Protection with Many Sellers: An Application to Legislatures with Malapportionment

William R. Hauk, Jr.*

University of South Carolina

November 16, 2007

Abstract

What effect, if any, does legislative malapportionment have on international trade protection? This paper argues that malapportioned legislatures, such as the U.S. Senate, can lead to small constituencies where one industry, by dominating that consituency's economy, can influence a legislator more easily than a similar industry in a larger constituency. As a result, industries that are disproportionately located in smaller constituencies are likely to receive greater protection from international trade. To argue this point theoretically, this paper combines a model of legislative bargaining and a model of lobbying to study trade protection while allowing for a legislature with multiple legislators and differently-sized constituencies. We then test empirically the predictions of this new model using tariff votes from the U.S. Senate in the late 19th and early 20th centuries and a panel of tariffs and non-tariff barriers to trade in the U.S. in the 1990s. Considerable support is found for the model's predictions. Industries concentrated in states where the population is low receive greater protection from imports.

JEL Codes: F1, D7, C7

Keywords: trade, protection, lobbying, bargaining

*Contact information: Department of Economics, Moore School of Business, 1705 College St., Columbia, SC 29208. Email: hauk@moore.sc.edu. Phone: 803-777-6044. The author gratefully acknowledges helpful comments from David Baron, Romain Wacziarg and participants in seminars at Stanford University, Washington University, the University of South Carolina, Southern Methodist University, the NBER Student Political Economy Meeting, the American Political Science Association and the Midwest Political Science Association. The author also thanks Daniel Kessler for generously sharing data collected for Brady, Goldstein and Kessler (2002). All remaining errors are the author's.

1 Introduction

What effect, if any, does legislative malapportionment have on a country's international trade policy? This paper argues that industries in small states are better able to lobby their legislator for protection because these industries will represent a large portion of the state's economy and will therefore have a greater influence than the relatively small numbers of consumers in that constituency adversely affected by trade protection. In malapportioned legislatures, small states are overrepresented relative to their population, so their representatives' trade policy positions are more likely to win out in legislative bargaining. To argue this point theoretically, this paper combines a model of legislative bargaining and a model of lobbying to study trade protection that allows for for a legislature with multiple legislators and differently-sized constituencies. We then test the predictions of this new model using tariff votes from the U.S. Senate in the late 19th and early 20th centuries and a panel of tariffs and non-tariff barriers to trade in the U.S. in the 1990s. The empirical results provide considerable support for the model.

One of the first attempts to help explain the political economy of trade protection was the model developed by Stolper and Samuelson (1941). Its major conclusion was that when an economy opens to free trade, the owners of the factors of production in which the economy is relatively well-endowed will prosper while the owners of the factor in which the economy is relatively poorly-endowed will be harmed by trade liberalization. This theorem provided a convincing economic rationale for why certain interest groups would be opposed to free trade. However, due to the Stolper-Samuelson assumption of perfect factor mobility across economic sectors, they tend to lack explicit reasons why protectionism might vary across industries. For instance, the U.S. (as well as many other industrialized nations) has been successful at excluding agricultural and textile trade from GATT/WTO negotiations throughout most of the regime's history, opting instead to erect high tariff and non-tariff barriers to protect these sectors while pushing for greater liberalization in other areas. The Bush administration has pursued protectionist actions in the steel, timber and agriculture industries while at the same seeking fast-track trade negotiating authority from Congress and signing and negotiating regional and bilateral agreements to reduce trade barriers elsewhere. A good model of trade politics should attempt to explain cross-industry variations in trade protection.

Busch and Reinhardt (1999) take one approach to this question based on the "political concentration" of industries. From this study, they find that industries that are broadly dispersed over political constituencies but geographically concentrated are most likely to be successful in lobbying for trade protection, as these industries are more capable of acting collectively, yet at the same time can influence a large number of representatives.

Like Busch and Reinhardt, this paper focuses on political concentration and argues that there is a relationship between legislative apportionment and the ability of industries to lobby for tariff protection. Our particular contribution is that we demonstrate that, all else equal, industries that are more heavily concentrated in smaller legislative constituencies will be more effective at lobbying for trade protection than those that are concentrated in large constituencies. An anecdotal motivation for this paper comes from the observation that in many advanced industrial countries, agriculture receives both strong protection against imports and government subsidies to maintain its viability in the face of a comparative disadvantage in production. As a result, malapportionment – the deviation of legislative bodies from equally-sized constituencies for each representative – tends to favor less populated areas at the expense of highly populated areas. The example most relevant to this paper is the U.S. Senate (the focus of our empirical tests) where each state receives two senators regardless of its population. The model could also apply to any country with a malapportioned legislative chamber such as the European Union Council of Ministers or the Japanese Diet.

A number of studies identify a correlation between inequalities in representation and inequalities in the receipt of government benefits. For instance, Atlas et al. (1995) observe in their study of federal government spending by state that less-populated states tend to receive a greater share of federal funds than their share of population. Ansolabehere, Gerber and Snyder (2002) use state and county-level data on government spending and note that in the aftermath of several Supreme Court decisions on apportionment that forced more equal representation in state legislatures, spending and revenue transfers tended to flow more equally across constituencies. Ansolabehere, Snyder and Ting (2003) present a bargaining model where, in a bicameral legislature with malapportionment such as in the U.S., transfers across states disproportionately benefit smaller states. Knight (2004) notes that the since their constituents will be paying a smaller share of tax revenues, small states are more interested in expanding government spending. Hauk and Wacziarg (2007) look at the 2005 U.S. Highway Bill as it moves through the different stages of the legislative process and notice a strong effect on malapportionment as the bill passed through the U.S. Senate.

Given these findings on the impact of apportionment on government spending, we should expect malapportionment to affect trade policy as well. This paper develops a formal model of lobbying and legislative bargaining taking into account the influence of malapportionment on the ability of industries to lobby for protection.

Grossman and Helpman (1994) have developed a widely-cited model of interest group lobbying by industries for trade protection. The major result of their model is that, holding a few other variables constant, industries that are effectively organized for lobbying will receive higher tariff protection for their goods than industries that are not. The precise magnitudes of the tariff barriers are determined in accord with a formula similar to the Ramsey Rule, where goods for which there is a relatively inelastic demand are taxed at a higher rate than goods for which there is a relatively elastic demand. Considerable empirical support has been found for the predictions of this model (see, for example, Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000) and Eicher and Osang (2002)). The model, however, is based on an assumption that industry lobbyists target a unitary government. This paper takes the literature in a more realistic direction by allowing for a multi-member legislature and coalition building amongst legislators over trade policy.

There has been relatively little theoretical work combining lobbying with legislative bargaining. Helpman and Persson (2001) have provided a model where lobbying and bargaining occur over the allocation resources from a fixed government budget. While the "divide the dollar" game in the Helpman-Persson paper does not readily apply to trade policy, the model does offer insights into how to extend the Grossman-Helpman framework to include multiple legislators. In contrast to Helpman-Persson, government resources in this paper's model are not fixed. The model combines the basic Grossman-Helpman (henceforth, GH) framework for deriving preferences for protection among legislators, with a three member legislature bargaining over tariff policy, similar to Helpman-Persson. In each state, a legislator is lobbied by a home industry. The states have different population sizes. By introducing a legislature with multiple members to the GH framework, this paper's methodological contribution goes beyond its substantive focus on legislative malapportionment and trade policy.

We derive several predictions on the determinants of trade protection. Specifically, we show that trade protection will be decreasing in an industry's import penetration ratio, decreasing in the population of the states that the industry is concentrated in, and decreasing in the share of total state output generated by that industry. Because legislative malapportionment means that there will be differently-sized legislative districts for industries to be concentrated in, the second prediction shows that there will be an impact of malapportionment on trade policy.

The predictions from this model are tested using two separate data sets. The first is from a series of tariff votes in the Senate during the late 19th and early 20th centuries (when tariffs were among the most contentious economic issues debated by Congress) that was collected by Brady, Goldstein and Kessler (2002). These data are used to test predictions about the voting behavior of legislators. The second data set is a collection of U.S. tariff and non-tariff barriers to trade during the 1990's. These data allow a test of the full range of effects that import elasticities, import penetration ratios and labor and output shares in a state's economy should have on the predicted level of trade protection. The results of tests on both of these datasets strongly support the predictions of the theory.

2 The Model

2.1 A Simple Example

It should come as no surprise that we would predict that a legislator would want to protect an industry that is a major part of his constituency's economy. However, a legislator that has a large constituency will have many other competing interests that he will have to serve who will be opposed to protectionism for products that they consume. For example, a senator from the state of Michigan would certainly be concerned with protecting the auto industry located in her state. However, she also has many other constituents who are not a part of the auto industry and who consume automobiles. Hence, she would not want to raise protection for the automobile industry indefinitely, as it would hurt the welfare of her other constituents.

The argument that this paper makes is that we should consider what would happen if, all else equal, the state of Michigan were to shrink. As long as the auto industry remained there, the lack of other interests (in particular, consumers of automobiles) would make the Senator devoted more and more to the protection of the auto industry. In our model, this will have two effects – first, it will make it easier for the auto industry to lobby the Senator, and second, it will make the Senator a more desirable coalition partner for an agenda-setter. The second effect arises because a Senator who has a stronger preference for tariffs in her industry will be more willing to acquiesce in tariffs for other industries, provided that she gets some sort of tariff for her own industry. As we shall see below, these two dynamics will both make a Senator more likely to be included in a winning coalition on a tariff bill and make tariffs on that Senator's industry higher once she is included in a coalition.

2.2 Setup

We begin with a modified version of the GH model where there are several industries producing tradeable goods, each of which is located in a different legislative constituency. While each constituency is represented by one legislator, constituencies are not restricted to being the same size in terms of population. Hence, the potential for legislative malapportionment exists in this model.

As in GH we begin with individuals who maximize the utility function:

$$U(\mathbf{x}) = x_0 + \sum_{i=1}^{N} u_i(x_i)$$

where $x_i = d_i(p_i)$ is the demand of each individual for good i as a function of its domestic price p_i,[1] each $u_i(x_i)$ is differentiable, increasing and strictly concave and good 0 is a numeraire good that is not imported, gives a utility of 1 per unit and has domestic and world price equal to 1. This setup gives each individual consumer c an indirect utility function of :

$$U_c(\mathbf{p}, E) = E_c + s(\mathbf{p})$$

where $s(\mathbf{p}) = \sum_i u_i[d_i(p_i)] - \sum_i p_i d_i(p_i)$ is the consumer surplus and E_c is the income of the individual.

