DO LABOR ISSUES MATTER IN THE DETERMINATION OF U.S. TRADE POLICY? AN EMPIRICAL REEVALUATION

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ABSTRACT. Some recent empirical studies, motivated by Grossman and Helpman's (1994) well-known "Protection for Sale" model, suggest that very few factors (none of them labor-related) determine trade protection. This paper reexamines the roles that labor issues play in the determination of trade policy. We introduce collective bargaining, differences in labor mobility across industries, and trade union lobbying into the protection for sale model and show that the equilibrium protection rate in our model depends upon these labor market variables. In particular, our model predicts that trade protection is structurally higher than in the original Grossman-Helpman model if the trade union of a sector lobbies but capital owners do not, because union workers collect part of the protection rents. On the other hand, equilibrium protection is lower if capital owners lobby but the trade union does not, because part of the protection rents is dissipated to workers. Using data from U.S. manufacturing, we find that collective bargaining, differences in labor mobility across industries, and trade union lobbying do indeed play important roles in the determination of U.S. trade policy.

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1. Introduction

Lobbyists for trade and other industrial policies represent different interest groups in society. In particular, it is common to distinguish between labor and capital lobbies. Labor interests, usually represented by trade unions, take an active stance in lobbying for trade protection. For example, NAFTA met with strong opposition from U.S. trade unions in the 1990s because of fears that freer trade would decrease domestic employment and wage levels. Further, Baldwin (1985) and Baldwin and Magee (2000) find that trade union contributions are positively correlated with the probability that a U.S. congressman votes against trade liberalization.

The observation that labor interests actively lobby for trade protection is in stark contrast to the predictions of the "Protection for Sale" model of Grossman and Helpman (1994). In their model, which has emerged as the new paradigm in the political economy of trade policy literature, Grossman and Helpman (henceforth GH) suggest that very few factors – none of them labor related – determine trade protection. In the protection for sale model, wages are fixed and equal across industries and there is full employment. Only capital owners are allowed to lobby for trade policy, but even if workers were also allowed to lobby, they would want import subsidies in order to benefit from lower product prices. Hence, the GH model cannot explain why trade unions lobby frequently and intensively for trade protection in the hope of securing higher wage and employment levels.

The protection for sale model is also at odds with findings in the older empirical trade protection literature (see Rodrik, 1995, for an overview) that labor market considerations are an important trade policy determinant. More recent empirical studies (e.g., Goldberg and Maggi, 1999; Gawande and Bandyopadyay, 2000; Eicher and Osang, 2002), however, find strong support for the protection for sale model. Some of these studies also test whether or not labor market variables have additional explanatory power and find the labor market variables to be statistically insignificant.

In this paper, we show that the conclusion drawn from these aforementioned studies that labor market variables do not matter for trade protection is misleading. The earlier papers that estimate the protection for sale model employ the nonlinear form of protection suggested by the GH model for estimation.[1] But since the GH model has nothing to say regarding labor market variables, empirical studies thus far have included these variables in an ad hoc manner. The main contribution of this paper is to show that once labor market

[1]For example, in the GH model, import protection decreases with import penetration ratio and import demand elasticity when capital owners lobby, but it increases with these two variables when capital owners do not lobby.

variables have been appropriately controlled for, statistical methods strongly reject the null hypothesis that labor market variables are irrelevant for trade protection.

To this end, we build a model in the same spirit as GH, but relax assumptions with respect to the labor market. In particular, we allow for (*i*) industry-specific trade unions that bargain with capital owners over union wages and employment, (*ii*) differences in labor mobility across industries, and (*iii*) active lobbying by trade unions. Our model predicts that trade protection is structurally higher than in the GH model if the trade union of an industry lobbies but capital owners do not, because union workers collect part of the protection rents. On the other hand, equilibrium protection is lower if capital owners lobby but the trade union does not, because workers receive part of the protection rents. Moreover, as long as trade protection increases the wages of at least some nonunionized workers, equilibrium protection is lower than in the GH model even if both capital owners and trade union of an industry lobby. In contrast to the protection for sale model without trade union activity, the equilibrium protection rate in our model depends upon sectoral wage and employment elasticities that, in turn, vary according to the mobility of workers across industries.

We test our model predictions using 1983 data from U.S. manufacturing. Since our framework nests the GH model, we can test the statistical validity of the GH restrictions. Our major finding is that we can reject the GH model in favor of our labor-augmented model. Moreover, consistent with our theory, we find that, as compared to the GH predictions, trade protection is indeed higher when trade unions lobby and capital owners do not, but lower when capital owners lobby. Not only does trade protection vary according to whether or not capital owners of an industry lobby, but it also depends on trade union activity and differences in labor mobility across industries.

The remainder of this paper is organized as follows: In Section 2, we derive the equilibrium tariffs for industries with mobile and immobile labor when trade unions bargain with firms over wages and employment and are also allowed to lobby for trade protection. Section 3 presents the econometric model and its predictions. In Section 4, we describe the data and then proceed with estimation and testing in Section 5. Section 6 makes suggestions for future research and concludes.

2. The Model

2.1. **Model Basics.** In the following, we augment the Grossman and Helpman (1994) protection for sale model to allow for labor market considerations. Consider a small country with $n+1$ industries which faces an exogenous vector of world prices. The country has fixed endowments of labor L and industry-specific capital K_i, where $i = 1, \dots, n$. Let

$\mathcal{I} = \{0, 1, 2, \ldots, n\}$ denote the set of all industries. Each of these industries produces a single good, with good 0 being the numeraire good.

On the consumption side, assume that all individuals have identical quasilinear preferences. The utility function for each individual is the sum of his good 0 consumption and strictly concave and increasing transformations of the consumption of each of the non-numeraire goods 1 to n. Furthermore, assume that each individual has enough income to consume all goods, i.e., corner solutions are excluded. Quasilinearity of preferences guarantees that the indirect utility function of any individual j is additively separable. More specifically, the indirect utility function can be written as the sum of income and the consumer surpluses from consuming goods $1, \ldots, n$. This ensures that domestic demand of any of the non-numeraire goods depends only on its own price, i.e., no cross-price or income effects exist. While utility functions are identical, endowments are not. Laborers inelastically supply one unit of labor each while each capital owner possesses one unit of specific capital. The individual labor and capital supply is inelastic as factor supply creates income at no disutility to its owners.

The numeraire industry ($i = 0$) uses only labor and is not divided into sectors. The world price of the numeraire good is fixed at $\overline{p}_0$ and one unit of labor produces one unit of output F^0 with a $1:1$ production technology, i.e., $F^0 = L_0$. Each non-numeraire industry $i = 1, \ldots, n$ consists of two sectors (unionized and nonunionized) with identical production functions. Firms in these industries employ three production factors: capital, labor, and the numeraire good 0 as an intermediate input.[2] Each unit of the final good i requires a fixed (but differing with i) amount of good 0 (Leontief technology). To keep notation simple, we denote the price of the amount of good 0 required for one unit of good i by q_i and then write $(p_i - q_i)F^i(K_i, L_i)$ as value-added, thus omitting good 0 as an argument in the production function. Contrary to the intermediate good 0, capital and labor are substitutable in the production function. Capital employed in the sectors of any non-numeraire industry i, namely, K_{iA} in the unionized sector A and $K_{iB} = K_i - K_{iA}$ in the nonunionized sector B, is immobile. In contrast, labor is mobile across sectors of an industry and may or may not be mobile across industries as will be discussed in the next paragraph. The reduced

[2] In order to keep the analysis focused on the influence of labor issues on trade protection, the modelling of intermediate goods as inputs is kept as simple as possible. The only reason why we introduce them at all is that when we allow for union-firm bargaining we have to take into account that firms and unions bargain over value-added, not the entire value of shipments. If we did not make this adjustment, we would very substantially and systematically underestimate the union bargaining strength.

production function $F^i(K_i, L_i)$ is linearly homogeneous and weakly concave where $F^i_{LL} < 0$, $F^i_{KK} < 0$, and $F^i_{KL} > 0$.[3]

We distinguish between industries whose labor force is mobile across industries and those whose labor force is immobile across industries. To keep things simple, we assume that nonunion workers are either completely mobile between certain industries or that they cannot leave their industry at all (and that at the same time, entry by laborers from other industries is not possible, either). If industry $i \in \mathcal{I}_M$ then its labor pool potentially consists of all laborers in the mobile subset of industries. Assuming that the numeraire industry 0 is also mobile, the world price for good 0 pins down the competitive wage for these industries, i.e., $w_i = \overline{p}_0$ for $i \in \mathcal{I}_M$. Union workers may switch industries if $i \in \mathcal{I}_M$, however, they cannot be employed in the unionized sectors of industries other than i itself.[4] If industry $i \in \mathcal{I}_I$, where $\mathcal{I}_M \cup \mathcal{I}_I = \mathcal{I}$ and $\mathcal{I}_M \cap \mathcal{I}_I = \emptyset$, then industry i's workers are immobile and can only work in industry i.

As previously noted, each non-numeraire industry $i = 1, 2, \ldots, n$ consists of two sectors, A and B. Sector A is unionized, i.e., the capital owners in A bargain with the i-specific trade union, which has N_i members, over wages and employment.[5] In sector B, employment is chosen by firms. As is commonly observed in practice, union workers do not exclusively work in the unionized sector nor are nonunion workers confined to work in the nonunionized sector.[6] Employment of union workers in the unionized sector A is measured as a fraction α_i of the N_i union members, while the share of covered nonunion workers as a percentage of the nonunion worker labor pool for industry i is $\delta_i \alpha_i$, where $\delta_i > 0$. The union wage, i.e., the wage paid in the unionized sector A, is denoted by $\bar{w}_i$.[7] In sector B,

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[3] We are omitting the intermediate input as argument in the production function. Note that because good 0 is a Leontief input, we have to adjust the amount of good 0 proportionally with F^i when capital and/or labor input vary.

[4] This assumption is made to maintain the de facto partial equilibrium structure of the GH model which would be destroyed if the industry-specific trade unions also had to take into account that their members might find employment in the unionized sectors of other industries.

[5] Assuming bargaining over both wages and employment (efficient bargaining) reduces the impact of union-firm bargaining to redistributive issues. Efficient bargaining seems a justifiable assumption because empirical tests between this model and the competing right-to-manage model have been either inconclusive or have even produced (weak) evidence in favor of the efficient bargaining model (MaCurdy and Pencavel, 1986). For a discussion how employing the right-to-manage model of union-firm bargaining alters the results, see Matschke (2003).

[6] According to information obtained from the Bureau of Labor Statistics, approximately 15% of union workers in the U.S. were not covered by collective bargaining agreements in 2001. At the same time, 1.5% of nonunion workers were covered by such contracts.

[7] In Section 2.2, we discuss how α_i and $\overline{w}_i$ are determined.

where employment is chosen by the firms, the wage is equal to either $\bar{p}_0$ (if $i \in \mathcal{I}_M$) or the wage which equates residual labor supply with labor demand (if $i \in \mathcal{I}_I$).

In some of the industries (but not the numeraire industry 0), either capital owners, the trade union, or both are active lobbies that solicit trade protection from the domestic government. In the first (lobbying) stage, each lobby offers the government a schedule that lists its contributions as a function of the domestic price vector p. The domestic price p may differ from the world price p^* if the domestic government imposes a vector t of specific import tariffs (or import subsidies) or export taxes (or export subsidies) at this stage. In the second (production) stage, firms and unions take goods prices as given when they determine wages and employment. Suppose good i is an import good. Then $t_i > 0$ ($t_i < 0$) implies that an import tariff (import subsidy) is imposed. In contrast, if good i is an export good then $t_i > 0$ ($t_i < 0$) implies an export subsidy (export tax). To facilitate the description, we focus on import goods when describing the determination of the equilibrium trade policy. However, the reader should note that, with the information given above, the interpretation can readily be changed to accommodate export goods as well.

