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Politics and Trade Policy:
An Empirical Investigation

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Abstract

In this paper we examine the empirical relevance of three prominent endogenous protection models. Is protection for sale, or do altruistic policy makers worry about political support? We find strong evidence that protection is indeed "for sale." The important new result is, however, that not only the existence of lobbies matters, but also the relative size of the sectoral pro and anti protection contributions. All variables of both the *Influence Driven* (Grossman and Helpman, 1994) and the *Tariff Function* (Findlay and Wellisz, 1982) models are significant at the one percent level.

Novel is our application of a single, unified theoretical framework to take strict interpretations of the three theoretical models to the data. We thus extend the previous tests of the Influence Driven approach by comparing its performance to well specified alternatives. Using J tests to compare the power of the models directly, we find significant misspecification in the Political Support Function approach. We cannot reject the null hypothesis of correct specification of the Influence Driven model and find evidence of some misspecification in the Tariff Function model.

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1 Introduction

The trade literature offers a variety of competing explanations for the prevailing trade policies. In contrast to the traditional models that analyze trade policy in terms of economic efficiency, the lion's share of the recent literature is based on distributional considerations. In these endogenous protection models, self-interested politicians use trade policy to transfer income to particular interest groups. Given that contributions from lobbies and Political Action Committees figure prominently in the political landscape where tariffs, quotas, and voluntary export restraints exist in spite of their large social costs, this recent literature seems to provide particularly intuitive explanations for the observed pattern of protection.

Since the early 1980's, several alternative political economy approaches to endogenous protection have been advanced. There does not exist, however, a comparative study that takes the exact theoretical models to the data in order to examine their comparative empirical relevance. Previous empirical studies of the political economy determinants of trade protection are numerous, but rely on reduced forms (see Rodrik, 1995, for an excellent survey). However, the reduced form approach introduces ambiguity as to which model is actually tested, and the choice of independent variables is the subject of profound concern (see Rodrik, 1995).[1] Even more importantly, the distinct differences in the theoretical structures of the models have to date not permitted a comprehensive assessment as to exactly which approach to endogenous protection is more empirically relevant.[2]

The lack of comparative empirical tests can be attributed to the absence of a unified theory. In a recent paper, however, Helpman (1997) developed a comprehensive framework that we utilize to derive empirical models of endogenous protection that render the theoretical approaches easily comparable. Specifically, we test the tariff

[1] For the most extensive comparison of endogenous tariff formation models within this traditional framework see Gawande (1998). Aside from significance, his measure of validity is "that at least some subset of variables representing [any one] theory is shown to have the correct sign."

[2] For example, Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) develop excellent tests of the "Influence Driven Contributions" approach popularized by Grossman and Helpman (1994). The pattern of protection in the data seems to be consistent with the model's predictions. No matter how significant the results of one model may be, there still remains interest in ascertaining its predictive power relative to alternative models of endogenous protection.

formulas that are predicted by the political equilibria of the Influence Driven (Grossman and Helpman, 1994), Tariff Function (Findlay and Wellisz, 1982), and the Political Support Function (Hillman, 1982) approaches. This allows us to extend the tests of the Influence Driven model by Goldberg and Maggi (1999) (G-M from hereout) and Gawande and Bandyopadhyay (2000) (G-B from hereout) and compare the performance of all three approaches. This juxtaposition is especially relevant, since the Influence Driven model contains essential elements of both Tariff Function and Political Support Function.[3]

Helpman's (1997) theoretical framework holds clear implications for empirical testing: the sectoral import elasticities and the levels of import penetration are crucial variables for all models. Depending on the nature of the specific approach, these variables are augmented with additional explanatory variables suggested by the theory. This allows us to estimate key parameters, and to test the models' respective significance for endogenous protection. In the Political Support Model we introduce measures of sectoral profits and welfare to estimate the marginal rate of substitution between the two in the government's political support function. In the Tariff Function model we employ contributions to estimate the pro or anti tariff contributions' weights in the tariff function. In the Influence Driven model we utilize a measure of organization to test whether contributions or the existence of a lobby matter and to estimate the model's key parameters.

Our estimation takes into account the possible endogeneity of independent variables. Using a Tobit, instrumental variable approach and a GMM minimum distance estimator (MDE), the empirical results yield little ambiguity. The Political Support model does not perform well throughout; this may be due to imperfect data proxies (especially profit measures), or it may be a function of the model's inability to account for direct lobbying actions. The one interesting aspect about the estimation of the Political Support model is that the weight that the government places on welfare, relative

[3] The Tariff Function model focuses on contributions, much like the Influence Driven model, although the latter emphasizes the importance of organized lobbies. The Political Support model maximizes the government's support from consumers and firms. This is similar to the Influence Driven model, in which case governments care about consumers and firms, but also worry about their own welfare.

to profits, is large (but not statistically significant) and of similar magnitude as the one we estimate for the Influence Driven approach.

In clear contrast, the Tariff Function approach performs strongly. All coefficients are of the correct sign, and significant at the 1 percent level. Sectoral contributions are shown to have a strong positive impact on tariffs. In the absence of lobbying contributions, the relationship between import penetration and endogenous protection is positive, although the estimate is three orders of magnitude smaller than the estimate on contributions. The weight of supporters' contributions in the tariff formation function is estimated to be twice as large as the one associated with contributions of tariff opponents.

The Influence Driven model is also strongly confirmed, with all coefficients exhibiting the correct sign and strong statistical significance. In contrast to G-M, all three predictions of the model can be confirmed at the 1 percent level: a) protection is shown to be higher in industries represented by lobbies and with lower import elasticity, b) tariffs increase with import penetration in unorganized sectors, c) tariffs decrease with import penetration in organized sectors. In estimating the model's key parameters, we find, much like G-M, that the government's weight on aggregate welfare is about 10 times of what it attaches to contributions. This result contrasts with G-B, who find that the government has about equal weights on contributions and national welfare.

While our estimated government weight on aggregate welfare is very similar to G-M, our estimates indicate that about 26 percent of the population owns sector specific inputs, a more realistic number than the 88 percent estimated by G-M. Overall, we interpret our results of the Influence Driven model as a broad confirmation of previous tests of the Influence Driven model (G-M and G-B). The consistency of the results across the three papers is impressive, especially given the different methodologies, data sets, and specifications.

