have two effects: first, to reduce equilibrium protection; second, to raise the equilibrium level of contributions. The contribution-raising effect of counter-lobbying, a standard auction result, emerges (algebraically) in our model, but its protection-reducing effect doesn't (statistically). Thus, in the case of India, the political effect of vertical linkages seems to be to raise the cost of influence while leaving its policy outcome largely unaffected.

The weight on welfare in the government's objective function implied by our estimates is 5.1, well below recent estimates for the United States which range between 100 and 3000. This number is still implausibly high in that it implies that a lobby should contribute five dollars to the government for each dollar of deadweight loss. Given the size of the deadweight losses estimated by empirical studies of the cost of trade protection (see e.g. Gawande and Krishna's 2003 survey) this would put the price tag of protection at a prohibitive level. On that criterion, however, our estimate appears "closer to the truth" than previous ones by a substantial margin.

As for the pattern of political organization, we find that unorganized industries include sectors in which India has a comparative advantage, the pattern of protection and lobbying being, in some sense, the mirror image of that which prevails in industrial countries. Exporter hostility to trade protection seems to be mitigated by duty drawbacks, confirming previous findings, but counterlobbying against protection seems weak in the first place.

Finally, we provide a method to estimate rent transfers on the basis of Mitra's endogenous-lobbying model. We find that excluding three outliers, the average equilibrium contribution was \$33 million per ISIC sector (\$183 million per contributing sector). Being based on a "literal" interpretation of structural parameter estimates and a fair amount of algebra, these numbers should, of course, be taken very cautiously. Indeed, they are likely to be seriously over-estimated, and the interest of the exercise should be thought of as pushing the model to its limit rather than yielding numerically accurate numbers. As it turns out, the model emerges from this brutal exercise with fewer bruises than one might have expected at the outset.

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Data Appendix

Tariff data is for the year 1997 and its source is India’s WTO notification to the Integrated Database System of the WTO. The data comes originally at the six digit of the Harmonised System (5112 tariff line). It was converted to 4 digit of the ISIC classification for manufactures (81 sectors) using a filter developed at the World Bank and which is available from the authors upon request. Output and other industry-type data (employment, number of firms, etc...) are for the years 1993-1995 (average) and its source is UNIDO's Industrial database. Because output is measured at domestic prices, whereas imports are measured at world prices, in order to construct the import penetration ratio (z_j), output was divided by $(1 + t_j)$ before dividing it by imports, so that they are both measured at world prices. Trade data is also for the years 1993-1995 and its source is United Nation's Comtrade. It comes originally at the six digit level of the Harmonized System (HS) and it was filtered using the same concordance as for the tariff data.

Input-output matrix

The input-output matrix is for the year 1994 and its source is the social accounting matrix of GTAP. The GTAP commodity classification differs from the ISIC classification, but a concordance exists to the 3 digit of the ISIC (available upon request). [17] Because our tariff and industry level data is at the 4 digit of the ISIC, we inflate the input-output components of the Social accounting matrix assuming that intermediate sales to GTAP category j are evenly allocated into each ISIC 4 digit sector in GTAP category i. The value and the share of intermediate sales in total output for each ISIC 4 digit sector is then calculated using this "inflated" input-output matrix. Capital stocks are calculated using historic data on gross fixed capital formation from UNIDO, using the permanent inventory method and a 10 percent annual depreciation rate.

Estimating import demand elasticities

India import-demand elasticities at the industry level were estimated using the following methodology. Imported quantities and unit prices at the 6 digit of the Harmonized System for the period 1988 to 1999 was used as raw data (the source is United Nations' Comtrade database). All unit prices are measured at constant 1995 US dollars and the units of imported quantities vary from product to product. Then the following panel regressions

[17] There are five sectors in the GTAP categories that have no correspondance in the ISIC classification, such as services for example.

were run for each 4 digit ISIC category using as observations the information available at the 6 digit of the Harmonized System:

$$\log q_{c,t} = \alpha_c - \varepsilon \log p_{c,t} + \omega \log y_t + \mu_{c,t} \tag{29}$$

