Queen's Economics Department Working Paper No. 1151

Is Protection Really for Sale? A Survey and Directions for Future Research

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12-2007

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December 2007

Abstract

This paper critically and selectively surveys the literature on protection for sale and discusses directions for future research in this area. It suggests that the standard approach need to be augmented to provide more compelling tests of this model.

JEL Classification: F13, D72, F17

Keywords: Common agency, Political economy, Protection for sale, Quotas, Non tariff barriers.

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1 Introduction

Over the past decades, the Grossman and Helpman (1994) model of "Protection for Sale" (PFS) has become the most influential one in the political economy of trade. The PFS model provides a clear-cut prediction on the relationships between the level of protection and the import penetration ratio: protection is positively related to the import penetration for politically unorganized industries, but negatively related for politically organized ones. This simple relationship is based on an equilibrium model where each politically organized industry proposes campaign contribution bid function that specifies the relationship between campaign contribution and tariff. Then the government, given those bids from industries, chooses the tariffs so as to maximize its objective function, which is a weighted sum of the campaign contribution and the welfare of the voters.

Several theoretical concerns, however, have been raised about the model. First is the question of whether the model itself is a reasonable depiction of reality. Should lobbies be thought of as "buying protection" in a menu auction as posited by the model? Or is it that contributions buy something else, like access to politicians? Ansolobehere et al. (2003), for example, argue forcefully against thinking of contributions as buying policy.

Second, as is well understood now, the menu auctions model on which the PFS model is based, gives rise to a continuum of equilibria in general. What pins down the equilibrium is the assumption that bids are "locally truthful," a restriction which makes agents bid so as to be equally well off whatever tariff is chosen by the government. However, the logic of this restriction in a static model in the absence of trembles that might make the government choose randomly, is not apparent.

Third, the key prediction of the PFS model has been depicted as "unintuitive." One would expect that unlike the model's prediction, protection is positively related to a *change* in import penetration. This is because industries where import penetration used to be low and has increased tend to be those where a comparative advantage existed but has been eroded and intuition suggests that in such industries, protectionist pressures are likely to be largest. This view is indeed consistent with findings by Trefler (1993); regressing a measure of protection on the change in and the level of import penetration ratio (and other control variables), he found that the coefficient on the former is positive and significant, while the latter is insignificant.

Despite these concerns, the PFS model has had numerous empirical support. A number of studies have estimated the protection equation derived by the model and found that the parameter estimates follow the pattern predicted by the model. (e.g., Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; Mitra et al., 2002; Eicher and Osang, 2002; McCalman, 2004). Recently, researchers have extended the original PFS model by incorporating firm size (Bombardini, 2004), foreign and domestic lobbies (Gawande and Krishna, 2004), lobbying of both upstream and down stream producers (Gawande and Krishna, 2005), and labor unions and labor immobility (Matschke and Sherlund, 2006). While the original model accounts for tariffs, its quota version was also constructed and estimated (Facchini et al., 2006). These extensions, in effect, graft some complications onto the original PFS model and provide evidence that additional factors are also essential. It should be stressed that as the extensions typically leave its basic predictions unchanged, they seem to provide more evidence in favor of the original PFS framework.

This paper takes a critical look at past empirical work on the PFS model. After presenting a simple and intuitive way of outlining further predictions of the PFS model, we discuss important issues in testing the PFS model. We mainly focus on the following points. First, we argue that the procedure of testing whether the signs of the estimated coefficients are consistent with the PFS model is not a formal econometric test of the PFS hypothesis. This is because in most studies it is not clear what the alternative hypothesis is. Furthermore, even in studies that test the PFS model against an alternative, only the protection equation is tested, not the entire PFS model. Second, we argue that the way past literature classified industries into politically organized and unorganized industries is not consistent with the PFS model and results in bias of the coefficients of the protection equation. We then survey the recent papers that address those issues and explain potentially promising future research directions.

2 A Simple Exposition of the PFS Model

The exposition in this section relies heavily on Grossman and Helpman (1994). There is a continuum of individuals, each of infinitesimal size. Each individual has preferences that are linear in the consumption of the numeraire good and are additively separable across all goods. As a result, there are no income effects and no cross price effects in demand which comes from equating marginal utility to own price. On the production side, there is perfect competition in a specific factor setting: each good is produced by a factor specific to the industry, k_i in industry i, and a mobile factor, labor, L. Thus, each specific factor is the residual claimant in its industry. Some industries are politically organized, and being organized or not is exogenous to the model. Tariff revenue is redistributed to all agents in a lump sum manner. Owners of the specific factors in organized industries can make contributions to the government to try and influence policy if it is worth their while.

Government cares about both social welfare and contributions made to it and puts a relative weight of α on social welfare. The timing of the game is as follows: first, lobbies simultaneously bid contribution functions that specify the contributions made contingent on the trade policy adopted (which determines domestic prices). The government then chooses what to do to maximize its own objective function. In this way, the government is the common agent all principals (organized lobbies) are trying to influence.

An easy way to explore the restrictions imposed by this setting is to break the problem into three parts. In the first part, ask what the cost is to a lobby, given the contribution schedules of all other lobbies, of getting a particular policy chosen by the government. In other words, if $\mathbf{p}$ is the outcome vector[1] (depicted as uni-dimensional in figures below) what is the minimum amount a lobby has to pay to get a particular $\mathbf{p}$ chosen?[2] Call this cost $C_i(\mathbf{p})$. Once this cost is known, the second part consists of finding the desired outcome for a lobby. This is found by maximizing the difference between the lobby's welfarer as a function of $\mathbf{p}$, $W(\mathbf{p})$, and $C_i(\mathbf{p})$ derived in the first part. Finally, since the desired outcome could be attained by a continuum of different contribution functions on the part of this lobby (all that is needed is that the contribution be large enough to make the government do what is most desired by the lobby: its behavior at other prices is less tied down), the "locally truthful" restriction is imposed on contributions. This restriction ties down the equilibrium in a neat way as shown below.