To figure out the value of E_c, we assume that the numeraire good is produced with labor alone and that one unit of labor produces one unit of output. In a competitive equilibrium, then, the wage rate will be 1. Therefore, a person's income from labor will simply be his labor supply, which we label ℓ_c. Since the wage rate is fixed at one, the rents on specific factors used to produce goods depend solely on the domestic price of the good, which is indicated by $\pi_i(p_i)$. If consumer c owns a fraction s_c of the specific factor used in producing good i, his income from that source will be $s_c\pi_i(p_i)$. The per-capita tariff revenue that the

[1] Demand is only a function only of the good's own price, since each individual is assumed to have additively-separable preferences and quasi-linear utility functions.

government receives will be equal to:

$$r(\mathbf{p}) = \sum_i (p_i - p_i^*) \left[d_i(p_i) - \frac{1}{N} y_i(p_i) \right]$$

where p_i^* is the exogenous world price of good i, $y_i(p_i)$ is the domestic production of good i, and N is the size of the electorate. Assuming that the government makes lump-sum transfers to its citizens, $r(\mathbf{p})$ is also the net government transfer to each individual. Combining all of the above, we can rewrite the indirect utility function as

$$U_c(\mathbf{p}) = \ell_c + s_c \pi_i(p_i) + r(\mathbf{p}) + s(\mathbf{p})$$

Next, assume that the country has a legislature where each legislator represents one constituency (indexed by j) consisting of N_j citizens. We can find the total welfare $W_j(\mathbf{p})$ of constituency j by summing individual utilities across the population of constituency j

$$W_j(\mathbf{p}) = \sum_{c \in j} U_c(\mathbf{p}) = \ell_j + \sum_i I_{ij} \pi_i(p_i) + N_j [r(\mathbf{p}) + s(\mathbf{p})]$$

where ℓ_j is the total labor supply in j and I_{ij} is an indicator variable that takes on the value of 1 if the owners of the specific factor used in industry i are located in constituency j and a value of 0 otherwise.[2]

Differentiating $W_j(\mathbf{p})$ with respect to the price of a good i yields

$$\frac{\partial W_j(\mathbf{p})}{\partial p_i} = \left(I_{ij} - \frac{N_j}{N} \right) y_i(p_i) + N_j (p_i - p_i^*) \frac{\partial m_i(p_i)}{\partial p_i} \tag{1}$$

where $m_i(p_i) = d_i(p_i) - \frac{1}{N} y_i(p_i)$ is the per-capita level of imports of good i. (A complete derivation is in the appendix.) Note that $\frac{\partial m_j(p_j)}{\partial p_j} < 0$, and if $(p_i - p_i^*) \geq 0$, then the second term in this equation is weakly negative. Thus, a higher tariff will lower state welfare by reducing imports of good i. Second, the entire expression will be negative if $I_{ij} = 0$. That is, the necessary condition for a tariff increase on good i to benefit state j is that the owners of the specific factor used in the production of good i are located in the state. The necessary and sufficient condition for the tariff increase to be beneficial is that the impact of factor ownership is large enough to overcome the loss in consumer surplus and tariff revenue resulting from a fall in imports. In general, the larger the value $\left(I_{ij} - \frac{N_j}{N} \right)$, that is, the smaller state j's population, the more a tariff on good i will benefit state j.

Assume that each import-competing industry i produces one good i, and each is organized into a lobbying group. Each lobby promises contributes resources to one legislator in the form of a contribution schedule

[2] For the purposes of this model, we restrict ourselves to the scenario where all owners of a specific factor of production are all located in the same political constituency.

$C_i(\mathbf{p}) \geq 0$ that is a function of the vector of domestic prices. The utility $U_i(\mathbf{p})$ of each industry lobby i is

$$U_i(\mathbf{p}) = V_i(\mathbf{p}) - C_i(\mathbf{p})$$

where $V_i(\mathbf{p})$ is

$$V_i(\mathbf{p}) = \pi_i(p_i) + \ell_i + N_i^* [r(\mathbf{p}) + s(\mathbf{p})]$$

and N_i^* is the number of people owning a specific factor in that industry. It will be convenient for future analysis to write N_i^* as a fraction of the population of the legislative constituency in which the industry is located. For example, if industry i is located in constituency j, we can write $N_i^* = \beta_{ij} N_j$ where $0 \leq \beta_{ij} \leq 1$.

The legislator for constituency j has utility function $L_j(\mathbf{p})$

$$L_j(\mathbf{p}) = \sum_i I_{ij} C_i(\mathbf{p}) + aW_j(\mathbf{p}) + g_j$$

where a is a non-negative constant representing the weight the legislator puts on the welfare of her constituency relative to political contributions and g_j is a transfer of "goodies" (in this model, we treat these simply as side payments between legislators, but in the real world, these payments may consist of legislative perks, support for other bills and other favors) that a bill's proposer can offer to the legislator in return for supporting a bill.

Differentiating $V_i(\mathbf{p})$ (industry i's welfare) with respect to p_k yields

$$\frac{\partial V_i(\mathbf{p})}{\partial p_k} = \left(I_{i,k} - \frac{N_i^*}{N} \right) y_k(p_k) + N_i^* (p_k - p_k^*) \frac{\partial m_k(p_k)}{\partial p_k} \tag{2}$$

where $I_{i,k}$ is an indicator variable that takes the value of 1 if $i = k$ and 0 otherwise. As in (1), we see that the lobby can only benefit from a tariff increase on its own good. Conflict in this model comes from the fact that, as long as $N_i^* \neq N_j$, or $I_{ij} \neq 1$, lobby i and legislator j will have differing views on the optimal tariff policy for a given good.

2.3 Game form

The game form is similar to the model used in Helpman and Persson (2001), but is of a more general form where legislators' and lobbies' welfares depend on the tariff policy agreed on for all three goods. Assume, as in Helpman and Persson, that there are 3 states and 3 goods. States are indexed by i, j and k, and each has one legislator representing it regardless of its size. Each state also produces exactly one import-competing good and all of the holders of factors used in the production of that good are located in that state. Therefore, we may also index the goods by i, j and k

The game form is the following:

1. Nature selects a legislator to propose a tariff policy

2. Lobbies offer contribution schedules to the legislators representing their states; these contributions are a function of the tariff policy proposal and the legislator's vote.

3. The agenda-setter proposes a tariff policy and an allocation of intra-legislature "goodies" $\mathbf{g} = (g_i, g_j, g_k)$ among the legislators if they vote in favor of the bill where $\sum_l g_l = G$, where $l = i, j, k$.

4. Legislators vote on the tariff policy, where $v_l \in \{0, 1\}$, $l = i, j, k$, and $v_l = 1$ denotes a vote for the policy and $v_l = 0$ a vote against.

5. If the tariff policy passes, the tariff policy becomes law and the goodies are transferred; if it fails, a default tariff policy $\mathbf{p}^d = \mathbf{p}^*$ (i.e., free-trade) prevails, and no goodies are distributed.[3]

Also as in Helpman and Persson, we restrict the contribution functions offered to the following form: industry l offers a contribution function $C_l(\mathbf{p})$, where $\mathbf{p}$ is the price vector proposed by the agenda-setter. If legislator l votes in favor of the tariff bill, he receives $C_l(\mathbf{p})$. If he votes against the tariff bill, he receives a contribution of 0. The contribution schedules are also restricted to being continuous and differentiable almost everywhere.

2.4 Equilibrium Characterization

Assume that legislator i is chosen as the proposer. An equilibrium is a set of contribution schedules, a policy vector, transfers of "goodies," and legislative votes

$$\left\{C_i^0(\mathbf{p}), C_j^0(\mathbf{p}), C_k^0(\mathbf{p}), \mathbf{p}^0, \mathbf{g}^0, v_i^0, v_j^0, v_k^0\right\}$$

that satisfy the following conditions:

1. Legislator l $(l = i, j, k)$ votes according to

$$\begin{aligned} v_l &= 1 \text{ if } C_l^0\left(\mathbf{p}^0\right) + aW_l\left(\mathbf{p}^0\right) + g_l^0 \geq aW_l(\mathbf{p}^*) \\ v_l &= 0 \text{ otherwise} \end{aligned}$$

[3] One might question the realism of a game form under which the legislature has no ability to amend the proposal or where the proposal dies if not ratified on the first vote. However, this game form closely resembles the ratification of trade agreements in the U.S. using the "fast-track" system whereby the President negotiates an agreement and submits it to the Senate, and the Senate only takes an up-or-down vote on the agreement.

2. For legislator i, $\left(\mathbf{p}^0, \mathbf{g}^0\right)$, the equilibrium policy and goodies transfer, satisfies

$$\left(\mathbf{p}^0, \mathbf{g}^0\right) \in \arg\max \left\{C_i^0\left(\mathbf{p}\right) + aW_i\left(\mathbf{p}\right) + g_i\right\}$$

subject to $g_i + g_j + g_k = G$ and either

$$C_j^0\left(\mathbf{p}\right) + aW_j\left(\mathbf{p}\right) + g_j \geq aW_j\left(\mathbf{p}^*\right) \tag{3}$$

or

$$C_k^0\left(\mathbf{p}\right) + aW_k\left(\mathbf{p}\right) + g_k \geq aW_j\left(\mathbf{p}^*\right) \tag{4}$$

3. $\mathbf{p}^0$ satisfies

$$\mathbf{p}^0 \in \arg\max \left\{U_i\left(\mathbf{p}\right) + C_i\left(\mathbf{p}\right) + aW_i\left(\mathbf{p}\right) + g_i^0\right\}$$

subject to $g_i + g_j + g_k = G$ and either

$$C_j^0\left(\mathbf{p}\right) + aW_j\left(\mathbf{p}\right) + g_j^0 \geq aW_j\left(\mathbf{p}^*\right) \tag{5}$$

or

$$C_k^0\left(\mathbf{p}\right) + aW_k\left(\mathbf{p}\right) + g_k^0 \geq aW_j\left(\mathbf{p}^*\right) \tag{6}$$

