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Protection for Sale or Surge Protection?
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ABSTRACT

This paper asks whether the results obtained from using the standard approach to testing the influential Grossman and Helpman "protection for sale (PFS)" model of political economy might arise from a simpler setting. A model of imports and quotas with protection occurring in response to import surges, but only for organized industries, is simulated and shown to provide parameter estimates consistent with the protection for sale framework. This suggests that the standard approach may be less of a test than previously thought.

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1. Introduction

Over the past decade, the Grossman and Helpman (1994) model of "Protection for Sale" (PFS) has become the most influential one, both theoretically and empirically, in the political economy of trade. Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), (GM and GB respectively from here on) were the first few papers that took the model to the data and found estimates consistent with the model. While GM and GB use US data, Mitra, Thomakos and Ulubasoglu (2002) and McCalman (2001) use Turkish and Australian data, respectively. Eicher and Osang (2002) test the PFS model against an alternative tariff formation function model. All of these studies provide additional evidence in favor of the PFS model. A key prediction made by the PFS model in explaining protection levels is that organized and unorganized industries have opposite signs for a key coefficient. This prediction, which differs from that of other models, seems to be borne out in the data. In this paper we ask whether this (compelling) result could be illusionary: that is, whether results like this could arise even in the absence of the kind of behavior posited by the PFS literature. We argue that a model where protection tends to be for the organized, without being for "sale" as in the menu auction framework of Grossman and Helpman (1994), generates data that, as far as protection levels alone go, gives the same pattern for the key coefficients in the PFS model. It also helps explain some puzzling results in previous work.

More recently, researchers have extended the original PFS model in various directions. Bombardini (2004) incorporates firm size into the protection equation.[1] Gawande and Krishna (2004) incorporate foreign lobbies as well as domestic ones while Gawande and Krishna (2005) add lobbying of both upstream and downstream producers. Matschke and Sherlund (2004) add labor unions and labor immobility

[1] However, there are some problems with pinning down a unique equilibrium in her model.

to the model. Facchini et al. (2004) construct and estimate the quota version of the PFS model. While such extensions seem to provide more evidence in support of the PFS model, they, in effect, graft on additional complications onto the basic PFS model and so provide evidence that other variables are also important. However, they leave the basic predictions of the PFS model unchanged. For this reason, we choose to look at the basic model and its key predictions.

Over the years, many "flaws" of the PFS model have been highlighted.[2] On the theoretical side, there are three main concerns. 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 this theory? Or is it that contributions buy something else, like access to politicians? Ansolobehere et al. (2002), 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. The assumption that bids are "locally truthful" is what pins down the equilibrium. This restriction 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 predictions of the PFS model have been depicted as "un-intuitive". The PFS model predicts that protection is higher the *lower* the import penetration ratio.[3] Intuition suggests that industries where import penetration used to be low and has increased tend to be those where a comparative advantage existed but has been eroded.[4] It is in such industries that protectionist pressures would be largest. This is

[2] The issues raised below have been voiced in the literature, see Rodrik (1995), Helpman (1995), and Gawande and Krishna (2003) for more on much of what follows.

[3] This is also predicted by the models of Findlay and Wellisz (1982) and Hillman (1982).

[4] Maybe, the problem is that this intuition on where protection occurs is basically dynamic, while

consistent with non-tariff barrier (NTB) coverage being positively and significantly related to the *change* in import penetration and the coefficient on the level of import penetration being insignificant, see Trefler (1993). When only import penetration is used, as in Lee and Swagel (1997), then protection is positively and significantly related to it. Goldberg and Maggi (1999) argue that there is no inconsistency between their results which support this prediction of the PFS model and the above empirical regularity as import penetration enters additively in these models and interactively with political organization in theirs.

On the empirical side, there is much room for improvement. First, as is usual with any empirical enterprise, the data is far from perfect. Data on contributions is often not available outside the US.[5] In addition, the elasticity estimates commonly used, those of Shiells, Deardorff and Stern (1985) are dated and at the three digit level of aggregation. Moreover, half the estimates are of the wrong sign or insignificant.[6] More recent estimates at a disaggregated level need to be used since testing political economy models, in particular, should be done at as disaggregated a level as possible.

Second, the results seem relatively fragile and the extent to which the estimation does a stringent job of testing the PFS model is an open question.[7] All of this makes

most models are static. One exception is the work of Brainard and Verdier (1993), which explains the persistence of protection by pointing out that protection today raises production relative to imports, which in turn, raises protection tomorrow.

[5] A way around this, using an iterative procedure, is proposed by Cadot et al. (2005). As a by product they find that their estimates of the weight on social welfare are lower than that on contributions! However, how well their procedure performs is not as yet clear.

[6] They estimate 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 control 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.

[7] As the data used by GM is not available, it is hard to exactly replicate their work. GB's data is easily available, but neither we nor Bombardini (2004) could exactly replicate their results quantitatively, though we were able to do so qualitatively: more on this below. Close replication of the

one wonder how much of what researchers are getting is due to choosing a set of regression results that validates existing empirical work? How much of it is due to the same forces at work in a variety of setups that result in estimates that look like support for the model? How much of the work supposedly supporting the PFS model actually tests for results that are common in a variety of different models other than PFS? For example, to what extent should firm size effects mattering as in Bombardini (2004) or protection on being lower when there are organized downstream users of the industry's output be seen as a validation of the PFS model? Would similar predictions not arise in other models? All of this makes one suspect that the model is, perhaps, not being subjected to the right kind of test in much of this work. These concerns should not be taken negatively: these are hard questions to tackle. Rather, they should be taken as an attempt to refocus attention on the key issues and so guide future work.

Third, the size of estimated coefficients for the various PFS models has also led to some concern. In all the work we are aware of, the estimate of the weight on contribution relative to welfare, which is derived from the estimated coefficients, tends to be low so that political economy factors seem to matter little. However, 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, and given that contributions are small relative to their effects on firm profits and welfare, one would expect a reasonably high weight on contributions relative to welfare.[8]

The estimated low weight on contributions relative to welfare, we argue, could have a number of causes. First, data on contributions is not actually used in the estimation procedure of either GM or GB. The only paper we know that actually uses

results seems to depend on the exact combination of instruments used.In personal communication, Gawande confirmed this.

[8] 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.

contribution data directly is Kee, Olarreaga, and Silva (2005). They assume lobbies have a first mover advantage over government as is the norm in this literature and look at foreign lobbying in the US for preferential access (which reduces tariffs to zero or leaves them unchanged) assuming world prices are given.[9] 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 using either the GM or GB approach!

The standard approach basically estimates the predicted outcome of the PFS model: protection in equilibrium is related to its determinants but contributions do not explicitly enter this equation. Hence, there is no direct way for the low level of contributions to influence the estimated weight on contributions relative to welfare! Contributions are used to obtain a cutoff above which industries are taken to be organized in GM. They are used to see if lobbying expenditure follows predicted patterns in GB, but are not used to estimate the key parameters of the model. If contributions data was actually used to estimate a structural model, then the key parameters might have been quite different.[10]

Also, using data generated from a simpler model than PFS may yield similar estimated coefficients, but without the strict PFS interpretation. Thus, the supposedly high values for the weight on welfare can be thought of as just a misinterpretation of the parameter estimates. This is the key idea that we explore in this paper. We argue that a simple setting, where government provides protection for politically organized industries when imports exceed a trigger level, is also consistent with the

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

[10] We are exploring this avenue in ongoing work.

estimates in the literature. In other words, a setting where 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, could explain the size of the estimates obtained!

In this paper, we simulate a simple equilibrium model of domestic consumption and imports, where imports in the politically organized sector are subject to an exogenously and uniformly set quota. There are no quotas if a sector is not organized. Political organization is set exogenously and randomly. Obviously, in this simple model of quotas, there is no strict protection for sale effect. Parameters are set so the simulated data roughly match the basic statistics of the actual data. Then, we estimate the key equation of the PFS model on the artificial data following the procedures by GM and GB. We obtain coefficient estimates that are consistent with the protection for sale paradigm! We then explain where our estimates are coming from. We also consider the analogous tariff setting version of the model and show that our results also go through there.