2.1 Deriving Costs

The objective function of the government is denoted by $G(\mathbf{p})$. It is made up of social welfare, $W(\mathbf{p})$, (which has a weight α given to it) plus the contributions or bribes the government receives from lobbies, $\sum_{j \epsilon J_0} B_j(\mathbf{p})$:

$$G(\mathbf{p}) = \alpha W(\mathbf{p}) + \sum_{j \epsilon J_0} B_j(\mathbf{p}),$$

where the set J_0 consists of the sectors that are organized. Lobby group j in J_0 submits contribution schedule $B_j(p)$. Let

$$G_{-i}(\mathbf{p}) = \alpha W(\mathbf{p}) + \sum_{j \neq i, j \epsilon J_0} B_j(\mathbf{p}).$$

This is the objective function of the government when lobby group i does not enter the picture. Figure 1 depicts $G_{-i}(\mathbf{p})$ which has a peak at $\mathbf{p}(\mathbf{i})$. If lobby i wants $\mathbf{p}$ chosen, all it has to offer is what the government would get if i was not in the picture! In this event, the government would choose $\mathbf{p}(\mathbf{i})$ and get $G_{-i}(\mathbf{p}(\mathbf{i}))$.

[1] All vectors are in **bold**, while scalars are not.

[2] In the small country case as the world price p^* is given, choosing p is equivalent to choosing the ad valorem tariff, t.

Thus, if lobby i offered the government $G_{-i}(\mathbf{p}(\mathbf{i})) - G_{-i}(\mathbf{p})$, it would be indifferent between $\mathbf{p}$ and $\mathbf{p}(\mathbf{i})$. Thus,

$$C_i(\mathbf{p}) = G_{-i}(\mathbf{p}(\mathbf{i})) - G_{-i}(\mathbf{p})$$

is the minimum that needs to be offered to get $\mathbf{p}$ chosen. Note that as $\mathbf{p}(\mathbf{i})$ would be chosen if i did not participate, the cost of having $\mathbf{p}(\mathbf{i})$ chosen by the government is zero, so $C_i(\mathbf{p}(\mathbf{i})) = 0$.

2.2 The Desired Outcome

Lobby group i has welfare $W_i(\mathbf{p})$. It wants to maximize its net welfare or

$$A_i(\mathbf{p}) = W_i(\mathbf{p}) - C_i(\mathbf{p}).$$

This maximum occurs at $\mathbf{p}^m(i)$ as depicted in Figure 2. Note that $W_i(\mathbf{p}) - C_i(\mathbf{p})$ is tangent to $W_i(\mathbf{p})$ at $\mathbf{p} = \mathbf{p}(\mathbf{i})$ as $C_i(\mathbf{p}(\mathbf{i})) = 0$. It lies below $W_i(\mathbf{p})$ elsewhere.

Now given the contribution functions of all other lobby groups, there are any number of ways for lobby group i to get $\mathbf{p}(\mathbf{i})$ chosen by the government. All it has to do is offer a little more than $C_i(\mathbf{p})$ at $\mathbf{p} = \mathbf{p}(\mathbf{i})$ and anything weakly below $C_i(\mathbf{p})$ everywhere else. However, as this is a game, what it offers will affect what others want the government to choose and the bribes they offer. This in turn will affect the equilibrium. It is for this reason that such games have a continuum of equilibria.

2.3 Choosing a Contribution Function

Suppose lobby i offered contributions (subject to these being non negative) at $\mathbf{p} \neq \mathbf{p}^m(i)$ so that it was as well off as it is at $\mathbf{p}^m(i)$. After all, at the "right price" any outcome can be made desirable! In this manner, its contribution function keeps it "regret free", at least locally. In other words, it bids $\max(0, B_i^*(\mathbf{p}))$ where $W_i(\mathbf{p}^m(i)) - C_i(\mathbf{p}^m(i)) = W_i(\mathbf{p}) - B_i^*(\mathbf{p})$ or

$$\begin{aligned} B_i^*(\mathbf{p}) &= W_i(\mathbf{p}) - [W_i(\mathbf{p}^m(i)) - C_i(\mathbf{p}^m(i))] && (1) \\ &= W_i(\mathbf{p}) - K_i, && (2) \end{aligned}$$

where $K_i (= A_i(\mathbf{p}^m(i)))$ is a constant. Of course, $B_i^*(\mathbf{p})$ will lie weakly below $C_i(\mathbf{p})$ since offering $C(\mathbf{p})$ would reduce its net welfare below $W_i(\mathbf{p}^m(i)) - C_i(\mathbf{p}^m(i))$. This contribution function can thus be thought of as $W_i(\mathbf{p})$ where it lies above $A_i(\mathbf{p}^m(i))$ in Figure 2. Note that near $\mathbf{p}^m(i)$ contributions are positive, so that at least locally, the curvature of the equilibrium bid is the same as that of welfare.

Restricting lobbies to contributions that are "regret free", does two things. First, it pins down these functions and gives a unique equilibrium. Second, it yields the useful property that the bids have the same curvature as welfare as is evident from equation (1).[3] In effect, lobbies bid their welfare function less a constant! However, since government chooses $\mathbf{p}$ (the domestic price) to maximize the sum of α weighted social welfare and total contributions, it in effect maximizes the sum of α weighted social welfare and the aggregate welfare of all organized sectors. In other words, the equilibrium outcome of this game is the $\mathbf{p}$ that maximizes

$$Z(\mathbf{p}) = \alpha W(\mathbf{p}) + \sum_{j \epsilon J_0} W_j(\mathbf{p}) + \sum_{j \epsilon J_0} K_j$$

where the K_j's are constants. The equilibrium outcome, thus, is as if the government was maximizing the sum of welfare with greater weight placed on the welfare of organized industry groups. Consequently, equilibrium tariffs in this relatively complicated setting can be characterized by performing a simple maximization exercise!