where $q_{c,t}$ are quantities of commodity c (at the 6 digit of the HS) at time t (years go potentially from 1988 to 1999, but it depends on how many years each product was imported by India), $p_{c,T}$ is the unit price of commodity c at time t, y_t is India's GDP at time t (the source is World Development Indicators of the World Bank and is also measured in constant US dollars), α_c are commodity dummies, ε is the estimate of the import-demand elasticity and ω is the income elasticity of import demand. We tried alternative specifications using lagged imported quantities as an explanatory variable and the average unit price of other products within the 4 digit ISIC category to capture substitution effects. All estimates were robust. When the number of observations in a 4 digit ISIC sector was smaller than 15, we proceed to estimate the import demand elasticity at the three digit of the ISIC classification. This was done for only two sectors: ISIC 3131 (Distilling Rectifying and Blending Spirits) and ISIC 3853 (Manufactures of watches and clocks). The estimated import demand elasticities are reported in the Table appendix below. All estimates of import demand elasticities are negatives (we report positive the positive values for ε) and only two sectors had import demand elasticities which are not significant at the 5 percent level. These are ISIC 3114 (Canning, preserving of processing of fish, crustacea, etc.) and ISIC 3119 (Manufacture of cocoa chocolate and sugar confectionery). Estimates of import demand elasticity vary between 0.16 for ISIC 3841 (Ship building and repairing) to 3.09 for ISIC 3117 (Bakery products). Income elasticities are not reported below, but they are all positive (except in 7 out of 81 sectors) and significant in 63 industries.

Appendix Table
Import demand elasticity estimates

ISIC	Description	Elasticity	Std Error
3111	Slaughtering, preparing and preserving meat	0.90	0.29
3112	Manufacture of dairy products	1.12	0.36
3113	Canning and preserving of fruits and vegetables	1.74	0.25
3114	Canning, preserving and processing of fish, crustacea, etc..	0.38	0.46
3115	Manufacture of vegetable and animal oils and fats	1.97	0.23
3116	Grain mill products	2.17	0.38
3117	Manufacture of bakery products	3.09	0.47
3118	Sugar factories and refineries	1.00	0.18
3119	Manufacture of cocoa, chocolate and sugar confectionery	0.47	0.39
3121	Manufacture of food products n.e.c.	1.37	0.14
3122	Manufacture of prepared animal feeds	2.57	0.55
3131	Distilling, rectifying and blending spirits	1.77	0.25
3132	Wine industries	1.44	0.20
3133	Malt liquors and malt	2.44	1.18
3134	Soft drinks and carbonated waters industries	2.85	0.36
3140	Tobacco manufactures	1.07	0.30
3211	Spinning, weaving and finishing textiles	1.03	0.04
3212	Made-up textile goods except wearing apparel	0.97	0.05
3213	Knitting mills	0.87	0.36
3214	Manufacture of carpets and rugs	1.32	0.35
3215	Cordage, rope and twine industries	1.27	0.48
3219	Manufacture of textiles n.e.c	0.78	0.28
3220	Manufacture of wearing apparel, except footwear	0.98	0.03
3231	Tanneries and leather finishing	1.21	0.09
3233	Products of leather, except footwear and wearing apparel	0.95	0.05
3240	Manufacture of footwear	1.17	0.29
3311	Sawmills, planing and other woods	1.18	0.14
3312	Manufacture of wooden and cane containers	1.11	0.16
3319	Manufacture of wood and cork products n.e.c.	1.20	0.29
3320	Manufacture of furniture	1.10	0.15
3411	Manufacture of pulp, paper and paperboard	1.42	0.11
3412	Manufacture of containers and boxes of paper and paperboard	1.39	0.25
3419	Pulp, paper and paperboard articles n.e.c	1.16	0.35
3420	Printing, publishing and allied industries	1.00	0.06
3511	Manufacture of basic industrial chemicals except fertilizers	1.33	0.04
3512	Manufacture of fertilizers and pesticides	1.76	0.26
3513	Synthetic resins, plastic mat., man-made fibers except glass	1.43	0.07
3521	Manufacture of paints, varnishes and lacquers	1.30	0.24
3522	Manufacture of drugs and medicines	0.81	0.08
3523	Soap and cleaning preparations, perfumes, cosmetics, etc	1.12	0.12
3529	Manufacture of chemical products n.e.c	0.94	0.12
3530	Petroleum refineries	2.16	0.27
3540	Manufacture of miscellaneous products of petroleum and coal	1.11	0.10
3551	Tyre and tube industries	1.05	0.10
3559	Manufacture of rubber products n.e.c	1.22	0.04
3560	Manufacture of plastic products n.e.c	1.14	0.13
3610	Manufacture of pottery, china and earthenware	1.01	0.10
3620	Manufacture of glass and glass products	1.28	0.06
3691	Manufacture of structural clay products	1.01	0.11
3692	Manufacture of cement, lime and plaster	1.61	0.14
3699	Manufacture of non-metallic mineral products n.e.c	1.13	0.07
3710	Iron and steel basic industries	1.80	0.09
3720	Non-ferrous metal basic industries	1.35	0.08
3811	Manufacture of cutlery, hand tools and general hardware	0.96	0.02
3812	Manufacture of furniture and fixtures primarily of metal	1.35	0.34
3813	Manufacture of structural metal products	0.62	0.14
3819	Fabricated metal products except machinery and equipment	1.02	0.07
3821	Manufacture of engines and turbines	0.50	0.11
3822	Manufacture of agricultural machinery and equipment	0.66	0.08
3823	Manufacture of metal and wood working machinery	0.37	0.04
3824	Special industrial machry and equip. except metal and wood machry	0.66	0.08
3825	Manufacture of office, computing and accounting machinery	1.09	0.09
3829	Machinery and equipment except electrical, n.e.c.	0.79	0.03
3831	Manufacture of electrical industrial machinery and apparatus	1.03	0.01
3832	Radio, television and communication equipment and apparatus	1.01	0.02
3833	Manufacture of electrical appliances and housewares	1.15	0.11
3839	Manufacture of electrical apparatus and supplies n.e.c.	0.98	0.04
3841	Ship building and repairing	0.16	0.07
3842	Manufacture of railroad equipment	0.25	0.11
3843	Manufacture of motor vehicles	0.48	0.10
3844	Manufacture of motorcycles and bicycles	1.00	0.14
3845	Manufacture of aircraft	0.35	0.11
3849	Manufacture of transport equipment n.e.c.	0.28	0.02
3851	Professional and scientific, and measuring and controlling equipt	0.97	0.02
3852	Manufacture of photographic and optical goods	0.94	0.02
3853	Manufacture of watches and clocks	0.94	0.01
3901	Manufacture of jewelry and related articles	1.23	0.11
3902	Manufacture of musical instruments	0.85	0.13
3903	Manufacture of sporting and athletic goods	1.29	0.18
3909	Manufacturing industries n.e.c.	0.94	0.03