To find the subgame-perfect Nash equilibrium of the lobbying game we have to proceed backwards. We thus start with the description of the production stage, in which employment and wages are determined, and then consider the lobbying stage.

2.2. **Second Stage: Employment and Wage Determination.** At the production stage, it is assumed that firms maximize profits and the union maximizes the wage bill of union workers.[8]

2.2.1. *Industries with mobile labor.* In sector B, the firms choose the number of workers L_{iB} such that the first-order condition of profit maximization

$$(p_i - q_i)F_L^i(K_{iB}, L_{iB}) = \bar{p}_0 \tag{2.1}$$

holds. The wage w_i is predetermined by the price $\bar{p}_0$ of the numeraire good so that L_{iB} adjusts to ensure that Equation 2.1 holds. Any labor not employed in the non-numeraire industries will be absorbed by the numeraire industry. It is straightforward to verify that L_{iB} is strictly increasing in p_i, i.e., after using the first-order condition (Equation 2.1) to

[8]Notice that this contrasts with the lobbying stage where unions and firms also take into account that they consume goods and receive part of the tariff revenue. This goal discrepancy in the different stages is also present in the original Grossman and Helpman (1994) paper where firms maximize profits in the post-lobbying stage, but in the first (lobbying) stage they maximize utility of their shareholders. This assumption is made to maintain the validity of standard economic results, for example, that profit maximization by firms implies the equality of wage and marginal value product of labor.

substitute for F_L^{iB},

$$\frac{dL_{iB}}{dp_i} = -\frac{\bar{p}_0}{(p_i - q_i)^2 F_{LL}^{iB}} > 0. \tag{2.2}$$

In sector A, we assume that firms and unions bargain over wages and employment jointly and split the surplus according to the generalized Nash bargaining solution. If bargaining is successful then the wage bill for union workers equals $\alpha_i \bar{w}_i N_i + (1 - \alpha_i)\bar{p}_0 N_i$, i.e., $\alpha_i N_i$ union workers work in sector A and receive union wage $\bar{w}_i$ and $(1 - \alpha_i)N_i$ union workers work for the competitive wage in any of the nonunionized sectors within $\mathcal{I}_M$. Notice that union membership is industry-specific and that any laborer can be only in one union at a time. If a worker is member of union N_i then he cannot receive a union wage in any industry apart from i. Let $\bar{N}_z = \sum_{z \in \mathcal{I}_M} N_z$. Then the profits that remain for capitalists in sector A amount to

$$\Pi_{iA} = (p_i - q_i)F^i(K_{iA}, \alpha_i[N_i + \delta_i(L_M - \bar{N}_z)]) - \bar{w}_i \alpha_i [N_i + \delta_i(L_M - \bar{N}_z)],$$

where L_M denotes the total labor pool for all industries in $\mathcal{I}_M$ and $L_M - \bar{N}_z$ is the pool of nonunion members within L_M. If bargaining fails then all workers have to find employment in the nonunionized sectors of the industries in $\mathcal{I}_M$ and the expected wage bill reduces to $\bar{p}_0 N_i$. The capitalists are even worse off because the union succeeds in interrupting production in sector A so that $\underline{\Pi}_{iA} = 0$. The generalized Nash bargaining solution thus maximizes

$$\{\alpha_i(\bar{w}_i - \bar{p}_0)N_i\}^{s_i}\{(p_i - q_i)F^i(K_{iA}, \alpha_i[N_i + \delta_i(L_M - \bar{N}_z)]) - \bar{w}_i \alpha_i [N_i + \delta_i(L_M - \bar{N}_z)]\}^{1-s_i}, \tag{2.3}$$

where s_i denotes the relative bargaining strength of industry i's trade union and $1 - s_i$ the relative bargaining strength of industry i firms. The bargaining strength of each of the two groups is assumed to be exogenously given.

Maximizing Equation 2.3 with respect to the employment share α_i and the union wage $\bar{w}_i$ leads to two equations. The employment share α_i is determined by

$$(p_i - q_i)F_L^i(K_{iA}, \alpha_i[N_i + \delta_i(L_M - \bar{N}_z)]) = \bar{p}_0. \tag{2.4}$$

Equation 2.4 says that production will be efficient, i.e., the marginal value-added of labor is set equal to $\bar{p}_0$. Hence, the condition which determines employment in the unionized sector is similar to the one in the nonunionized sector (compare with Equation 2.1). Straightforward comparative statics establish that α_i is increasing in p_i:

$$\frac{d\alpha_i}{dp_i} = -\frac{\alpha_i \bar{p}_0}{(p_i - q_i)^2 L_{iA} F_{LL}^{iA}} > 0. \tag{2.5}$$

The second equation

$$\bar{w}_i = s_i \frac{(p_i - q_i)F^{iA}}{L_{iA}} + (1 - s_i)\bar{p}_0, \tag{2.6}$$

resulting from maximization of Equation 2.3, describes how the union wage serves to distribute the bargaining surplus between the union and the capitalists. In particular, Equation 2.6 shows that the union wage is a weighted average of the value-added per worker (weighted by the union bargaining power) and the competitive wage $\bar{p}_0$ (weighted by the capitalists' bargaining power). Hence, if $s_i = 1$ then the union wage equals the value-added per worker and if $s_i = 0$ then it equals the competitive wage (which in equilibrium is also equal to the marginal value-added of labor). As is common in union-firm bargaining games over employment and wage, the reaction of wages due to price changes is ambiguous in sign. For example, if labor demand were isoelastic then a price change would not affect the union wage. However, clear sign predictions can be given concerning $\alpha_i \bar{w}_i$, i.e., the wage paid in the unionized sector weighted by the probability that a union worker receives it. In particular, we find that

$$\frac{d(\alpha_i \bar{w}_i)}{dp_i} = \frac{s_i F^{iA}}{N_i + \delta_i (L_M - \bar{N}_z)} + \bar{p}_0 \frac{d\alpha_i}{dp_i} > 0. \tag{2.7}$$

This implies that the wage bill $[\alpha_i \bar{w}_i + (1-\alpha_i)\bar{p}_0]N_i$ for union workers is also increasing in p_i.

2.2.2. *Industries with immobile labor.* As in the previous section, we discuss sector B first. When labor was mobile, we found that equilibrium labor adjusted so that the marginal value-added of labor equaled the competitive wage. When labor is immobile between industries, however, equilibrium labor in sector B has to equal the residual labor supply of the industry $L_i - \alpha_i[N_i + \delta_i(L_i - N_i)]$, i.e., all labor not employed in sector A of i. This now means that the competitive wage must adjust. The equilibrium condition, following from profit maximization and labor market clearing, is

$$(p_i - q_i) F_L^i (K_{iB}, L_i - \alpha_i[N_i + \delta_i(L_i - N_i)]) = w_i. \tag{2.8}$$

How w_i depends on p_i will be discussed once we have determined α_i.

In sector A, firms and unions split the surplus according to the generalized Nash bargaining solution. If bargaining is successful then the wage bill for union workers equals $\alpha_i \bar{w}_i N_i + (1-\alpha_i) w_i N_i$. $\alpha_i N_i$ union workers work in sector A and receive union wage $\bar{w}_i$ and $(1-\alpha_i)N_i$ union workers work for the competitive wage in the nonunionized sector B within industry i. The profits achieved by capitalists in sector A equal

$$\Pi_{iA} = (p_i - q_i) F^i (K_{iA}, \alpha_i[N_i + \delta_i(L_i - N_i)]) - \bar{w}_i \alpha_i [N_i + \delta_i(L_i - N_i)].$$

If bargaining fails then all workers have to find employment in the nonunionized sector B of industry i, in which case the wage bill reduces to $\underline{w}_i N_i$, where $\underline{w}_i = (p_i - q_i) F_L^i (K_{iB}, L_i)$.

If negotiations break down then the union succeeds in interrupting production in sector A, so that $\underline{\Pi}_{iA} = 0$. The generalized Nash bargaining solution thus maximizes

$$\{\alpha_i \bar{w}_i N_i + (1-\alpha_i) w_i N_i - \underline{w}_i N_i\}^{s_i} \times \left\{(p_i - q_i) F^i(K_{iA}, \alpha_i[N_i + \delta_i(L_i - N_i)]) - \bar{w}_i \alpha_i [N_i + \delta_i(L_i - N_i)]\right\}^{1-s_i}, \tag{2.9}$$

where, as before, s_i denotes the relative bargaining strength of industry i's trade union.

Maximizing Equation 2.9 with respect to α_i and $\bar{w}_i$ leads to two equations. The employment share α_i is determined by

$$(p_i - q_i) F^i_L(K_{iA}, \alpha_i[N_i + \delta_i(L_i - N_i)]) = w_i - (1-\alpha_i)\frac{\partial w_i}{\partial \alpha_i}$$

or after substituting for w_i and $\frac{\partial w_i}{\partial \alpha_i}$ and dividing by $p_i - q_i$:

$$F^{iA}_L = F^{iB}_L + (1-\alpha_i)[N_i + \delta_i(L_i - N_i)] F^{iB}_{LL}. \tag{2.10}$$

This means that when labor is immobile between industries the marginal product of labor across the sectors of i is usually not equalized. This follows from the fact that the unions and firms realize that the competitive wage depends on their employment choice. Furthermore, Equations 2.8 and 2.10 suggest constant employment shares as solution, i.e., changes in p_i do not affect α_i.[9] Therefore, we find that, in contrast to the case of mobile labor, price changes are solely reflected in wage changes when labor is immobile across industries.[10] Using $\frac{d\alpha_i}{dp_i} = 0$ when totally differentiating Equation 2.8, $\frac{dw_i}{dp_i} = \frac{\partial w_i}{\partial p_i} = \frac{w_i}{p_i - q_i}$.

The second equation

$$\bar{w}_i = s_i \frac{(p_i - q_i) F^{iA}}{L_{iA}} + (1-s_i)\frac{\underline{w}_i - (1-\alpha_i) w_i}{\alpha_i}, \tag{2.11}$$

resulting from maximization of Equation 2.9, determines the union wage. If $w_i = \underline{w}_i = \bar{p}_0$ then, as was the case when labor was mobile, Equation 2.11 would coincide with Equation 2.6. However, because $w_i > \underline{w}_i$, the union wage is smaller than $\bar{w}_i = s_i \frac{(p_i - q_i) F^{iA}}{L_{iA}} + (1-s_i) w_i$, the weighted average of the average value-added per worker and the competitive wage. Because α_i does not depend on the goods price, we can also establish that the union wage is increasing in p_i:

$$\frac{d\bar{w}_i}{dp_i} = s_i \frac{F^{iA}}{L_{iA}} + (1-s_i)\frac{\underline{w}_i - (1-\alpha_i) w_i}{\alpha_i (p_i - q_i)} = \frac{\bar{w}_i}{(p_i - q_i)} > 0. \tag{2.12}$$

[9] This need not be the only solution, but without further assumptions about F^i_{LL}, the existence of other solutions is not guaranteed.

[10] This assumes flexible wages. With inflexible wages, unemployment is likely (see Matschke, 2003).