4. Lobbies j and k choose $C_j^0\left(\mathbf{p}\right)$ and $C_k^0\left(\mathbf{p}\right)$ to satisfy

$$\mathbf{p}^0 \in \arg\max \left\{U_j\left(\mathbf{p}\right) + C_j\left(\mathbf{p}\right) + aW_j\left(\mathbf{p}\right) + g_j^0\right\} \tag{7}$$

and

$$\mathbf{p}^0 \in \arg\max \left\{U_k\left(\mathbf{p}\right) + C_k\left(\mathbf{p}\right) + aW_k\left(\mathbf{p}\right) + g_k^0\right\}$$

subject to

$$\begin{aligned} V_j\left(\mathbf{p}\right) - C_j\left(\mathbf{p}\right) &\geq V_j\left(\mathbf{p}^k\right) \\ V_k\left(\mathbf{p}\right) - C_k\left(\mathbf{p}\right) &\geq V_k\left(\mathbf{p}^j\right) \end{aligned} \tag{8}$$

where $\mathbf{p}^k$ and $\mathbf{p}^j$ are the tariff policy vectors that satisfy the previous conditions when legislators k

and j are included in the winning coalition, repsectively, and

$$\begin{aligned} C_j(\mathbf{p}) + aW_j(\mathbf{p}) + g_j &\geq aW_j(\mathbf{p}^*) \\ C_k(\mathbf{p}) + aW_k(\mathbf{p}) + g_k &\geq aW_j(\mathbf{p}^*) \end{aligned} \tag{9}$$

For the rest of this analysis, let $(\mathbf{p}^j, \mathbf{g}^j)$ be the equilibrium policy vector when legislator j is included in a minimal winning coalition with the proposer and $(\mathbf{p}^k, \mathbf{g}^k)$ be the policy vector when legislator k is included in the coalition. As will be shown, $\mathbf{p}^0 \in \{\mathbf{p}^j, \mathbf{p}^k\}$.

Condition 1 states that legislators j and k vote in favor of the proposal if the new policy makes them better off than free trade given the contribution schedules and goodies that they are offered in return for a yes vote. Because a proposer wants to offer a policy that passes, this condition leads directly to constraints (3), (4), (5), (6) and (9).

Condition 2 states that the proposer i maximizes his utility given the contribution schedules offered by the lobbies subject to getting at least one other legislator to vote for the policy. This condition implies that, when legislator j is chosen by the proposer as a coalition partner, the equilibrium policy $\mathbf{p}^j$ satisfies

$$\nabla C_i(\mathbf{p}^j) + a\nabla W_i(\mathbf{p}^j) + \lambda_j\left[\nabla C_j(\mathbf{p}^j) + a\nabla W_j(\mathbf{p}^j)\right] = \mathbf{0} \tag{10}$$

where λ_j is the Lagrange multiplier associated with (3). Since utility is transferrable between the proposer and legislator j in the form of goodies, $\lambda_j = 1$ in equilibrium. Also, legislator i only transfers enough goodies to legislator j to just satisfy (3). Hence, g_j^j, the equilibrium allocation of goodies to legislator j, is

$$g_j^j = a\left[W_j(\mathbf{p}^*) - W_j(\mathbf{p}^j)\right] - C_j(\mathbf{p}^j) \tag{11}$$

Similarly, if the proposer decides to form a coalition with legislator k, $\mathbf{p}^k$ satisfies:

$$\nabla C_i(\mathbf{p}^k) + a\nabla W_i(\mathbf{p}^k) + \lambda_k\left[\nabla C_k(\mathbf{p}^k) + a\nabla W_k(\mathbf{p}^k)\right] = \mathbf{0} \tag{12}$$

and g_k^k is

$$g_k^k = a\left[W_k(\mathbf{p}^*) - W_k(\mathbf{p}^k)\right] - C_k(\mathbf{p}^k) \tag{13}$$

Condition 3 states that the equilibrium policy and transfers of goodies must maximize the joint utility of the proposer and the proposer's lobby subject to (5) or (6). If condition 3 were not satisfied, the lobby could change its contribution schedule so that the legislator would be at least as well off choosing the jointly optimal policy $\mathbf{p}^j$, and the lobby could capture the remaining gain in total surplus for himself. Hence, condition 3 is a Pareto optimality condition between legislator i and lobby i and implies that the equilibrium policy $\mathbf{p}^j$ must satisfy the Lagrangian

$$\nabla V_i\left(\mathbf{p}^j\right) + a\nabla W_i\left(\mathbf{p}^j\right) + \mu_j\left[\nabla C_j\left(\mathbf{p}^j\right) + a\nabla W_j\left(\mathbf{p}^j\right)\right] = \mathbf{0} \tag{14}$$

As before, the Lagrange multiplier $\mu_j = 1$ due to the transfer of goodies. Similarly, $\mathbf{p}^k$ must satisfy

$$\nabla V_i\left(\mathbf{p}^k\right) + a\nabla W_i\left(\mathbf{p}^k\right) + \mu_k\left[\nabla C_k\left(\mathbf{p}^k\right) + a\nabla W_k\left(\mathbf{p}^k\right)\right] = \mathbf{0}$$

where $\mu_k = 1$.

Since the Lagrange multipliers in (10) and (14) are both equal to 1, we can combine these two equations and find that

$$\nabla C_i\left(\mathbf{p}^j\right) = \nabla V_i\left(\mathbf{p}^j\right) \tag{15}$$

That is, the contribution schedule offered by lobby i to legislator i when legislator j is included in the winning coalition will be locally truthful, revealing the lobby's preferences in a neighborhood around the equilibrium policy $\mathbf{p}^j$. Using a similar argument, when legislator k is in the winning coalition

$$\nabla C_i\left(\mathbf{p}^k\right) = \nabla V_i\left(\mathbf{p}^k\right)$$

Condition 4 states that lobbies j and k choose their contribution efficiently, i.e. to maximize their and their legislator's utility conditional on being in the coalition.. The logic behind condition 4 is similar to the logic in condition 3: if the proposal did not maximize the joint utility of the lobby and the legislator, the lobby would have an incentive to change its contribution schedule leaving the legislator indifferent between the two policies and retaining the surplus for itself. Substituting (11) into (7) yields

$$\mathbf{p}^j \in \arg\max\left\{V_j\left(\mathbf{p}\right) + aW_j\left(\mathbf{p}^*\right) - C_j\left(\mathbf{p}\right)\right\}$$

which implies that

$$\nabla C_j\left(\mathbf{p}^j\right) = \nabla V_j\left(\mathbf{p}^j\right)$$

Hence, when it is included in the winning coalition, lobby j chooses its contribution function so that

$$\nabla V_i\left(\mathbf{p}^j\right) + a\nabla W_i\left(\mathbf{p}^j\right) + \nabla V_j\left(\mathbf{p}^j\right) + a\nabla W_j\left(\mathbf{p}^j\right) = \mathbf{0}$$

That is, lobby j has a truthfully-revealing contribution schedule around the equilibrium policy $\mathbf{p}^j$, and this strategy causes legislator i to propose a policy that maximizes the joint utility of both the lobbies and the legislators in the winning coalition. Similarly, when legislator k is included in the winning coalition

$$\nabla C_k\left(\mathbf{p}^k\right) = \nabla V_k\left(\mathbf{p}^k\right)$$

and

$$\nabla V_i\left(\mathbf{p}^k\right) + a\nabla W_i\left(\mathbf{p}^k\right) + \nabla V_k\left(\mathbf{p}^k\right) + a\nabla W_k\left(\mathbf{p}^k\right) = \mathbf{0}$$

Hence, we have the first-order conditions and gradients of the contribution schedules that occur when $\mathbf{p}^j$ is chosen the tariff policy and when $\mathbf{p}^k$ is chosen as the tariff policy. We demonstrate in the Appendix that, if legislator j is included in the proposer's winning coalition, the precise functional form of the contribution schedule offered by lobby i will be

$$C_i\left(\mathbf{p}\right) = \max\left\{V_i\left(\mathbf{p}\right) + V_i\left(\mathbf{p}^m\right) - 2V_i\left(\mathbf{p}^j\right) - 2a\left[W_i\left(\mathbf{p}^j\right) - W_i\left(\mathbf{p}^m\right)\right] + V_k\left(\mathbf{p}^j\right) - V_k\left(\mathbf{p}^m\right), 0\right\}$$

where $\mathbf{p}^m$ is the solution to problem if lobby i contributes nothing, that the contribution schedule offered by lobby j will be

$$C_j\left(\mathbf{p}\right) = \max\left\{V_j\left(\mathbf{p}\right) - V_j\left(\mathbf{p}^j\right) + \left[\begin{array}{c} V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) + V_k\left(\mathbf{p}^j\right) \\ -V_k\left(\mathbf{p}^k\right) - a\left[W_k\left(\mathbf{p}^*\right) - W_k\left(\mathbf{p}^k\right)\right] \end{array}\right] - \left[\begin{array}{c} V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) \\ -a\left[W_j\left(\mathbf{p}^*\right) - W_j\left(\mathbf{p}^j\right)\right] \end{array}\right], 0\right\}$$

and that the contribution schedule offered by lobby k will be

$$C_k\left(\mathbf{p}\right) = \max\left\{V_k\left(\mathbf{p}\right) - V_k\left(\mathbf{p}^j\right), 0\right\}$$

Likewise, we show that legislator j will, in fact, be included in the winning coalition if

$$\begin{aligned} & V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) + V_j\left(\mathbf{p}^j\right) - V_j\left(\mathbf{p}^k\right) + a\left[W_j\left(\mathbf{p}^j\right) - W_j\left(\mathbf{p}^*\right)\right] \\ \geq\ & V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) + V_k\left(\mathbf{p}^k\right) - V_k\left(\mathbf{p}^j\right) + a\left[W_k\left(\mathbf{p}^k\right) - W_k\left(\mathbf{p}^*\right)\right] \end{aligned} \tag{16}$$

Conversely, if (16) does not hold, legislator k will be included in the winning coalition and the contribution schedules can be found by substituing subscript j for k in the above contribution equations and vice-versa.