The paper proceeds as follows. The PFS model is laid out in the next section. Section 3 then develops a simple model of imports and quotas with protection occurring in response to import surges, but only for the organized industries, which we calibrate to broadly match the data. We then generate data from it. Section 4 then runs the standard regressions on the simulated data and shows that the standard results are obtained despite the absence of any strict PFS effects. Section 5 verifies that our results go through even with tariffs. Section 6 then explains why this is happening. Section 7 suggests and runs some further robustness tests using GB's data. Section 8 concludes.

2. The PFS Model and Its Estimation

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 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 the 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 that all principals (organized lobbies) are trying to influence. Such games are known to have a continuum of equilibria.[11] By restricting agents to bids that are "truthful", so that their bids

[11] Given the bids of all other lobbies, each lobby wants a particular outcome to occur, namely, the one where it obtains the greatest benefit less cost. This can be attained by offering the minimal contribution needed for that outcome to be chosen by the government. However, what is offered for other outcomes (which is part of the bid function) is not fully pinned down as given other bids, it is irrelevant. However, bids at other outcomes affect the optimal choices of other lobbies and as their behavior affects yours, multiplicity arises naturally. Uniqueness is obtained by pinning down the bids at all outcomes to yeild the same payoff as at the desired one.

have the same curvature as their welfare, a unique equilibrium is obtained.[12] The equilibrium outcome, thus, is as if the government was maximizing weighted social welfare ($W(p)$ where p is the domestic price and equals the tariff vector plus the world price vector, p^*) with a greater weight on the welfare of organized industries. Thus, equilibrium tariffs can be found by maximizing

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

where J_0 is the set of politically organized industries and the welfare of agents in industry j is

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

where $\pi_j(p_j)$ is producer surplus in industry j, l_j is labor employed in industry j, wage is unity, $\frac{N_j}{N}$ is the share of workers employed in the jth industry, while $T(p) + S(P)$ is the sum of tariff revenue and consumer surplus in the economy.

This is the great charm of the PFS model: not only does it cleanly model where both the demand and the supply of protection are coming from, but the results can be derived from a simple maximization exercise! Small wonder it is so popular.

Differentiating $W_i(p)$ with respect to p_j gives[13]

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

where so $\delta_{ij} = 1$ if $i = j$ and 0 otherwise, α_i is the share of labor employed in industry i, $m_j'(p_j)$ is the derivative of the demand for imports, and $x_j(p_j) = \pi_j'(p_j)$ denotes

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

[13] 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.

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

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

Now $\sum_{i \in J_0} \alpha_i = \alpha_L$, the employment share of organized industries and $\sum_{i \in J_0} \delta_{ij} = I_j$ is unity if j is organized and zero otherwise. Thus, the above is the same as

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

Using the fact that $(p_j - p_j^*) = (t_j)\, p_j^*$, the above equation can be rewritten as

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

where $z_j = \frac{x_j(p_j)}{m_j(p_j)}$ and $e_j = -m_j'(p_j)\frac{p_j}{m_j(p_j)}$. This is the basis of the key estimating equation. Note that protection is predicted to be positively related to $\frac{z_j}{e_j}$ if the industry is organized, but negatively related to it if the industry is not organized, and that the sum of the coefficients is positive. Moreover, the coefficients on $\frac{z_j}{e_j}$ and $I_j\frac{z_j}{e_j}$, γ and δ below, can be used to infer the weight on welfare placed by government. It is easy to verify that $\alpha = \frac{1+\gamma}{\delta}$ and $\alpha_L = \frac{-\gamma}{\delta}$. An even stronger prediction is that z_j and e_j do not enter separately once their ratio is controlled for.

GM and GB add an error term to the above model to permit estimation:

$$\frac{t_j}{1+t_j} = \gamma \frac{z_j}{e_j} + \delta I_j \frac{z_j}{e_j} + \varepsilon_j. \tag{2.1}$$

The error term is interpreted as the composite of variables potentially affecting protection that may have been left out, and the measurement error of the dependent variable. Both GB and GM used the coverage ratios for non-tariff barriers as t_j instead of the tariff itself. GB estimated a variant of equation (2.1) together with the other equations which determine the political contribution and the inverse import penetration ratio. Their protection for sale equation also accounts for tariffs on intermediate goods and adds as explanatory variables the tariff and NTBs on intermediates goods used by the industry. As shown in Grossman and Helpman (1994), protection for the final good is increasing in that of the intermediate inputs used. To consistently estimate the above equation (since the inverse import penetration ratio and the import elasticity could be endogenous), they used a nonlinear IV estimation technique proposed by Kelejian (1971).

GM explicitly considered the corner solution of the protection measure on the LHS. Using full information maximum likelihood, they estimated the following system of equations. First, the "true level of protection" in industry i, the latent variable t_i^*, is related to organization and z_i.[14]

$$\frac{t_i^* e_i}{1+t_i^*} = \gamma z_i + \delta I_i z_i + \epsilon_i. \tag{2.2}$$

The true protection level is a multiple of the coverage ratio which lies between zero

[14] Note that e_j is moved to the left hand side to alleviate concerns about its endogeneity. Also, they actually use $1 + z_i$ not z_i which results in a few complications as discussed later.

and unity (to account for the boundedness of the coverage ratio in the data)

$$\begin{aligned} t_i &= \frac{1}{\mu} t_i^* \quad if \quad 0 < t_i^* < \mu \\ &= 0 \qquad\quad if \quad t_i^* \leq 0 \\ &= 1 \qquad\quad if \quad t_i^* \geq \mu \end{aligned} \tag{2.3}$$

where μ is exogenously set at the value 1, 2, or 3.[15] Domestic production to import ratios are related to a variety of factors in

$$z_i = \varsigma_1' R_{1i} + u_{1i}. \tag{2.4}$$

$$\begin{aligned} I_i^* &= \varsigma_2' R_{2i} + u_{2i} \\ I_i &= 1 \quad if \;\; I_i^* > 0 \\ &= 0 \quad if \;\; I_i^* \leq 0 \end{aligned} \tag{2.5}$$

where I_i^* is a latent variable for political organization, and R_{1i} and R_{2i} are vectors of exogenous variables. The key parameters γ and δ have the predicted signs and are significant at the 5% level. No matter what level of μ is used, the estimate of α is high (over 49) and α_L is close to unity (over .95), though as expected, a high μ reduces the estimates of α and α_L. (A high μ raises true tariffs and this, in turn, is consistent with a higher δ and lower γ and hence, lower weight on welfare and a lower degree of organization.

[15] Though there is no reason for μ not to be less than unity as quotas may be barely binding.

3. A Simple Model of Imports

We now develop a simple model of imports that we will simulate. To match the key statistics of the data, our model has to have several features. First, in the data some industries are politically organized and others are not. To match the data, in our model we simply assume political organization is randomly determined. Second, in the data some politically organized industries are protected by quota and others are not. To capture that in a simple way, we assume that politically organized industries whose equilibrium imports exceed some level would face a quota.

First, consider the domestic and foreign goods equilibrium without quota. For each industry i and subindustry j, there are two types of goods: domestic and foreign goods. To make matters simple, we assume that each good's demand depends only on its own price and random shocks and that home is the only source of demand. Let x_{ij}^H be the equilibrium quantity of home goods in industry i subindustry j, and let p_{ij}^H be its equilibrium price.