Since the Influence Driven model and the Tariff Function model both perform well when taken to the data, the question arises: does a combination of the two improve the estimation of endogenous protection, or doe s if one of the variables hold relatively more explanatory power? We find that the key variable of the Influence Driven model (an indicator variable that identifies the existence of an organized lobby) seems to be more significant than the pure volume of sectoral lobby expenditures.

To formally juxtapose all three models we employ J-Tests. We cannot reject the null hypothesis of correct specification of the Influence Driven model, but find evidence of some misspecification in the Tariff Function, and of significant misspecification in the Political Support Function approach. The results provide additional evidence as to the strength and robustness of the Influence Driven model and to the significance of the Tariff Function model in explaining endogenous protection. Our tests of the strict theories add to the voluminous empirical literature on protection that focussed on heuristic or general factor endowment approaches, such as Ray (1981), Baldwin (1985), or Trefler (1993). Especially interesting is the comparison of our results to the findings of previous reduced form juxtapositions of endogenous tariff formation models in Gawande (1998). He finds, similar to our results, that the political-self-interest/special-interest model performs best against alternative models, while the public-interest/political-altruism type model associated with Hillman (1982) evidence is at best weak.

The remainder of the paper is organized as follows. The theoretical framework of endogenous protection is reviewed in section 2. We discuss the empirical methodology used to estimate the three models in Section 3. Data issues and empirical results are discussed in sections 4 and 5, respectively. Section 6 concludes the paper. All tables are relegated to the appendix.

2 Theoretical Approaches to Endogenous Protection

We commence by outlining the common theoretical framework that serves as the basis for our empirical analysis. The analysis is a succinct representation of Helpman (1997), who discusses both the motivations and derivations in detail. The critical advantage of Helpman's (1997) model is that the derived equations for endogenous protection are sufficiently similar to allow for comparative testing of the various approaches. In addition, the model nicely highlights the common fundamental structure that the models share.

Consider a continuum of individuals, j, populate an economy whose population size is normalized to unity. Each individual possesses a utility function

$$u(c) = c_o + \sum_{i=1}^{n} u_i(c_i) \tag{1}$$

where c_i is consumption of product i. A numeraire good, indexed 0, is produced using only one unit of labor per unit output. All other products are produced with labor and a sector-specific input.

An individual owns l^j of the aggregate labor supply, and γ_i^j of the sectors' specific input. The wage rate then equals one, and the return to a sector specific input, $\Pi_i(p_i)$, is an increasing function of the producer price, p_i. Let aggregate imports be denoted by M_i, and normalize all foreign prices to unity, which implies $p_i = \tau_i$, and $\tau_i > 1$ for positive rates of protection. Finally, suppose that the government redistributes tariff revenue lump-sum, and uniformly to all individuals. The reduced form of the indirect utility function can then be written as an additive composite of the incomes derived from labor, transfer and the specific factor incomes, plus the consumer surplus, S_i:

$$\hat{v}(\tau, \gamma^j) = l^j + \sum_{i=1}^{n}(\tau_i - 1)M_i(\tau_i) + \sum_{i=1}^{n}\gamma_i^j\Pi_i(\tau_i) + \sum_{i=1}^{n}S_i(\tau_i), \tag{2}$$

By integrating over all individuals (2), the aggregate welfare is given by

$$W(\tau) = 1 + \sum_{i=1}^{n}(\tau_i - 1)M_i(\tau_i) + \sum_{i=1}^{n}\Pi_i(\tau_i) + \sum_{i=1}^{n}S_i(\tau_i). \tag{4}$$

From these general definitions of the indirect utility and welfare we can derive three distinct models of endogenous protection based on different specifications of the political economy process.

2.1 The *Political Support Function* Approach

The Political Support Function approach was developed by Hillman (1982) and generalized by Van Long and Vousden (1991). In this approach the government trades off political support from consumers against higher industry profits. The support for the government from the industry increases in industry's profits, while consumers raise their support when product prices decline. The exact mechanics by which either group provides support are not specified. Much like in Staiger and Tabellini (1987), the government does not have a self-interested motive, other than to redistribute in order to minimize the loss to either constituency. It is thus possible to interpret the model as one in which an altruistic government chooses a tariff to maximize aggregate support from its constituents.

Following Hillman (1982), the government's generic political support function

$$\Theta[\tau] = \Theta[\Pi[\tau], W[\tau]],$$

contains domestic welfare and industry profits, both as functions of the tariff. Higher support from the industry and from the general population is forthcoming if profits and welfare increase, $\Theta_\Pi, \Theta_W > 0$. However, profits increase with tariffs, while welfare decreases. The government maximizes the political support by choosing a tariff that maximizes the political support function, or

$$\frac{d\Theta}{d\tau} = \frac{d\Pi}{d\tau}\frac{\partial\Theta}{\partial\Pi} + \frac{dW}{d\tau}\frac{\partial\Theta}{\partial W} = 0,$$

which implies

$$-\frac{d\Pi}{dW} = \frac{\partial\Theta}{\partial W}\Big/\frac{\partial\Theta}{\partial\Pi} \equiv \delta_P .$$

Helpman (1997) defines δ_P as the marginal rate of substitution between aggregate welfare and profits of special interests in the government's political support function. The greater δ_p, the more likely is the government to give up industry profits to increase aggregate welfare. Extending Hillman (1982) to many sectors, i, and using a specific functional form, Helpman (1997) rewrites the political support function as

$$\hat{\Theta}[\tau] = \sum_{i=1}^{n}\frac{1}{\delta_i}(\Pi_i[\tau_i] - \Pi_i[1]) + (W[\tau] - W[1,1,\ldots,1]). \tag{5}$$

Using (4) and (5), the government chooses the optimal tariff to maximize its political support, which implies the tariff rate[4]

$$\tau_i - 1 = \frac{1}{\delta_{Pi}}\frac{X_i}{(-M_i')} = \sigma_{W,\Pi_i}\frac{W}{\Pi_i}\frac{X_i}{(-M_i')}, \tag{6}$$

where $\sigma_{W,\Pi_i} \equiv -(dW/d\Pi_i)(\Pi_i/W) > 0$ is the support function's elasticity of substitution between profits and aggregate welfare in sector i. From the definition of δ_p, we know that σ_{W,Π_i} also equals the ratio of the profit and welfare elasticities in the political support function $(\partial\Theta/\partial\Pi_i * \Pi_i/\Theta)/(\partial\Theta/\partial W * \Pi_i/W)$. Hence σ_{W,Π_i} can be loosely interpreted as the weight the government places on profits, relative to aggregate welfare.