The analysis of lobby i's contribution schedule makes a prediction that is substantially different than the Helpman-Persson model despite the fact that both models share a similar game form. In Helpman-Persson, the proposer's lobby does not make any contributions to the proposer in equilibrium. However, in our model that lobby's equilibrium contribution schedule is positive and truthfully revealing over some values of $\mathbf{p}$. This difference can be accounted for by the functional form used in Helpman-Persson, which has the legislator's utility dependent only on the government expenditures given to his lobby group in equilibrium. Hence, the lobby has its interests perfectly aligned with the proposing legislator in that they both want the highest level of expenditure possible in their district consistent with forming a winning coalition with another legislator. In our model, however, the alignment of interests between the lobby and its legislator is not perfect. Lobbies and legislators in this model care not only about not only the domestic price of their own goods but about also the prices of other goods, since they represent consumers as well as producers. However, the lobbies and legislators do not necessarily view the trade off between increased rents on the production of their own goods and higher consumer prices the same way – the legislator worries about every consumer in his district while the lobby only worries about consumers that happen to own specific factors of production used in his industry. Therefore, the proposer and its lobby do not have their interests in perfect alignment, and the lobby has an incentive to contribute to the legislator. Hence, the functional forms used in the Helpman-Persson model may be considered a special case of this model where the proposing legislator and lobby group have their interests aligned, and their prediction that the proposer does not get lobbied in equilibrium is dependent on the assumptions of this special case.

To complete the characterization of the equilibrium, we can make the equilibrium tariff policies explicit functions of the parameters of the model. As shown above, the first-order condition that the equilibrium policy $\mathbf{p}^j$ must satisfy maximizes the joint utility of lobbies i and j and legislators i and j

$$\nabla V_i\left(\mathbf{p}^j\right) + a\nabla W_i\left(\mathbf{p}^j\right) + \nabla V_j\left(\mathbf{p}^j\right) + a\nabla W_j\left(\mathbf{p}^j\right) = \mathbf{0}$$

Expanding this first order condition and rearranging terms yields

$$\begin{aligned}
\frac{t_i}{1+t_i}\frac{e_i}{z_i} &= \frac{\left[(1+a) - (a+\beta_i)\frac{N_i}{N} - \left(a+\beta_j\right)\frac{N_j}{N}\right]}{\left[(a+\beta_i)\frac{N_i}{N} + \left(a+\beta_j\right)\frac{N_j}{N}\right]} \\
\frac{t_j}{1+t_j}\frac{e_j}{z_j} &= \frac{\left[(1+a) - (a+\beta_i)\frac{N_i}{N} - \left(a+\beta_j\right)\frac{N_j}{N}\right]}{\left[(a+\beta_i)\frac{N_i}{N} + \left(a+\beta_j\right)\frac{N_j}{N}\right]} \\
\frac{t_k}{1+t_k}\frac{e_k}{z_k} &= -1
\end{aligned} \tag{17}$$

where $t_i = \frac{p_i - p_i^*}{p_i^*}$ is the ad-valorem tariff rate, $e_i = -\frac{\partial m_i(p_i)}{\partial p_i}\frac{p_i}{m_i(p_i)}$ is the own-price elasticity of demand for imports, and $z_i = \frac{y_i(p_i)}{N m_i(p_i)}$ is the inverse import penetration ratio.

This equilibrium is quite similar to the equilibrium tariff policy in Grossman and Helpman, which is

$$\frac{t_i}{1+t_i}\frac{e_i}{z_i} = \frac{I_i - \alpha_L}{a + \alpha_L}$$

where α_L is the fraction of the national population that is represented by an industry lobbying group (and is therefore analogus to the $\left(\beta_i \frac{N_i}{N} + \beta_j \frac{N_j}{N}\right)$ term from our model) and I_i is an indicator variable taking on the value of 1 if industry i has an active lobbying group (which is analogus to industry i being included in the winning coalition in our model). Because the Grossman and Helpman model implicitly has only one legislative constituency due to its unitary government assumption, its equilibrium tariff policies are not dependent on population share terms and therefore not affected by legislative malapportionment.

Finally, we have thus far assumed that the equilibrium coalition would be minimally winning, where the proposer and the legislator that satisfies (16) are included in the winning coalition and vote in favor of the bill. We can demonstrate that this is necessarily true in equilibrium. Suppose that legislator i makes a proposal $(\mathbf{p}^n, \mathbf{g}^n)$ that is supported by both legislator j and legislator k. Legislator j's vote will not be pivotal to the policy outcome, so he will only vote yes if

$$C_j(\mathbf{p}^n) + aW(\mathbf{p}^n) + g_j^n \geq aW(\mathbf{p}^n)$$

This implies that $g_j^n = -C_j(\mathbf{p}^n)$ and $C_j(\mathbf{p}^n) = 0$. Similarly, it will be true that $g_k^n = -C_k(\mathbf{p}^n)$ and $C_k(\mathbf{p}^n) = 0$. Therefore, there were be neither any lobbying nor any goodies if legislator j is not pivotal to the outcome of the vote. However, in the absence of lobbying or goodies, there are no policies that will make all three legislators better off than free trade. Hence, legislator i will be unable to propose a tariff policy that all three legislators will prefer to free trade.

Given that the proposer will only offer a trade policy that only benefits himself and the one other legislator in his winning coalition, it is not in the interest of the remaining legislator to vote in favor of the tariff proposal. If legislator k is left out of the winning coalition, he will not receive any goodies and he will vote in favor of the proposal if

$$C_k\left(\mathbf{p}^j\right) + aW_k\left(\mathbf{p}^j\right) \geq aW_k\left(\mathbf{p}^j\right)$$

He will vote yes if $C_k\left(\mathbf{p}^j\right) > 0$ and will be indifferent if $C_k\left(\mathbf{p}^j\right) = 0$. However, we have shown above that $C_k\left(\mathbf{p}^j\right) = 0$ in equilibrium. Therefore, legislator k will not have an incentive to vote in favor of the tariff proposal in equilibrium. Thus, legislator i has no incentive to propose a grand coalition in equilibrium, and legislator k has no incentive to vote in favor of one.

3 Comparative Statics

Comparative statics can easily be derived from the equilibrium tariff policies. This section looks at the change in the equilibrium tariff policy with respect to the percentage of the state population owning a specific factor used in the production of the good and the population share of the state.

First, note that e_i, e_j and e_k as well as z_i, z_j and z_k are endogenous variables, as they are functions of the policy vector $\mathbf{p}$. To simplify this analysis, we create new variables $T_l = \frac{t_i}{1+t_i}\frac{e_i}{z_i}$ $(l = i, j, k)$ which combine all of the terms that are functions of the endogenous varibles into one term. Note that all of the parameters in this system of three policies are either exogenous to the model or are functions only of the good in question's own price. Hence, we can show the comparative statics of this model can be done in a straightforward fashion by taking the partial derivatives of T_l with respect to the exogenous terms.

T_k is the most straightforward to derive comparative statics from, as it does not depend on any of the exogenous parameters of the model. Hence, taking the derivative of T_k with respect to the other parameters in (17) yields

$$\begin{aligned}\frac{\partial T_k}{\partial \beta_k} &= 0 \\ \frac{\partial T_k}{\partial\left(\frac{N_k}{N}\right)} &= 0\end{aligned}$$

Therefore, the equilibrium tariff policy for good k is not affected by the parameters β_k or $\frac{N_k}{N}$.

Taking the derivative of T_i with respect to the other parameters relating to good i in (17) yields:

$$\begin{aligned}\frac{\partial T_i}{\partial \beta_i} &= \frac{-\frac{N_i}{N}(1+a)}{\left((a+\beta_i)\frac{N_i}{N} + (a+\beta_j)\frac{N_j}{N}\right)^2} < 0 \\ \frac{\partial T_i}{\partial\left(\frac{N_i}{N}\right)} &= \frac{-(a+\beta_i)(1+a)}{\left((a+\beta_i)\frac{N_i}{N} + (a+\beta_j)\frac{N_j}{N}\right)^2} < 0\end{aligned}$$

Hence, the equilibrium tariff policy for good i will be decreasing in the percentage of the population of constituency i who owns a specific factor used in the production of good i and decreasing in the size of constituency i.

The comparative statics for good j are very similar to good i:

$$\begin{aligned}\frac{\partial T_j}{\partial \beta_j} &= \frac{-\frac{N_j}{N}(1+a)}{\left((a+\beta_i)\frac{N_i}{N} + (a+\beta_j)\frac{N_j}{N}\right)^2} < 0 \\ \frac{\partial T_j}{\partial\left(\frac{N_j}{N}\right)} &= \frac{-(a+\beta_j)(1+a)}{\left((a+\beta_i)\frac{N_i}{N} + (a+\beta_j)\frac{N_j}{N}\right)^2} < 0\end{aligned}$$

The equilibrium tariff policy for good j will be decreasing in the percentage of the population of constituency j who owns a specific factor used in the production of good j and decreasing in the size of constituency j.

However, this analysis assumes that legislator j has been included in the winning coalition. Because the size of state j can affect the likelihood that legislator j will be included in that coalition, we must also show that a decrease in the size of state j will, all else equal, make it more likely that its legislator will be included. To see that this statement is true, assume that the proposer is indifferent between including legislators j and

k in the winning coalition, and that $\beta_j = \beta_k$, $e_j(p_j) = e_k(p_k)$ and $z_j(p_j) = z_k(p_k)$. We can see from the comparative statics above that if $\frac{N_j}{N}$ decreases, then the equilibrium tariff policy for both good i and good j will increase if good j is included in the winning coalition. This will increase the joint utility of legislators i and j and lobbies i and j, which is what is on the left-hand side of (16). Hence, holding other variables constant, having a low population share in his constituency makes it more likely that legislator j will be included in a winning coalition in addition to making his equilibrium tariff higher once in that coalition.

This analysis shows that equilibrium tariffs are decreasing in the size of the constituency that they are located in. Hence there is a direct link between malapportionment and trade policy, as malapportionment by definition creates legislative districts that vary in size. A smaller legislative constituency will, all else equal, lead to a higher tariff on the goods produced in that constituency. Also, the larger the portion of the population of a district owning a specific factor used in the production of a good, the lower the equilibrium tariff will be.

4 Empirical Tests

There are two data sets that we use to test our propositions that trade protection should be decreasing in the size of the legislative district that the industry is located in. The first is a collection of U.S. Senate votes on tariffs on various agricultural commodities produced in the U.S. during the late 19th and early 20th centuries. The data set was originally collected by Brady, Goldstein and Kessler (2002, henceforth BGK) and is used in this paper to test whether voting behavior by legislators conforms to the predictions of the model. The second data set is a panel of data on U.S. tariffs and non-tariff barriers across industrial sectors in the 1990s. These data are used to test the predictions about the level of protection across economic sectors.