The equilibrium is described by the demand and supply equations. The demand for industry i subindustry j of the home good depends on a constant, the price of the good, and random terms as follows:

$$\ln x_{ij}^{Hd} = ahd_1 + ahd_2 \ln p_{ij}^H + xhd_i + uhd_{ij}. \tag{3.1}$$

Similarly, the supply of the same good follows the supply equation:

$$\ln x_{ij}^{Hs} = ahs_1 + ahs_2 \ln p_{ij}^H + xhs_i + uhs_{ij}. \tag{3.2}$$

The random terms xhd_i and xhs_i are industry specific demand and supply shocks, and hence, common across all subindustries, while uhd_{ij} and uhs_{ij} are subindustry specific demand and supply shocks and are idiosyncratic to each subindustry. All

shocks are assumed to be i.i.d. with normal distributions though the parameters of the distribution differ. Thus, for all i, xhd_i has mean 0 and standard deviation σ_{xhd}, while uhs_i has mean 0 and standard deviation σ_{xhs}. Similarly, for all ij, uhd_{ij} has mean 0 and standard deviation σ_{uhd}, while xhs_i has mean 0 and standard deviation σ_{uhs}. Equilibrium satisfies

$$x_{ij}^{Hd} = x_{ij}^{Hs} = x_{ij}^{H}. \tag{3.3}$$

Similarly, let import demand be given by

$$\ln x_{ij}^{Md} = amd_1 + amd_2 \ln p_{ij}^{M} + xmd_i + umd_{ij} \tag{3.4}$$

and supply by:

$$\ln x_{ij}^{Ms} = ams_1 + ams_2 \ln p_{ij}^{M} + xms_i + ums_{ij}. \tag{3.5}$$

As before, the random terms xmd_i, xms_i, umd_{ij}, and ums_{ij} are industry and subindustry specific demand and supply shocks. They are distributed i.i.d. normally with means zero and standard errors σ_{xmd}, σ_{xms}, σ_{umd}, and σ_{ums} respectively. Equilibrium satisfies

$$x_{ij}^{Md} = x_{ij}^{Ms} = x_{ij}^{Me}. \tag{3.6}$$

We assume that there are $n_t = 200$ industries and each industry has $n_j = 6$ subindustries. Each subindustry ij is politically organized with probability Po_i. We allow for some variation in the political organization probability across industries: $Po_i = 0.9$ with probability 0.3,, $Po_i = 0.8$ with probability 0.2, $Po_i = 0.7$ with probability 0.2, and $Po_i = 0.1$ with probability 0.3. This is done to ensure that there is sufficient variation in the numbers of subindustries that are politically organized within industries. If we had only one probability of political organization for every

industry, say .6, the fraction of industries that are politically organized will be clustered around .6. We simulate political organization by generating a $(0,1)$ uniformly distributed random variable u_{pi}, and generate independently another $(0,1)$ uniformly distributed random variable u_{oij}. If $u_{pi} \leq 0.3$, then $I_{ij} = 1$ if $u_{oij} \leq 0.1$. $I_{ij} = 0$ otherwise. If $0.3 < u_{pi} \leq 0.5$, then $I_{ij} = 1$ if $u_{oij} \leq 0.7$ and $I_{ij} = 0$ otherwise. If $0.5 < u_{pi} \leq 0.7$, then $I_{ij} = 1$ if $u_{oij} \leq 0.8$ and $I_{ij} = 0$ otherwise. If $0.7 < u_{pi}$, then $I_{ij} = 1$ if $u_{oij} \leq 0.8$ and $I_{ij} = 0$ otherwise.

We simulate the output and prices of each industry by first drawing n_t industry demand and supply shocks xmd_i and xms_i for $i = 1, ..., n_t$ and for each industry i, drawing n_s subindustry demand and supply shocks umd_{ij} and ums_{ij} for $j = 1, ..., n_s$. Then, given these shocks and parameters of the demand and supply equations, we compute the equilibrium price and quantities for each subindustry ij.

We now introduce a uniform quota level $\hat{Q}$ for all subindustries. That is, the quota becomes binding in industry ij if the equilibrium output for the foreign goods exceeds $\hat{Q}$. Let d^q_{ij} be the indicator for a binding quota. That is, if x^{Me}_{ij} for subindustry ij exceeds $\hat{Q}$, then actual imports, x^M_{ij}, equal $\hat{Q}$ and $d^q_{ij} = 1$. Otherwise, $x^M_{ij} = x^{Me}_{ij}$ and $d^q_{ij} = 0$. 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.

Next we aggregate subindustry output to the industry level. Total industry equilibrium output is computed as

$$X^H_i = \sum_{j=1}^{n_j} x^H_{ij}$$

for home goods and

$$X_i^M = \sum_{j=1}^{n_j} x_{ij}^M$$

for foreign goods.

We then generate the variables that we used in the estimation as follows. First, we compute the coverage ratio C_i of industry i to be:

$$C_i = \frac{\sum_{j=1}^{n_j} x_{ij}^M d_{ij}^q}{X_i^M}.$$

That is, coverage ratio is the fraction of industry output i where quota is binding. Furthermore, the inverse import penetration ratio, z_i, for industry i is the ratio of domestic production to imports or

$$\frac{X_i^H + X_i^M}{X_i^M} = 1 + z_i.$$

We also derive the political organization dummy of industry i, I_i, as:

$$\begin{aligned} I_i &= 1 \; if \sum_{j=1}^{n_j} I_{ij} > \frac{n_j}{2} \\ &= 0 \;\; otherwise. \end{aligned}$$

In other words, we call industry i politically organized if more than half of its subindustries are politically organized.

We chose the parameters of the above model so that the simulation is reasonably close to the actual data in several dimensions. The parameters of the home goods

demand and supply equations are: $ahd_1 = 4.0$, $ahd_2 = -1.3$, $ahs_1 = 3.4$, $ahs_2 = 1.4$, $amd_1 = 1.4$, $amd_2 = -1.5027$, $ams_1 = 1.4$, $ams_2 = 1.0$.

The import demand elasticity, i.e., $-amd_2$, is set at the mean of the industry import demand elasticity from the estimation of Shiells et. al. (1986). Furthermore,

$$\begin{aligned} \sigma_{xhd} &= \sigma_{xhs} = 2.0,\ \sigma_{xmd} = \sigma_{xms} = 0.48, \\ \sigma_{uhd} &= \sigma_{uxhs} = 0.2, \sigma_{umd} = \sigma_{ums} = 0.05. \end{aligned}$$

In Table 1, we compare the simulation of the model to the data used in GB. The simulation size is 1000. 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.

Table 1. Summary Statistics

	Simulation	Data
Political organization frequency	0.626	0.680
NTB positive	0.541	0.533
Average log output/import ratio	2.354	2.783
Std. error of log output/import ratio	1.347	1.620

Notice that we did not vary the import demand elasticity because, together with the uniform quota level, it would generate correlation between the import demand elasticity and the NTB coverage ratio in the simulation, which we wanted to purge from the model.

4. Estimating the Model Using Simulated Data

Next we generate data using the simple model of protection outlined above. Then we estimate the standard protection equation by following the procedures of both GB and GM.

4.1. OLS-IV Regression

To replicate the IV estimation done by GB, we generated 200 data points from our simple model and estimated the following equation by three stage least squares. Note that we scale variables by dividing by 10,000 so that estimated parameters are larger, as done by GB.

$$\frac{C_i}{1+C_i} \mid amd_2 \mid = \beta_0 + \gamma \frac{(1+z_i)}{10000} + \delta I_i \frac{(1+z_i)}{10000} + u_i.$$

Note that we use $1+z$, not z, as GB and GM use consumption (which equals domestic production plus imports in the standard homogeneous good model) relative to imports, not production relative to imports. Thus, they in effect use $1+z$ and we follow their lead for comparability. Note however, that due to the presence of the interaction term, $I(1+z)$, this choice of variable results in some mis-specification which could affect the estimates of γ and δ as well as β_0. However, the impact of using one versus the other turns out to be quite small in GM but larger in our model. We say more on this when we discuss our maximum likelihood estimation below.