The tariff increases in the sector's output level, X_i, because the larger the domestic output, the greater the benefits to domestic producers when the domestic price increases. The tariff decreases in the elasticity of the import demand function, since the welfare loss increases and the government is less willing to impose excess burden on society. In addition, the more likely the government is to trade off sectoral profits for national welfare, the lower the tariff in that sector.

While the theory does not provide insights into the determinants of the elasticity of substitution between aggregate welfare and special interest profits, we can utilize the data to obtain an estimate. Using proxies for wealth, as well as for industry profits, we can derive estimates for σ_{W,Π_i}. How relevant this estimate is will depend on the power of equation (6) to predict endogenous protection.

2.2 The *Tariff Function* Approach

Rather than the passive form of support assumed in the Political Support Function approach, our next approach assumes that agents actively participate in the process of tariff determination. Findlay and Wellisz (1982) pioneered the approach in which pro and anti protectionists "invest" in the political process, so that the outcome, a tariff, is the result of a lobbying contest. How responsive the tariff is to the respective groups' lobbying is given by a tariff function, $\tau_i = T(C_i^S, C_i^O)$, with $\partial T/\partial C_i^S > 0$ and $\partial T/\partial C_i^O < 0$, where C_i^S and C_i^O represent the respective expenditures of protection supporters and opponents.

Helpman (1997) captured the idea of active intervention by supposing that the owners of the specific factor in sector i, who constitute a fraction α_i of the population, form an interest group. This group lobbies for protection to maximize the joint welfare, $W_i^s(\tau_i)$, of the participants of the lobby, which can be represented by

$$W_i^s(\tau_i) = l^j + \Pi_i(\tau_i) + \alpha_i(\tau_i - 1)M_i(\tau_i) + S_i(\tau_i). \qquad \text{(A)}$$

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[4] The derivation uses the properties of the utility that $M = -[S' + \Pi']$ and that $X = \Pi'$.

Similar to (2), the joint welfare can be written as an additive composite of labor and specific factor income, the lobby's share of the tariff rebate, and the consumer surplus. The marginal benefit to protection of the supporters of protection then equals $W_i^{s'} = (1-\alpha_i)X_i + \alpha_i(\tau_i - 1)M_i'$, which is positive for sufficiently small values of τ_i.

The antagonists of the owners of the specific factor in sector i also form a lobby to oppose protection. To simplify the analysis, Helpman (1997) assumes that this group consists of all other individuals in the economy. This group's joint welfare is

$$W_i^o(\tau_i) = (1-\alpha_i)[\tau_i - 1)M_i(\tau_i) + S_i(\tau_i)], \tag{B}$$

which implies that $1-\alpha_i$ of the tariff rebate and consumer surplus is recaptured. The marginal benefit of the opponents of protection, $W_i^{o'} = (1-\alpha_i)[-X_i + (\tau_i - 1)M_i']$, is negative for positive tariff rates.

An interior equilibrium of the non-cooperative game among interest groups requires that the marginal benefit to joint welfare equals the partial derivatives of the tariff function with respect to the spending level of each lobby (the marginal cost). These additional conditions (one for each group) yield the tariff function

$$\tau_i - 1 = \frac{(1-\alpha_i)(b_i - 1)}{\alpha_i b_i + (1-\alpha_i)} \frac{X_i}{(-M_i')}, \tag{7}$$

where b_i is the marginal rate of substitution between the supporters' and opponents' spending levels in the tariff function. The Tariff Function approach thus implies that a sector is protected if and only if this ratio of elasticities exceeds unity, or $b_i > 1$. This implies that a sector is protected only if a dollar spent by pro-protectionists raises the tariff by more than it declines due to a dollar spent by anti protectionists. If both sides' expenditures are equally potent in influencing the tariff function with an additional dollar, free trade will result.

In addition, if a sector is protected, the tariff increases in the fraction of people in the population that belong to the protectionist group. As in the Political Support Function approach, the tariff increases in the sector's output level and in the elasticity of the import demand function. Feenstra and Bhagwati (1982) extend the Findlay and Wellisz framework to allow for a government that cares not only about the lobbyists' welfare, but also about the general public; a theme subsequently developed fully by the Influence Driven approach.

2.3 The *Influence-Driven Contributions* Approach

The Political Contributions approach, developed by Grossman and Helpman (1994), is in many ways the natural extension of the Tariff Function and the Political Support approach. This approach illuminates the "black box" that generates the tariff in Section 2.2 and allows for a natural way to introduce the excess burden, so that not all individuals are involved in either pro and anti lobbying in all sectors. In addition, the politicians care about their own interest (contributions) as well as consumer/firm welfare.

In the Political Contribution approach, interest groups that maximize benefits to their members offer politicians campaign contributions to influence their policy stance. Accordingly, politicians seek to maximize a political objective function that depends on contributions and on the well being of the general public. Knowing how contributions from constituents depend on the selected policies, politicians choose their policy stance.

Suppose the political objective function that the policy maker maximizes is $(1-\beta)C+\beta W$, where $C=\sum_i C_i$ stands for the sum of campaign contributions from all sectors, W represents aggregate welfare, and β is a parameter that represents the weight the government places on welfare considerations. If a sector does not contribute to the campaign, the policy maker disregards that sector's special interest concerns.