4.1 Voting Models and Data

The votes collected for the BGK paper are a series of Senate roll-call votes on 50 tariff proposals on 14 different commodities from the 47th-71st Congresses (between 1880 and 1930). During this period, tariffs were probably the most salient economic issue debated by Congress. In each case, only one commodity's tariff is changed by each vote. The data set also includes information about the concentration of production across states for each of these commodities. The votes in the data are coded as 1 if a Senator voted in favor of a tariff increase or against a tariff decrease and as a 0 if he voted in favor of a tariff decrease or against a tariff increase.[4] Fourteen commodities are included in the data set, and the break-down of their frequencies as well as the overall percentage of votes in favor of a tariff increase appears in Table 1. The majority of the commodities are successfully able to put together winning coalitions in favor of higher tariffs, as we would

[4] For ease of exposition, we will henceforth assume that all votes were on a proposed tariff increase, meaning that a 1 represents a vote in favor of a tariff increase and that a 0 represents a vote against a tariff increase.

predict from the model. Ten out of the fourteen commodities have a majority of votes in favor of higher tariffs. Since the model also makes an argument in favor of minimal winning coalitions, it is consistent with the theory that most of the vote shares are only slightly higher than 50% (the largest is only 65.2%). Outside of this sample it has been argued that, in general, tariff policy coalitions exhibited majoritarian behavior during this time period (see, for example, Wawro and Schickler (2004), chapter 5).

Equation (1) from the theory says that

$$\frac{\partial W_j(\mathbf{p})}{\partial p_i} = \left(\alpha_{ij} - \frac{N_j}{N}\right) y_i(p_i) + \frac{N_j}{N}(p_i - p_i^*) N \frac{\partial m_i(p_i)}{\partial p_i}$$

That is, the benefit the state gets from an increase in tariffs is increasing in the interaction term between the production and population shares $\left(\alpha_{ij} - \frac{N_j}{N}\right)$ and decreasing in the population share variable $\frac{N_j}{N}$. It does not predict an effect from the production share variable ($\frac{y_{ij}}{y_i}$ in the regression) independently of the interaction term. Intuitively, the first term in (1) measures the change in consumer and producer surplus from an increase in tariffs (producer surplus increases the more that production of the commodity is located in the state and consumer surplus decreases the more that consumers are located in the state) and the second term represents the decrease in tariff revenues resulting from a decrease in imports. A legislator will therefore vote in favor of a particular tariff increase if

$$\left(\alpha_{ij} - \frac{N_j}{N}\right) y_i(p_i) + \frac{N_j}{N}(p_i - p_i^*) N \frac{\partial m_i(p_i)}{\partial p_i} > 0$$

which can be rewritten as

$$1 - \frac{y_i}{y_{ij}}\frac{N_j}{N} + \frac{N_j}{N}(p_i - p_i^*) N \frac{\partial m_i(p_i)}{\partial p_i} > 0$$

We can rewrite this theoretical prediction in a probit formulation, where the legislator votes yes if

$$\delta_0 + \delta_1 \frac{y_i}{y_{ij}}\frac{N_j}{N} + \delta_2 \frac{y_{ij}}{y_i} + \delta_3 \frac{N_j}{N} + \delta_4 X_i + \varepsilon_{ij} > 0$$

where ε_{ij} is a white-noise, normally-distributed error term and X_i is a vector of control variables which include dummy variables for Democratic and Progressive Republican senators (both of which had an ideological aversion to higher tariffs) and dummy variables for Congressional eras that historians have classified as one of high or low tariff sentiment so that

$$\Pr[Vote_{ij} = yes] = F\left[\delta_0 + \delta_1 \frac{y_i}{y_{ij}}\frac{N_j}{N} + \delta_2 \frac{y_{ij}}{y_i} + \delta_3 \frac{N_j}{N} + \delta_4 X_i\right]$$

Thus, we use these data to run a probit regression where the voting behavior of individual legislators as a function of the commodity production share of their state relative to the national production of that commodity, the share of the state's population in the national population and an interaction term between these two variables.

The theory predicts that the coefficients on this regression are:

$$\begin{aligned}\delta_0 &= 1 > 0 \\ \delta_1 &= -1 < 0 \\ \delta_2 &= 0 \\ \delta_3 &< 0\end{aligned}$$

The results from this exercise can be found in Table 2 and are supportive of our theory of voting behavior. In the regression specification that does not include control variables, δ_1 is negative and significant at the 1% level, the coefficient on the population share term is negative and significant at the 1% level, the coefficient on the production share term is positive, but not significantly different from zero, and the constant term is positive and significant at the 1% level. These results are robust to the addition of the control variables, though δ_1 is no longer significant in this case. However, δ_0 and δ_1 are not of the same magnitudes as the theory predicts, but are instead closer to zero, even though they are of the predicted sign.

The marginal effects of changes in each of these variables can be found in Table 3. The effect of the population share variable immediately jumps out. For every percentage increase in a state's population share, the probability that a Senator votes against a bill increases by over 1.5% when other variables are held constant at their means – even after controlling for his party affliation and his state's share of the output of the commodity in question. Therefore, just on the basis of differences in population alone, a Senator from Nevada in the 53rd Congress (who represented only 0.07% of the U.S. population) would be more than 20% more likely to vote in favor of a given tariff than a Senator from New York in the 51st Congress (who represented 13.14% of the U.S. population at the time) even after controlling for potential differences in those Senators' party affiliations and the industry shares located in their respective states.

Taken together, these results are strongly supportive of the pattern of voting behavior predicted by the model. A senator is more likely to vote in favor of a tariff on an industry that is disproportionately concentrated in his state relative to that state's population, and he is much less likely to vote in favor of a tariff as his state's population share increases. For example, the Senator John Townsend was a Republican senator from the state of Delaware from 1929-1941. All six votes cast by him that are in our sample were in favor of higher tariffs, which makes him the Senator in our sample with the largest number of votes to have a perfect protectionist voting record. This result is not surprising given that tiny Delaware accounted for only two-tenths of one percent of the U.S. population during this time period. Because legislative malapportionment leads directly to variation in shares of national population represented by Senators, malapportionment potentially has a dramatic effect on the pattern of tariff barriers across industries.

Therefore, we have a strong result that confirms our intuition about voting from an era when tariff votes were among the most import economic issues debated in the U.S. Senate. It is good to have this prediction confirmed, because the assumptions that our model makes follow pretty closely the actual political situation in the U.S. Senate at that time in that tariff barriers were decided largely through legislative discretion and would have been a major issue of concern for lobbying groups. However, there are limitations to this result. First, we do not have information on either the import elasticities of the commodities in question or on their import penetrations. Hence, we cannot test all of the comparative statics derived above with these data. Secondly, this is not a comprehensive list of all tariffs in the U.S. at the time, so we cannot test the variation in the levels of tariffs as predicted by the model. To correct these defects, we perform cross-sectional regressions on tariff and non-tariff barrier data from the United States in the 1990's.

4.2 Cross-Sectional Data

4.2.1 Data Description

The second data set used for empirical testing is a cross-sectional data set on U.S. tariffs, non-tariff barriers (NTBs), and industry concentration constructed for this paper.[5] Six main data series are used in the empirical tests of this section. The first is employment by sector for each state. Data for this series come from the U.S. Census Bureau 1997 Economic Census, and are aggregated into 4-digit NAICS (North American Industry Classification System) 1997 sectors. The second and third data series are data on import values and tariffs, which are available at the 10-digit Harmonized Tariff System industry aggregation level from the Center for International Data (CID) from work done by Feenstra, Romalis and Schott (2002). The fourth data series is non-tariff barriers at the Harmonized System of Tariffs (HS) 8-digit level of aggregation for years 1993-1995 and 1998-2000, which are taken from Haveman (2003), which is, in turn, based on information from the UNCTAD TRAINS database. The fifth data series that we use are the estimated own-price elasticities of demand for imports by U.S. consumers. These data (which are also reported in 4-digit NAICS sectors) come from our own research as described in Hauk (2007). Finally, we use the population of U.S. States as measured by the 1990 and 2000 U.S. Census.

Because the trade data are aggregated using the HS industry aggregation, we use industry concordances provided along with the CID data to convert the trade data into 4-digit NAICS sectors. The dependent variable used in these regressions is the product $\frac{t_i}{1+t_i}e_i$ where t_i is either the ad-valorem tariff rate or the non-tariff barrier coverage ratio for that sector and e_i is the own-price elasticity of demand for imports. We use tariff rates and NTB coverage ratios because, while the model is based around an assumption that the primary form of trade protection is through tariffs, U.S. tariffs are generally bound by multilateral agreements negotiated through the World Trade Organization and cannot be strongly affected by Congressional

[5] The data set and accompaning Stata codes used to carry out the tariff regressions in this section are available upon request. The regressions involving NTBs make use of a proprietary dataset developed by Jon Haveman (2003).

legislation (though the Senate does have to ratify all trade treaties in order for them to have the force of law). However, there is more legislative discretion in the creation of NTBs. The NTB coverage ratios are formed by coding each 8-digit HS sector that has at least one NTB as being protected. Then, after using the concordance tables to match the 8-digit HS industries to 4-digit NAICS industries, we define the NTB coverage ratio as the import-weighted percentage of 8-digit HS industries that are classified as protected in a given 4-digit NAICS industry. Tariff measurements are formed by adding the data on tariff duties collected by 10-digit HS sector from the CID data across all sectors mapped into a given NAICS 4-digit sector and dividing it by the c.i.f. value of the imports from those sectors. Because the data series on elasticity estimates that we use are themselves the result of previous statistical work it seems likely that measurement error is a major problem with these estimates. Therefore, we run regressions including e_i in the composition of the dependent variable on the left-hand side of the regression. However, because we do not have elasticity estimates for all of the NAICS sectors, we also run regressions without this variable included in the interest of having a broader cross-section of data.

The independent variables for each sector are: the weighted average population share of the states that the sector generates activity in, the average across states of employees in the sector-state as a fraction of total state employment, and the inverse import penetration ratio of the sector. The population share variable (which is the most relevant variable for the primary hypothesis of this paper) comes from the 1997 Economic Census of the U.S. Census Bureau and is intended to be a proxy for the size of the state that the industry is located in ($\frac{N_l}{N}$ in the model). We calculate it by multiplying the state's share of the sector's total employment by the state's share of the total U.S. population and adding this figure across states.[6] The employment share variable (β_l in the model), is proxied by finding a sector-state's share of total state employment, and taking the average of this variable across all states in which the industry is located in, weighted by the share of the sector's national employment in each state.[7] The census report gives us the employment of each 4-digit NAICS sector in each U.S. state. These data were then used to create total employment by state, and this information was used to calculate the share of each sector in each state's total employment. This figure was then added across states by sector to create an aggregate measure of the sector's importance in the states where it is located.