We report the OLS regression, 3 stage least squares regression results where the instruments are the exogenous home demand and supply shocks and political organization shocks: xhd_i, xhs_i, u_{pi}. (3SLS 1). We also run another 3 stage least squares regression where the instruments include the above exogenous variables, their square terms, and interactions (3SLS 2). The results are shown in Table 2.

All the parameter estimates as well as their standard errors are the average of 10

simulation/estimation exercises. Notice that in all the above estimates, the coefficients on $(1+z_i)$ are significantly negative, the coefficients on $I_i(1+z_i)$ are significantly positive, and the sums of these two coefficients are positive, just as the PFS model predicts.

Table 2. Regression Results

Parameter	OLS	3SLS 1	3SLS 2	GB	GM
β_0	0.3152	0.3117	0.3104	-0.042	
	(0.0250)***	(0.0383)***	(0.0267)***	(0.017)**	
γ	-28.14	-95.78	-47.27	-3.088	-0.0093
	(7.91)***	(22.9)***	(12.3)***	(1.532)**	(0.0040)**
δ	35.24	141.4	66.83	3.145	0.0106
	(9.05)***	(31.3)***	(15.8)***	(1.575)**	(0.0053)**
α	355.15	73.11	166.50	3178.67	93.46
α_L	0.8308	0.6761	0.6854	0.9819	0.8773

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively. GB is from the first column in Table 3A (p.145). GM is from the first column in Table 3A (p.145). GM is from the first column in Table 1 (p.1145).

Note that our estimates are an order of magnitude larger than those of GB, but as will be seen, are close to those estimated by GM as well as those estimated for the simulated data following the procedure of GM. We use a sample size of 200 as this is close to that used in both GB and GM. The IV estimates, which are consistent, may be subject to small sample bias as the sample size of 200 may be a bit small. To see if there was a significant bias in the mean we also ran the same simulation/estimation exercises once with the simulation sample size of 1000. Table 3 reports these results. As is evident, the estimates do differ as expected, but the estimates for the coefficients in both table 2 and 3 follow the patterns predicted by PFS: the coefficients of $(1+z_i)$ are significantly negative, the coefficients of $(1+z_i)$ times the political organization

dummy are significantly positive, and the sums of these two coefficients are positive. Moreover, their sizes are roughly the same as those in GM (recall we need to divide these coefficients by $10,000$ to make them comparable to GM's).

In both table 2 and 3, the value of α is "too high" to be reasonable.[16] All of this comes about in spite of the fact that the data comes from a simple model where the quota is set exogenously at a uniform level in all subindustries, the import elasticity is set constant across all industries, and political organization is completely exogenous to the system. That is, it is fair to say that the simulated data comes from a much less restrictive model than that of protection for sale.

Table 3. Regression Results

Parameter	OLS	3SLS 1	3SLS 2	GB	GM
β_0	0.3055	0.2912	0.3040	-0.042	
	(0.0109)***	(0.0173)***	(0.0119)***	(0.017)**	
γ	-26.64	-101.03	-53.83	-3.088	-0.0093
	(3.56)***	(11.2)***	(5.68)***	(1.532)**	(0.0040)**
δ	35.33	155.6	77.11	3.145	0.0106
	(3.96)***	(14.9)***	(7.10)***	(1.575)**	(0.0053)**
α	282.28	63.64	128.98	3178.67	93.46
α_L	0.7540	0.6494	0.6981	0.9819	0.8773

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively. GB is from the first column in Table 3A (p.145). GM is from the first column in Table 1(p.1145).

4.2. Maximum Likelihood Estimation

Next we follow GM and assume the error terms of the equations (2.2), (2.4), and (2.5) are jointly normally distributed. That is, $(\epsilon_i, u_{1i}, u_{2i})$ ~$N(0, \Sigma)$. We use full-

[16] The large value of α comes in large part from low estimates of δ: recall, that as $\alpha = \frac{1+\gamma}{\delta}$, small changes in δ give large changes in α especially at low values of δ.

information maximum likelihood to estimate the parameters of the model, where the instruments for $(1 + z_i)$ are the exogenous home demand and supply shocks and political organization shocks: $\mathbf{R}_{1i} = (xhd_i, xhs_i, u_{pi})$. The instruments for the political organization dummy are the exogenous demand and supply shocks as well as the political organization shocks: $\mathbf{R}_{2i} = (xhd_i, xhs_i, xmd_i, xms_i, u_{pi})$. Again, we conducted 10 simulation/estimation exercises and took the average of those results.

The estimation results are shown in Table 4. Specification 1 estimates the original equation system (2.2)-(2.5) taking $\mu = 1$. Specification 2 adds a constant to equation (2.2), and specification 3 further adds the political organization dummy to the RHS of equation (2.2). In both specifications, the coefficient of $(1 + z_i)$ is negative and significant and that of the product of the political organization dummy and $(1 + z_i)$ is positive and significant. In both specifications 1 and 2, the sum of the coefficients of the terms that include $(1 + z_i)$ is positive, which is in line with the results of GM. Again, we obtain results consistent with the protection for sale model of Grossman and Helpman (1994), reported in column 4 and 5 of Table 4,even though the simulated model comes from a model where protection occurs in response to import surges, but only for the organized, and not the strict PFS model. Also, the estimate of α is still "too high".

Specification 3 adds a political organization dummy. This allows the intercept to differ for organized and unorganized industries. Note that only the intercepts remain significant. In fact, in this small sample case, it looks like organized industries are protected and the remainder get negative protection. Our stark result seems to arise from small sample bias and goes away when the sample size increases to 1000. These are presented in Table 5. Note that GM are careful to estimate this specification as part of their specification checks, see Table $A3$ in their Appendix, and find that, allowing for different intercepts for organized and unorganized industries results in insignificant coefficients for the intercepts and does not affect their estimates for γ

and δ by much. Their estimates are reported in Column 5 of Tables 4 and 5.

Table 4. Maximum Likelihood Results

Parameter	Specification 1	Specification 2	Specification 3	GM	GM-A3
β_0		0.1782	-0.4352		-0.2545
		(0.0704)**	(0.127)***		(0.241)
β_I			0.9510		0.3851
			(0.156)***		(0.347)
γ	-0.0073	-0.0103	-0.0026	-0.0093	-0.0092
	(0.0034)**	(0.0031)***	(0.0035)	(0.0040)**	(0.0044)**
δ	0.0112	0.0118	0.0025	0.0106	0.0089
	(0.0039)***	(0.0034)***	(0.0037)	(0.0053)**	(0.0089)**
α	88.46	83.62	396.38	93.46	
α_L	0.6508	0.8674	1.033	0.8773	
Log likelihood	-971.97	-968.61	-950.18		

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively. β_I is the coefficient on I_i. GM is from the third column in Table 1 (p.1145).

Overall, the results in Table 5 are consistent with PFS: γ is positive and significant, δ is negative and significant and their sum is positive. The intercept in specification 2 is positive and significant and this is clearly coming from the absence of separate intercepts for organized and unorganized firms. However, in specification 3, while the intercept is significantly negative and the organization dummy is significantly positive as in Table 4, the coefficients γ and δ remain significant, with the "correct" signs, and with their sum positive. The implied estimate of α remains "too high". One small inconsistency is worth noting. If we add both constant term and the political organization dummy to the RHS of the PFS equation, both in GM and our case, the constant term is estimated to be negative and the coefficient of the political organization dummy positive. If the true model is the PFS equation (2.2) but we use $z_i^* = 1 + z_i$ instead of z_i, then equation (2.2) can be expressed as follows

$$
\begin{aligned}
\frac{t_i^* e_i}{1+t_i^*} &= \gamma\left(z_i^*-1\right)+\delta I_i\left(z_i^*-1\right)+\epsilon_i \\
&= -\gamma-\delta I_i+\gamma z_i^*+\delta I_i z_i^*+\epsilon_i.
\end{aligned}
$$

Now, because $\gamma < 0$ and $\delta > 0$, the constant term should be estimated to be positive and the coefficient on the political organization dummy to be negative, which is neither the case in our results nor in GM's. In both results the constant terms have negative and the political organization dummies have positive coefficients. In this sense, one could argue that our and GM's results are not in line with the PFS model.