2.2.3. *Major differences between results in the cases of mobile versus immobile labor.* We summarize the so-far obtained major differences in the predictions of how employment and wages react when a tariff is increased. Union wages may be influenced in both cases, but only in the case of immobile labor is it clear that the union wage will move up (because employment and employment shares are fixed). For nonunion wages, we note that they are constant by assumption in the mobile labor case, whereas they increase in the immobile labor case. The latter result reflects the increase in the marginal value-added of labor caused by a tariff increase. In contrast, industry employment is constant in the case of immobile labor (because wage flexibility clears the labor market), whereas it is increasing in the tariff in the case of mobile labor. Comparing these results to empirical findings, previous studies have found that import protection has a higher impact on employment than on wages (Revenga, 1992), and moreover, the trade policy impact on wages seems to be strictly a union phenomenon (see Gaston and Trefler, 1995).[11] The Revenga (1992) findings suggest that the case of mobile labor seems to be the more prevalent one in the U.S. This is also supported in relative terms by noting that the U.S. has a much more mobile labor force than most other industrialized countries, e.g., Germany or France (OECD, 1994).

2.3. **First Stage: Lobbying.** In this stage, the different lobbies (namely, trade unions and capital owner groups) present the domestic government with menus that consist of a mapping of all possible tariff vectors into contributions a lobby would pay in case a certain tariff vector is chosen. This setup is called a common agency model (Bernheim and Whinston, 1986), i.e., we have several principals (lobbies) trying to influence the choice (tariff vector) of a single agent (government). The government takes these menus as given and chooses a tariff vector that maximizes the weighted sum of total contributions and aggregate gross welfare (i.e., the sum of production value, tariff revenue, and consumer surplus) where the weight on aggregate welfare is denoted by a. Contributions C receive an implicit weight of 1. This in turn implies that contributions receive a higher weight than net domestic welfare ("net" meaning "net of contributions").

The equilibrium tariff vector is defined by the following conditions (Grossman and Helpman, 1994): it maximizes the government's utility function and it maximizes the sum of governmental utility and the utility of any lobby. The number of conditions is thus equal to the number of lobbies plus one.

[11]Notice that Gaston and Trefler find that union wages are negatively correlated with trade protection. This is clearly a possibility in our model when labor is mobile. But even in the case with immobile labor, $\overline{w}_i$ may be negatively correlated with t_i because wages also influence tariff levels once we come to the lobbying game.

The common agency framework in which lobbies confront the government with an infinite listing of tariff vectors and contributions attached to them clearly looks quite different from real-world lobbying. Lobbies typically tell the government what protection they want (or they provide selected information from which the government can infer these wishes). The government then takes some weighted average of the wishes of the different lobby groups and its own ideas of what the optimal tariff would look like to determine the equilibrium tariff.

Matschke (2003) reconciles these two alternative views of lobbying. She defines the "unilaterally optimal tariff" as the tariff a group would set (if it could do so) to maximize its own welfare. Let $t_i^{N_j}$ and $t_i^{K_j}$ denote the unilaterally optimal tariffs of industry groups N_j and K_j, respectively (we are neglecting notation here by using the same symbol for lobby groups and the number of their members). Also, let t_i^G denote the domestic welfare-maximizing tariff. This is the tariff the government would set if no lobbies existed and can thus also be interpreted as a unilaterally optimal tariff. Matschke (2003) then shows that the equilibrium tariff for industry i in the lobbying game can be written as the weighted average of the unilaterally optimal tariffs for the different players of the lobbying game:

Lemma 2.1 (Matschke 2003)**.** *The equilibrium tariff for industry i is given by*

$$t_i^* = \frac{a t_i^G(t_i^*)}{a+\Theta} + \sum_{K_j \in \Omega} \frac{\theta_{K_j} t_i^{K_j}(t_i^*)}{a+\Theta} + \sum_{N_j \in \Omega} \frac{\theta_{N_j} t_i^{N_j}(t_i^*)}{a+\Theta}, \tag{2.13}$$

where θ_{g_j} stands for the population share of group g_j and Ω is the set of all groups organized in a lobby.

The equilibrium tariff can thus be determined by first calculating the unilaterally optimal tariffs and then using Lemma 2.1.[12]

2.4. **Lobby Interests and the Equilibrium Tariff.**

2.4.1. *General results.* In order to find out about the equilibrium tariff structure, let us understand the interests of the players of the lobbying game first and calculate the unilaterally optimal tariffs. The natural starting point is the welfare-maximizing tariff t_i^G, i.e., the tariff the government would impose if no lobby influences were present. In a small-country

[12]Notice here that the unilaterally optimal tariffs are functions of the equilibrium tariff. This does not diminish the usefulness of Lemma 2.1 because the equilibrium tariff predictions in the original GH model are also only given as implicit functions where t_i^* appears both on the right-hand and left-hand sides of the equilibrium tariff equation. So in order to use this lemma, we solve for every unilaterally optimal tariff as an implicit function of itself just as we would have solved for the equilibrium tariff in the original GH model. To obtain t_i^*, we add up the unilaterally optimal tariff functions, keeping in mind that their argument changes to t_i^*. Examples of this procedure can be found in the next section.

setting with no market imperfections this tariff will equal zero. The government maximizes domestic welfare

$$W_i^G = (p_i - q_i)F^{iA} + (p_i - q_i)F^{iB} + \bar{p}_0 F^0 + \left(L + \sum_{j=1}^{n} K_j\right) V_i + t_i M_i$$

by choice of p_i, where $(L + \sum_{j=1}^{n} K_j)V_i$ is the consumer surplus of consuming good i. In the formula for W_i^G we have omitted all parts that do not depend on p_i. The corresponding first-order condition is

$$F^i + (p_i - q_i)F_L^{iA}\frac{dL_{iA}}{dp_i} + (p_i - q_i)F_L^{iB}\frac{dL_{iB}}{dp_i} - \left(\frac{dL_{iA}}{dp_i} + \frac{dL_{iB}}{dp_i}\right)\bar{p}_0 F_L^0 - D_i + M_i + t_i M_i' = 0.$$

When labor is completely mobile between industries the marginal value-added of labor is equalized across all industries and sectors, i.e., $(p_i - q_i)F_L^{iA} = (p_i - q_i)F_L^{iB} = \bar{p}_0 F_L^0 = \bar{p}_0$ for $i \in \mathcal{I}_M$. This means that the government can use a tariff to increase production in industry i (at the expense of production in the numeraire industry) but, because the marginal value-added is the same across all industries, the government does not have any incentive to do so.

When labor is immobile across industries, the marginal value-added of labor is neither equal across industries nor across sectors of an industry. However, we previously found that employment is independent of the product price and therefore labor cannot be shifted to industries or sectors with higher marginal value-added. This undermines the case for an import tariff and again we have the result that free trade is welfare-maximizing. Thus,

$$t_i^G = 0 \tag{2.14}$$

follows for both $i \in \mathcal{I}_M$ and $i \in \mathcal{I}_I$.

For lobbies g_j outside industry i the desire to drive a wedge between the domestic and the world price for product i stems from two sources: as consumers, the lobby wants as low a price as possible; as a recipient of tariff revenue, the lobby desires a strictly positive tariff. Formally, the lobby maximizes the sum of consumer surplus and its share in tariff revenue

$$W_i^{g_j} = \theta_{g_j}\left(L + \sum_{j=1}^{n} K_j\right) V_i + \theta_{g_j} t_i M_i \quad \text{for } j \neq i,$$

which leads to the first-order condition

$$-\theta_{g_j} D_i + \theta_{g_j} M_i + \theta_{g_j} t_i M_i' = 0$$

or, solved for the import tariff,

$$t_i^{g_j} = \frac{F^i}{M_i'}. \tag{2.15}$$

Because $M_i' < 0$, lobby g_j would like to impose an import subsidy on good $i \neq j$. This means that the consumer surplus considerations outweigh any tariff revenue considerations.

Finally, consider the interests of lobby groups inside industry i itself. Capital owners maximize the sum of profits, consumer surplus, and tariff revenue share, i.e.,

$$W_i^{K_i} = (p_i - q_i)F^{iA} + (p_i - q_i)F^{iB} - \bar{w}_i L_{iA} - w_i L_{iB} + \theta_{K_i}\left(L + \sum_{j=1}^{n} K_j\right) V_i + \theta_{K_i} t_i M_i.$$

The corresponding first-order condition is

$$\begin{aligned} 0 \;=\; & F^i + (p_i - q_i)F_L^{iA}\frac{dL_{iA}}{dp_i} + (p_i - q_i)F_L^{iB}\frac{dL_{iB}}{dp_i} \\ & -\bar{w}_i\frac{dL_{iA}}{dp_i} - w_i\frac{dL_{iB}}{dp_i} - L_{iA}\frac{d\bar{w}_i}{dp_i} - L_{iB}\frac{dw_i}{dp_i} \\ & -\theta_{K_i}D_i + \theta_{K_i}M_i + \theta_{K_i}t_i M_i'. \end{aligned}$$

Solving for the capitalists' unilateral optimal tariff in general form gives

$$t_i^{K_i} = \frac{1}{\theta_{K_i}M_i'}\left[-(1-\theta_{K_i})F^i + (\bar{w}_i - (p_i - q_i)F_L^{iA})\frac{dL_{iA}}{dp_i} + L_{iA}\frac{d\bar{w}_i}{dp_i} + L_{iB}\frac{dw_i}{dp_i}\right]. \quad (2.16)$$

We see that $t_i^{K_i}$ consists of four components. The first component is also present in the original GH model. Capital owners are interested in a positive tariff for their industry because such a tariff increases sales revenues and leads to higher tariff revenues, but they also take into account that they consume their own good. Thus the unilaterally optimal tariff in the original GH model would be $-\frac{(1-\theta_{K_i})F^i}{\theta_{K_i}M_i'}$. However, when labor market influences are present, the capital owners realize that a higher tariff may also lead to higher wages in sectors A and B and may distort production towards the unionized sector A where workers receive wages above the marginal value-added of labor. These influences taken together decrease $t_i^{K_i}$.

The trade union of industry i maximizes the sum of the wage bill, consumer surplus, and tariff revenue share accruing to union members, i.e.,

$$W_i^{N_i} = \alpha_i\bar{w}_i N_i + (1-\alpha_i)w_i N_i + \theta_{N_i}\left(L + \sum_{j=1}^{n} K_j\right) V_i + \theta_{N_i} t_i M_i,$$

leading to the first-order condition

$$(\bar{w}_i - w_i)N_i\frac{d\alpha_i}{dp_i} + \alpha_i N_i\frac{d\bar{w}_i}{dp_i} + (1-\alpha_i)N_i\frac{dw_i}{dp_i} - \theta_{N_i}D_i + \theta_{N_i}M_i + \theta_{N_i}t_i M_i' = 0.$$

Thus the unilaterally optimal tariff for the trade union in industry i is

$$t_i^{N_i} = \frac{1}{\theta_{N_i}M_i'}\left[\theta_{N_i}F^i - (\bar{w}_i - w_i)N_i\frac{d\alpha_i}{dp_i} - \alpha_i N_i\frac{d\bar{w}_i}{dp_i} - (1-\alpha_i)N_i\frac{dw_i}{dp_i}\right]. \quad (2.17)$$

In the original GH model, union workers, just as any other consumers who do not own capital, want the government to grant an import subsidy for good i because consumer interests more than offset tariff revenue considerations. However, once we allow for labor market imperfections, three additional components appear that may actually make the union of industry i prefer a positive import tariff for its good. Not only may union workers obtain higher wages when the domestic price of good i increases, but it is also possible that more union workers find employment in the unionized sector A where rents can be earned, because $\bar{w}_i > w_i$.

In the next two subsections, we specify $t_i^{K_i}$ and $t_i^{N_i}$ and derive the equilibrium tariff equations for the cases of mobile and immobile labor.