However, the model has predictions, other than those on the equilibrium tariff levels, which are usually not incorporated into the estimation. For example, the contribution function in equilibrium keeps the government indifferent between the outcome in the absence of lobby i participating at all, and the equilibrium outcome, $\mathbf{p}^E$ or

$$0 = [Z(\mathbf{p(i)}) - (W_i(\mathbf{p(i)}) + K_i)] - \left[Z(\mathbf{p}^E)\right].$$

Recall, $W_i(\mathbf{p(i)}) + K_i = 0$, since i can get $p(i)$ chosen by contributing nothing,

[3] For a detailed discussion of this concept, see Bernheim and Whinston (1986).

so in equilibrium

$$Z(\mathbf{p}(\mathbf{i})) = Z(\mathbf{p}^E),$$

so that

$$\alpha W(\mathbf{p}(\mathbf{i})) + \sum_{j \epsilon J_0, j \neq i} (W_j(\mathbf{p}(\mathbf{i})) + K_j) = \alpha W(\mathbf{p}^E) + \sum_{j \epsilon J_0, j \neq i} \left(W_j(\mathbf{p}^E) + K_j\right) + B_i^*(\mathbf{p}^E).$$

Hence, if the outcome is $\mathbf{p}(\mathbf{i})$ in the absence of lobby $i's$ participating, and is $\mathbf{p}^E$ or the equilibrium price vector when lobby i does participate, then lobby i pays the difference in $\alpha W(\mathbf{p}) + \sum_{j \epsilon J_0, j \neq i} W_j(\mathbf{p})$ evaluated at these two points.

$$B_i^*(\mathbf{p}^E) = \alpha W(\mathbf{p}(\mathbf{i})) + \sum_{j \epsilon J_0, j \neq i} W_j(\mathbf{p}(\mathbf{i})) - \left[\alpha W(\mathbf{p}^E) + \sum_{j \epsilon J_0, j \neq i} W_j(\mathbf{p}^E)\right].$$

Thus, if lobbying by a group i results in distortions that result in a large loss in $\alpha W(\mathbf{p}) + \sum_{j \epsilon J_0, j \neq i} W_j(\mathbf{p})$, then equilibrium contributions must be large. Of course, if the outcome with lobby i not participating is not very different in welfare terms from that when it does, then equilibrium contributions could be small.

How can equilibrium contributions be evaluated empirically? This can easily be done if the $W_j(.)$ functions are known. In this case, simple maximization exercises would yield $\mathbf{p}^E$ and $\mathbf{p}(\mathbf{i})$. Thus, an empirical strategy boils down to a strategy for estimating $W_j(.)$. We will say more on this in section 5.

2.4 Solving for Tariffs

In the PFS model, the welfare of agents in industry j is

$$W_j(\mathbf{p}) = \pi_j(p_j) + l_j + \frac{N_j}{N}\left[T(\mathbf{p}) + S(\mathbf{p})\right],$$

where $\pi_j(p_j)$ is producer surplus in industry j, l_j is labor employed in industry j, wage is unity, and $\frac{N_j}{N} = \alpha_j$ is the fraction of agents who own the specific factor j, while $T(\mathbf{p}) + S(\mathbf{p})$ is the sum of tariff revenue and consumer surplus in the economy.

Differentiating $W_i(\mathbf{p})$ with respect to p_j gives[4]

$$x_j(p_j)\delta_{ij} + \alpha_i\left[-x_j(p_j) + (p_j - p_j^*)m_j'(p_j)\right],$$

where $\delta_{ij} = 1$ if $i = j$ and 0 otherwise, $m_j'(p_j)$ is the derivative of the demand for imports, and $x_j(p_j) = \pi_j'(p_j)$ denotes supply of industry j. Differentiating $W(p)$ with respect to p_j gives

$$(p_j - p_j^*)m_j'(p_j).$$

Hence, maximizing $G(p)$ with respect to p_j gives

$$\alpha\left[(p_j - p_j^*)m_j'(p_j)\right] + \sum_{i\in J_0}\left[x_j(p_j)\delta_{ij} + \alpha_i\left[-x_j(p_j) + (p_j - p_j^*)m_j'(p_j)\right]\right] = 0.$$

Let $\sum_{i\in J_0}\alpha_i = \alpha_L$ and let $\sum_{i\in J_0}\delta_{ij} = I_j$ which is unity if j is organized and zero otherwise. Therefore, this equation can be reduced to

$$x_j(p_j)(I_j - \alpha_L) + (p_j - p_j^*)m_j'(p_j)(\alpha + \alpha_L) = 0,$$

or

$$x_j(p_j)(I_j - \alpha_L) + \frac{(p_j - p_j^*)}{p_j}\left(\frac{m_j'(p_j)p_j}{m_j(p_j)}\right)(\alpha + \alpha_L)m_j(p_j) = 0,$$

or

$$\frac{(p_j - p_j^*)}{p_j} = \frac{(I_j - \alpha_L)}{(\alpha + \alpha_L)}\frac{z_j\,(p_j)}{e_j}, \tag{3}$$

where $\sum_{i\in J_0}\alpha_i = \alpha_L$, assuming that agent own the specific factor of at most one sector, is the fraction of the population that owns the specific capital of organized industries, and where $z_j = \frac{x_j(p_j)}{m_j(p_j)}$ and $e_j = -m_j'(p_j)\frac{p_j}{m_j(p_j)}$.

If we further use the fact that $(p_j - p_j^*) = (t_j)\,p_j^*$, equation (3) can be also expressed as

$$\frac{t_j}{1+t_j} = \left(\frac{I_j - \alpha_L}{\alpha + \alpha_L}\right)\left(\frac{z_j}{e_j}\right).$$

This is the basis of the key estimating equation:

$$\frac{t_j}{1+t_j} = \gamma\frac{z_j}{e_j} + \delta I_j\frac{z_j}{e_j} + \varepsilon_j, \tag{4}$$

[4] This follows from the derivative of consumer surplus from good j with respect to p_j being equal to $-d_j(p_j)$, where $d_j(p_j)$ is the demand for good j.

where ε_j is an error term. Note that $\gamma = \left(\frac{-\alpha_L}{\alpha+\alpha_L}\right) < 0$, $\delta = \frac{1}{\alpha+\alpha_L} > 0$, and $\gamma + \delta > 0$; protection is negatively related to z_j/e_j for politically unorganized industries, but positively related to it if the industry is organized. Note also that $\alpha_L = -\frac{\gamma}{\delta}$ and $\alpha = \frac{1+\gamma}{\delta}$. If γ and δ are small and similar in their absolute value, then α is large, or the relative weight on contributions small, *and* the closer γ *and* δ are to each other in absolute value, the closer is α_L to unity. *Thus, coefficients γ and δ that are close to zero explain both the low weight on contributions and the high level of α_L.*

3 Issues in Testing the PFS Model

3.1 A Summary of The Evidence

Table 1 presents a summary of the empirical results in major papers in this area. Goldeberg and Maggi (1999), Gawande and Bandyopadhyay (2000), and McCalman (2004) estimated γ and δ and then derived α and α_L from those estimates. Mitra et al. (2002) estimated α and α_L directly using the nonlinear GMM. In all these studies, the estimates of γ and δ follow the pattern predicted by the PFS model, i.e., $\widehat{\gamma} < 0$, $\widehat{\delta} > 0$, and $\widehat{\gamma} + \widehat{\delta} > 0$. These results appear to support the PFS model. In what follows, we discuss some potential problems in previous empirical studies, which may be severe enough to cast some doubts on the validity of their results in support of the PFS.