Table 5. Maximum Likelihood Results

Parameter	Specification 1	Specification 2	Specification 3	GM	GM-A3
β_0		0.1265	-0.3925		-0.2545
		(0.0327)***	(0.0592)***		(0.241)
β_I			0.8203		0.3851
			(0.0706)***		(0.347)
γ	-0.0121	-0.0152	-0.0040	-0.0093	-0.0092
	(0.0016)***	(0.0015)***	(0.0019)**	(0.0040)**	(0.0044)**
δ	0.01916	0.0203	0.0061	0.0106	0.0089
	(0.0018)***	(0.0016)***	(0.0021)***	(0.0053)**	(0.0089)**
α	51.57	48.56	163.03	52.93	
α_L	0.6328	0.7482	0.6564	0.833	
Log likelihood	-4755.9	-4749.2	-4685.7		

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively. β_I is the coefficient on I_i. GM is from the third column in Table 1 (p.1145) of their paper.

Note that our estimates are significant, while theirs are not, and adding the constant and dummy for organization affects their results less than ours. Why might these differences arise?

We have three explanations for why our estimates for the constant and dummy

are more significant than theirs. First, their sample size is quite small (107) and this may well result in imprecise estimates when using maximum likelihood techniques where the estimator is merely consistent. Recall that our results in Table 4 and 5 differ a fair deal. Second, since the true model is

$$\frac{t_i}{1+t_i}e_i = \beta_0 + \beta_1 I_i + \gamma\left(1+z_i\right) + \delta I_i\left(1+z_i\right)$$

if one omits I_i, the estimate of δ will be biased upward (as occurs in Table 4 and 5) due to the positive correlation of $\beta_1 I_i$ and $\delta I_i\left(1+z_i\right)$. The correlation between I_i and $(1+z_i)$ is smaller in the data (0.105) than the one in the simulation (0.325)which explains why our results change more than those of GM. The correlation between I_i and $(1+z_i)$ is high for the simulated data because of the uniform quota level. When quota is binding for a subindustry, its import is constant. We find it noteworthy that even in this simple setup, we obtain a significant and negative value for γ and a significant and positive value for δ despite allowing for different intercepts for organized and unorganized industries as required by the PFS model when $1+z$ is used instead of z! Third, the data on z in GM is clustered away from the origin since it is for the US, a large economy, and hence with a low ratio of imports to domestic production in most industries. In addition, there is more variance in the dependent variable in the data than in our simulated data as we keep e constant. As a result, a greater variation in the dependent variable is being explained by a smaller variation in the explanatory ones in GM. This could be an additional reason for the insignificance of the intercept term in the GM results.

5. Tariffs instead of Quotas

Although most of the empirical work estimating the Grossman and Helpman model uses NTB's as proxies for tariffs, there are some notable exceptions such as McCalman (2004), who uses Australian data on tariffs. In this section, we simulate a simple equilibrium model of trade with exogenously determined tariff levels, which has the same spirit as our equilibrium model with quotas. We solve the model and estimate the protection for sale model on the simulated data using tariffs not quotas. Again, we obtain parameter results consistent with the protection for sale framework, even though the model from which the data was generated is far from the strict PFS one. As before, equations $(3.1) - (3.3)$, and $(3.4) - (3.6)$ define the demand, supply and equilibrium for domestic goods and imports respectively.

The parameterization is the same as in the quota case except for the inclusion of the uniform tariff t in the import demand equation. We set a uniform import tolerance level $\hat{Q}$ for all sub industries. We assume that if the equilibrium output for the foreign goods exceeds $\hat{Q}$, then government imposes an uniform tariff $t = .1$. Otherwise, the tariff is set to be 0. Let d_{ij}^{t} be the indicator that takes on the value of one if the tariff is positive. That is, $d_{ij}^{t} = 1$ if x_{ij}^{Me} exceeds $\hat{Q}$ and $d_{ij}^{t} = 0$ and $x_{ij}^{M} = x_{ij}^{Me}$, otherwise. For industries with positive tariffs, the industry demand equation becomes as follows:

$$\ln x_{ij}^{Md} = amd_1 + amd_2 \ln \left[(1+t)\, p_{ij}^{M} \right] + xmd_i + umd_{ij}$$

Equilibrium under the tariff is computed by equalizing industry demand and supply. The output, $(1 + z_i)$, and political organization for each industry are computed by aggregating over subindustries, just as in the quota model. The industry level tariff is the simple average of the subindustry tariffs.

$$t_i = \frac{\sum_{j=1}^{n_i} t_{ij}}{n_i}.$$

Generating data from our model, we replicate GB's results by estimating the following equation by OLS and 3SLS:

$$\frac{t_i}{1+t_i} \mid amd_2 \mid = \beta_0 + \gamma \frac{(1+z_i)}{10000} + \delta I_i \frac{(1+z_i)}{10000} + u_i.$$

The results presented in Table 6 are the average of 10 simulation/estimation exercises with the sample size of 200, while those in Table 7 are based on the sample size of 1000.

Table 6. Regression Results

Parameter	OLS	3SLS 1	3SLS 2
β_0	0.0508 (0.0040)***	0.0489 (0.0064)***	0.0487 (0.0044)***
γ	-4.927 (1.31)***	-16.04 (3.84)***	-7.753 (2.02)***
δ	5.482 (1.54)***	24.34 (5.40)***	11.16 (2.68)***
α	2285.43	427.38	984.90
α_L	0.9393	0.6590	0.6748

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively.

We see that the results are fully consistent with the protection for sale model, even though the simple tariff model from which we generated data is quite different from the PFS one. Table 8 depicts the ML estimates of the model. The first column shows the average of the 10 simulation/estimation exercise with sample size being 200, and the second column shows that of one simulation/estimation exercise with

Table 7. Regression Results

Parameter	OLS	3SLS 1	3SLS 2
β_0	0.0492 (0.0018)***	0.0455 (0.0029)***	0.0476 (0.0020)***
γ	-4.504 (0.585)***	-16.72 (1.90)***	-8.792 (0.948)***
δ	5.339 (0.669)***	26.77 (2.62)***	13.05 (1.22)***
α	1872.26	372.99	765.50
α_L	0.8436	0.6245	0.6736

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively.

sample size of 1000. They also are consistent with the protection for sale model. Again, in both Tables 7 and 8 the value of α is "too high".

Table 8. Maximum Likelihood Results

Parameter	ML 1	ML 2
γ	-0.00082 (0.00047)*	-0.001503 (0.00022)***
δ	0.001370 (0.00056)***	0.00251 (0.00027)***
α	99.17	397.46
α_L	0.6900	0.5981
Log likelihood	-713.0	-3457.9

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively.