2.4.2. *Tariff predictions when labor is mobile.* Noting that $\frac{dw_i}{dp_i} = 0$ and that $(p_i - q_i)F_L^{iA} = (p_i - q_i)F_L^{iB} = \bar{p}_0$, we can use Equations 2.5 and 2.7 to substitute into Equation 2.16. We obtain lobby K_i's optimal tariff as

$$t_i^{K_i} = -\frac{(1-\theta_{K_i})F^i - s_i F^{iA}}{\theta_{K_i} M_i'}. \tag{2.18}$$

This is the same expression as in the original GH model except for the component $\frac{s_i F^{iA}}{\theta_{K_i} M_i'}$. The capital owners' optimal tariff is diminished because part of the rents from protection goes to workers. If θ_{K_i} and s_i are big and the unionized sector of industry i is relatively large then it is even possible that capital owners lobby for an import subsidy on their own product. Similarly, we can calculate the trade union's preferred tariff as

$$t_i^{N_i} = \frac{\theta_{N_i} F^i - s_i F^{iA} \frac{\alpha_i N_i}{L_{iA}}}{\theta_{N_i} M_i'}. \tag{2.19}$$

If it were not for union wage bargaining, the union would want an import subsidy on product i just as is the case for all lobby groups outside industry i. Profit sharing, however, may make a tariff desirable. This is the more likely the smaller θ_{N_i}, the higher the union bargaining power s_i, the higher the union employment share, and the higher the relative production share in the unionized sector A.

Having obtained the unilaterally optimal tariff levels of the government and the different lobbies, the equilibrium tariff is straightforward to derive. In order to only include observable characteristics in the optimal tariff equation, we use

$$s_i = \frac{\bar{w}_i - w_i}{\frac{(p_i - q_i)F^{iA}}{L_{iA}} - w_i}$$

(from Equation 2.6). Furthermore, to facilitate comparability with the expressions given by Grossman and Helpman (1994), we rewrite the optimal tariff equation in terms of the ad valorem tariff τ_i^* which is related to the specific tariff t_i^* via $p_i^* + t_i^* = p_i = p_i^*(1 + \tau_i^*)$.

Notice that $\frac{\tau_i^*}{1+\tau_i^*} = \frac{t_i^*}{p_i}$. Let e_i stand for the import demand elasticity, $-\frac{M_i' p_i}{M_i}$, in absolute terms. Then the following proposition results:

Proposition 2.1. *Consider the model with mobile labor, i.e., $i \in \mathcal{I}_M$. Noting that $w_i = w_0 = \bar{p}_0$, the equilibrium ad valorem tariff τ_i^* of the lobbying game is characterized by*

$$\frac{\tau_i^*}{1+\tau_i^*} = \begin{cases} -\frac{\Theta}{\Theta+a}\frac{F^i}{e_i M_i} & \text{if nobody in } i \text{ lobbies,} \\ -\frac{\Theta}{\Theta+a}\frac{F^i}{e_i M_i} + \frac{1}{\Theta+a}\frac{\alpha_i N_i}{L_{iA}}\frac{\bar{w}_i - w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}} - w_i}\frac{F^{iA}}{e_i M_i} & \text{if only the union in } i \text{ lobbies,} \\ \frac{1-\Theta}{\Theta+a}\frac{F^i}{e_i M_i} - \frac{1}{\Theta+a}\frac{\bar{w}_i - w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}} - w_i}\frac{F^{iA}}{e_i M_i} & \text{if only capitalists in } i \text{ lobby,} \\ \frac{1-\Theta}{\Theta+a}\frac{F^i}{e_i M_i} - \frac{1}{\Theta+a}\left(1 - \frac{\alpha_i N_i}{L_{iA}}\right)\frac{\bar{w}_i - w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}} - w_i}\frac{F^{iA}}{e_i M_i} & \text{if all in } i \text{ lobby.} \end{cases}$$

Proof. The result follows immediately from substituting Equations 2.14, 2.15, 2.18, and 2.19 into the equilibrium tariff in Lemma 2.1. □

Not surprisingly, the equilibrium tariff equals the tariff of the original GH model when nobody in industry i lobbies. When both the union and capital owners of industry i lobby, the tariff would also be the same as in the original GH model if union wages were only paid to union workers. This result follows because efficient union wage bargaining only redistributes income between two lobbies in case that $L_{iA} = \alpha_i N_i$. However, as long as also nonunion workers benefit from higher union wages, protection benefits are dispersed from a lobby (the capital owners) to a population group (the nonunion workers) that does not lobby, therefore the equilibrium tariff will be structurally lower than in the original GH model. Finally, if one of the two groups in industry i does not lobby then the optimal equilibrium tariff is distinct from the one found in the original GH model. The reason lies in the profit sharing due to union wage bargaining. If capital owners lobby then they take into account that they cannot capture the entire rents from protection and are therefore less interested in tariff protection for their product. The resulting equilibrium tariff is hence lower by a dispersion component. If the trade union lobbies then the equilibrium tariff is now higher than in the original GH model by a collection component because part of the protection rents is captured by the trade union, an active lobby. The discrepancy between the equilibrium tariffs found here and in the original GH model is higher the greater the share of unionized production in industry i and the higher the bargaining strength of the trade union, reflected in a higher union wage differential. Only if the union wage equaled the competitive wage would the results match the predictions of the original GH model.

2.4.3. *Tariff predictions when labor is immobile.* As in the previous section, we derive the unilaterally optimal tariffs for lobbies in industry i first and then use Lemma 2.1 to find the equilibrium tariff of the lobbying game.

When labor is immobile between industries, we know that $\frac{d\alpha_i}{dp_i} = \frac{dL_{iA}}{dp_i} = 0$, $\frac{dw_i}{dp_i} = \frac{w_i}{p_i - q_i}$ and $\frac{d\bar{w}_i}{dp_i} = \frac{\bar{w}_i}{p_i - q_i}$. We can thus rewrite Equation 2.16 as

$$t_i^{K_i} = -\frac{(1-\theta_{K_i})F^i}{\theta_{K_i}M_i'} + \frac{1}{\theta_{K_i}M_i'}\left(\frac{\bar{w}_i - w_i}{p_i - q_i}L_{iA} + \frac{w_i}{p_i - q_i}L_i\right). \tag{2.20}$$

Compared with the original GH model, two components reduce $t_i^{K_i}$: even without a non-competitive union wage, a tariff increases the wage that has to be paid to workers. This reduces the capital owners' interest in trade protection. The higher union wage exacerbates this effect for firms in the unionized sector A. For the trade union, the unilaterally optimal tariff is

$$t_i^{N_i} = \frac{F^i}{M_i'} - \frac{1}{\theta_{N_i}M_i'}\left(\frac{\bar{w}_i - w_i}{p_i - q_i}\alpha_i N_i + \frac{w_i}{p_i - q_i}N_i\right). \tag{2.21}$$

Compared with the original GH model, $t_i^{N_i}$ is higher because all union workers benefit from higher wages regardless of the sector they work in, but union workers in sector A benefit more because $\frac{d\bar{w}_i}{dp_i} > \frac{dw_i}{dp_i}$.

From the unilaterally optimal tariffs for the players in the lobbying game, the following equilibrium tariff structure emerges:

Proposition 2.2. *Consider the model with immobile labor, i.e., $i \in \mathcal{I}_I$. Denote the labor force share in industry i which is covered by collective bargaining by λ_i, i.e., rewrite $L_{iA} = \lambda_i L_i$ and $L_{iB} = (1-\lambda_i)L_i$. The equilibrium ad valorem tariff τ_i^* of the lobbying game is characterized by:*

$$\frac{\tau_i^*}{1+\tau_i^*} = \begin{cases} -\frac{\Theta}{\Theta+a}\frac{F^i}{e_iM_i} & \text{if nobody in } i \text{ lobbies,} \\ -\frac{\Theta}{\Theta+a}\frac{F^i}{e_iM_i} + \frac{1}{\Theta+a}\frac{\alpha_i\bar{w}_i+(1-\alpha_i)w_i}{e_i(p_i-q_i)M_i}N_i & \text{if only the union in } i \text{ lobbies,} \\ \frac{1-\Theta}{\Theta+a}\frac{F^i}{e_iM_i} - \frac{1}{\Theta+a}\frac{\lambda_i\bar{w}_i+(1-\lambda_i)w_i}{e_i(p_i-q_i)M_i}L_i & \text{if only capitalists in } i \text{ lobby,} \\ \frac{1-\Theta}{\Theta+a}\frac{F^i}{e_iM_i} - \frac{1}{\Theta+a}\frac{\alpha_i\delta_i\bar{w}_i+(1-\alpha_i\delta_i)w_i}{e_i(p_i-q_i)M_i}(L_i - N_i) & \text{if all in } i \text{ lobby.} \end{cases}$$

Proof. The result follows immediately from substituting Equations 2.14, 2.15, 2.20, and 2.21 into the equilibrium tariff in Lemma 2.1. □

If nobody in industry i lobbies then the optimal tariff will be the same as in the original GH model. But the tariff structure differs as soon as industry i lobbies enter the scene. As in the case with mobile labor, the GH predictions are altered by a collection component if the trade union lobbies and capital owners do not and by a dispersion component if capital owners lobby and the union does not. And just as in the case with mobile labor, an additional dispersion component arises if both groups lobby. When labor is immobile, however, this dispersion component does not disappear as δ_i goes to zero: trade protection increases the wages paid to workers even if no unionized sector exists. A higher tariff increases labor demand which meets completely inelastic supply. The price increase is thus accompanied by an increase in the competitive wage w_i. This wage increase in turn means that workers in the nonunionized sector share in the protection rents. Profit-sharing is even higher in the unionized sector because the union wage exceeds the competitive wage. The union interest in a higher wage partly counterbalances the dispersion effect for the case that both capital owners and union lobby. The dispersion component is then only caused by wage increases that go to nonunion workers: every nonunion worker in i gets at least w_i, and $\alpha_i\delta_i(L_i - N_i)$ nonunion workers get even more because they are employed in the unionized sector and receive the higher union wage $\overline{w}_i$.

3. The Econometrics

Propositions 2.1–2.2 provide our basis for estimation. Define the dummy variables

$$k_i = \mathbb{I}\{K_i \in \Omega\}, \quad n_i = \mathbb{I}\{N_i \in \Omega\}, \quad m_i = \mathbb{I}\{i \in \mathcal{I}_M\}. \tag{3.1}$$

That is, the capitalist lobby indicator, k_i, takes the value one when capitalists in industry i lobby actively (zero otherwise); the trade union indicator, n_i, equals one when trade unions in industry i lobby actively (zero otherwise); and the labor mobility indicator, m_i, equals one when labor in industry i is mobile (zero otherwise). These indicators essentially produce a series of 'switches,' defining the equilibrium ad valorem tariff for any industry regardless of active lobbies or labor mobility. We introduce an additive error term, ε_i, with $\mathbb{E}[\varepsilon_i] = 0$ and $\mathbb{E}[\varepsilon_i^2] = \sigma^2$.[13] Writing Propositions 2.1–2.2 using the indicator variables and introducing the error term gives the equilibrium ad valorem tariff, τ_i^*, of the lobbying game for any industry:

$$\begin{aligned} \frac{\tau_i^*}{1+\tau_i^*} &= -\frac{\Theta}{\Theta+a}\frac{F^i}{e_iM_i} + \frac{1}{\Theta+a}k_i\frac{F^i}{e_iM_i} \\ &+\frac{1}{\Theta+a}\left(\begin{array}{l} (1-k_i)n_im_i\frac{\alpha_iN_i}{L_{iA}}\frac{\bar{w}_i-w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}}-w_i}\frac{F^{iA}}{e_iM_i} \\ -k_i(1-n_i)m_i\frac{\bar{w}_i-w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}}-w_i}\frac{F^{iA}}{e_iM_i} \\ -k_in_im_i\left(1-\frac{\alpha_iN_i}{L_{iA}}\right)\frac{\bar{w}_i-w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}}-w_i}\frac{F^{iA}}{e_iM_i} \\ +(1-k_i)n_i(1-m_i)\frac{\alpha_i\bar{w}_i+(1-\alpha_i)w_i}{e_i(p_i-q_i)M_i}N_i \\ -k_i(1-n_i)(1-m_i)\frac{\lambda_i\bar{w}_i+(1-\lambda_i)w_i}{e_i(p_i-q_i)M_i}L_i \\ -k_in_i(1-m_i)\frac{\alpha_i\delta_i\bar{w}_i+(1-\alpha_i\delta_i)w_i}{e_i(p_i-q_i)M_i}(L_i-N_i) \end{array}\right) + \varepsilon_i. \end{aligned} \tag{3.2}$$