3.2 Data on Import Demand Elasticity

As equation (4) shows, estimation of the protection equation requires estimates of e_j, the import demand elasticity. The elasticity estimates commonly used for US studies are those of Shiells et al. (1986). The problem is that half the estimates are of the wrong sign or insignificant. They estimated import elasticity industry by industry by using OLS or 2SLS. Obviously, OLS is subject to endogeneity and measurement error bias. 2SLS as executed by them is problematic because the industry by industry sample size is very small and 2SLS has potentially serious finite sample bias. Furthermore, they controled for tariffs in their elasticity estimation but not for the non-tariff barrier. Hence, if researchers use their estimates, the reverse causality from non-tariff barrier to the import elasticity, which could arise with aggregation in the industry data, cannot be controlled for. Another shortcoming of their estimates is that they are at the three digit level of aggregation. More disaggregated data need to be used for testing the PFS model, since testing political economy models, in particular, should be done at as disaggregated a level as possible. At the very least, more recent estimates, such as those of Kee et al. (2004) which are at the six digit level, should be used.

3.3 The Classification of Industries

One of the key explanatory variables in equation (4) involves a dummy variable for whether the industry is politically organized, I_j. Therefore, an important issue is how to classify industries into politically organized and unorganized ones. Past studies have used some simple rules for classification. Goldberg and Maggi (1999) classified an industry as politically organized if its PAC contribution is greater than a pre-specified threshold level. Gawande and Bandyopadhyay (2000) used a regression-based procedure. Their procedure is based on the idea that if industries are politically organized, then industries with higher import penetration ratios are likely to make higher campaign contributions.[5]

Several questions naturally arise about these classification rules. First, are their rules consistent with the PFS model? Second, do their rules correctly distinguish between politically organized and unorganized industries? And if there are classification errors, would that lead to bias in the parameter estimates of the PFS model?

Imai et al. (2008*b*) argue forthfully against the classification rules in Gold-

[5] More recently, a second generation of empirical studies has taken a different approach to reconciling theory and the data. For example, Ederington and Minier (2005) extend the PFS model by hypothesizing that industries can lobby for both trade and domestic policies. In their model, it is possible that some industries are politically unorganized for trade policies and yet make contributions for domestic policies. Matschke (2005) takes a similar approach. Since the models by Ederington and Minier (2005) and by Matschke (2005) are more comprehensive than the PFS model, the authors impose additional assumptions to make the models tractable for estimation.

berg and Maggi (1999) and in Gawande and Bandyopadhyay (2000). Imai et al. (2008*b*) formally derive the equilibrium relationship between campaign contributions and the inverse import penetration ratio and then use the theoretical result to provide a simple numerical example of the PFS model where the level of the industry's contribution varies greatly depending on its import penetration. Specifically, they show that politically organized industries may make very small contributions if their import penetration is high, i.e., inverse import penetration is low. This implies that using a particular threshold of campaign contribution as a device to distinguish between politically organized and unorganized industries as is done in Goldberg and Maggi (1999) is inconsistent with the PFS model and thus results in misclassification of the political organization. Furthermore, in their numerical example, import penetration and equilibrium campaign contributions are negatively correlated. This is exactly the opposite of the relationship that is assumed by Gawande and Bandyopadhyay (2000) and most papers using their data, that classify industries as politically organized when the import penetration and the PAC contributions per value added are positively correlated. Imai et al. (2008*b*) argue that if we were to reclassify the political organized industries, then we would obtain parameter estimates which no longer support the PFS hypothesis.

Imai et al. (2008*b*) also claim that due to classification error, the estimation strategies used in Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) cannot provide consistent estimates. In equation (4), the inverse import penetration ratio should be treated as an endogenous regressor, as has been discussed in the literature (e.g., Trefler, 1993). Potential mis-classification of industries makes it even more challenging to estimate equation (4), since the political organization dummy would also be econometrically endogenous in the presence of classification error. As Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) were both fully aware of these problems, they used an IV strategy which, at a first glance, appears to provide consistent estimates. However, Imai et al. (2008*b*) show that if the PFS model is true, then the existence of the classification error results in the disturbance term in the estimating equation to be a function of the inverse import penetration ratio. It is therefore impossible to find an instrument that is correlated with the inverse import penetration ratio and uncorrelated with the disturbance term as needed.

In sum, according to Imai et al. (2008*b*), if we are to structurally estimate the PFS model on the data used by Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000), we should not use an arbitrary classification scheme along with the campaign contributions to generate political organization dummies. The structural estimation and testing of the PFS model would require treatment of the political organization dummies to be fully consistent with the prediction of the PFS model.

Several papers use institutional characteristics for political organization classification. McCalman (2004) classifies industries in Australia that filed an inquiry at the Tariff Board as politically organized. Belloc (2007) classifies those who participate in the meetings of the EU commission on tariff policy as politically organized. They all report parameter estimates of the protection equations to be consistent with the PFS hypothesis.

This is intriguing, since the underlying institutional setting in these studies is far from the PFS model where campaign contributions determine protection policies. For example, Belloc (2007) examines EU tariff policy, but campaign contributions to the tariff board are prohibited. One interpretation is that contributions are being made but are hidden because of their illegality. Consequently, the political process that determines tariffs and NTBs can be very well explained by campaign contribution based PFS model. Another interpretation is that the results in support of the PFS models are spurious.