6. Why the Simulation Results?

Why is it that we spuriously estimate a protection for sale effect from the simulated data? In this section, we try to explain the reason by using an even simpler model of protection, which does not even have any aggregation over subindustries. Suppose that the demand for and supply of home goods have no random component:

$$\begin{aligned} \ln X_i^{Hd} &= ahd_1 + ahd_2 \ln p_i^H \\ \ln X_i^{Hs} &= ahs_1 + ahs_2 \ln p_i^H. \end{aligned}$$

Then, the home goods equilibrium quantity is:

$$\ln X_i^H = \frac{ahd_2 ahs_1 - ahs_2 ahd_1}{ahd_2 - ahs_2}.$$

We choose parameters so as to set the home goods equilibrium quantity to unity. That is,

$$\ln X_i^H = \frac{ahd_2 ahs_1 - ahs_2 ahd_1}{ahd_2 - ahs_2} = 0.$$

For imported goods in the same industry, however, demand and supply are random. Furthermore, let

$$\begin{aligned} \ln X_i^{Md} &= amd_1 + amd_2 \ln p_i^H + xmd_i \\ \ln X_i^{Ms} &= ams_1 + ams_2 \ln p_i^H + xms_i. \end{aligned}$$

Thus, the equilibrium of the foreign goods market is

$$\ln X_i^M = \frac{amd_2 ams_1 - ams_2 amd_1}{amd_2 - ams_2} + \frac{amd_2 xms_i - ams_2 xmd_i}{amd_2 - ams_2}.$$

We set the parameters so as to set the foreign goods equilibrium to be as follows.

$$\ln X_i^M = -1.0 + 2.0U_i,$$

where U_i is assumed to be uniformly distributed on [0,1]. This gives the desired level of imports. Also, we set the uniform quota level, $\hat{Q} = 1$, so $\ln\hat{Q} = 0$. As before, organization is random and there is a .5 chance of being organized. Protection occurs if the quota is binding and the industry is organized. There is, of course, no strict PFS.

Then, the coverage ratio, C_i , the ratio of trade under quota to total trade is:

$$C_i = 0 \text{ so } \frac{C_i}{1 + C_i} = 0, \text{ if } \ln(X_i^M) = -1.0 + 2.0U_i < 0$$

and

$$C_i = 1 \text{ so } \frac{C_i}{1 + C_i} = .5, \text{ if } \ln(X_i^M) = -1.0 + 2.0U_i \geq 0.$$

Since the probability of being organized is .5, with a large enough number of industries, half of them will be organized and half will not. For the half that are not organized, the consumption to import ratio is:

$$\begin{aligned}\frac{X_i^H + X_i^M}{X_i^M} &= 1 + z_i \\ &= 1 + \frac{1}{e^{(-1.0+2.0U_i)}}.\end{aligned}$$

For the other half of the industries, which are politically organized, it is:

$$\begin{aligned}1 + z_i &= 1 + \frac{1}{e^{(-1.0+2.0U_i)}}, \text{ if } \ln(X_i^M) = -1.0 + 2.0U_i < 0, \\ &= 2, \qquad\qquad\qquad\quad \text{ if } \ln(X_i^M) = -1.0 + 2.0U_i \geq 0.\end{aligned}$$

Now consider that we have drawn 2000 industries. For a large enough sample size, in any realization, roughly half will be organized. To illustrate the intuition, we take exactly half to be organized. Number the industries that are not organized by integers between 1 and 1000 with a higher index given to the industry with a larger U_i. Similarly, number the industries that are organized by integers between 1001 and 2000 with a higher index given to the industry with a higher U_i. Only industries with an index above 1000 will ever get protection. As the number of draws gets large enough, we would expect to see a uniform empirical distribution of the realizations of U_i. To capture this in our picture below, we place one firm at each integer. That is, we assume that industry i has $U_i = \frac{i}{1000}$ for $i = 1, ..., 1000$, and $U_i = \frac{i-1000}{1000}$ for $i = 1001, ..., 2000$. Industries with an index higher than or equal to 1500 will have the quota invoked and be binding while industries with an index below the cutoff, while organized, never have the quota invoked.

Figure 1 plots the U_i and the import quantity. Notice that for industry $i = 1001, ..., 2000$, which are politically organized, the quota binds and import quantity

equals the quota when U_i is large (industries 1500 to 2000).

Figure 1: Import Shock U(i) and Import Quantity

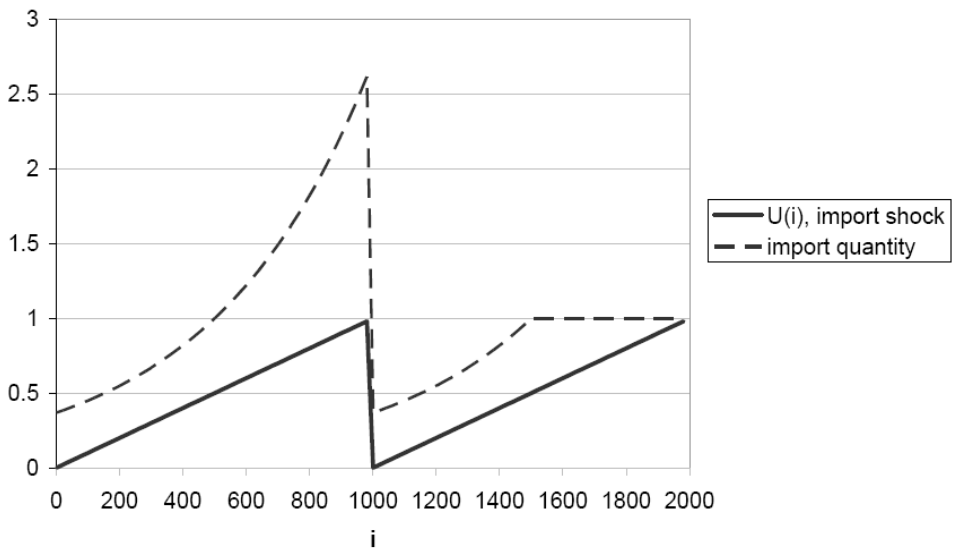


Figure 2 plots the protection measure. The coverage ratio is positive only for industries that are politically organized and whose quota is binding, i.e., industries 1500 to 2000. Their protection measure is .5. Thus, the protection measure in Figure 2 is what we need to fit.