Noticeably, the coefficients on $k_i\frac{F^i}{e_iM_i}$ and the new labor variable are equal, so that contrary to previous tests of the protection for sale model, we have an additional test at hand to

[13] We explore the sensitivity of our results to the homoskedasticity assumption by introducing multiplicative heteroskedasticity of the form $\mathbb{E}[\varepsilon_i^2] = \sigma_i^2 = \sigma^2 e^{z_i'\alpha}$, where z_i is a vector of skedastic conditioning variables (including a constant) and α is a vector of parameters to be estimated.

evaluate how the model performs. Letting $\beta_0 = 0$, $\beta_1 = -\frac{\Theta}{\Theta+a}$, $\beta_2 = \beta_3 = \frac{1}{\Theta+a}$, and

$$\begin{aligned} labvar_i &= (1-k_i)n_i m_i \frac{\alpha_i N_i}{L_{iA}} \frac{\bar{w}_i - w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}} - w_i} \frac{F^{iA}}{e_i M_i} \\ &\quad -k_i(1-n_i)m_i \frac{\bar{w}_i - w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}} - w_i} \frac{F^{iA}}{e_i M_i} \\ &\quad -k_i n_i m_i \left(1 - \frac{\alpha_i N_i}{L_{iA}}\right) \frac{\bar{w}_i - w_i}{\frac{(p_i-q_i)F^{iA}}{L_{iA}} - w_i} \frac{F^{iA}}{e_i M_i} \\ &\quad +(1-k_i)n_i(1-m_i)\frac{\alpha_i \bar{w}_i + (1-\alpha_i)w_i}{e_i(p_i-q_i)M_i} N_i \\ &\quad -k_i(1-n_i)(1-m_i)\frac{\lambda_i \bar{w}_i + (1-\lambda_i)w_i}{e_i(p_i-q_i)M_i} L_i \\ &\quad -k_i n_i (1-m_i)\frac{\alpha_i\delta_i \bar{w}_i + (1-\alpha_i\delta_i)w_i}{e_i(p_i-q_i)M_i}(L_i - N_i), \end{aligned} \tag{3.3}$$

we have

$$\frac{\tau_i^*}{1+\tau_i^*} = \beta_0 + \beta_1 \frac{F^i}{M_i}\frac{1}{e_i} + \beta_2 k_i \frac{F^i}{M_i}\frac{1}{e_i} + \beta_3 labvar_i + \varepsilon_i. \tag{3.4}$$

The GH specification emerges when $\beta_3 = 0$ or when labor is perfectly mobile ($m_i = 1$), unions do not lobby ($n_i = 0$), and no firms are unionized ($F^{iA} = 0$). Notice that a parsimonious specification results by letting $\beta_2 = \beta_3$, as the theory predicts:

$$\frac{\tau_i^*}{1+\tau_i^*} = \beta_0 + \beta_1 \frac{F^i}{M_i}\frac{1}{e_i} + \beta_2 \left(k_i \frac{F^i}{M_i}\frac{1}{e_i} + labvar_i\right) + \varepsilon_i. \tag{3.5}$$

While there are no testable GH implications resulting from this latter specification, we do think our estimates will be 'sharper' than those resulting from the GH specification. In addition, this stricter interpretation of our model will facilitate the analysis of the structural parameters a and Θ (e.g., in Equation 3.4, is $\Theta = -\frac{\beta_1}{\beta_2}$ or is $\Theta = -\frac{\beta_1}{\beta_3}$?).

4. The Data

Following earlier literature, we limit our analysis to manufacturing industries in the U.S. during 1983. This is the same time period and industry range used in the studies by Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), and Eicher and Osang (2002) who all found that the basic GH model without labor market influences predicts U.S. trade policy well. It is thus possible to directly investigate whether model misspecification is responsible for the finding that the introduction of extraneous labor market variables does not improve the empirical model fit.

Many of the data we use were already employed in the above mentioned previous literature. These data are not sufficient, however, for our purposes. In order to test our labor-augmented model, additional information about wages and unionization is needed, which we extract from the Current Population Survey (CPS) of the Bureau of Labor Statistics (BLS). These data are given at the 3-digit CIC level, the standard classification used by the BLS, but can be concorded into 3-digit SIC. Because the limited number of observations poses a potentially severe problem for estimation, we opt to keep the data set at the 4-digit SIC level in order to retain as much information as possible in our data set. Whenever variables are only available at the 3-digit or even 2-digit level, they are simply replicated for all 4-digit SIC codes within the corresponding 3-digit (or 2-digit) classification. Keeping the data set at the 4-digit level also allows us to avoid questions about how to best aggregate the data.[14] This procedure follows the study by Gawande and Bandyopadhyay (2000). After deleting any industries for which the data set was incomplete, we are left with 194 observations. Descriptive statistics and units of measurement for key variables are provided in Table 1.

We use nontariff barrier (NTB) coverage ratios as a measure for trade barriers. These data were provided by Daniel Trefler and Kishore Gawande. Using NTB measures is obviously in conflict with the theoretical predictions derived in Section 2 where tariffs were considered. It has been well established (Maggi and Rodriguez-Clare, 1999) that the predictions of the protection for sale model are sensitive to the form of trade barrier used. On the other hand, it is also true that U.S. tariffs in 1983 were determined by multilateral (GATT) tariff negotiations and as such do not lend themselves easily to the tariff determination process of the protection for sale model, which assumes that a country has the power to set tariffs unilaterally. From this viewpoint, NTBs are more appropriate because they are usually set unilaterally. We therefore use the NTB coverage ratio as our measure of trade restrictiveness, as did Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), and Eicher and Osang (2002). Thus, our results should be somewhat comparable to the results of these studies.

Apart from wages and unionization and coverage measures, the right-hand side variables of the trade protection equation are the import penetration ratio, import demand elasticity, and indicator variables for union and capital owner lobbying and labor mobility. The import penetration ratio is defined as value of gross imports divided by the value of shipments. These series are taken from the trade and immigration data base maintained by the National Bureau of Economic Research. To correct for the existence of intermediate inputs, we also use the value-added from the same source to substitute for $(p_i - q_i)F^i$. The import demand elasticities were provided by Kishore Gawande. The original source for these elasticities is Shiells et al. (1986). The correction procedure to account for the fact that

[14] But now we have introduced data clustering which we account for in estimation.

these variables are generated regressors is described in great detail in Gawande (1997). The elasticity estimates were calculated using import demand data of the time period 1962-1978. As in Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000), estimates on who is organized as a lobby are based on Political Action Committee (PAC) contributions data for congressional elections 1977-1978, 1979-1980, 1981-1982, and 1983-1984 originally assembled by Gawande. Diverging from previous tests of the protection for sale model, however, we use separate data for corporate PAC contributions and labor PAC contributions (for a detailed description, see Gawande, 1995) to be able to distinguish between firm and union lobby groups. The corporate PAC contributions are available at the 3-digit SIC level, the labor PAC contributions at the 2-digit level. To determine whether the capital owners of an industry lobby for trade protection, we follow the procedure in Gawande and Bandyopadhyay (2000): we regress corporate contributions divided by value-added against the import penetration ratio interacted with 2-digit SIC dummies. Industries with positive coefficients are assumed to have an active capital owner lobby, i.e., industries with large import penetration ratios are likely to have strong capitalist lobbies. Similarly, to determine whether trade unions in an industry lobby for trade protection, we regress trade union contributions divided by value-added against annual, per-person union-nonunion wage bill differentials interacted with 2-digit SIC dummies. Industries with positive coefficients are assumed to have an active union lobby, i.e., industries with large union-nonunion wage differentials are likely to have strong trade unions. In our sensitivity analysis, we experiment with alternative ways of determining who lobbies.

In order to obtain the remaining variables, we employ CPS data from 1983.[15] One important piece of information taken from these data is the percentage of union workers. In the sample of manufacturing industries, 27.9% of workers were union members in 1983. Unionization varies widely across industries, with percentages between 0 and nearly 100%. Equally important for our model is the question how many workers are covered by collective bargaining agreements. Unfortunately, a major problem encountered when working with CPS data is that while workers in the outgoing rotation groups were asked whether they were union members, only workers who answered "no" to the union question were also asked whether they were covered by a collective bargaining agreement. For union workers, the BLS simply assumed that union workers were covered by a collective bargaining agreement. For this reason, the BLS's reported coverage ratios have always exceeded actual unionization rates. In fact, according to newer information obtained from the BLS, when union workers were asked in 2001 whether they were covered by a collective bargaining agreement, only

[15]These are available from the NBER data disk titled "Current Population Survey: Merged Outgoing Rotation Groups 1979-2001".

85% of union workers answered "yes." We are unaware of an obvious method to impute who among the union workers was covered in 1983. Yet, it seems reasonable to assume that any union workers who did not work at the time of the CPS survey were not covered by any collective bargaining agreement. When this assumption is made, we find that 7.8% of the union workers are not covered. This number can be viewed as a lower boundary on the percentage of uncovered union workers because at any point in time there are also union workers employed in firms that are not subject to collective bargaining (yet). Union and nonunion wages for the different industries are calculated using hourly wage data from the CPS, adjusted for worker characteristics. These hourly wages are then adjusted by multiplying by weekly work time and weeks per year in order to obtain an annual wage rate per worker, because our labor input variable is measured as number of workers.

We experiment with several different approaches to impute which industries have immobile labor. The reader should note that we could write down the equilibrium tariff equation without having to decide which industries have mobile or immobile labor, but then we would need sound estimates of wage and employment elasticities in the unionized and nonunionized sectors for the different industries to perform the econometric analysis. Because we do not have such estimates, we adopt the approach of sorting industries into those with completely mobile and those with completely immobile labor, but perform extensive sensitivity analysis in order to account for the fact that any such sorting appears rather arbitrary. In the basic specification, we classify any industry with an unemployment rate of 10% or higher as having immobile labor. Alternative specifications are based on the average age of workers in an industry and on inter-industry wage differentials.

Table 2 reports means for several key variables across our active capitalist lobby, active trade union, and labor mobility classifications. The main result here is that trade protection, as measured by $\frac{\tau_i^*}{1+\tau_i^*}$ (where τ_i^* is the NTB coverage ratio), depends not only upon our measure of capitalist lobby activity, but also upon our measures of trade union activity and labor mobility. This is evident given the stark contrasts between means when $n_i = 0$ and $n_i = 1$ (fixing k_i and m_i – moving across the table) and between means when $m_i = 0$ and $m_i = 1$ (fixing k_i and n_i – moving up and down the table). Although not reported here, we have also considered alternative methods for defining our lobby and mobility classifications, but the results were very similar to the results we report here, i.e., differences were still evident between active trade union and labor mobility measures.