Table 1
Sample data

ISIC	Description	t_i	z_i	$\sum_j \frac{a_{ij} y_j}{y_i}$	# lines
3111	Slaughtering, preparing and preserving meat	19	3	7.54	77
3112	Manufacture of dairy products	32	392	0.3	23
3113	Canning and preserving of fruits and vegetables	37	10,390	5.4	63
3114	Canning, pres. and process of fish, crustacea and sim foods	41	173	1.12	19
3115	Manufacture of vegetable and animal oils and fats	38	46	0.13	47
3116	Grain mill products	34	88	0.17	34
3117	Manufacture of bakery products	43	42	1.38	13
3118	Sugar factories and refineries	34	651	0.16	14
3119	Manufacture of cocoa, chocolate and sugar confectionery	39	248	6.26	13
3121	Manufacture of food products not elsewhere classified	43	46	0.27	31
3122	Manufacture of prepared animal feeds	23	28	1.67	2
3131	Distilling, rectifying and blending spirits	105	31,538	1.15	1
3132	Wine industries	96	123	10.53	7
3133	Malt liquors and malt	57	1,206	2.23	3
3134	Soft drinks and carbonated waters industries	164	53	2.99	9
3140	Tobacco manufactures	45	895	0.43	6
3211	Spinning, weaving and finishing textiles	42	46	0.06	389
3212	Manuf. of made-up textile goods except wearing apparel	45	12	13.21	64
3213	Knitting mills	45	207	1.22	18
3214	Manufacture of carpets and rugs	46	937	8.15	27
3215	Cordage, rope and twine industries	45	65	5.86	12
3219	Manufacture of textiles not elsewhere classified	44	8	4.37	26
3220	Manufacture of wearing apparel, except footwear	45	597	0.3	257
3231	Tanneries and leather finishing	4	8	0.12	21
3232	Fur dressing and dyeing industries	13	0	752.16	6
3233	Manuf. of prod. of leather & leather substit., exc. footwear	45	7	0.53	20
3240	Manufacture. of footwear	45	1,850	0.13	14
3311	Sawmills, planing and other wood mills	35	35	0.56	25
3312	Manufacture of wooden and cane containers and small cane	35	58	9.28	5
3319	Manuf. of wood and cork products not elsewh. class.	35	49	8.97	8
3320	Manuf. of furniture and fixtures, except primarily of metal	45	27	6.27	23
3411	Manufacture of pulp, paper and paperboard	25	6	0.4	104
3412	Manuf. of containers and boxes of paper and paperboard	45	46	2.21	8
3419	Manufacture of pulp, paper and paperboard articles n.e.c.	45	40	7.51	11
3420	Printing, publishing and allied industries	24	27	0.53	27
3511	Manufacture of basic industrial chemicals except fertilizers	34	2	0.44	500
3512	Manufacture of fertilizers and pesticides	22	9	0.24	27
3513	Manuf. of synthetic resins, plastic mat. and man-made fibres	36	7	0.39	114
3521	Manufacture of paints, varnishes and lacquers	35	94	0.9	12
3522	Manufacture of drugs and medicines	34	15	0.32	60
3523	Manuf. of soap and cleaning prep., perfumes, cosmetics	45	41	0.94	32
3529	Manufacture of chemical products not elsewhere classified	35	8	0.81	76
3530	Petroleum refineries	34	3	0.78	23
3540	Manufacture of miscellaneous products of petroleum & coal	33	33	4.86	8
3551	Tyre and tube industries	42	177	0.73	13
3559	Manufacture of rubber products not elsewhere classified	45	11	1.47	36
3560	Manufacture of plastic products not elsewhere classified	37	45	0.65	50
3610	Manufacture of pottery, china and earthenware	42	21	2.07	14