Suppose that in some subset of the sectors, $L\subset\{1,2,...,n\}$, the owners of the sector-specific inputs form lobbies. The aggregate welfare of the interest group is then given by

$$W_i(\tau)=l_i+\Pi_i(\tau_i)+\alpha_i\sum_{j=1}^{n}[(\tau_j-1)M_j(\tau_j)+S_j(\tau_j)], \qquad (8)$$

which again includes labor and specific factor incomes as well as the tariff rebates and consumer surplus. The lobby maximizes $W_i(\tau)-C_i$ and takes the contribution functions of all the other interest groups $j\neq i$, $C_j(\tau)$, as given. If lobby i wants to generate a tariff, it must offer a contribution. The size of the contribution is determined by the condition that the lobby must contribute sufficiently to raise the policy maker's welfare above

$G_{-i} = \max_\tau[(1-\beta)\Sigma_{j\neq i}C_j(\tau) + \beta W(\tau)]$, which is the level generated in the absence of lobby i's contribution. In short, the standard participation constraint in principal-agent problems requires that in equilibrium contributions equal

$$C_i(\tau) = G_{-i} - [(1-\beta)\sum_{j\neq i} C_j(\tau) + \beta W(\tau)]. \tag{9}$$

This implies that interest groups lobby not only for their own cause, but for an entire tariff policy vector, that maximizes each lobby's objective function $W_i(\tau) - C_i$

$$\tau^i \in \arg\max_\tau W_i(\tau) + \left[(1-\beta)\sum_{j\neq i} C_j(\tau) + \beta W(\tau)\right].$$

When politicians maximize their welfare function, subject to L interest groups' optimal policy vectors, the resulting tariff formula is

$$\tau_j - 1 = \frac{I_j - \alpha_L}{\frac{\beta}{(1-\beta)} + \alpha_L} \frac{X_j}{-(M_j')}, \tag{10}$$

where $\alpha_L = \sum_{j\in L} \alpha_j$ stands for the fraction of people that own sector specific inputs and I_j is a dummy that takes the value of one if $i \in L$, that is, if the sector is organized, and zero otherwise.

In the extreme case, when all sectors have organized pressure groups and every individual has a stake in some sector, there is free trade. From (10) we find that the rate of protection in sector i increases in the concentration of the ownership in that sector's specific factor, since the greater the concentration, the less the lobby cares about dead weight loss. The tariff also increases in the weight the policy maker places on contributions relative to welfare, since it becomes "cheaper" to influence the policy maker with contributions. The effects of output and of the slope of the import demand function are the same as in the formulas that derived for both the Political Support Function approach, and the Tariff Function approach. However there is an added twist to the model. For protected sectors, I = 1, the tariff rate should decrease in the import penetration ratio. This is because the larger the domestic output, the more owners of specific factors gain from an increase in the domestic price, while the economy as a whole incurs fewer inefficiency losses when the volume of imports is low, *ceteris* *paribus*. For unprotected sectors, the relationship between tariffs and import penetration is positive.

In comparing the Influence Driven approach with the previous ones, we observe several similarities. The effect of the degree of concentration of ownership is similar to the Tariff Function approach, while the role of the marginal rate of substitution between welfare and contributions plays a similar role to the marginal rate of substitution between welfare and profits in the Political Support Function approach.

3 Empirical Methodology

To allow for the estimation of the three competing approaches contained in equations (6), (7), and (10), we must introduce several simplifying assumptions. First, for each model we follow the procedure of G-M and move the import elasticities to the left-hand side, to counter measurement errors.[5] Measurement errors in the dependent variable cause a loss of efficiency, while measurement errors in the exogenous variables cause biased and inconsistent coefficient estimates. Second, we assume that the elasticities in equations (6) and (7) are constant across sectors. We use the Wald Test to check the validity of this assumption, and it can already be said that parameter instability will be rejected in either model.[6]

Our third assumption concerns the Tariff Function model (7), where we assume a specific functional form for the tariff function to conveniently take the model to the data. In essence this approach is the same as in the political support model, where Helpman (1997) assumed a specific functional form of the political support function (5). As in Helpman's political support function, we introduce the factors additively. Furthermore we assume increasing returns to lobbying (to reflect the real world observation that large donors command relatively greater influence). The simplest form is then $T[.] = \lambda(C^S)^2 - (1-\lambda)(C^O)^2$, where λ and 1 - λ respectively indicate the weight of the

[5] G-B have improved the estimation procedure by utilizing the standard errors on the elasticities. We maintain the G-M methodology for comparison purposes.

[6] Alternatively, we could consider the elasticities random coefficients in which case we would estimate its mean instead of its true value. However, estimating a random coefficient model implies that the errors are heteroscedastic. While ignoring heteroscedasticity in a standard least square regression model leads to inefficient but consistent estimates, heteroscedasticity of the errors in a Tobit model is likely to cause the maximum likelihood estimator to be inconsistent (see Greene (1997), chapter 20).

different contributions in the Tariff Function. In addition we assume that the concentration of ownership is small relative to the rest of the population. This implies that $\alpha_i/(1-\alpha_i)$ is negligible and approaches zero. The approximation error introduced by this assumption is small if the number of industries is large and if ownership of the specific factor is fairly evenly distributed among the population.

Therefore, the three empirical models that will be tested are given by

Political Support Function $$\frac{\tau_i^*}{\tau_i^*+1}e_i = a_1\frac{W}{\Pi_i}\frac{1}{z_i}+\varepsilon_{1i}, \quad (6a)$$

Tariff Function $$\frac{\tau_i^*}{\tau_i^*+1}e_i = a_2\frac{C_i^S}{C_i^O}\frac{1}{z_i}+a_3\frac{1}{z_i}+\varepsilon_{2i}, \quad (7a)$$

Influence Driven Contributions $$\frac{\tau_i^*}{\tau_i^*+1}e_i = a_4 I_i\frac{1}{z_i}+a_5\frac{1}{z_i}+\varepsilon_{3i}, \quad (10a)$$

where $\tau_i^* = \tau_i - 1$, e_i is the import demand elasticity, and $z_i = \frac{M_i}{X_i}$ is the import penetration ratio. Since we employ stochastic versions of (6), (7), and (10) in the econometric analysis, a disturbance term, ε_{ji}, was added. A Tobit estimation is necessary for (6a), (7a) and (10a) due to the censoring of the dependent variable at zero.

There are both theoretical and empirical reasons to question the exogeneity of the independent variables in (6a), (7a), and (10a) (see Trefler, 1993, and G-M, for a discussion). To correct for the possible bias in the estimates caused by the endogeneity of the explanatory variables, we use the same set of exogenous (instrumental) variables as in G-M which allows us to directly compare our results to the results reported in G-M.