3.4 Some Testing Issues

The extent to which past studies did a stringent job of testing the PFS model is an open question. This results from the fact that most past studies did not formally test the PFS model. Past studies typically estimated equation (4) and examined whether the signs of the key coeffcients (i.e., γ and δ) follow the pattern predicted by the model. However, such an estimation exercise was typically conducted in the absence of a well-specified alternative model. This problem was noticed by Goldberg and Maggi (1999) who mentioned that "(s)trictly speaking, we do not test the G-H model, because we do not have a well-specified alternative hypothesis"(p.1135). Indeed, their concern is real; Imai et al. (2008*a*) recently showed that estimation of equation (4) is not enough to test the validity of the PFS model against alternatives such as a simple example model, which they call the "Surge Protection" model.

Unlike most studies, Eicher and Osang (2002) and Gawande (1998) formally tested the PFS model. However, in our view, their results are far from satisfactory. Eicher and Osang (2002) is a good example to make our point. They compared the tariff equation derived by the PFS model and that of the Tariff Function approach by using the Davidson-McKinnon non-nested hypothesis test, concluding that the results are in favor of the PFS model. While this kind of formal approach, when carefully done, could be very helpful in making model comparisons, the simplistic approach traditionally being followed can be more misleading than helpful. Even though the tariff equation is sufficient for the estimation of the structural parameters, it is a small part of the entire PFS model or the Tariff Function model. Hence, testing the tariff equation only could give us misleading results.

For example, the tariff equation of the Tariff Function model imposes some restrictions on the relationship between the campaign contributions and the tariffs, but the tariff equation of the PFS model does not. It only requires the coefficients on the inverse import penetration ratio of the politically organized and unorganized industries to have opposite signs and for their sum to be positive, where political organization dummies are derived from the campaign contributions. The PFS model, however, imposes strong restrictions on the relationship between the tariffs and the campaign contribution via the menu auction framework, but these are not present in the tariff equation. Therefore, if we just look at the tariff equation, the PFS model may look less restrictive, while this is not the case when all the restrictions are incorporated into a test. We suspect this is the reason why in Eicher and Osang (2002) the PFS model was chosen over the Tariff function model. To correctly execute the non-nested model specification tests we need to impose *all* the restrictions of the model on the data. This involves the full solution of the model, which is difficult for the PFS model and to the best of our knowledge, has not been done in the literature.

3.5 Some Puzzling Results in Past Studies

As Table 1 shows, past studies typically found that political factors matter little; the weight on welfare relative to contribution, α, is estimated to be very high (i.e., the relative weight on contribution is very low). However, given that contributions are small relative to their effects on firrm profits and welfare, one would expect a reasonably high weight on contributions, because in the PFS model, equilibrium contributions by a group keep the government as well off as in the absence of the lobby group, i.e., just compensate the government.[6]

The estimated low weight on contributions could have a number of causes. To begin with, data on contributions is not actually used in the estimation procedures of previous studies. The standard approach basically estimates equation (4) and then the weight on welfare is backed out of the estimates of γ and δ. As contributions do not explicitly enter equation (4), they are not directly used to estimate the structural parameters. As mentioned earlier, Goldberg and Maggi (1999) used contributions just for the classification of industries. In Gawande and Bandyopadhyay (2000), contributions were used to see if lobbying expenditure follows predicted patterns, but were not used to estimate the key parameters of the model. Hence, there is no direct way for the low level of contributions to influence the estimated weight on contributions relative to welfare! If contributions data was actually used to estimate a structural model, then the estimates of the key parameters would probably have been quite different.

The only paper we know that actually used contribution data directly is Kee et al. (2005). They assumed that lobbies have a first mover advantage over

[6] See Rodrik (1995) for an early survey of political economy models in trade and Gawande and Krishna (2003) for a recent one of the empirical work in the area.

government as is the norm in this literature, and looked at foreign lobbying in the US for preferential access (which reduces tariffs to zero or leaves them unchanged) assuming world prices are given.[7] As a result, the welfare cost to the US is the loss of tariff revenue. This loss is, in essence, compared to the contributions received to obtain a weight on contributions relative to welfare. Their results suggest that the government seems to value contributions five times more than welfare: a vast difference from the results in the Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000).[8]

Second, it is possible that the relationship between the variables specified in the PFS model is spurious and thus the supposedly low values for the weight on contribution obtained by past studies can be thought of as just a misinterpretation of the parameter estimates. This is the tack taken in Imai et al. (2008*a*) discussed in more detail below. They showed that a simpler model than the PFS framework yields similar estimated coefficients, but without the strict PFS interpretation.

Third, it might, of course, be the case that the government does not need much compensation to keep it indifferent to the outcome in the absence of a particular lobby, or intuitively, that the supply of protection is very elastic at a low price. However, the PFS model is quite clear about the determinants of the equilibrium contribution level at a conceptual level. We argue below that it may be possible, given the tools we have these days, to actually compute the equilibrium campaign contributions given information of elasticities.

[7] In their model, preferences are given if contributions compensate for this welfare loss. Contributions are offered if the increase in profits exceeds the full cost of obtaining them. In equilibrium, contributions leave the government as well off as without lobbying.

[8] Mitra et al. (2006) estimate the model assuming all sectors are organized. For reasonable numbers for the share of the population that is organized, they back out lower weights on welfare than come from the standard approach.

4 Recent Findings and Interpretations

4.1 A Model with Institutional Protection

Could it be that the data is actually coming from a slightly different setting than the PFS framework? If data generated from a simpler model than PFS can easily yield similar estimated coefficients, then the strict PFS interpretation being put on the coefficient estimates may be misplaced. This is the key idea explored in Imai et al. (2008*a*).

Imai et al. (2008*a*) develop and simulate such a very simple competitive model called the "Surge Protection" (SP) model. They assume that political organization is randomly determined. Demand and supply are subject to random shocks. All shocks are assumed to be i.i.d. with normal distributions though the parameters of the distributions differ. Politically organized subindustries whose equilibrium imports exceed a given level face a quota. The data is aggregated over subindustries. Each subindustry is politically organized with some random variation in the political organization probability across industries. This is done to ensure that there is sufficient variation in the numbers of subindustries that are politically organized within industries.[9] Industry is said to be politically organized if at least half the sub-industries are organized.