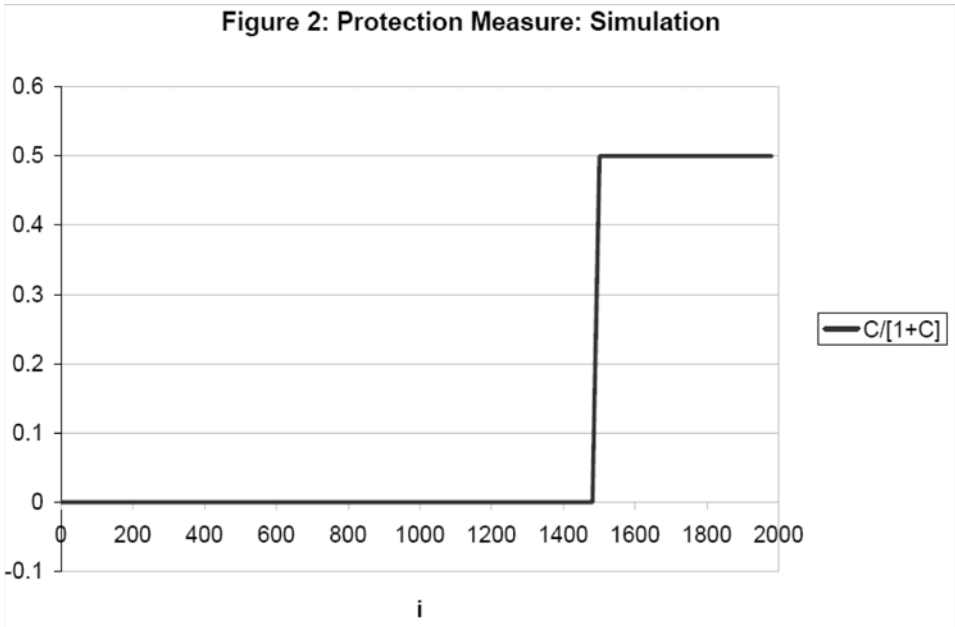
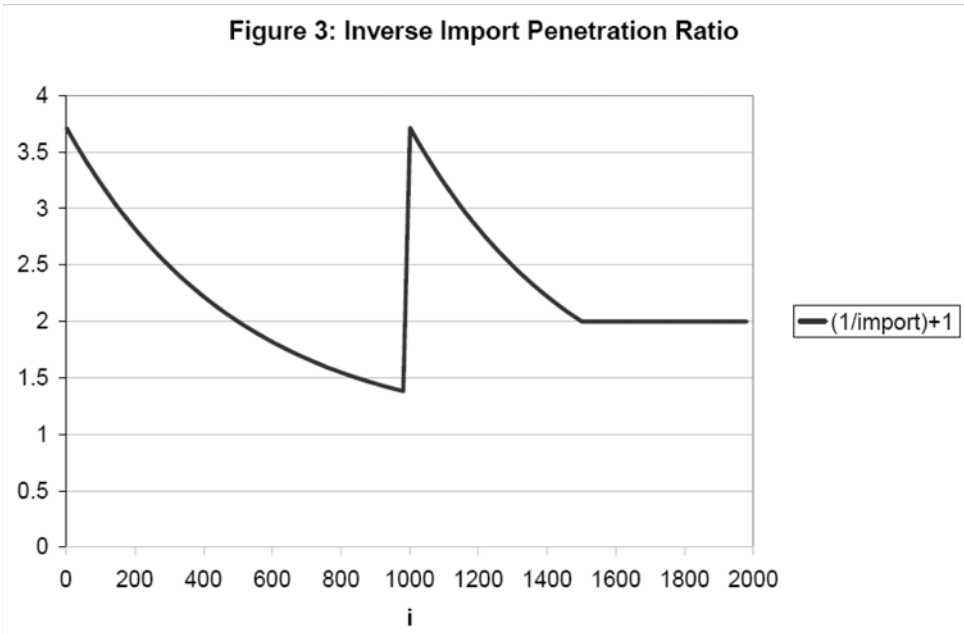
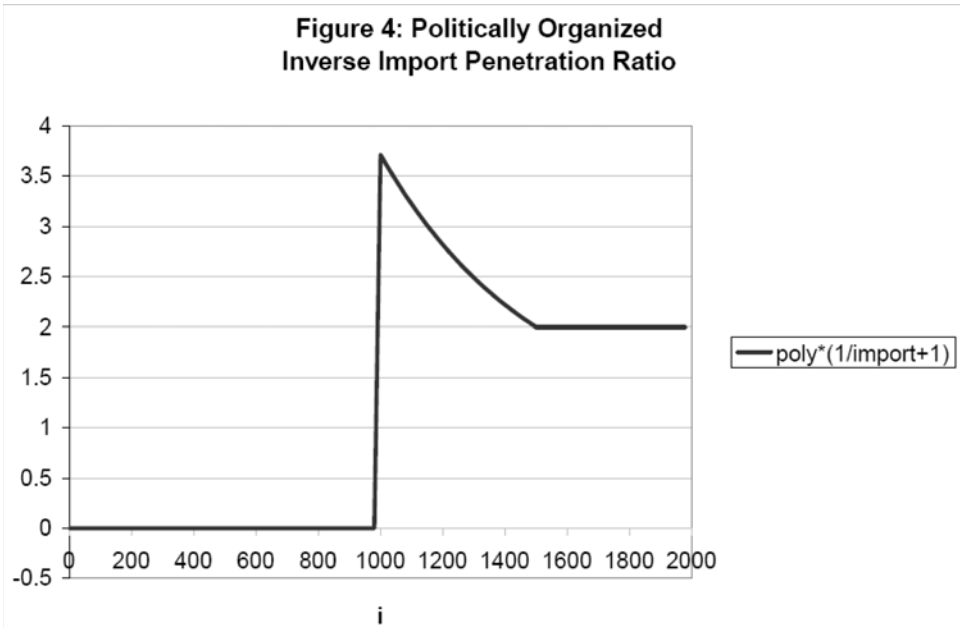


Figure 3 plots 1+ z_i. As we can see, this is high for industries with small imports and low for industries with large imports. It is constant for industries with index 1500 to 2000 because of the binding quota.



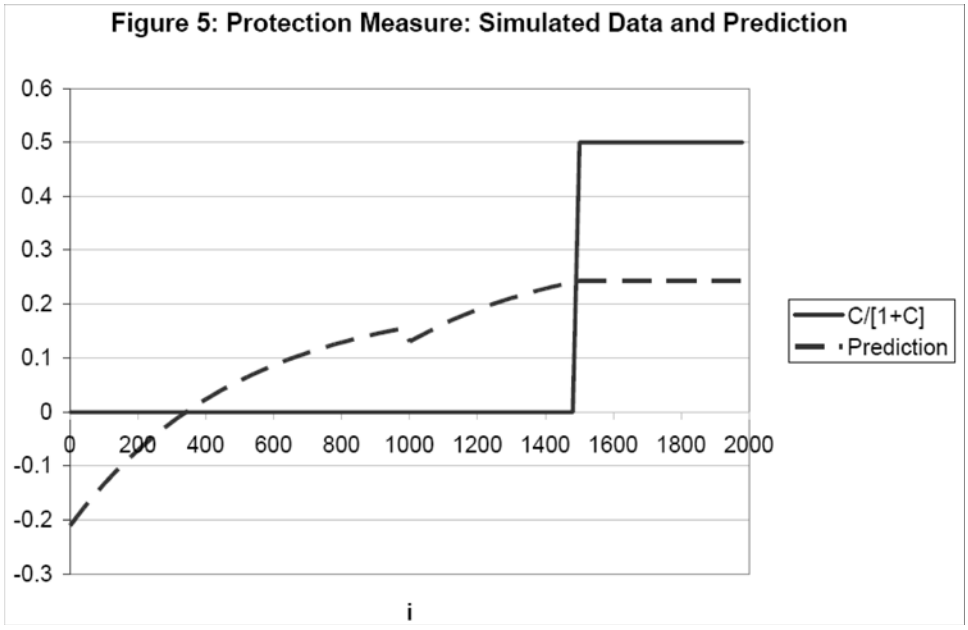
We next plot the $1 + z_i$ times the political organization dummy in Figure 4, i.e., $I_i\,(1 + z_i)$. Notice that for industries 1 to 1000, $I_i\,(1 + z_i)$ is zero because they are never politically organized.



Let us try to fit the protection measure in Figure 2 by using $(1 + z_i)$ (Figure 3) and $I_i(1 + z_i)$ (Figure 4) by OLS. That is,

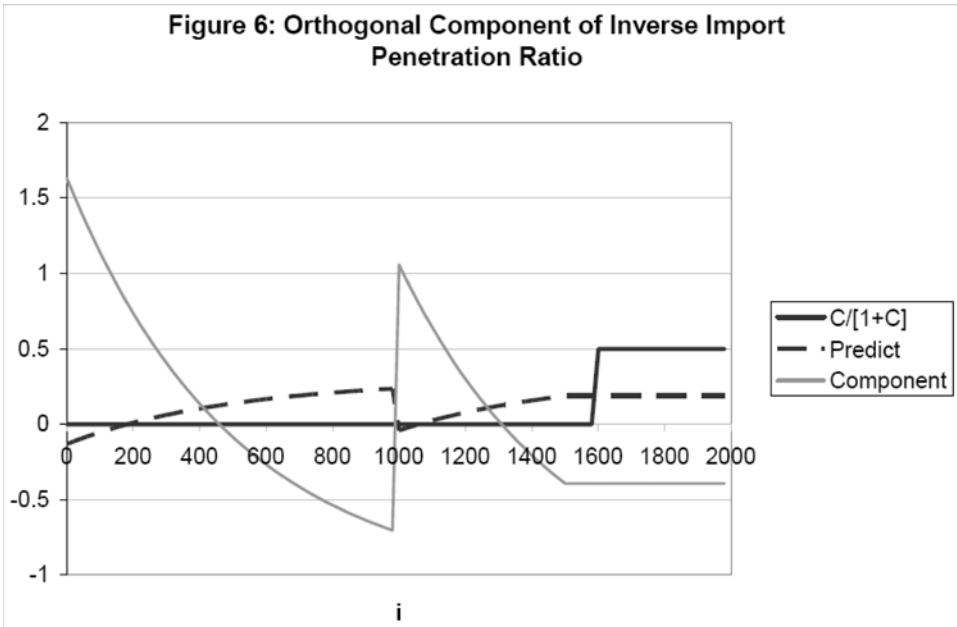
$$\begin{aligned}\left(\frac{\widehat{C}}{1+C}\right) &= \hat{\beta}_0 + \hat{\gamma}\,(1+z) + \hat{\delta} I\,(1+z) \\ &= \underset{(0.0160)}{0.3728} - \underset{(0.0072)}{0.1571}(1+z) + \underset{(0.0035)}{0.0921} I\,(1+z)\end{aligned}$$

Again, note the opposite signs of γ and δ as in the PFS model. Figure 5 plots the dependent variable and the model prediction.