In contrast to the maximum likelihood estimator (MLE) used in G-M, we apply a minimum distance estimator (MDE). The MDE approach is useful in estimating simultaneous equations (see Lee, 1996, chapter 5 and 9) and can be easily extended to models with censored and/or binary dependent variables. The main problem the MDE answers is how to optimally impose the overidentifying restrictions. The MDE is a two-step estimator. In the first step, the relationship between each of the K endogenous variables and the set of exogenous variables is estimated. In the second step, the parameter vector of interest, *a*, is consistently estimated with feasible GLS using only the first-step coefficient estimates. The reason why we can apply GLS to a data set with only K "observations" is that the error term in the second step estimation has a degenerate distribution converging to 0. Finally, in the case that the reduced form estimator is MLE and the overidentying restrictions are linear, MLE applied directly to the estimation of a and the two-step MDE are identical[7].

4. Data[8]

We follow G-M in the construction of the key data, Political Action Committee contributions, non-tariff barriers, import penetration ratios and import elasticities. We thus use U.S. data for 106 manufacturing industries at the three-digit SIC level for 1983. Estimates of import demand elasticities are not available at the four-digit SIC level, hence we base this study on three-digit level data. The data on non-tariff barriers (NTBs), τ_i, import penetration ratio, z, and the instrumental variables used in the Tobit IV estimates are taken from Trefler (1993), but aggregated to the three-digit level using as weights the share in value of shipment. $TOTALSALES_i$ denotes the value of shipments per industry, obtained from the 1996 NBER productivity database, and TOTALSALES is the value of shipment aggregated over all industries and scaled by 10,000. Import demand elasticities, e_i, are taken from Sheills, Stern, and Deardorff (1986).[9] Political Action Committee contributions by firms and unions in each sector were obtained from Gawande (for details on how these data were constructed, see the appendix in G-B). The data, covering contributions over four Congressional election cycles 1977-78, 1979-80, 1981-82, and 1983-84, measure spending per firm and union divided by value added. Multiplying by value added as well as by the number of contributing firms and unions, we obtain total contributions by firms and unions per industry. $TOTALCONTRIBUTIONS_i$ represents the sum of firm and union contributions in a sector, while TOTALCONTRIBUTIONS is measured as the sum of all sector-specific contributions by firms and unions. For the organization dummy, ORGANIZED, in the Influence Driven approach we use a contribution threshold level similar to the one used in G-M.

[7] For further details, see Lee, 1996, pp92-94.
[8] See the appendix for an overview.
[9] There is a small number of industries with positive import demand elasticities in our sample. Following G-M, we set these elasticities to zero.

Our data set deviates from G-M since we have to construct additional variables to test the alternative endogenous protection approaches. We construct two different profit measures. The first profit variable, PROFITS1, is based on the latest version of the 1996 NBER productivity database, from which we derive profits per industry as value-added minus total labor cost. The second profit measure, PROFITS2, was obtained from pre-tax income for 1983 as derived from the IRS source book, after converting the IRS data from SOI classification to three-digit SIC level. Both measures are imperfect. PROFITS2 is a direct profit measure, while PROFITS1 is an indirect measure that includes the regular return to capital as well as true industry profits. While PROFITS1 is a precise three-digit SIC industry measure, PROFITS2 contains the usual conversion error. The correlation between profit measures is 0.4, which confirms substantial differences between the two proxies. However, if we were to remove one outlier (industry 291; Petroleum Refining), the correlation coefficient would increase to 0.7.

5. Empirical Results

5.1 Political Support Function

The first round of estimates of the theoretical models is provided in Table 1. In the Political Support Function model, we estimate the elasticity of substitution between profits and aggregate welfare in the political support function. We attempted several specifications of welfare for the political support function. None worked as well as TOTALSALES and still the results are not satisfactory.[10] Test results using either profit measure ($PROFITS1_i$ or $PROFITS2_i$) disappoint, the coefficient estimates are statistically insignificant. In addition, only the direct profit measure, $PROFITS2_i$ exhibits the expected positive sign.

Despite the insignificant estimates, we venture to remark that the elasticity of substitution between aggregate welfare and profits is extremely low in either regression, indicating that the policy makers' political support function places significantly larger weight on aggregate welfare than on profits. The value of 0.23 implies an elasticity of the support function with respect to welfare of about 0.81. This value of the implied

[10] Any welfare measure is only going to affect the scale but not the qualitative results.

weight on welfare is strikingly similar to the one we derive in the Influence Driven model below.

The fact that these regressions also exhibit the lowest log-likelihood ratio values may serve as additional evidence that the model is either misspecified or missing key elements. We will discuss this issue further when we compare the models in section 6. Alternatively one could argue that governments do not in fact maximize their political support (because of bounded rationality, or imperfect information).

5.2 Tariff Function

Translating contributions of the "supporters" and "opponents" of tariffs in each sector from the theory into the real world requires some interpretation. In the spirit of Findlay and Wellisz, supporters of protection in sector i would be that sector's owners of factors and workers, at least in the short run. Lobbying against would be the factor owners and workers in all other sectors. Hence we aggregate union and firm contributions in each sector and divide by the contributions of all unions and firms.[11]

The model carries 3 predictions. First, since Helpman (1997) augmented the Findlay and Wellisz model to explicitly include consumer surplus, the effect of import penetration on tariffs is negative in the absence of contributions. Second, the model predicts that the greater the contributions of supporters relative to opponents of protection, the larger the negative impact of import penetration on tariffs.

The Tariff Function model performs surprisingly well. Both parameter estimates are significant at the one percent level and exhibit the right sign. An increase one sector's contributions relative to all other sectors has a surprisingly large effect on the dependent variable. The fit is better than for either Political Support model we tested. The implied weight of the contributions of supporters of tariffs, λ, is estimated to be .66, implying that the tariff function weighs contributions from pro lobbies twice as much as those from tariff opponents.

It may not be all that surprising that the Tariff Function model performs so well. From previous work (G-M and G-B) we know that the strict version of the Influence

[11] Alternative specifications pitting firms against unions in each sector did not generate plausible results. Baldwin and Magee (1998) find that votes in Congress against (for) freer trade are associated with aggregate contributions of Labor (business).