Output and prices of each industry are simulated with a uniform quota level $\hat{Q}$ for all subindustries. One way of interpreting this is that there is a trigger level of imports, $\hat{Q}$, above which the relevant agency would restrict imports if asked, but only politically organized agencies ask for such protection. In other words, that there are provisions for preventing a surge of imports, but only organized industries can actually make use of these provisions perhaps because they can overcome the usual free rider problems. Subindustry output is aggregated to the industry level. The variables used in the estimation are then generated. The coverage ratio was calculated as the fraction of industry output i where quota is binding. The inverse import penetration ratio for industry i, z_i, is the ratio

[9] With only one probability of political organization for every industry, say 0.6, the fraction of industries that are politically organized wwould be clustered around 0.6.

of domestic production to imports.

The SP model is based on the followng observation about institutional settings. In the US for example, there are institutional channels with varying conditions under which an industry can ask for and obtain protection. Boltuck and Litan (1991) provided a description of the administration of such unfair trade laws that can result in protection. One such channel that is perceived as open to abuse today is anti-dumping. This is intended as a recourse for firms subject to foreign competitors selling their product below "fair" or "normal" price that causes injury to the domestic firm. Practices such as pricing below full cost, which need not be anti-competitive, would then be subject to duties which could be quite high given the way such duties have been calculated in practice in the US. See for example, Blonigen (2006). Although there are sunset clauses built into such duties, in practice, such duties can continue for quite a while. Safeguards are another example. Under WTO rules, safeguard actions allow a country to temporarily protect against all imports with the intention of allowing domestic industry time to adjust to import competition. Though injury has to be shown, it is easy to see that such institutional measures would allow protection more easily in times of stress, i.e., when foreign supply shifts out and imports surge. Moreover, it is also likely to be easier for organized sectors to obtain such protection as it involves jumping through some hoops and because they can more easily overcome the usual free rider problems.[10]

In such a setting, it might make sense to think of an institutional model such as above where government provides protection (and does so more easily for politically organized industries) when imports exceed a trigger level. If data generated for from the calibrated version of such a model is also consistent with the estimates in the literature, then we might want to look for deeper tests of the PFS model. If a setting where there are provisions for preventing a surge of imports, but only organized industries can actually make use of these provisions, is observationally equivalent to the data, this could explain the size

[10]Though the government can also intitiate such actions, they are usually initiated by domestic industry.

of the estimates obtained!

The parameters of the model are chosen so that the simulation is reasonably close to the actual data in terms of the frequency of political organization, the share of NTB covered subindustries, the mean and standard deviation of the log of output to imports. The import demand elasticity is set at the mean of the industry import demand elasticity from the estimation of Shiells et al. (1986). They compare the simulation of the model to the data used in Gawande and Bandyopadhyay (2000). The model matches the average political organization, NTB coverage ratio, log output/import ratio, and the standard error of log output import ratio reasonably closely.

They then simulate the model and run the standard regression on this data to find estimates that are close to those in Goldeberg and Maggi (1999) and Gawande and Bandyopadhyay (2000)! This suggests the possibility that the crucial point is that organized sectors behave differently from unorganized ones, not that the PFS model is valid. The results also suggest that estimation of equation (4) is not sufficient to conclude the validity of the PFS model against their simple model.

They argue that their results come from the following observation. In the SP model the protection measure is negatively correlated with the inverse import penetration ratio. This is because an increase in imports increases the probability that it will exceed the pre-set quota. Furthermore, the interaction term of the inverse import penetration ratio and the political organization dummy is positively correlated with the protection measure because only politically organized industries can have positive quota. These together roughly imply that the regression coefficients of the inverse import penetration ration is positive and that of the interaction of the inverse import penetration ratio and the political organization dummy is negative. Furthermore, in IV estimation, for some range of parameters, the sum of those parameters become positive as well, hence satisfying all the conditions of the PFS hypothesis.

4.2 An Alternative Test

Imai et al. (2008*b*) suggest testing the predictions of the PFS model in a way that does not rely on classifying industries as organized or not. Their estimation procedure relies heavily on the relationship between observables implied by the PFS model.

Once all other variables have been controlled for, the PFS model predicts that the inverse import penetration ratio has a negative effect on the level of protection for politically unorganized industries while it has a positive effect for politically organized industries. As a result, controlling for all other variables, and given z/e, politically organized industries should have higher protection. These implications lead to the following claim: given z/e, high protection industries, i.e. those industries whose protection measures are at high quantiles, are more likely to be politically organized and thus the effect of an the increase in z/e on protection would tend to be that of politically organized industries: in other words, the coefficient estimate for the inverse of the import penetration ratio converges to $(\gamma + \delta) > 0$ as the conditional quantile given z/e approaches its highest level of unity from below.

There are several advantages of their quantile approach. First, their method does not suffer from the corner solution problem, i.e., zero protection in a number of industries, as the focus is mainly on the higher quantiles where the effect of corner solution is minimal. Findings based on the linear model in Gawande and Bandyopadhyay (2000), Bombardini (2004), and others are likely to be subject to bias due to the existence of such corners. Second, quantile regression results are not driven by the parametric assumption on the error term; such assumptions are not required by the quantile regression. To address the corner solution problem, several studies (e.g., Goldberg and Maggi, 1999; Facchini et al., 2006) estimated a system of equations as well as an import penetration equation, and an equation for political organization. In these studies, the assumption of normality of the error terms is usually made and this may affect the estimation results.

Using the data from Gawande and Bandyopadhyay (2000), Imai et al. (2008*b*) find that the coefficient on the inverse penetration ratio starts from zero at low quantiles and decreases to negative value as the quantile rises. Note that this is the opposite of what the PFS model predicts, casting some doubt on the validity of the PFS model. In the simple quantile regression, the inverse import penetration ratio is assumed to be an exogenous variable. However, z/e is likely to be endogenous as discussed in the literature and hence the parameter estimates of the quantile regression could be inconsistent. To correct for this, they use IV quantile techniques which have been recently developed by Chernozhukov and Hansen (2006). The the estimated slope coefficients remain negative by and large, except at the lower quantiles where they are zero.