The inverse import penetration ratio was calculated using output data by 4-digit NAICS sector in the economic census data and c.i.f. import value from the CID data. This variable poses a problem in a regression framework in that it depends on the domestic price of the good in question and is therefore endogenous to the model. We address this issue by keeping the variable on the right-hand side of the regression but instrumenting for it using variables exogenous to the model. For this step, we use the

[6] Mathematically, we can represent this figure as $\frac{N_i^*}{N} = \sum_{i=1}^{50} \frac{N_{i,j}}{N_j} \frac{N_i}{N}$, where $N_{i,j}$ is the employment of sector j in state i, N_j is the total national employment of sector j, N_i is the total population of state i, and N is the total national population.

[7] Mathematically, we can represent this as $\left(\frac{N_{i,j}}{N_i}\right)^* = \sum_{i=1}^{50} \frac{N_{i,j}}{N_i} \frac{N_{i,j}}{N_j}$.

c.i.f. value of imports by 4-digit NAICS sector in the year 1989 (the earliest year for which we have data). Obviously, trade protection in the mid-90s could not influence the level of imports into the country in 1989, but it does seem likely that the level of imports in 1989 would be correlated with import levels (and thus import penetration) in the mid-90s.[8]

Table 4 tests the relevant moment conditions necessary for import levels in 1989 to be a valid instrument for inverse import penetration in 1997. In the first regression, we see that the log of import levels in 1989 is, as predicted, negatively and significantly correlated with inverse import penetration in 1997, and that the F-statistic is 65.12, well above the rule of thumb level of 10 for strong instruments. On the other hand, when it is included along with the other relevant regressors, it is not a signficant predictor of NTB coverage ratios or tariffs. Hence, lagged log import levels are a valid and strong instrument for the inverse import penetration ratio.

Summary statistics for all variables appear in Table 5. A few points about this data stand out immediately. First, because the dependent variables we have measure only protection, the minimum value for tariffs and NTB coverage ratios is zero. Thus, unlike in the model, there will be no sectors which have import subsidies. Protection is therefore constrained to being a positive number. Also, the variation in the population share variable is relatively low. Consequently, the coefficient on this variable in the regressions will have to be large if it is going to have an important effect on variation in levels of protection.

Looking closer at individual data points also yields some interesting observations. When using NTB coverage ratios as a measure of protection, the most protected NAICS sector is 3117 (Seafood Product Preparation and Packaging), which received a 100% coverage ratio in years 1998-2000. The relevant population share variable for this industry is 0.0167, which is 1.17 standard deviations below the average. The largest ad-valorem tariff in the sample is for NAICS sector 3152 (Cut and Sew Apparel Manufacturing) even though its population share variable is above the average across industries at 0.0417. At the other extreme, of the six industries that have an NTB coverage ratio of 0 for all six years, the average population share variable is 0.0281, which is slightly above the average. The one sector that has a tariff rate of 0 for all years, sector 2121 – Coal Mining, has a population share variable of 0.0200, which is slightly below the average. The NAICS sector that has the highest population share variable (sector 3169 – Other Leather and Allied Product Manufacturing) has an average NTB coverage rate of 0.0674, which is well below the average of 0.1834, but an above average tariff rate of 0.0734. The NAICS sector with the lowest population share variable is sector 3162 – Footwear Manufacturing, which has an NTB coverage ratio slightly above the average at 0.1835, and an ad-valorem tariff of 0.1054, which is well above the average. Based on these data, we have reason to believe that our primary hypothesis that industries with a low population share variable will have higher levels of trade protection will be true when NTB coverage ratios are used as the measure of protection, but

[8] We do not use import penetration from 1989 for the reason that the NAICS system did not exist then, so we do not have the relevant domestic production data to calculate import penetration ratios by sectors.

less likely to be true when tariff rates are used. Despite these differing results, tariffs and NTBs appear to be mildly complementary forms of protection in our data, as the correlation between the two measures is 0.2068 across all sector-years in our dataset.

4.2.2 Regression Results

In order to test the cross-sectional implications for our theory on protection, we run four sets of regressions. There are two sets in which the dependent variable is composed of ad-valorem tariff rates and two sets in which the dependent variable is composed of NTB coverage ratios. Likewise, there are two sets where import elasticity is included in the composition of the dependent variable, and two where it is not. Because we have six years worth of import data, but only one year of employment data, we take averages across the six years of import data for inclusion in the regression.

The results of these regressions are reported in Table 7, and their functional form is

$$\frac{t_i}{1+t_i}e_i = \gamma_0 + \gamma_1 P_i + \gamma_2 E_i + \gamma_3 M_i + \varepsilon_i$$

where t_i is either the ad-valorem tariff or NTB coverage ratio for sector i, P_i is the population share variable for sector i, E_i is either the employment share variable for sector i, and M_i is the (instrumented for) inverse import penetration ratio for sector i. The comparative statics exercise above predicts the following signs on the coefficients

$$\begin{aligned} \gamma_1 &< 0 \\ \gamma_2 &< 0 \\ \gamma_3 &> 0 \end{aligned}$$

The results shown in Table 7 are partially consistent with our theory. In particular the prediction of primary interest, the coefficient on the population share variables, is strongly confirmed by the data. In the regressions with NTB coverage ratios in the dependent variable, the population share variable is of the expected sign and significant (at the 5% level when import elasticities are included and at the 1% level when we drop elasticites in favor of a larger sample. The coefficient on the employment share variable is of the expected sign in the NTB regressions, but not significant in either case. The inverse import penetration ratio is very close to zero and not significant for both NTB regressions. As anticipated, the results when tariffs are used in the dependent variable are very weak. Only half of the coefficients are of the correct sign, and are never significant.

Hence, the coefficient that we were primarily interested in gives us results that were of the expected sign and highly significant. In addition to the coefficient's significance, it is also of a large magnitude. The sign on the population coefficient when we use import elasticities is -7.070. This number implies that, when we increase the population share variable by one standard deviation, the dependent variable composed of NTB coverage ratios and elasticities will fall by 0.0664, which is about 30% of that variable's standard deviation. When elasticities are not included in the dependent variable, the coefficient is -3.572, implying that when the population increases by one standard deviation, the dependent variable will fall by -0.0336, or about 23% of the dependent variable's standard deviation.

5 Conclusion

This paper develops a model that allows us to address how trade protection might be affected by a malapportioned legislature. It confirms our initial hypothesis that industries that are concentrated in smaller legislative constituencies will receive more trade protection than those located in larger constituencies. In the case of the U.S. Senate, this logic might explain the greater protection given to industries typically found in smaller states, such as agriculture. In making this point, it also addresses a technically interesting question about the implications of modifying the Grossman and Helpman "Protection for Sale" model for a situation where the unitary government assumption used in the original model is unhelpful for the substantive question that we want to address. There has been much research in the political science and economics literature that focuses on legislative bargaining and lobbying in isolation, but there has thus far been relatively little literature linking to two to each other. This paper attempts to take another step in this direction.

On the methodological side, this paper combines the Grossman and Helpman framework with a modified version of the game form used in Helpman and Persson's "Lobbying and Legislative Bargaining" model. Through this combination it shows that we can find an equilibrium where tariff protection is a function of import penetration, population in the legislative constituencies where goods are produced and the fraction of total employment that a good accounts for in a state. It also demonstrates that, within the Helpman and Persson framework, a lobbying group may contribute to the proposer in equilibrium when both the legislator and lobby care about the outcome of prices on goods produced in other constituencies.

The empirical section provides some information on voting behavior that confirms the voting predictions made by the model. In particular, the higher a share that an industry has in a state relative to that state's share in the national population is a good predictor of the probability that a legislator will vote in favor of a tariff increase. The cross-sectional trade barrier tests show that the pattern of trade protection that existed in the U.S. during the 1990s is consistent with the predictions the theory that industries which are concentrated in smaller states will receive more trade protection than those that are not.

References

[1] Ansolabehere S., Gerber A and Snyder J. 2002. Equal Votes, Equal Money: Court Ordered Redistricting and the Distribution of Public Expenditures in the American States. American Political Science Review 96, 767-777.

[2] Ansolabehere S, Snyder J and Ting M. 2003. Bargaining in Bicameral Legislatures: When and Why Does Malapportionment Matter? American Political Science Review 97, 471-481.

[3] Atlas C, Gilligan T, Hendershott R and Zupan M. 1995. Slicing the Federal Government Net Spending Pie. American Economic Review 85, 624-629.

[4] Brady D, Goldstein J and Kessler D. 2002. Does Party Matter? An Historical Test Using Senate Tariff Votes in Three Institutional Settings. Journal of Law, Economics and Organization18, 140-154.

[5] Busch M and Reinhardt E. 1999. Industrial Location and Protection. American Journal of Political Science 43, 1028-1050.

[6] Eicher T and Osang T. 2002. Protection for Sale: An Empirical Investigation: Comment. American Economic Review 92, 1702-1710.

[7] Feenstra R, Romalis J and Schott P. 2002. "U.S. Imports, Exports and Tariff Data, 1989-2001. NBER Working Paper #9387.

[8] Gawande K and Bandyopadhyay U. 2000. Is Protection for Sale? Evidence on the Grossman-Helpman Theory of Endogeneous Protection. Review of Economics and Statistics 82, 139-152.

[9] Goldberg P and Maggi G. 1999. Protection for Sale: An Empirical Investigation. American Economic Review 89, 1135-1155.

[10] Grossman, G and Helpman E. 1994. Protection for Sale. American Economic Review 84, 833-850.

[11] Hauk W and Wacziarg R. 2007. Small States, Big Pork. Quarterly Journal of Political Science 2, 95-106.

[12] Hauk W. 2007. U.S. Import Demand Elasticities: A New Dataset. manuscript.

[13] Haveman J. 2004. Industry Concordances. Data available online at http://www.macalester.edu/research/economics/

[14] Haveman J. 2003. The Ultimate Trade Barrier Catalog, version 3. CD-ROM.

[15] Helpman E and Persson T. 2001. Lobbying and Legislative Bargaining. Advances in Economic Analysis and Policy 1; 3.

[16] Knight B. 2004. Legislative Representation, Bargaining Power, and the Distribution of Federal Funds: Evidence from the U.S. Senate. NBER Working Paper #10385.