Driven model performs adequately in empirical tests. The Tariff Function approach shares some close similarities with the Influence Driven approach. In essence equation (7a) tests two hypotheses. One is that if the marginal rate of substitution of the tariff formation function is zero (or if supporters' contributions are zero), then the effect of the import penetration on tariffs is positive. This is similar to the Influence Driven model, in which protection increases in import penetration if a lobby is not organized. If, on the other hand, the tariff function contains some element of weight for the pro tariff supporters, and if there are positive contributions from a pro tariff lobby, then the impact of import penetration is negative. This is similar to the Influence Driven model in which protection is higher in industries with lower import penetration when sectors are organized.

5.3 Influence Driven

The estimates of the Influence Driven model are in line with the estimates reported in G-M. Small differences remain due to both minor differences in the data set and different estimation procedures.[12] If anything, this should be seen as a strong confirmation of the results obtained by G-M.[13]

As the theory predicts, the estimates show that in addition to the positive effect of import penetration on the dependent variable, there is a negative effect of import penetration on non-tariff barriers for organized industries (i.e. for industries with firm contributions above a certain, exogenously determined threshold). Thus we confirm the Grossman and Helpman (1994) proposition at the 1 percent significance level, that whether or not a sector is organized plays a crucial role in explaining the relationship between import penetration and protection.

Based on the coefficient estimates, the implied value for the government weight on welfare, β, is 0.96 (0.986), while the fraction of the population that owns sector

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[12] We did not receive the G-M dataset. In reconstructing the 3 digit SIC level data set from 4 digit level data, we end up with 106 SIC industries compared to 107 in G-M. This difference may be due to the fact that we use a data set that includes additional variables not included in the G-M data set and/or a more recent version of the NBER Manufacturing Productivity database. Besides sample size, the slight differences in the coefficient estimates may be the result of differences in the estimation procedure (MDE here instead of MLE in G-M).

[13] G-M conduct extensive sensitivity analysis. Their results are robust and the same pertains to the results above.

specific inputs, α_L, is 0.26 (0.88). The numbers in the brackets indicate the results of G-M. The estimates of the government weight on welfare are equally high, while G-M estimate a significantly higher level of ownership of the sector specific input. The estimates in our model and in G-M are significant at the 1 percent level, hence the strong difference in the estimates for the degree of concentration within a sector is likely due to the differences in the estimation method.

While our results in this section are similar to G-M, they contrast to those of G-B, who find that the respective government weighs on aggregate welfare and contributions are about the same. In case studies, governments are generally found to be significantly more concerned about welfare (see Hufbauer et. al. 1986, and Stern 1988, as cited by G-B).

All sign predictions were correct in G-M, however, their estimation method did not yield a significant positive sign for the key third prediction, that $a_5 + a_4 > 0$ in equation (7a), implying a negative relationship between import penetration and protection within the set of organized sectors. Using a slightly improved estimation technique that otherwise generates just about identical results to G-M, we find that $a_5 + a_4 > 0$ is significant at the 1 percent significance level. Using a simple two-sided test for a null hypothesis of $a_5 + a_4 = 0$, the estimate for $a_5 + a_4$ is 0.0276, with a t-statistic of 5.905. We therefore reject the null hypothesis and can state with some confidence that $a_5 + a_4 > 0$.[14] Hence we provide additional strong support for the Grossman Helpman (1994) approach in that all its predictions are strongly reflected in the data.

The goodness of fit of the Influence Driven model is better than the fit of the other two models. This adds empirical evidence to the discussion of the effect of import penetration on endogenous protection. Several previous studies have found that NTB coverage increases with import penetration (i.e., Finger and Harrison 1996, Lee and Swagel, 1997) or with the change in import penetration (Treffler 1993). Only the tests of the Grossman and Helpman (1994) model by G-M and G-B find evidence to the contrary as they take the exact theory to the data. Both find a negative influence although not

[14] More complicated, one-sided tests would only increase the power of this result.

statistically significant.[15] Maggi and Rodriguez-Clare (2000) provide a succinct model how positive and negative impacts can be reconciled, by introducing further policy tools (VER's and quotas) to the government in Grossman and Helpman (1994). Maggi and Rodriguez-Claire (2000) also make the important distinction between importers and producers to flesh out the destination between quotas and tariffs.

5.4 Parameter Stability

To test for structural change of the estimated coefficients, we separate the samples and perform a Wald test for each approach to endogenous protection. The Wald statistic,

$$\Lambda_1 = (\hat{\theta}_1 - \hat{\theta}_2)'(V_1 + V_2)^{-1}(\hat{\theta}_1 - \hat{\theta}_2),$$

has a chi-squared distribution with k degrees of freedom where k=1 in (6a), k=2 in (7a) and (10a), and k=4 in (11). To estimate Λ_1, we replace V_1 and V_2 by their estimated values, a procedure that is valid in large samples. The test statistics and the corresponding p-values for each model are provided in the last row of Table 1.

We cannot reject the null hypothesis of parameter stability at the one percent significance level for any of the three models. Since the Wald test for parameter stability has the property in small and medium-sized samples that the probability of type I error is larger than the chosen critical value, a larger critical value is appropriate to correct for this problem. We therefore conclude that parameter instability is not a problem in the Political Support, Tariff Function, or Influence Driven models.

6. Model Comparisons

Both the Tariff Function and the Influence Driven model perform exceedingly well, while the Political Support model disappoints. This raises two further questions. First, does one of the highly significant models hold unambiguously more explanatory power? This question goes beyond a comparison of the goodness of fit, it addresses the issue of correct specification of the exogenous variables. We employ non-nested hypothesis testing in form of J tests in an attempt to provide an answer in Section 6.2.

[15]Grossman and Helpman (1994) emphasize that the result is dependent on the relative magnitudes of import penetration and import demand elasticities across sectors. Only G-M and Gawande and Bandyopadhyay have previously controlled for sectoral differences in these elasticities.