Imai et al. (2008*a*) find that performing the same estimation exercise on the artificial data generated by the SP model gives estimates similar to those found using actual data. At lower quantiles, the estimated coefficients on the inverse import penetration are close to zero, because industries at lower quantiles have zero protection. The estimated slope coefficients for higher quantiles all become negative, although they do not fall with the quantile, and are statistically significant at the five percent level.

Extending the SP model by allowing the quota to be stochastically determined gives results that are even closer to the actual data. In this case they find the coefficients on the inverse import penetration ratio are zero at lower quantiles and decrease with quantile, which is consistent with the results of the actual data. Their results overall suggest that the qualitative feature of the SP model might be more consistent with the actual data than the PFS model.

The intuition behind the negative coefficient estimate of the surge protection model is simple. A surge in imports, which increases the import penetration ratio, tends to result in the quota being binding, which corresponds to an increase in the NTB coverage ratio. Hence, the negative relationship between the inverse import penetration ratio and the NTB coverage ratio.

5 Direction of Future Research

Earlier we have discussed the limitation of the conventional approach, where researchers estimate and test the PFS model mainly based on the protection equation only. In order to test the model against alternatives such as the SP model, we need to statistically compare the implications of the entire model against alternatives, which includes the campaign contribution equation that determines how equilibrium campaign contributions are determined as the outcome of the menu auction.[11] This is especially important after the results in Imai et al. (2008*a*) where they argue that one cannot statistically distinguish between the PFS model and the Surge Protection model by just looking at the estimated coefficients of the protection equation. However, one could immediately recognize challenges that need to be overcome when trying to conduct the kinds of tests mentioned above. That is, one important component of the PFS model is the determination of the equilibrium campaign contributions, which involves comparisons of welfares of two different tariff policies. Since welfare is not observed, it has to be computed based on the model. Below, we discuss an algorithm that efficiently computes the welfare given tariffs. Then, we explain the required data to compute the welfare and roughly sketch the estimation procedure.

An Estimation Algorithm

We can get $\mathbf{p}^E$ from the data. Recall that $\mathbf{p}(\mathbf{i})$ is the arg max of

$$\alpha W(\mathbf{p}) + \sum_{i \neq j \in L} \left(W_j(\mathbf{p}) + K_j \right).$$

Since the arg max of

$$G(\mathbf{p}) = \alpha W(\mathbf{p}) + \sum_{j \in L} \left(W_j(\mathbf{p}) + K_j \right)$$

[11] A notable exception is Gawande and Bandyopadhyay (2000) where they also estimated both the protection equation and the campaign contribution equation. However, the campaign contribution equation they estimated is a linear regression equation where the RHS variables are possible determinants of the campaign contributions, and does not tightly correspond to the menu auction equilibrium of the PFS model.

is given by equation (3), it follows that the condition here should be such α_L is replaced by $\alpha_L - \alpha_i$. Thus, we get:

$$\frac{p(i) - p_i^*}{p_i} = \frac{-(\alpha_L - \alpha_i)}{\alpha + (\alpha_L - \alpha_i)} \frac{z^i}{e^i}. \tag{5}$$

This shows that knowledge of α, α_L, α_i, tariffs, output, imports, and import elasticities substituted into equation (5) would suffice to obtain $p_i(i)$ and thus the vector $\mathbf{p}(\mathbf{i})$. Note that equation (5) can also be solved to find the tariffs that would have obtained had i not lobbied.

As shown earlier, the contribution levels themselves would be easy to estimate if we had the $W_j(p)$ functions. However, if we take a first order approximation we do not need the entire function, only its derivative. The equilibrium campaign contribution can be expressed as follows.[12]

$$\begin{aligned} B_i^*(\mathbf{p}^E) &= -\left[\alpha W(\mathbf{p}^E) + \sum_{j\epsilon J_0, j\neq i} W_j(\mathbf{p}^E)\right] + \alpha W(\mathbf{p}(\mathbf{i})) + \sum_{j\epsilon J_0, j\neq i} W_j(\mathbf{p}(\mathbf{i})) \\ &= H_i(\mathbf{p}(\mathbf{i})) - H_i(\mathbf{p}^E). \end{aligned} \tag{6}$$

where[13] $H_i(\mathbf{p}) = \alpha W(\mathbf{p}) + \sum_{j\epsilon J_0, j\neq i} W_j(\mathbf{p})$**.** This says that equilibrium contributions are essentially the difference in the value of the function $H_i(\mathbf{p}) : R^N \rightarrow R$ between $\mathbf{p}(\mathbf{i})$ and $\mathbf{p}^E$. Let $\mathbf{p}(t)$ be a path from $\mathbf{p}^E$ to $\mathbf{p}(\mathbf{i})$ as t goes from zero to unity. Since the line integral is path independent, we can choose this path as desired. In particular, we can choose it so that $\mathbf{p}(t) = \mathbf{p}^E + t\left[\mathbf{p}(\mathbf{i}) - \mathbf{p}^E\right]$ so that $\mathbf{p}(t=0) = \mathbf{p}^E$, $\mathbf{p}(t=1) = \mathbf{p}(\mathbf{i})$, and $\mathbf{D}\mathbf{p}(t) = \left[\mathbf{p}(\mathbf{i}) - \mathbf{p}^E\right]$.

Hence,

$$\begin{aligned} H_i(\mathbf{p}(\mathbf{i})) - H_i(\mathbf{p}^E) &= H_i(\mathbf{p}(t=1)) - H_i(\mathbf{p}(t=0)) \\ &= \int_0^1 \frac{dH_i(\mathbf{p}(t))}{dt} dt \\ &= \int_0^1 DH_i(\mathbf{p}(t)) \bullet \mathbf{D}\mathbf{p}(t) dt, \end{aligned} \tag{7}$$

[12] As the equilibrium bids of a lobby group equal its welfare of the lobby group less a constant, the constants will cancel out in the expression below and so are omitted.

[13] Note that H has to be indexed by i.