To make this relationship even clearer, Figure 1 plots Nadaraya-Watson kernel estimates and 95-percent confidence bands for $\frac{\tau_i^*}{1+\tau_i^*}$, conditional on $\frac{F_i}{M_i}\frac{1}{e_i}$, for various levels of our labor variable, defined in Equation 3.3.[16] Compared to the case in which $labvar_i = 0$, trade protection is generally higher when $labvar_i > 0$ and lower when $labvar_i < 0$ – consistent with our theoretical prediction that $\beta_3 > 0$. Note that the confidence bands for $labvar > 0$ and $labvar < 0$ do not overlap for $\frac{F_i}{M_i}\frac{1}{e_i} < 25$ – which encompasses nearly three-quarters of our data – signifying the need to control for labor market variables. Further, as shown in the figure, trade protection is generally decreasing in $\frac{F_i}{M_i}\frac{1}{e_i}$ when $labvar_i = 0$ or $labvar_i > 0$, but increasing in $\frac{F_i}{M_i}\frac{1}{e_i}$ when $labvar_i < 0$ – consistent with our theoretical predictions that $\beta_1 < 0$ and $\beta_1 + \beta_2 > 0$. The key result here is that, even conditional on $\frac{F_i}{M_i}\frac{1}{e_i}$, trade protection (as measured by $\frac{\tau_i^*}{1+\tau_i^*}$) depends upon labor market variables, $labvar_i$. Our model captures this important feature of the data.

Following Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), and Eicher and Osang (2002), we use the same set of instrumental variables for all endogenous variables (see also the discussion in Section 5), plus the capital-labor ratio and the relative bargaining strength of the trade union (s_i). The instrumental variables include factor shares (defined as factor revenues divided by production value) for physical capital, inventories, engineers and scientists, white-collar labor, skilled labor, semiskilled labor, cropland, pasture, forest, coal, petroleum, and minerals. Other instruments include seller concentration, seller number of firms, buyer concentration, buyer number of firms, scale, capital stock, unionization (we use the CPS version), geographic concentration, and tenure. These instruments were provided by Daniel Trefler and are described in Trefler (1993). The capital-labor ratio comes from Gawande. The relative bargaining strength of the trade union is computed.

The validity and relevance of instrumental variables is of central concern in empirical work. Ideally, we like to have instruments uncorrelated with the error term, i.e., $\mathbb{E}[z_i\varepsilon_i] = 0$, while still identifying the underlying parameters of the reduced-form equation,

$$x_i = z_i'\Pi + v_i,$$

so that $\Pi \neq 0$ and $v_i \neq 0$ (for all i). To this effect, validity of our instrument set seems plausible given the quasi-fixed nature of factor shares, seller and buyer concentrations, scale, and unionization rates, especially in the short-run (in which our model is particularly well-suited, lest all labor be perfectly mobile to begin with).

5. Estimating and Testing the Model

We estimate and compare the GH specification (Equation 3.4 with $\beta_3 = 0$), the full specification (Equation 3.4), and the short specification (Equation 3.5).

[16] Bandwidths are selected via the leave-one-out estimator of the crossvalidation function using the Gaussian kernel. The remaining bandwidths were 35, 38, and 31 for $labvar > 0$, $labvar = 0$ and $labvar < 0$, respectively.

5.1. **Methodology.** Several complications arise in estimating the model. First, our measure of trade protection is censored, requiring the use of limited dependent variable methods. Second, components of the explanatory variables are endogenously determined, thereby suggesting that we implement instrumental variable techniques. To this end, we estimate a Tobit model (therefore, $\varepsilon_i \sim \mathcal{N}(0, \sigma^2)$) with endogenous explanatory variables, using the approach of Smith and Blundell (1986) (see Wooldridge, 2001, for a discussion). A third complication arises because certain components of our explanatory variables are constructed (for instance, we have the option of using wages, age, tenure, or unemployment to form our labor mobility indicator variable). We therefore explore the sensitivity of our results to different variable formulations, as well as heteroskedasticity and additional explanatory variables. Finally, to avoid aggregation bias, we kept all data at the 4-digit SIC level, requiring the expansion of some data from 2- or 3-digit SIC levels. Thus, all standard errors have been adjusted to account for clustering on 3-digit SICs.

The first step to the Smith and Blundell approach is to estimate the residuals from the instrumental variable equations. Let z_i denote the instrumental variables and x_i our (endogenous) explanatory variables. Then the estimated residuals are

$$\hat{v}_i = x_i - z_i'\hat{\Pi}, \tag{5.1}$$

with $\hat{\Pi} = Z(Z'Z)^{-1}Z'X$ (equation-by-equation ordinary least squares). The second step involves estimating the Tobit model including the estimated residuals, $\hat{v}_i$, as additional right-hand-side variables. That is, we estimate

$$\frac{\tau_i^*}{1+\tau_i^*} = \max\left\{0, x_i'\beta + \hat{v}_i'\gamma + \varepsilon_i^*\right\}, \tag{5.2}$$

where ε_i^* is just a scaled version of ε_i, using Tobit procedures. Then, of course, we need to adjust the usual variance-covariance matrix for the first-stage estimation (see Smith and Blundell for the exact form). Clearly, if $\hat{\gamma} \neq 0$ (via the usual Wald test, for example) then we can reject the null hypothesis that the x_i are exogenous.

Various literature suggests that the import penetration ratio in our model is an endogenous variable, i.e., not only does import penetration affect trade protection, but trade protection in turn influences import penetration, higher trade protection leading to lower import penetration. Furthermore, the political organization variables are endogenously determined in the model. Clearly, wages, employment, and trade protection per industry are intrinsically linked (in our theoretical model, union wages depend on trade protection, nonunion wages depend on trade protection in the industries with immobile labor, employment depends on trade protection in the industries with mobile labor, and employment also depends on nonunion wages) and are thus endogenous. We therefore instrument for each of the explanatory variables on the right-hand sides of the GH specification (Equation 3.4

with $\beta_3 = 0$), the full specification (Equation 3.4), and the short specification (Equation 3.5).[17] First-stage R^2-values and their associated p-values (from F-tests) are reported in Table 3. As shown, our instruments generally do a decent job of explaining variation in our endogenous explanatory variables.

We further enhance the estimation procedure by considering multiplicative heteroskedasticity of the form $\sigma_i^2 = \sigma^2 e^{z_i'\alpha}$, following the approach of Petersen and Waldman (1981) and Greene (1997). We include a constant, (corrected) import demand elasticities and their standard errors, and the labor stock as conditioning variables for the heteroskedastic function. If $\hat{\alpha} \neq 0$ (via Wald tests; excluding the constant) then we can reject the null hypothesis of homoskedastic errors. Maddala (1983) shows that coefficient estimates of a Tobit model are inconsistent when heteroskedastic errors are ignored, unlike the linear model in which coefficient estimates are still consistent (just not efficient), thus our concern for heteroskedasticity.

5.2. **Results.** Parameter estimates are reported in Table 4. The results for Wald tests of parameter restrictions are reported in the upper half of Table 6. As shown, our labor-market variables are indeed important determinants of trade protection. We reject the null hypothesis that labor-market variables do not matter ($\beta_3 = \gamma_3 = 0$), as evidenced by a Wald test score (p-value) of 10.29 (.0058)! We fail to reject the null hypothesis that $\beta_2 = \beta_3$ (and $\gamma_2 = \gamma_3$), with a Wald statistic of 3.95 (.1384). For all three specifications, $\beta_1 < 0$ and $\beta_2 > 0$ to statistically significant degrees. All three models explain a significant portion of the variance in our trade protection measure, because Wald tests reject the null hypothesis that $\beta_1 = \beta_2 = (\beta_3) = 0$ at at least the 99 percent confidence level. However, we cannot reject the null hypothesis of exogenous explanatory variables ($\gamma_1 = \gamma_2 = (\gamma_3) = 0$) at even the 90 percent confidence level for any of the three specifications.

Estimation results under heteroskedastic errors (Table 5) are very similar to those under homoskedastic errors. As reported in the lower half of Table 6, our labor market variables enter estimation to a statistically significant degree, $\beta_1 < 0$ and $\beta_2 > 0$ to statistically significant degrees, and we marginally reject the null hypothesis that $\beta_2 = \beta_3$ (p-value of 0.0884). Again, we explain a significant portion of the variance in our trade protection measure, because Wald tests reject the null hypothesis that $\beta_1 = \beta_2 = (\beta_3) = 0$ at at least the 99 percent confidence level. We also marginally reject the null hypothesis of exogenous explanatory variables (p-value of 0.0929) under our short specification with heteroskedastic

[17]Contrary to the approach of GM, we instrument for entire explanatory variables, not just components of explanatory variables. This means that we instrument for $\frac{F^i}{e_i M_i}$, $k_i \frac{F^i}{e_i M_i}$, and $labvar_i$ instead of instrumenting for $\frac{F^i}{M_i}$, k_i, $\frac{1}{e_i}$, and so on. In fact, in a 2SLS interpretation, one can show that a nonlinear function of fitted values is not the same as fitted values of a nonlinear function.

errors. The similarity of results across homoskedastic and heteroskedastic errors is not surprising, given that we cannot reject the null hypothesis of homoskedastic errors for any of the three specifications, at least for the heteroskedastic function we have specified.

These results suggest that the differences in NTB means across industry groups as seen in Table 2 are not just unconditional differences. That is, even conditional on the inverse import penetration ratio, inverse import demand elasticity, and active capitalist lobbying, the differences arising due to trade unions and labor mobility are still profound enough to influence trade policy determination to a statistically significant degree. Indeed, the NTB coverage ratio varies not only across $\frac{F_i}{M_i}\frac{1}{e_i}$ and $k_i\frac{F_i}{M_i}\frac{1}{e_i}$, but also conditionally across $labvar_i$. This is what we believe our estimation has picked up, just as hypothesized in the discussion of Figure 1.

Not surprisingly, industries with low import penetrations tend to have lower trade restrictiveness ($\beta_1 < 0$). Industries with active capitalist lobbies tend to have higher trade protection ($\beta_2 > 0$), holding the labor variable constant. In the short specification of the labor-augmented model, the coefficient estimates of β_1 and β_2 add up to more than 0 (and in the full specification the estimates of β_1 and β_2 and of β_1 and β_3) as predicted by theory, in contrast to the basic GH specification where the sum is negative. Yet, as indicated by the p-values in Table 6, we cannot reject $\beta_1 + \beta_2 \leq 0$ (and, in addition, $\beta_1 + \beta_3 \leq 0$ in the full specification) in the GH, short, or full specifications. We find that trade union lobbying and labor mobility issues are important determinants of trade protection ($\beta_3 > 0$). Hence our estimation results are in favor of the labor-augmented model, and labor immobility issues and trade union lobbying indeed seem to influence trade policy. The reader should also note from Table 1 that the redistributive labor market variable can be quite sizeable. Interestingly, the mean-average labor market component in the sample is negative, so that (with fixed coefficients) accounting for trade union activity and labor immobility reduces the average in-sample tariff prediction.

Under the GH specification, we estimate the structural parameters, Θ and a, to be 1.11 and 710, respectively. This is compared to estimates of 0.80 and 382 under the short specification and $\{0.82,\ 0.37\}$ and $\{513,\ 230\}$ under the full specification, respectively. We cannot reject the null hypothesis that any of these parameters lie within the theorized spaces at the 90-percent confidence level.[18] Thus, the government places much more weight on gross social welfare – around 99.7 percent of total weight – than on political contributions. Still, our estimate of the weight on contributions in the domestic welfare function is higher than in the GH specification. Also, we estimate the percentage of the population organized

[18]Standard errors are calculated using the Delta method.

as a lobby at about 80 percent to be much lower and thus more realistic than in the basic GH specification.