There seems to be a positive correlation between protection and $(1 + z_i)$ for politically organized industries but a negative one between protection and $(1 + z_i)$ for non organized industries. This is what the regression is picking up.

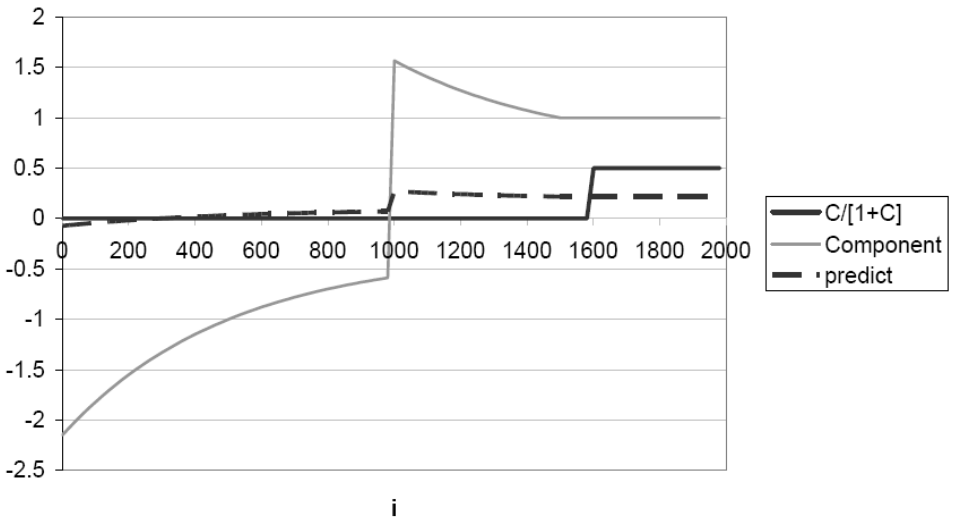
We can confirm the above insight by looking at the regression results from a different angle, i.e., by using the partitioned regression. Let RIP_i be the component of $(1 + z_i)$ that is orthogonal to $I_i (1 + z_i)$. It is obtained by regressing $(1 + z_i)$ on the constant term and $I_i (1 + z_i)$ and taking the residual. The blue line in Figure 6 plots this orthogonal component.



Due to the properties of the partitioned regression, the coefficients of the OLS regression of the protection measure on the orthogonal component gives the coefficient on $(1+z_i)$ back. As can be seen from the graph, the thin line is the orthogonal component of the $(1+z_i)$, which clearly is negatively correlated with the protection measure, which is the reason for the negative coefficient of the $(1+z_i)$ in the original OLS.

The dotted line in Figure 7 is the prediction by the constant term and the orthogonal component. Similarly, let $RIIP_i$ be the component of $I_i\,(1+z_i)$ that is orthogonal to $(1+z_i)$. We obtain it by regressing $I_i\,(1+z_i)$ on the constant term and $(1+z_i)$ and taking the residual. The thin line in Figure 7 plots the orthogonal component.

Figure 7: Orthogonal Component of Politically Organized Inverse Import Penetration Ratio



Again, the coefficient of the OLS regression of the protection measure on the orthogonal component gives the coefficient on $I_i\,(1+z_i)$ back. As can be seen from the graph, the **thin** line is the orthogonal component of $I_i(1+z_i)$, which clearly is positively correlated with the protection measure, which is the reason for the positive coefficient of $(1+z_i)$ in the original OLS.

The qualitative aspects of the above results do not change if we used IV estimation with U_i, U_i^2 as instruments instead of OLS. In Table 9, we show the estimation results of the same equation where we use $(1+z_i)$ and its square as instruments. In this case, not only are the signs right but $\gamma+\delta>0$, which is even more consistent with the PFS model.

Conventional empirical studies in trade estimating the political economy effects use non-tariff barriers as a proxy for tariff protection measures, even though non-tariff barriers could be better interpreted as quotas. The above results show that the real reason behind the results in support of PFS models could be the difference between the quota being binding and non-binding. That is, $\delta I_i\,(1+z_i)\,,\ \delta>0$ fits well for

the industries under quota (1500 to 2000) and industries that are not politically organized, but does not fit well for industries that are politically organized but not under quota (1001 to 1499).

Table 9. 2SLS Estimates

Parameter	Estimate	Std. error
β_0	0.3195	0.166
γ	-0.6102	0.280
δ	1.008	0.645

On the other hand, $\gamma(1+z_i)$, $\gamma < 0$ fits well for industries that are politically organized since those with high equilibrium imports face binding quotas, but fits very poorly for those that are not politically organized. Hence, it is natural that combining both would give the best fit, and these results correspond to the signs obtained by GM and others. Similar interpretations can be offered for the tariff version in Section 6.

7. Robustness Checks for PFS

The original Grossman and Helpman (1994) model imposes a strong structural model restriction on the data. There has been some work done to check the robustness of the Protection for Sale results with respect to the changes in the model specifications. Examples include GM, GB,[17] Facchini et al. (2004), and others. In this section, we further examine the model specification issue, in particular, we check for the robustness of the assumption that in equation (2.1) only the inverse import penetration

[17] Their original working paper version had alternative specifications that included production and imports separately as well as their ratio, but this did not survive in the published version.

matters and not imports or domestic production, once inverse import penetration has been controlled for. We use part of the data used by GB to estimate various specifications of the Protection for Sale equation. The results are summarized in Table 10.

Table 10. Robustness Checks

Variable	Specification 1	Specification 2
Constant	-0.042	-0.268
	(0.018)**	(0.063)***
$(1 + z_i)$	-3.077	-2.905
	(1.550)**	(1.690)*
$I_i\,(1 + z_i)$	3.0440	2.883
	(1.580)*	(1.650)*
INTERMTAR	0.786	1.119
	(0.244)***	(0.253)***
INTERMNTB	0.360	0.352
	(0.063)***	(0.061)***
Log imp.		0.011
		(0.008)
Log cons.		0.020
		(0.009)**

Standard errors are shown in the parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% respectively. INTERMTAR is the average tariff and INTERMNTB is the average NTB coverage ratio on intermediate goods.

We used IV's similar to Bombardini (2004) first, to replicate GB's results. These results come under the heading of Specification 1. The size of the coefficients differs from that of GB whose estimate of γ in their small model is -3.088 with a standard error of 1.532 and that of δ is 3.145 with a standard error of 1.575. So the signs and magnitudes of γ and δ are similar but the sum of the two is slightly negative in our estimates and slightly positive in theirs. We have not been able to obtain the

estimates in their large model but hope to fully replicate their results once we obtain more information from them.

If we add log of import value and log of consumption value to the RHS, as in Specification 2, then even though the signs remain the same, these coefficients are no longer significant or close to being significant at the 95% confidence interval, whereas log consumption value is significant. This suggests that the strong functional form predictions derived from the PFS model may not be supported in the data.

8. Conclusion

In this paper, we suggest that the usual tests of the PFS model are actually also consistent with a simpler model where protection tends to occur when imports surge and the industry is organized. Since our model does not allow the estimates of γ and δ to be used to construct a weight on welfare placed by the government, there is no puzzle regarding the high weight on welfare generated by these "tests" of the PFS model.

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