Now using the line integral defined in equation (7) and substituting for $DH_i(\mathbf{p}(t)) = \left[\frac{\partial H_i(\mathbf{p})}{\partial p_j}\right]$, it can be shown (see Imai et al. (2008b) for details) that we get

$$\begin{aligned} B_i^*(\mathbf{p}^E) &= \int_0^1 \sum_j \{(\alpha + \alpha_L - \alpha_i)(p_j(t) - p_j^*)\frac{\partial m_j(p_j(t))}{\partial p_j} \\ &\quad + [I(j \in L - \{i\}) - (\alpha_L - \alpha_i)]\, x_j(p_j(t))\}\{p_j(i) - p_j^E\}dt \\ &= \sum_j \{p_j(i) - p_j^E\}\int_0^1 \{-(\alpha + \alpha_L - \alpha_i)\frac{(p_j(t) - p_j^*)}{p_j(t)}\left(\frac{z_j(t)}{e_j(t)}\right)^{-1} \\ &\quad + [I(j \in L - \{i\}) - (\alpha_L - \alpha_i)]\} x_j(p_j(t))\, dt. \end{aligned}$$

Import demand elasticities could be taken from other sources such as Kee et al. (2004) or estimated. $z_j(p_j(t))$ and $x_j(p_j(t))$ can be obtained by estimating the import demand function and the output function, which can be derived from the derivative of the log GDP function. Then we could build a moment based estimation strategy by directly comparing estimated campaign contributions $C_i(\mathbf{p})$, to actual ones, Co.

6 Conclusion

While the PFS model has been widely studied, we argue that further implications of its predictions need to be explored and tested for a truly convincing test. Some directions in which such research might proceed are outlined and a critical look at the literature is provided in this paper.

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Figure 1: Constructing Costs

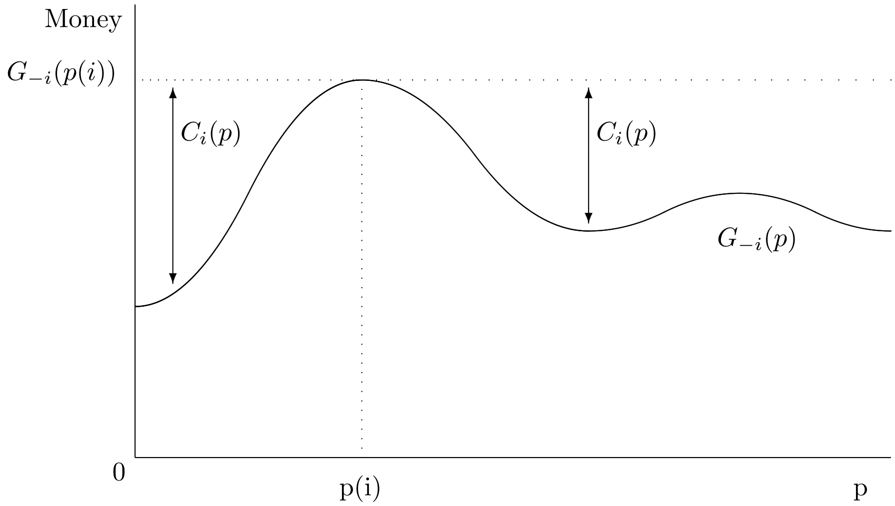

Figure 2: Regret Free Bids

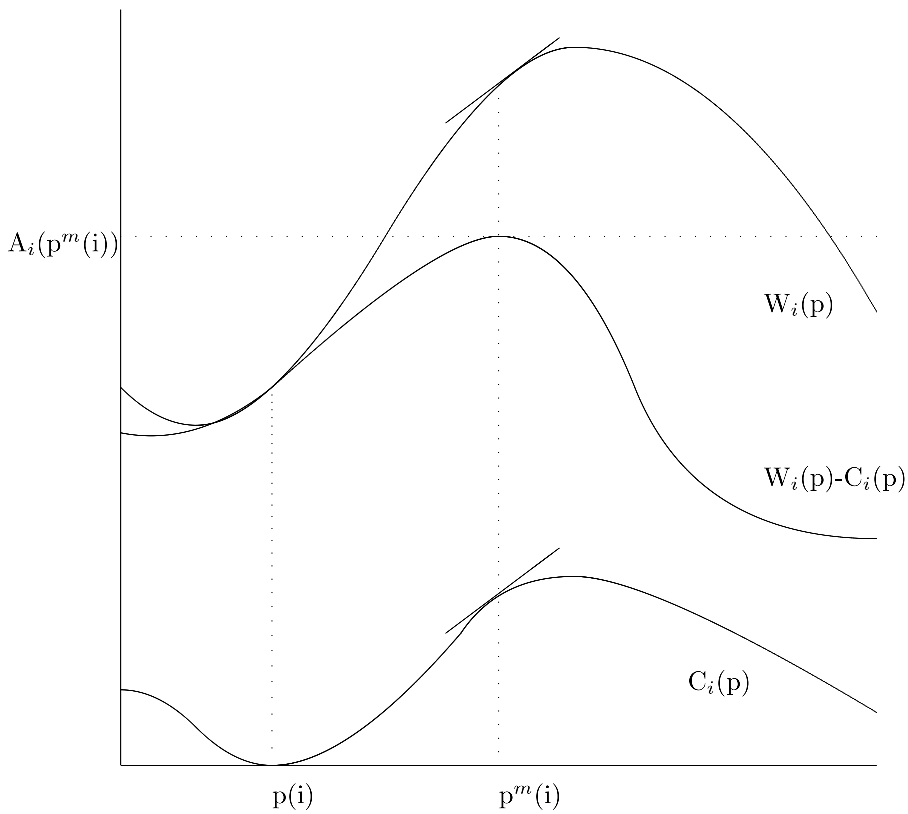

Table 1: A Summary of Results in Past Studies (Standard errors are in brackets)

	γ	δ	α	α_L
Goldber and Maggi (1999)	-0.0093	0.0106	70.43	0.883
	(0.0040)	(0.0053)		
Gawande and Bandyopadhyay (2000)	-3.088/10000	3.145/10000	3175	0.9819
	(1.532)	(1.575)		
Mitra et al. (2002)	-0.00799	0.01166	85.11	0.68
			(35.54)	(0.29)
McCalam (2004)	-0.022	0.025	40.88	0.88
	(0.012)	(0.013)	(14.63)	(0.004)