The second question to ask leads us away from strict theory and concerns the explanatory power of each individual exogenous variable in the three models. It is natural to inquire if the fit and the explanatory power of the regression can be improved by combining variables from all approaches in one regression. This question is not entirely devoid of theory. In a sense the generic Political Support model is augmented in the Influence Driven model by contributions and by the influence of lobbies. On the other hand, the Tariff Function model's contributions are augmented in the Influence Driven model's emphasis on organization. Here it would be interesting to ascertain which is the better determinant of endogenous protection, contributions or organization. This question is tackled in Section 6.1, while the J tests are presented in Section 6.2.

6.1 General Models

We can compare the power of the variables suggested by the strict theoretical models in a "General" model that combines all variables in one regression.

General1(a & b)
$$\frac{\tau_i^*}{\tau_i^*+1}e_i = a_6\frac{W}{\Pi_i}\frac{1}{z_i} + a_7\frac{C_i^S}{C_i^O}\frac{1}{z_i} + a_8 I_i\frac{1}{z_i} + a_9\frac{1}{z_i} + \varepsilon_{4i}. \qquad (11)$$

The results from the Tobit MDE estimation of General1a and General1b (using our two profit measures) is reported in the first column of Table 2. The results show that little explanatory power is derived from either profit measure, PROFITS1 or PROFITS2. In General1a the relative contribution variable from the Tariff Function model is significant (at the 10 percent level), all other variables are statistically insignificant. The alternative profit measure in General1b yields a highly significant organization variable and an excellent fit, but no other significant variables. Since either contributions or organization were significant, but never the profit measures, we proceed by excluding profit measures and basically combine the Tariff Function and the Influence Driven approach in

General2
$$\frac{\tau_i^*}{\tau_i^*+1}e_i = a_{10}\frac{C_i^S}{C_i^O}\frac{1}{z_i} + a_{11} I_i\frac{1}{z_i} + a_{12}\frac{1}{z_i} + \varepsilon_{5i}. \qquad (12)$$

General2 generates by far the best fit of all regressions, including the strict theoretical approaches in Table 1. As expected, in the absence of contributions or organization, import penetration is positively related to tariffs, and statistically significant at the 1 percent level. However, only the Influence Driven and not the contribution variable from the Tariff Function model is significant at the 1 percent level. The lack of significance of the estimate of the contribution variable suggests that organization is indeed more important than outright contributions.

6.2 Non-Nested Hypothesis Testing

In keeping with the objective of the paper, we return to the models that were suggested by the theory. Section 6.1 provides heuristic evidence that organization is more significant than contribution variables. In this section we seek to further evaluate the relative strength of each exact theoretical model in explaining endogenous protection, by performing a series of non-nested tests. Our methodology is to test the relative strength of each model against each of the two competing alternatives. We follow the test procedure for non-nested J tests developed by Davidson and MacKinnon (1981, 1993).[16] An insignificant coefficient estimate in Table 3 implies that the null hypothesis can be rejected, implying that the alternative does not add significant estimation power to the null hypothesis.[17]

Table 3 reports the J test statistics, and the results of the first four rows provide surprisingly powerful evidence in favor of the Influence Driven model and against the other two models. In rows one and two, the J test rejects the null hypothesis that either the Political Support Model (with PROFITS1) or the Tariff Function model is the true model. In both cases the addition of the Influence Driven model's variables - specifically the information whether a sector is organized or not - turns out to add significant information in estimating endogenous protection. In rows two and three, the J test reports that neither the Tariff Function model, nor the Political Support model add information to the Influence Driven model in estimating endogenous protection. The null hypothesis of

[16] The intuition of the J tests is the following. Suppose the truth (the null hypothesis) we wish to test is $H_0 = y_i = f_i(\lambda_i, a) + \varepsilon_{0i}$ where a is a vector of parameters to be estimated and λ_i is a vector of observations on exogenous variables. Suppose theory suggests an alternative hypothesis $H_1 = y'_i = g_i(\lambda_i', a') + \varepsilon_{1i}$ where a' and λ_i' are different vectors of parameters and observations. The J test tests for $\kappa = 0$ in $y_i = \kappa f_i(\lambda_i, a) + (1-\kappa) g_i(\lambda_i', \hat{a}') + \varepsilon_i$ where $\hat{a}'$ is the ML estimate of a'. See Davidson and MacKinnon (1981) for details.

[17] For this class of tests, the non-nested alternative hypothesis need not be true. Nor does a rejected null hypothesis imply that the alternative is accepted.

the Influence Driven model being the "true" model cannot be rejected. All test statistics are at an astonishing 1 percent significance level.

The search for second best alternatives among the Tariff Function and the Political Support model yield ambiguous results. In row five, Political Support adds no information to the Tariff Function model at the 1 percent significance level. On the other hand, the Tariff Function model adds weak additional information to the Political Support model, as indicated in row six. The low J statistic in row 6 suggests the Tariff Function model came close to adding sufficient information to reject the hypothesis that Political Support is indeed the true model.

The interpretations of the J test results are in line with the results in Table 1 and Table 2, but add important further information. The Influence Driven model had the best fit in Table 1 and survived as the only significant estimate in Table 2. Hence it is not surprising that it "beat" both models soundly in the J test. Surprising is how resoundingly the Influence Driven model beats the Tariff Function model in the J test, given that both models generated similar results in Table 1. The weakness of the Tariff Function is also unexpected as it fails to reject the Political Support Model, which has not performed throughout.

7 Summary and Conclusions

The contribution of this paper is the exact empirical investigation of three prominent endogenous protection models. In the absence of reduced forms and extraneous variables to the regression we find that the simple testable implications of the models yield powerful results. All estimated coefficients in the Political Support Function, the Tariff Function, and Influence Driven models have the expected sign. For the Tariff Function and the Influence Driven models, the implied values of the parameters of the underlying theoretical models are plausible and highly statistically significant. Our results of the Influence Driven model are comparable to the values reported in previous studies, however, our different estimation method allows us to confirm all of the models predictions, in contrast to previous work.

The Influence Driven model exhibits the best overall fit among the individual models. Further evidence for the superiority of the Influence Driven model comes from non-nested misspecification tests which indicate that the Influence Driven model, when tested against each of the other models, cannot be rejected. Overall the Political Support Function approach disappoints. This may be because of shortcomings in the data. Profit data are notoriously noisy, and even using two alternative measures does not help the results. The results give rise to the strong impression that the Political Support Function approach suffers from its exclusion of the explicit modeling of the incentives of agents to lobby or contribute, as it focuses exclusively on the political interests.