3620	Manufacture of glass and glass products	44	12	0.64	58
3691	Manufacture of structural clay products	42	56	0.53	14
3692	Manufacture of cement, lime and plaster	39	13,293	0.14	8
3699	Manufacture of non-metallic mineral products n.e.c.	44	26	0.32	56
3710	Iron and steel basic industries	33	16	0.83	163
3720	Non-ferrous metal basic industries	31	5	1.15	152
3811	Manufacture of cutlery, hand tools and general hardware	35	9	0.04	80
3812	Manufacture of furniture and fixtures primarily of metal	45	571	0.19	3
3813	Manufacture of structural metal products	28	15	0.05	23
3819	Manuf. of fabricated metal prod. except mach. and equipment	36	25	0.02	124
3821	Manufacture of engines and turbines	25	10	0.34	16
3822	Manufacture of agricultural machinery and equipment	27	66	0.43	33
3823	Manufacture of metal and wood working machinery	25	3	0.97	92
3824	Manuf. of special industrial mach. and equipment except metal	25	3	0.2	136
3825	Manufacture of office, computing and accounting machinery	39	4	0.54	30
3829	Machinery and equipment except electrical n.e.c.	29	4	0.17	192
3831	Manufacture of electrical industrial machinery and apparatus	30	13	0.14	65
3832	Manuf., television and comm. equipment and apparatus	38	5	0.16	81
3833	Manufacture of electrical appliances and housewares	44	112	1.06	25
3839	Manufacture of electrical apparatus and supplies n.e.c.	41	16	0.2	35
3841	Ship building and repairing	19	6	1.03	20
3842	Manufacture of railroad equipment	40	34	0.4	22
3843	Manufacture of motor vehicles	43	33	0.07	52
3844	Manufacture of motorcycles and bicycles	44	136	0.2	22
3845	Manufacture of aircraft	16	0	1.81	19
3849	Manufacture of transport equipment n.e.c.	45	190,624	2.22	1
3851	Manuf. of prof. & scientific, and measuring & controlling	26	1	0.95	77
3852	Manufacture of photographic and optical goods	38	4	3.37	59
3853	Manufacture of watches and clocks	39	14	2.1	52
3901	Manufacture of jewellery and related articles	40	0	1.58	22
3902	Manufacture of musical instruments	35	17	51.5	23
3903	Manufacture of sporting and athletic goods	31	35	20.97	22
3909	Manfuacturing industries not elsewhere classified	42	6	3.02	97

Table 2

Explaining India's tariff structure

	Unconstr.[a]	Constrained[b]
Dependent variable: $\lvert\varepsilon_i\rvert \widetilde{t}_i / z_i$		
Producer lobbying (I_i)	0.1392	
	(2.72)	
Intermediate sales ($\sum_j a_{ij} y_j / y_i$)	0.0031	
	(0.31)	
Duty drawback ($\sum_j \lambda_j a_{ij} y_j / y_i$)	-0.1869	
	(-1.99)	
Downstream counter-lobbying ($\sum_j I_j a_{ij} y_j / y_i$)	0.0022	
	(0.20)	
Lobbying effect of duty drawback ($\sum_j I_j \lambda_j a_{ij} y_j / y_i$)	0.1875	
	(1.99)	
Net lobbying ($I_i - \sum_j I_j (1 - \lambda_j) a_{ij} y_j / y_i$)		0.1916
		(2.54)
Net welfare effect ($1 - \sum_j (1 - \lambda_j) a_{ij} y_j / y_i$)		-0.0176
		(-2.28)
R^2-adj.	0.89	0.26
# obs.	81	81
Number of organized sectors		17

Notes

Estimation by OLS, White-robust t-statistics in parentheses.

a) Cutoff at -0.2 standard deviation below regression line.

b) Cutoff at 0.1 standard deviation above regression line; procedure stopped at 1st iteration.