5.3. **Sensitivity Analysis.** We consider several alternatives to the specification results we report in Tables 4–5. First, we consider different measures of labor mobility as alternatives to our unemployment-based indicator, including wage mobility, age mobility, complete mobility, and complete immobility. Next, we explore the use of different capitalist lobbying indices as alternatives to our own GB-like, regression-based indicator – those of Gawande and Bandyopadhyay (2000) and Goldberg and Maggi (1999). Third, we examine different trade union lobbying indicator variables as alternatives to our union-nonunion-wage-differential-based indicator, instead using threshold per-value-added and per-union-laborer contribution levels as criteria. As a final specification test, we move the import demand elasticity to the left-hand side of Equation 3.4 and also consider directly the Shiells et al. (1986) elasticities, on which Gawande's measurement-error-corrected elasticities are based. We report results for the short specification only, but also report Wald tests of the restrictions implied by the GH and short specifications. Overall, we find that our estimates are quite robust to these alternatives.

5.3.1. *Alternative variable specifications.* We first consider alternatives to our unemployment-based labor mobility indicator variable – mobility based on inter-industry wage differentials, average age, complete labor mobility, and complete labor immobility. With wage mobility, we regressed individual (logged) hourly wages against various worker characteristics[19] from the CPS data set and 3-digit CIC dummies. The regression coefficients on the industry dummy variables are measures of inter-industry wage differentials (see Krueger and Summers, 1988). These wage differentials are then used to sort industries according to labor mobility, i.e., industries with coefficient estimates greater than one standard deviation away from the average coefficient estimate were considered immobile. We considered labor immobile on the basis of age if the industry's average worker age was greater than 39.5. Under the complete labor mobility specification, all industries were assumed to have mobile labor; opposite the case of completely immobile labor. Parameter estimates for these labor mobility measures appear in Table 7. In each case, the parameter estimates obtain the correct (statistically significant) signs. But when labor is completely mobile, we fail to reject the restrictions imposed by the GH model, which isn't all that surprising because we are close to the GH 'world' in this case (labor is perfectly mobile). Also, we reject the short specification when we base labor mobility on inter-industry wage differentials. The

[19]Education, employed fulltime, union status, union coverage status, gender, race, household head, marital status, region, and occupation.

structural parameters, Θ and a, also do not differ substantially from estimates when labor mobility was constructed from the industry-specific unemployment rate.

Next, we examine the sensitivity of our results to the definition of active capital lobbying. We consider two alternatives: the industry organization indicator from Gawande and Bandyopadhyay (2000) and the politically organized indicator from Goldberg and Maggi (1999). These estimates are contained in Table 8. Because our capitalist lobby indicator variable was constructed in much the same manner as GB's (just with a refined sample), it is not surprising to see that these two specifications produce very similar results. Goldberg and Maggi's specification, however, yields some strange results. The parameter estimate for β_2 is not statistically significant, and the structural parameter estimates have far larger standard errors than results we have seen so far. We should note that the GM political organization dummy is constructed based on a threshold of corporate contributions and does not reflect per-value-added influence or cost, i.e., size probably matters here.

We also explore different definitions for active trade union lobbying, implementing per-value-added and per-union-laborer threshold values for trade union political contributions. Threshold values were chosen to give a good balance of active and inactive trade unions. The results under these specifications are reported in Table 9. In each case, the parameter estimates obtain the correct (statistically significant) signs, except that we cannot reject $\beta_2 = 0$ under one value-added specification at conventional confidence levels. We can reject the GH model in only one case, but cannot reject the short specification. But to some degree, this comes as no surprise. We have not derived an explicit model for determining the level of trade union (or capitalist) contributions and therefore might have some trouble mapping contributions to active lobbies.

5.3.2. *Import demand elasticities.* In Table 10, we compare our estimation results using Gawande's corrected import demand elasticities with results using the import demand elasticities of Shiells et al. (1986). We also conduct estimation with each of these elasticities on the left-hand side of the estimating equation, for comparison with GM. Our results are quite robust to which elasticities are used and where they appear in estimation, though the largest differences arise when comparing results where elasticities are a component of the explanatory variables with results where elasticities are a component of the dependent variable. The model using Shiells' elasticities on the right-hand side appears to have a better model fit than our favored results, but does not account for the estimation of the import-demand elasticities in some initial stage, so that these results may be misleading. Gawande's elasticities have been corrected for this potential problem. In each case, $\beta_1 < 0$ and $\beta_2 > 0$ at the 99-percent confidence level. In addition, we reject the GH specification in favor of the full specification, we cannot reject the short specification in favor of the full specification, and the structural parameters each take on values within the admissible regions.

In all, our estimation results are quite robust to the choice of labor mobility and capitalist lobby measures, but less robust to trade union measures. We also show that our results are relatively insensitive to two different estimates of import demand elasticities as well as how they are treated endogenously in estimation.

6. Conclusion

When discussing special interest groups, a common distinction drawn is the one between capital and labor lobbies, where labor interests are usually represented by trade unions. The leading political economy model of trade protection, the Grossman-Helpman (1994) protection for sale model, however, abstracts from any kind of trade union influence. Moreover, it is set up in such a way as to eliminate any labor market related variables from the equilibrium trade protection equation. Surprisingly, empirical studies have found that this basic protection for sale model seems to explain trade protection well. In particular, it has been claimed that augmenting the basic model with model-extraneous explanatory variables, such as labor market variables, does not seem to improve the empirical model fit. This result seems at odds with both common perception and earlier empirical studies of the determinants of trade protection.

In this paper, we have shown how trade union lobbying, collective bargaining, and differences in labor mobility across industries can be incorporated into the Grossman-Helpman protection for sale model in a theoretically consistent manner to generate empirically verifiable implications. It is shown that the previous empirical studies suffer from model misspecification, as far as tests of the importance of variables beyond the ones in the basic protection for sale model are concerned. In general, our model predicts that if the trade union of industry i lobbies but capital owners do not, then trade protection is structurally higher than in the original Grossman-Helpman model where capital owners do not lobby because union workers collect part of the protection rents. On the other hand, if capital owners lobby but the trade union does not, equilibrium protection is reduced compared to the original Grossman-Helpman model where capital owners lobby because part of the protection rents are dissipated to workers. In contrast to the protection for sale model without trade union activity, the equilibrium protection rate in our model depends upon sectoral wage and employment elasticities. These, in turn, vary according to the mobility of workers across industries. Using a 1983 data set of U.S. manufacturing industries which has been extensively used to test the protection for sale model, we reevaluate the empirical evidence of whether labor market variables help explain trade protection in a protection for sale framework. The introduced labor market variable has a statistically significant effect on trade protection, consistent with patterns evident in the data. We attribute our finding to the derivation of the protection for sale model that allows for active trade unions and labor immobility. In our sample, the labor market variable can be large and its estimated effect on trade policy can be very sizeable. Moreover, the estimated structural parameters of the protection for sale model become more reasonable once we include the labor market variable. This is particularly true for the reduced estimate of the percentage of organized lobbies in the population. We thus find that trade union activity and labor mobility, in addition to the import penetration ratio, import demand elasticity, and capitalist lobby activity, do indeed play important roles in the determination of trade policy.

Several important extensions of our work seem noteworthy. First, an application using more recent data would prove particularly interesting. Next, a theoretical underpinning mapping political contributions to trade union and capitalist lobby activity would be useful. Third, good estimates of wage and employment elasticities would eliminate the need to define mobile and immobile industries. Lastly, our model seems particularly well suited for countries besides the U.S., for which collective bargaining, trade union lobbying, and labor mobility are significant issues.

Appendix A. Tables

Table 1. Descriptive Statistics

Variable Name	Unit	Mean	Median	Std. Dev.	Minimum	Maximum
$\frac{\tau_i^*}{1+\tau_i^*}$	none	0.08	0.00	0.13	0.00	0.50
$\frac{F^i}{M_i}\frac{1}{e_i}$	none	71.39	11.18	473.59	0.06	6518.82
$k_i\frac{F^i}{M_i}\frac{1}{e_i}$	none	55.15	4.29	470.40	0.00	6518.82
$labvar_i$	none	-18.59	-0.21	197.04	-2,735.86	104.94
Annual $\bar{w}_i$	$1,000	18.44	18.44	2.17	13.21	23.86
Annual w_i	$1,000	16.74	16.93	1.71	12.98	22.32
Import demand elasticity	absolute value	1.47	1.57	0.37	0.55	2.13
Imports	$100 million	5.57	1.67	15.95	0.00	174.83
Shipments	$100 million	52.58	24.14	142.66	0.73	1,825.92
Union shipments	$100 million	22.25	7.59	69.88	0.06	860.57
Union value added	$100 million	21.24	11.14	31.61	0.52	215.93
Labor force	thousands	38.49	21.10	54.54	1.30	486.00
Covered union (α_i)	fraction	0.92	0.91	0.04	0.76	1.00
Covered nonunion $(\alpha_i\delta_i)$	fraction	0.04	0.03	0.02	0.00	0.12
Covered	fraction	0.28	0.26	0.11	0.07	0.60

TABLE 2. Variable Means Across Industry Types

		$k_i = 0$		$k_i = 1$	
$m_i = 0$	Unit	$n_i = 0$	$n_i = 1$	$n_i = 0$	$n_i = 1$
τ_i^*	none	0.0504	0.0816	0.0701	0.2790
$\frac{\tau_i^*}{1+\tau_i^*}$	none	0.0441	0.0561	0.0476	0.1919
$\frac{M^i}{F_i}$	none	0.0472	0.4029	0.1918	0.2534
e_i	absolute	1.5597	1.5262	1.4990	1.4498
$labvar_i$	none	0.0000	4.9272	-48.0423	-15.7753
Annual $\bar{w}_i$	$1,000	19.5049	17.2621	18.5215	16.7496
Annual w_i	$1,000	18.2219	15.6839	16.5560	15.7073
PACCORP/VA	100s	0.0019	0.0026	0.0056	0.0062
PACLAB/VA	100s	0.0000	0.0158	0.0151	0.0256
Unemployment	rate	0.1167	0.1576	0.1381	0.1564
Age	years	38.2810	37.2409	38.2134	39.4502
# observations	–	9	39	73	18
		$k_i = 0$		$k_i = 1$	
$m_i = 1$	Unit	$n_i = 0$	$n_i = 1$	$n_i = 0$	$n_i = 1$
τ_i^*	none	0.2009	0.4414	0.0740	0.0894
$\frac{\tau_i^*}{1+\tau_i^*}$	none	0.1091	0.2462	0.0531	0.0676
$\frac{M^i}{F_i}$	none	0.0413	0.2076	0.2149	0.2073
e_i	absolute	1.4435	0.8612	1.5481	1.3860
$labvar_i$	none	0.0000	1.4068	-0.6943	-0.0404
Annual $\bar{w}_i$	$1,000	19.5181	20.9171	19.6778	18.2705
Annual w_i	$1,000	17.7500	17.8811	18.1644	17.1215
PACCORP/VA	100s	0.0009	0.0013	0.0056	0.0060
PACLAB/VA	100s	0.0008	0.0114	0.0074	0.0156
Unemployment	percent	0.0590	0.0798	0.0467	0.0823
Age	years	37.4013	38.6139	38.4826	37.9688
# observations	–	5	9	28	13

TABLE 3. First-Stage R^2

Variable	R^2
$\frac{F^i}{M_i}\frac{1}{e_i}$	.1940
	(.0205)
$k_i\frac{F^i}{M_i}\frac{1}{e_i}$	.1813
	(.0408)
$k_i\frac{F^i}{M_i}\frac{1}{e_i} + labvar_i$	.1926
	(.0222)
$labvar_i$	.1665
	(.0842)

Table 4. Estimation Results under Homoskedasticity

Parameter	GH Specification	Full Specification	Short Specification
β_0	.0161	.0145	.0126
	(.0204)	(.0226)	(.0205)
β_1	$-.0016$	$-.0016$	$-.0021$
	(.0007)	(.0007)	(.0007)
β_2	.0014	.0019	–
	(.0007)	(.0008)	
β_3	–	.0043	–
		(.0015)	
$\beta_2 = \beta_3$	–	–	.0026
			(.0008)
γ_1	.0010	.0008	.0009
	(.0006)	(.0006)	(.0005)
γ_2	$-.0009$	$-.0011$	–
	(.0006)	(.0009)	
γ_3	–	$-.0011$	–
		(.0015)	
$\gamma_2 = \gamma_3$	–	–	$-.0012$
			(.0009)
σ^2	.0453	.0415	.0429
Θ	1.1083	.8192 .3668	.7972
	(.1118)	(.2697 .1903)	(.1288)
a	709.88	513.15 229.73	382.29
	(367.86)	(217.42 79.64)	(122.92)
$\ln L$	-48.77	-42.64	-44.67

Standard errors in parentheses.