[17] Stolper W and Samuelson P. 1941. Protection and Real Wages. Review of Economic Studies 9, 58-73.

[18] United States Census Bureau. 1997 Economic Census. Data available online at: http://www.census.gov/.

[19] United States Census Bureau. United States Census 1990. Data available online at: http://www.census.gov/

[20] Wawro G and Schickler E. 2004. Redoubtable Weapon: Obstruction and Lawmaking in the United States Senate. Manuscript.

6 Appendix

6.1 Derivation of (1)

$$\begin{aligned}
\frac{\partial W_j(\mathbf{p})}{\partial p_j} &= I_{ij}\frac{\partial \pi_i(p_i)}{\partial p_i} + N_j\left[\begin{array}{c} \frac{\partial u_i[d_i(p_i)]}{\partial d_i(p_i)}\frac{\partial d_i(p_i)}{\partial p_i} - d_i(p_i) - p_i\frac{\partial d_i(p_i)}{\partial p_i} \\ +(p_i - p_i^*)\frac{\partial m_i(p_i)}{\partial p_i} + m_i(p_i) \end{array}\right] \\
&= I_{ij}y_i(p_i) + N_j\left[\begin{array}{c} \left(\frac{\partial u_i[d_i(p_i)]}{\partial d_i(p_i)} - p_i\right)\frac{\partial d_i(p_i)}{\partial p_i} + m_i(p_i) - d_i(p_i) \\ +(p_i - p_i^*)\frac{\partial m_i(p_i)}{\partial p_i} \end{array}\right] \\
&= I_{ij}y_i(p_i) + N_j\left[-\frac{1}{N}y_i(p_i) + (p_i - p_i^*)\frac{\partial m_i(p_i)}{\partial p_i}\right] \\
&= \left(I_{ij} - \frac{N_j}{N}\right)y_i(p_i) + N_j(p_i - p_i^*)\frac{\partial m_i(p_i)}{\partial p_i}
\end{aligned}$$

The third step may be non-obvious. Recall that in this setup, consumers have additively separable utility functions with a numeraire good that has a price of 1 and gives a marginal utility of 1. In the consumer maximization problem, it must be the case that for all goods

$$\frac{\partial u_i[d_i(p_i)]}{\partial d_i(p_i)} = \lambda p_i$$

In the presence of the numeraire good, we can easily show that $\lambda = 1$, and hence that

$$\frac{\partial u_i\left[d_i\left(p_i\right)\right]}{\partial d_i\left(p_i\right)} = p_i$$

Therefore, $\left(\frac{\partial u_i[d_i(p_i)]}{\partial d_i(p_i)} - p_i\right)\frac{\partial d_i(p_i)}{\partial p_i} = 0$.

The derivation of (2) follows a similar process.

6.2 Derivation of Contribution Schedules

One implication of condition 3 is that the legislator chooses between these two policies to maximize his utility, which in equilibrium is the same as the joint utility of himself and his lobby. Legislator j is thus chosen as the coalition partner and $\mathbf{p}^j$ as the equilibrium policy if

$$V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) - g_j^j \geq V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) - g_k^k$$

Substituting the equilibrium level of goodies from (11) and (13) into this expression yields

$$\begin{aligned} & V_i\left(\mathbf{p}^j\right) + C_j\left(\mathbf{p}^j\right) + a\left[W_i\left(\mathbf{p}^j\right) + W_j\left(\mathbf{p}^j\right) - W_j\left(\mathbf{p}^*\right)\right] \\ \geq \quad & V_i\left(\mathbf{p}^k\right) + C_k\left(\mathbf{p}^k\right) + a\left[W_i\left(\mathbf{p}^k\right) + W_k\left(\mathbf{p}^k\right) - W_k\left(\mathbf{p}^*\right)\right] \end{aligned} \tag{18}$$

The left and right sides of (18) are increasing in $C_j\left(\mathbf{p}^j\right)$ and $C_k\left(\mathbf{p}^k\right)$, respectively, so lobbies j and k can affect whether their respective legislators are included in the winning coalition by varying the level of their contributions. Lobbies j and k prefer to have their respective legislators included in the winning coalition rather than excluded as long as (8) holds. Assume that lobbies j and k choose their contribution functions so that legislator i is indifferent between $\mathbf{p}^j$ and $\mathbf{p}^k$. As long as

$$V_k\left(\mathbf{p}^k\right) - C_k\left(\mathbf{p}^k\right) > V_k\left(\mathbf{p}^j\right)$$

then lobby k has an incentive to increase $C_k\left(\mathbf{p}^k\right)$ by a small amount and thereby persuade legislator i to include his legislator in the coalition. Similarly, as long as

$$V_j\left(\mathbf{p}^j\right) - C_j\left(\mathbf{p}^j\right) > V_j\left(\mathbf{p}^k\right)$$

then lobby j is willing to increase its contribution to ensure that legislator j is included in the coalition. Hence, it must be true in equilibrium that either

$$C_j\left(\mathbf{p}^j\right) = V_j\left(\mathbf{p}^j\right) - V_j\left(\mathbf{p}^k\right)$$

or

$$C_k\left(\mathbf{p}^k\right) = V_k\left(\mathbf{p}^k\right) - V_k\left(\mathbf{p}^j\right)$$

That is, the lobbies increase their equilibrium contribution level until one lobby is worse off increasing its contribution and being included in the coalition than it is contributing nothing and being excluded from the coalition. This happens first to the lobby that gives legislator i the lower utility when it offers its maximum possible contribution. Thus, legislator j is able to contribute enough to be included in the winning coalition if

$$\begin{aligned} & V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) + V_j\left(\mathbf{p}^j\right) - V_j\left(\mathbf{p}^k\right) + a\left[W_j\left(\mathbf{p}^j\right) - W_j\left(\mathbf{p}^*\right)\right] \\ \geq \; & V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) + V_k\left(\mathbf{p}^k\right) - V_k\left(\mathbf{p}^j\right) + a\left[W_k\left(\mathbf{p}^k\right) - W_k\left(\mathbf{p}^*\right)\right] \end{aligned} \tag{19}$$

Assume for the rest of this section that (19) is true and that legislator j is included in the winning coalition.[9] Then

$$C_k\left(\mathbf{p}^k\right) = V_k\left(\mathbf{p}^k\right) - V_k\left(\mathbf{p}^j\right) \tag{20}$$

and substituting into (18) yields

$$C_j\left(\mathbf{p}^j\right) \geq \left[\begin{array}{c} V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) + V_k\left(\mathbf{p}^j\right) \\ -V_k\left(\mathbf{p}^k\right) - a\left[W_k\left(\mathbf{p}^*\right) - W_k\left(\mathbf{p}^k\right)\right] \end{array}\right] - \left[\begin{array}{c} V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) \\ -a\left[W_j\left(\mathbf{p}^*\right) - W_j\left(\mathbf{p}^j\right)\right] \end{array}\right] \tag{21}$$

In equilibrium, the lobby does not contribute more than necessary to get its legislator included in the winning coalition, so (21) holds as an equality. Intuitively, what this equation says is that the amount that lobby j contributes in equilibrium is equal to the utility that legislator i gets when legislator k is including in the winning coalition minus the utility that i would get if j was included in the coalition but lobby j contributed nothing. Substituting (21) into (11) also gives us the equilibrium level of goodies

$$\begin{aligned} g_j^j \;=\; & V_i\left(\mathbf{p}^j\right) - V_i\left(\mathbf{p}^k\right) + a\left[W_i\left(\mathbf{p}^j\right) - W_i\left(\mathbf{p}^k\right)\right] \\ & +V_k\left(\mathbf{p}^k\right) - V_k\left(\mathbf{p}^j\right) + a\left[W_k\left(\mathbf{p}^*\right) - W_k\left(\mathbf{p}^k\right)\right] \end{aligned} \tag{22}$$

As shown in (23), lobby i's contribution schedule must be such that it is truthfully revealing around the equilibrium policy. Assume that it is truthfully revealing at all points where the contribution schedule is

[9] If (19) is not true and legislator k is included in the winning coalition, then the rest of the results will hold if k is substituted for j and vice-versa.

positive (which is a subset of all functions that are truthfully revealing around the equilibrium policy)[10], i.e.

$$C_i^j(\mathbf{p}) = \max\{V_i(\mathbf{p}) - b_i, 0\} \tag{23}$$

where b_i is a constant. Solving for b_i will tell us what the contribution schedule's level is.

Define $(\mathbf{p}^m, \mathbf{g}^m)$ as the policy that solves

$$(\mathbf{p}^m, \mathbf{g}^m) \equiv \arg\max\left[aW_i(\mathbf{p}) - g_j + \lambda_j\left[C_j^0(\mathbf{p}) + aW_j(\mathbf{p}) + g_j - aW_j(\mathbf{p}^*)\right]\right]$$

That is, $(\mathbf{p}^m, \mathbf{g}^m)$ is the equilibrium policy that would be proposed if lobby i did not contribute anything, but the rest of the game remained unchanged.