There is ample work remaining for future research. Most questionable perhaps might be the assumption, which we share with the previous literature, that a single country facing constant world prices is examined. At this point data constraints limit us to apply our approach to the potentially more realistic case of a large open economy. Secondly, we do not include two other prominent political economy models into our analysis. The Electoral Competition approach pioneered by Magee, Brock and Young (1989) could not be included because the formal modeling has not yielded a testable tariff formation function that is similar to the ones above, or that allows us to take the strict theory to the data. However, Grossman and Helpman (1996) have derived several sharp implications that can be taken to the data, using reduced forms. The other alternative endogenous protection model not included here is the prominent median voter model (Mayer 1984). Again the lack of information on the median voter rendered the empirical implementation impossible.

Appendix: Description of Variables

TOTALSALES$_i$, value of shipments per industry, 1996 NBER productivity database.

TOTALSALES, is the aggregation over all industries' value of shipments.

Import demand elasticities, e_i, are taken from Sheills, Stern, and Deardorff (1986). Following G-M, the small number of industries with positive import demand elasticities are set to zero.

Non-tariff barriers (NTBs), τ_i, (Trefler 1993), aggregated to the three-digit level using as weights the value of shipments.

Import penetration ratio, z, (Trefler 1993), aggregated to the three-digit level using as weights the value of shipments

Instrumental variables, (Trefler 1993), aggregated to the three-digit level using as weights the value of shipments. The list of instrumental variables is identical to the one used by G-M: Physical capital, inventories, engineers and scientists, white-collar, skill, semiskilled, cropland, pasture, forest, coal, petroleum, minerals, seller concentration, buyer concentration, seller number of firms, buyer number of firms, scale, capital stock, unionization, geographic concentration, tenure.

Political Action Committee contributions, total firm and union contributions by industry obtained for the 1983-84 congressional elections (Gawande, 1998); firm and union spending is multiplied by the number of firms and unions to obtain totals.

TOTALCONTRIBUTIONS$_i$, the sum of firm and union contributions per industry.

ORGANIZED, firm contribution dummy, set to zero if industry-level contribution is smaller than 10 million and 1 if it is larger.

PROFITS1, value-added minus total labor cost, 1996 NBER productivity database.

PROFITS2, 1983 pre-tax income from IRS source book, converted from SOI classification to three-digit SIC level.

Table 1:

Strictly Theory Based Tests of Endogenous protection Models

IV Tobit estimations

Dependent Variable $\frac{\tau_i^*}{1+\tau_i^*}e_i$	**Political Support 1**	**Political Support 2**	**Tariff Function**	**Influence Driven**
$\frac{1}{\text{Import Penetration}(z_i)}$			-.0128*** (6.30)	-.0098*** (4.3073)
$\frac{\text{TOTALSALES}(W)}{\text{PROFITS1}_i(\Pi_i)}\frac{1}{\text{Import Penetration}(z_i)}$	-.008 (.693)			
$\frac{\text{TOTALSALES}(W)}{\text{PROFITS2}_i(\Pi_i)}\frac{1}{\text{Import Penetration}(z_i)}$		.028 (.536)		
$\frac{\text{TOTALCONTRIBUTIONS}_i(C_i^S)}{\text{TOTALCONTRIBUTIONS}(C_i^O)}\frac{1}{\text{Import Penetration}(z_i)}$			1.904*** (6.998)	
$\text{ORGANIZED}(I)*\frac{1}{\text{Import Penetration}(z_i)}$				.0374*** (7.265)
Log-Likelihood	-54.82	-55.78	-52.80	-51.66
Wald Test, Λ (p-value)	5.2867 (.0215)	5.9576 (.0147)	6.465 (.0395)	7.7385 (.0209)

***/**/*: 1 percent/ 5 percent/ 10 percent significance level, t-statistics in parentheses

Table 2:

"General" Endogenous protection Models

IV Tobit estimations

Dependent Variable $\frac{\tau_i^*}{1+\tau_i^*} e_i$	**General 1a**	**General 1b**	**General 2**
$\frac{1}{\text{Import Penetration}\left(z_i\right)}$	-.0032 (1.02)	-.008 (1.63)	-.007*** (2.09)
$\frac{\text{TOTALSALES}(W)}{\text{PROFITS1}_i\left(\Pi_i\right)} \frac{1}{\text{Import Penetration}\left(z_i\right)}$	-.030 (1.56)		
$\frac{\text{TOTALSALES}(W)}{\text{PROFITS2}_i\left(\Pi_i\right)} \frac{1}{\text{Import Penetration}\left(z_i\right)}$		.026 (.18)	
$\frac{\text{TOTALCONTRIBUTIONS}_i\left(C_i^S\right)}{\text{TOTALCONTRIBUTIONS}\left(C_i^O\right)} \frac{1}{\text{Import Penetration}\left(z_i\right)}$	1.91* (1.89)	-.97 (.96)	-.98 (1.00)
$\text{ORGANIZED}\left(I\right) * \frac{1}{\text{Import Penetration}\left(z_i\right)}$	.003 (.15)	.055*** (2.68)	.055*** (2.79)
Log-Likelihood	-53.90	-50.58	-50.58

***/**/*: 1 percent/ 5 percent/ 10 percent significance level, t-statistics in parentheses

Table 3

Non-Nested Hypothesis Testing

Null Hypothesis	**Alternative Hypothesis**	**J-Test Statistic**	**Interpretation**
Political Support 1	**Influence Driven**	.148	Reject null hypothesis
Tariff Function	**Influence Driven**	.999	Reject null hypothesis
Influence Driven	Political Support 1	7.89***	Cannot reject null hypothesis
Influence Driven	Tariff Function	2.79***	Cannot reject null hypothesis
Tariff Function	Political Support 1	7.22***	Cannot reject null hypothesis
Political Support 1	Tariff Function	1.756*	Cannot reject null hypothesis

***/**/*: 1 percent/ 5 percent/ 10 percent significance level, t-statistics in parentheses

Not being able to reject the null hypothesis implies that the model associated with the null hypothesis is the "correct model" in the sense that information added by the alternative hypothesis does not improve the estimation of the dependent variable.

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