Table 5. Estimation Results under Heteroskedasticity

Parameter	GH Specification	Full Specification	Short Specification
β_0	.0208	.0143	.0133
	(.0211)	(.0234)	(.0206)
β_1	−.0017	−.0017	−.0022
	(.0007)	(.0006)	(.0007)
β_2	.0015	.0021	–
	(.0007)	(.0008)	
β_3	–	.0049	–
		(.0015)	
$\beta_2 = \beta_3$	–	–	.0028
			(.0008)
γ_1	.0011	.0009	.0010
	(.0006)	(.0006)	(.0005)
γ_2	−.0010	−.0013	–
	(.0006)	(.0008)	
γ_3	–	−.0014	–
		(.0014)	
$\gamma_2 = \gamma_3$	–	–	−.0015
			(.0008)
α_0	−1.8185	−1.9337	−1.9572
	(.6818)	(.6981)	(.6965)
α_1	−.8557	−.8657	−.8022
	(.4932)	(.5027)	(.5021)
α_2	−.0491	−.1004	−.0978
	(.2538)	(.2587)	(.2683)
α_3	−.0086	.0094	.0025
	(.0275)	(.0299)	(.0289)
Θ	1.1066	.8048 .3369	.8015
	(.1170)	(.2437 .1633)	(.1161)
a	664.32	485.81 203.40	361.86
	(320.35)	(189.30 63.40)	(108.48)
$\ln L$	−45.35	−38.73	−41.24

Standard errors in parentheses.

Table 6. Wald Tests for Parameter Restrictions

Homoskedastic Errors				
Null hypothesis	*df*	GH Spec.	Full Spec.	Short Spec.
H_0: $\beta_3 = \gamma_3 = 0$	2	–	10.29	–
(GH restrictions)			(.0058)	
H_0: $\left\{ \begin{smallmatrix} \beta_2=\beta_3 \\ \gamma_2=\gamma_3 \end{smallmatrix} \right.$	2	–	3.95	–
(Short restrictions)			(.1384)	
H_0: $\left\{ \begin{smallmatrix} \beta_1+\beta_2\leq 0 \\ (\beta_1+\beta_3\leq 0) \end{smallmatrix} \right.$	$1-2$	$-1.23*$	3.10	1.67
(Net effects)		(.8910)	(.2127)	(.1969)
H_0: $\beta_1 = \beta_2 = (\beta_3) = 0$	$2-3$	6.20	13.67	10.25
(Model fit)		(.0451)	(.0034)	(.0059)
H_0: $\gamma_1 = \gamma_2 = (\gamma_3) = 0$	$2-3$	3.98	4.22	4.36
(Exogeneity)		(.1365)	(.2389)	(.1129)
Heteroskedastic Errors				
Null hypothesis	*df*	GH Spec.	Short Spec.	Full Spec.
H_0: $\beta_3 = \gamma_3 = 0$	2	–	11.61	–
(GH restrictions)			(.0030)	
H_0: $\left\{ \begin{smallmatrix} \beta_2=\beta_3 \\ \gamma_2=\gamma_3 \end{smallmatrix} \right.$	2	–	4.85	–
(Short restrictions)			(.0884)	
H_0: $\left\{ \begin{smallmatrix} \beta_1+\beta_2\leq 0 \\ (\beta_1+\beta_3\leq 0) \end{smallmatrix} \right.$	$1-2$	$-1.10*$	4.15	1.95
(Net effects)		(.8647)	(.1257)	(.1625)
H_0: $\beta_1 = \beta_2 = (\beta_3) = 0$	$2-3$	6.50	16.10	11.80
(Model fit)		(.0387)	(.0011)	(.0027)
H_0: $\gamma_1 = \gamma_2 = (\gamma_3) = 0$	$2-3$	4.42	4.51	4.75
(Exogeneity)		(.1099)	(.2117)	(.0929)
H_0: $\alpha_1 = \alpha_2 = \alpha_3 = 0$	3	4.73	4.94	4.28
(Homoskedasticity)		(.1929)	(.1764)	(.2330)

*=*t*-statistic and one-sided *t*-test.

p-values in parentheses.

Table 7. Alternative Specifications of Labor Mobility Measure

Parameter	Original $\mathbb{I}\{un_i \leq 0.10\}$	Wage $\mathbb{I}\{\lvert\frac{w_i-\mu}{\sigma}\rvert \geq 1\}$	Age $\mathbb{I}\{age_i \geq 39.5\}$	Completely Mobile	Completely Immobile
β_0	.0126	.0184	.0189	.0155	.0130
	(.0205)	(.0196)	(.0200)	(.0202)	(.0204)
β_1	−.0021	−.0022	−.0020	−.0016	−.0019
	(.0007)	(.0007)	(.0007)	(.0007)	(.0006)
$\beta_2 = \beta_3$	.0026	.0021	.0020	.0016	.0023
	(.0008)	(.0008)	(.0008)	(.0008)	(.0008)
γ_1	.0009	.0009	.0010	.0010	.0007
	(.0005)	(.0006)	(.0006)	(.0006)	(.0005)
$\gamma_2 = \gamma_3$	−.0012	−.0008	−.0009	−.0009	−.0009
	(.0009)	(.0006)	(.0007)	(.0007)	(.0008)
σ^2	.0429	.0436	.0443	.0452	.0427
Θ	.7972	1.0254	1.0208	1.0421	.8030
	(.1288)	(.0678)	(.0723)	(.1000)	(.1475)
a	382.29	473.05	506.81	637.17	432.90
	(122.92)	(169.20)	(203.67)	(318.30)	(144.07)
GH	10.29	13.63	6.50	4.13	8.37
	[.0058]	[.0011]	[.0388]	[.1270]	[.0152]
Short	3.95	8.90	3.51	3.98	1.73
	[.1384]	[.0117]	[.1729]	[.1366]	[.4219]
$\ln L$	−44.67	−46.11	−47.19	−48.58	−44.33
$\#\{m_i = 1\}$	55	166	165	194	0

Standard errors in parentheses; p-values in brackets.

TABLE 8. Alternative Specifications of Capitalist Lobbying

Parameter	Original Specification	Gawande & Bandyopadhyay	Goldberg & Maggi
β_0	.0126	.0099	.0155
	(.0205)	(.0207)	(.0218)
β_1	−.0021	−.0021	−.0019
	(.0007)	(.0007)	(.0009)
$\beta_2 = \beta_3$	.0026	.0027	.0014
	(.0008)	(.0009)	(.0009)
γ_1	.0009	.0010	.0000
	(.0005)	(.0005)	(.0006)
$\gamma_2 = \gamma_3$	−.0012	−.0015	.0002
	(.0009)	(.0009)	(.0009)
σ^2	.0429	.0433	.0447
Θ	.7972	.7852	1.3827
	(.1288)	(.1251)	(.4308)
a	382.29	374.12	713.15
	(122.92)	(126.59)	(469.04)
GH	10.29	10.19	4.81
	[.0058]	[.0061]	[.0903]
Short	3.95	4.88	0.86
	[.1384]	[.0871]	[.6501]
$\ln L$	−44.67	−45.48	−48.53
$\#\{k_i = 1\}$	132	127	155

Standard errors in parentheses; p-values in brackets.

TABLE 9. Alternative Specifications of Trade Union Lobbying

Parameter	Original Specification	Contributions			
		$\mathbb{I}\left\{\frac{C_i}{VA_i} \geq \frac{1}{40{,}000}\right\}$	$\mathbb{I}\left\{\frac{C_i}{VA_i} \geq \frac{1}{8{,}000}\right\}$	$\mathbb{I}\left\{\frac{C_i}{\lambda_i L_i} \geq 5\right\}$	$\mathbb{I}\left\{\frac{C_i}{\lambda_i L_i} \geq 15\right\}$
β_0	.0126	.0057	.0060	.0047	.0077
	(.0205)	(.0207)	(.0207)	(.0207)	(.0208)
β_1	−.0021	−.0016	−.0012	−.0015	−.0015
	(.0007)	(.0007)	(.0007)	(.0006)	(.0007)
$\beta_2 = \beta_3$	.0026	.0018	.0014	.0018	.0018
	(.0008)	(.0008)	(.0010)	(.0008)	(.0009)
γ_1	.0009	.0005	.0006	.0007	.0006
	(.0005)	(.0005)	(.0006)	(.0005)	(.0005)
$\gamma_2 = \gamma_3$	−.0012	−.0006	−.0008	−.0009	−.0008
	(.0009)	(.0009)	(.0010)	(.0008)	(.0009)
σ^2	.0429	.0442	.0454	.0443	.0444
Θ	.7972	.8708	.8178	.8504	.8355
	(.1288)	(.1980)	(.2327)	(.1882)	(.1882)
a	382.29	552.65	690.21	556.50	547.29
	(122.92)	(255.78)	(453.88)	(243.55)	(256.40)
GH	10.29	5.03	0.85	3.61	3.38
	[.0058]	[.0808]	[.6528]	[.1641]	[.1844]
Short	3.95	3.11	2.20	1.76	1.78
	[.1384]	[.2108]	[.3327]	[.4154]	[.4113]
$\ln L$	−44.67	−47.32	−49.35	−47.49	−47.71
$\#\{n_i = 1\}$	79	124	55	114	70

Standard errors in parentheses; p-values in brackets.

Table 10. Specification of Elasticity

	Gawande Elasticities		Shiells Elasticities	
Parameter	Original Specification	Elasticity on LHS	Elasticity on RHS	Elasticity on LHS
β_0	.0126	.0191	.0184	−.0010
	(.0205)	(.0285)	(.0205)	(.0331)
β_1	−.0021	−.0023	−.0016	−.0024
	(.0007)	(.0007)	(.0005)	(.0007)
$\beta_2 = \beta_3$	.0026	.0028	.0017	.0032
	(.0008)	(.0008)	(.0005)	(.0010)
γ_1	.0009	.0011	.0004	.0018
	(.0005)	(.0005)	(.0003)	(.0006)
$\gamma_2 = \gamma_3$	−.0012	−.0016	−.0006	−.0028
	(.0009)	(.0008)	(.0004)	(.0010)
σ^2	.0429	.0843	.0417	.1111
Θ	.7972	.8001	.9599	.7390
	(.1288)	(.1112)	(.1363)	(.1075)
a	382.29	353.68	590.42	308.49
	(122.92)	(104.57)	(163.95)	(91.26)
GH	10.29	12.83	11.27	8.93
	[.0058]	[.0016]	[.0036]	[.0115]
Short	3.95	5.56	1.91	2.11
	[.1384]	[.0619]	[.3847]	[.3490]
$\ln L$	−44.67	−77.71	−42.46	−89.61

Standard errors in parentheses; p-values in brackets.

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Figure 1: Trade Protection Across Industries