For legislator i to want to implement $\mathbf{p}^j$ instead of $\mathbf{p}^m$ in equilibrium, it must be the case that that the legislator's utility is higher proposing $\mathbf{p}^j$ than $\mathbf{p}^m$ given the contribution schedule offered by lobby i. So

$$C_i^j\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) - g_j^j \geq aW_i(\mathbf{p}^m) - g_j^m$$

It follows that lobby i chooses

$$C_i^j\left(\mathbf{p}^j\right) = a\left[W_i(\mathbf{p}^m) - W_i\left(\mathbf{p}^j\right)\right] + g_j^m - g_j^j \tag{24}$$

where g_j^m is the level of goodies that would satisfy (11) Substituting the levels of goodies g_j^j and g_j^m from (22) into (24) yields

$$C_i^j\left(\mathbf{p}^j\right) = 2a\left[W_i(\mathbf{p}^m) - W_i\left(\mathbf{p}^j\right)\right] + V_i(\mathbf{p}^m) - V_i\left(\mathbf{p}^j\right) + V_k\left(\mathbf{p}^j\right) - V_k(\mathbf{p}^m)$$

which, in turn, implies that

$$b_i = 2V_i\left(\mathbf{p}^j\right) + 2a\left[W_i\left(\mathbf{p}^j\right) - W_i(\mathbf{p}^m)\right] + V_k(\mathbf{p}^m) - V_k\left(\mathbf{p}^j\right) - V_i(\mathbf{p}^m)$$

which, when substituted into (23) yields

$$C_i^j(\mathbf{p}) = \max\left\{V_i(\mathbf{p}) + V_i(\mathbf{p}^m) - 2V_i\left(\mathbf{p}^j\right) - 2a\left[W_i\left(\mathbf{p}^j\right) - W_i(\mathbf{p}^m)\right] + V_k\left(\mathbf{p}^j\right) - V_k(\mathbf{p}^m), 0\right\} \tag{25}$$

If $\mathbf{p}^m$ is the best proposal for legislator i when lobby i makes no contributions, it must also be true that $\nabla C_i^j(\mathbf{p}) = \mathbf{0}$ at $\mathbf{p}^m$. This implies that the equilibrium contribution schedule will be both flat and at zero

[10] For tractability purposes, we henceforth assume that all contribution functions are globally truthful when they are positive.

at $\mathbf{p}^m$. Therefore, for (25) to satisfy this equilibrium condition it must be true that

$$2V_i(\mathbf{p}^m) - 2V_i\left(\mathbf{p}^j\right) - 2a\left[W_i\left(\mathbf{p}^j\right) - W_i(\mathbf{p}^m)\right] + V_k\left(\mathbf{p}^j\right) - V_k(\mathbf{p}^m) < 0$$

Since $\mathbf{p}^j$ maximizes the the joint utility of lobby and legislator i given the constraint of getting at least one other legislator to vote in favor of the bill, the term $2V_i(\mathbf{p}^m) - 2V_i\left(\mathbf{p}^j\right) - 2a\left[W_i\left(\mathbf{p}^j\right) - W_i(\mathbf{p}^m)\right]$ must be negative. Similarly, because the lobbying by industry i causes the proposer to impose higher tariffs on good i and lower tariffs on good k than he would otherwise, $V_k\left(\mathbf{p}^j\right) - V_k(\mathbf{p}^m)$ is negative as well. Hence this statement must be true and (25) is the equilibrium contribution schedule for lobby i.

Similarly, we can rewrite $C_j(\mathbf{p})$ as

$$C_j(\mathbf{p}) = \max\{V_j(\mathbf{p}) - b_j, 0\}$$

Substituting (21) into this expression yields

$$b_j = V_j\left(\mathbf{p}^j\right) - \left[\begin{array}{c} V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) + V_k\left(\mathbf{p}^j\right) \\ -V_k\left(\mathbf{p}^k\right) - a\left[W_k(\mathbf{p}^*) - W_k\left(\mathbf{p}^k\right)\right] \end{array}\right] + \left[\begin{array}{c} V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) \\ -a\left[W_j(\mathbf{p}^*) - W_j\left(\mathbf{p}^j\right)\right] \end{array}\right]$$

which implies that

$$C_j(\mathbf{p}) = \max\left\{V_j(\mathbf{p}) - V_j\left(\mathbf{p}^j\right) + \left[\begin{array}{c} V_i\left(\mathbf{p}^k\right) + aW_i\left(\mathbf{p}^k\right) + V_k\left(\mathbf{p}^j\right) \\ -V_k\left(\mathbf{p}^k\right) - a\left[W_k(\mathbf{p}^*) - W_k\left(\mathbf{p}^k\right)\right] \end{array}\right] - \left[\begin{array}{c} V_i\left(\mathbf{p}^j\right) + aW_i\left(\mathbf{p}^j\right) \\ -a\left[W_j(\mathbf{p}^*) - W_j\left(\mathbf{p}^j\right)\right] \end{array}\right], 0\right\}$$

Likewise, if

$$C_k(\mathbf{p}) = \max\{V_k(\mathbf{p}) - b_j, 0\}$$

then substituting (20) into this expression yields

$$b_j = V_k\left(\mathbf{p}^j\right)$$

which implies that

$$C_k(\mathbf{p}) = \max\left\{V_k(\mathbf{p}) - V_k\left(\mathbf{p}^j\right), 0\right\}$$

Table 1: Commodities Used in Voting Regressions

Commodity	Congresses Voting Over Tariffs on Commodity	Total Number of Votes	Share of Votes for Tariff Increase
Barley	53, 55, 61, 62	437	0.508
Bituminous Coal	47, 71	115	0.652
Cattle	63, 71	218	0.624
Coal, Bituminous Plus	47, 50, 53, 61	279	0.531
Cotton	47, 55, 67	171	0.550
Hay	53, 55, 63	235	0.468
Oats	53	55	0.527
Pig Iron	47, 71	134	0.440
Potatoes	63	59	0.610
Sheep	63	139	0.496
Silver	50, 71	182	0.637
Spirits	53	100	0.499
Tobacco	47, 50, 51, 71	505	0.564
Wheat	55, 63, 66, 67	313	0.569

Table 2: Probit Regressions on Voting Data

	Probability of Vote in Favor of Higher Tariff	Probability of Vote in Favor of Higher Tariff	Probability of Vote in Favor of Higher Tariff
Proportion of population share / proportion of share in production of	-0.0111***	-0.00365	-0.00434
	(0.0042)	(0.0040)	(0.0040)
Proportion of state share in production of commodity	0.531	0.359	0.0536
	(0.50)	(0.51)	(0.51)
Share of state population in total population	-4.017***	-3.965***	-4.045***
	(1.48)	(1.52)	(1.55)
Democrat or Populist dummy variable		-0.832***	-0.815***
		(0.062)	(0.062)
55th - 62nd Congress dummy			-0.236***
			(0.068)
63rd - 71st Congress dummy			0.617***
			(0.097)
Constant	0.261***	0.679***	0.709***
	(0.049)	(0.059)	(0.072)
Observations	1846	1846	1846

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Probit Regressions on Voting Data (Marginal Probabilities)

	Probability of Vote in Favor of Higher Tariff	Probability of Vote in Favor of Higher Tariff	Probability of Vote in Favor of Higher Tariff
Proportion of population share / proportion of share in production of	-0.00440***	-0.00144	-0.00171
	(0.0017)	(0.0016)	(0.0016)
Proportion of state share in production of commodity	0.210	0.142	0.0212
	(0.20)	(0.20)	(0.20)
Share of state population in total population	-1.589***	-1.566***	-1.596***
	(0.59)	(0.60)	(0.61)
Democrat or Populist dummy variable		-0.319***	-0.312***
		(0.022)	(0.023)
55th - 62nd Congress dummy			-0.0929***
			(0.027)
63rd - 71st Congress dummy			0.227***
			(0.032)
Observations	1846	1846	1846

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Instrument Test Regressions

	Inverse Import Penetration	Non-Tariff Barriers with Elasticities	Non-Tariff Barriers without Elasticities	Tariffs with Elasticities	Tariffs without Elasticities
Log of 1989 Import Value	-15.21***	-0.0200	0.00698	-0.00680	-0.000468
	(1.88)	(0.030)	(0.011)	(0.0061)	(0.0023)
Employment-weighted State Population		-7.596**	-3.552**	0.460	0.156
		(2.93)	(1.36)	(0.59)	(0.27)
Employment Labor-Force Fraction		-3.201	-2.492	-0.0491	-0.117
		(3.08)	(1.74)	(0.62)	(0.34)
Inverse Import Penetration		0.000888	0.000177	-0.000281	-0.0000912
		(0.0017)	(0.00047)	(0.00035)	(0.000093)
Constant	344.8***	0.792	0.0821	0.164	0.0302
	(40.5)	(0.68)	(0.25)	(0.14)	(0.049)
Observations	528	342	528	342	528
Number of Sectors	88	57	88	57	88
R-squared	0.43	0.18	0.08	0.05	0.02
F-statistic	65.12				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Cross-Sectional Data Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Independent Variables					
Employment-weighted State Population	528	0.0278	0.0094	0.0058	0.0561
Employment Labor-Force Fraction	528	0.0047	0.0077	0.0003	0.0667
Inverse Import Penetration	528	18.9411	36.0241	0.1772	280.2769
Dependent Variables					
Non-Tariff Barriers with Elasticities	342	0.1516	0.2245	0.0000	1.2892
Non-Tariff Barriers without Elasticities	528	0.1246	0.1446	0.0000	0.5000
Tariffs with Elasticities	342	0.0262	0.0378	0.0000	0.2026
Tariffs without Elasticities	528	0.0222	0.0225	0.0000	0.1238

Table 6: NAICS Sectors and Elasticities Available			
NAICS 4-digit Sector	Elasticity Available?	NAICS 4-digit Sector	Elasticity Available?
2111	n	3274	n
2121	n	3279	n
2122	n	3311	y
2123	y	3312	y
3111	y	3313	y
3112	y	3314	y
3113	y	3315	y
3114	y	3321	n
3115	y	3322	y
3116	y	3323	n
3117	y	3324	y
3118	n	3325	y
3119	y	3326	n
3121	y	3327	y
3122	y	3329	y
3131	y	3331	y
3132	y	3332	y
3133	n	3333	y
3141	y	3334	n
3149	y	3335	n
3152	n	3336	n
3159	y	3339	y
3161	y	3341	n
3162	n	3342	n
3169	y	3343	y
3211	y	3344	y
3212	y	3345	y
3219	y	3346	y
3221	y	3351	n
3222	y	3352	n
3231	y	3353	y
3241	y	3359	y
3251	n	3361	n
3252	y	3362	y
3253	y	3363	y
3254	y	3364	n
3255	y	3365	y
3256	n	3366	n
3259	n	3369	n
3261	n	3371	n
3262	n	3372	n
3271	y	3379	n
3272	y	3391	y
3273	y	3399	y

Table 7: Protection Regression Results

	Non-Tariff Barriers with Elasticities	Non-Tariff Barriers without Elasticities	Tariffs with Elasticities	Tariffs without Elasticities
Instrumented Inverse Import Penetration	0.00251 (0.0018)	-0.000262 (0.00054)	0.000271 (0.00036)	-0.0000618 (0.00011)
Employment-weighted State Population	-7.070** (2.99)	-3.572*** (1.36)	0.639 (0.61)	0.157 (0.27)
Employment Labor-Force Fraction	-3.589 (2.94)	-2.282 (1.66)	-0.181 (0.60)	-0.131 (0.33)
Constant	0.325*** (0.10)	0.239*** (0.046)	0.00531 (0.021)	0.0196** (0.0091)
Observations	342	528	342	528
Number of Sectors	57	88	57	88
R-squared	0.1611	0.0704	0.0025	0.0237

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1