Table 3

Estimated organization dummy (I) and contributions

ISIC	Description	Organization	Contribution ($m)
3111	Meat prep.	1	22.9
3112	Dairy prod.	0	n.o.
3113	Canned fruit & veg.	0	n.o.
3114	Canned fish&crust	0	n.o.
3115	Veg & animal oils & fats	0	n.o.
3116	Grain mill prod.	0	n.o.
3117	Bakery prod.	0	n.o.
3118	Sugar refineries	0	n.o.
3119	Cocoa confect.	0	n.o.
3121	Food prod. Nec	0	n.o.
3122	Prep. Animal feeds	0	n.o.
3131	Alchoholic bev.	0	n.o.
3132	Wine industries	1	10.5
3133	Malt liquors&malt	0	n.o.
3134	Soft drinks	1	29.1
3140	Tobacco manuf.	0	n.o.
3211	Spinning textiles	0	n.o.
3212	Made-up textile goods	0	n.o.
3213	Knitting mills	0	n.o.
3214	Manuf. Carpets&rugs	0	n.o.
3215	Cordage, rope	0	n.o.
3219	Textiles nec	0	n.o.
3220	Apparel, ex. Footwear	0	n.o.
3231	Tanneries and leather	0	n.o.
3232	Fur dressing&dyeing	0	n.o.
3233	Leather ex. Footwear	1	29.8
3240	Footwear	0	n.o.
3311	Sawmills&wood mills	0	n.o.
3312	Wooden&cane containers	0	n.o.
3319	Wood&cork prod. Nec	0	n.o.
3320	Furnitures	0	n.o.
3411	Paper and Paper board	0	n.o.
3412	Paper boxes	0	n.o.
3419	Pulp & paper	0	n.o.
3420	Printing & publishing	0	n.o.
3511	Chemicals	1	648
3512	Fertilizers and pest.	0	n.o.
3513	Synthetic resins	1	719
3521	Paints	0	n.o.
3522	Drugs and medec.	0	n.o.
3523	Soap and cleaning	0	n.o.
3529	Chemical prod. Nec.	0	n.o.
3530	Petroleum refineries	1	1790
3540	Misc of petroleum	0	n.o.
3551	Tyre & tube indus.	0	n.o.
3559	Rubber prod. Nec	0	n.o.
3560	Plastic prod. Nec.	0	n.o.
3610	"Pottery, china"	0	n.o.
3620	Glass	0	n.o.
3691	Structural clay	0	n.o.
3692	Cement, lime	0	n.o.
3699	Non-metallic nec	0	n.o.
3710	Iron and steel	0	n.o.
3720	Non Ferrous metallic	1	572
3811	Cutlery, handtools	0	n.o.
3812	Metal Furniture	0	n.o.
3813	Metal Products	0	n.o.
3819	Metal prod. Nec.	0	n.o.
3821	Engines	0	n.o.
3822	Agricul. Machiner	0	n.o.
3823	Metal and wood mach.	0	n.o.
3824	Special ind. Machinery	1	373
3825	Office & computing eq.	1	230
3829	Equipment except. electr.	1	470
3831	Electrical industrial mach.	0	n.o.
3832	Radio, TV, & comm.	1	466
3833	Electrical appliances	0	n.o.
3839	Electrical eq. Nec	0	n.o.
3841	Ship building	0	n.o.
3842	Railroad equipment	0	n.o.
3843	Motor vehicles	0	n.o.
3844	Motorb. & bicycles	0	n.o.
3845	Aircraft	1	28.3
3849	Transport equip. Nec	0	n.o.
3851	Scientific equipment	1	89.5
3852	Optical goods	1	16
3853	Watches and clocks	0	n.o.
3901	Jewellery	1	139
3902	Musical inst.	0	n.o.
3903	Sporting goods	0	n.o.
3909	Manuf. prod. Nec	1	80.7