Free Riders Among the Rent-Seekers: A Model of Firm Participation in Antidumping Petitions

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April 15, 2004

Abstract

This research expands upon the current theoretical literature on the political economy of trade policy by empirically estimating the degree of rent-seeking in the presence of free riding. The results provide strong evidence that the level of trade protection awarded to industries is significantly influenced by political factors, including the number of firms that actively participate in a collective action. However, fewer firms participate in collective actions in industries characterized by either a large number of firms or high concentration levels because the free rider problem becomes more severe. I estimate a model of firm participation in antidumping petitions using a panel of U.S. petition filings and outcomes between 1980 and 1996. After estimating the parameters of the model, I simulate the impact of specific changes in U.S. antidumping law and find that even small changes in the private returns to participating in this rent-seeking activity will dramatically change the level of trade protection in the economy.

Keywords: antidumping, rent-seeking, free riding, collective actions, trade policy

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1 Introduction

All firms within an industry benefit from trade protection but only those firms that lobby for protection bear the costs. Thus, a firm deciding whether or not to lobby for trade protection has the incentive to both free ride and rent-seek. The issue of these opposing incentives has been addressed in the theoretical literature, but the difficulty of finding reliable data has resulted in a relative paucity of empirical work on the issue. Although other authors have studied the propensity to file for antidumping protection at the industry level, I provide the first direct estimation of the degree of free riding in this rent-seeking activity.[1]

Under Title VII of the Tariff Act of 1930, firms can file a petition requesting that antidumping tariffs be imposed on a specific product from a specific foreign country.[2] The petition may be filed by one or more firms; each firm in the industry must decide individually whether or not to actively participate in the petition. The petitioning firms assert that the product is being imported at less than “normal” or “fair” value and that these imports are causing (or threaten to cause) injury to the domestic industry.[3] If the petition is approved, the government imposes an antidumping tariff on the product. The petition may fail to reach a final government determination if the foreign and domestic industry negotiate an “out-of-court” settlement agreement that benefits both parties.[4]

[1] Research that studies an industry’s propensity to file antidumping petitions include Krupp [1994], Staiger and Wolak [1994], Sabry [2000], Feinberg and Hirsch [1989] and Herander and Pupp [1991].

[2] A petition can also be filed by workers in the domestic industry or initiated by the Department of Commerce.

[3] “Normal” value is defined as either the price in the foreign country or the average cost in the foreign country. Thus, Title VII is intended to combat both predatory pricing and price discrimination. It should be noted, however, that a growing body of literature challenges the government’s assertion that antidumping laws combat unfair trade, suggesting that the decision to file an antidumping petition is purely a rent-seeking activity. See, for example, Baldwin and Moore [1991].

[4] Between 1980 and 1996, approximately 20 percent of all antidumping petitions were either terminated or suspended prior to the government reaching a final determination. Suspended cases are those in which the government negotiates an outcome with the foreign industry to increase its price or reduce its exports in exchange for the petition being withdrawn. Terminated petitions are those that are withdrawn without a government-sanctioned agreement. There is strong evidence that the foreign and domestic industry are reaching an unofficial agreement in the case of terminated petitions. Throughout the course of this research, I treat both suspended and terminated petitions as those that are “settled.”

In the model presented here the expected benefits to each firm of filing an antidumping petition include both the change in profits that result from the government imposing a tariff and those that result from the domestic industry reaching a settlement agreement with their foreign competitors. Only those firms that participate in the petition pay the legal costs associated with filing the petition; therefore, firms are tempted to free ride off of other firms in the industry. Firms choose to participate in the petition only because the expected amount of protection increases as the number of firms participating increases.

I use Maximum Simulated Likelihood (MSL) to estimate the parameters of the structural model using a panel of U.S. antidumping petitions filed between 1980 and 1996. Simulation techniques allow for unobserved heterogeneity across industries and countries and address data challenges that arise in the course of estimating the model. I use the structural model to simulate the effect of specific changes in antidumping law on the level of protection in the United States.

I show that the level of trade protection awarded to industries is significantly influenced by political factors, including the number of firms that actively participate in a collective action.[5] However, fewer firms participate in collective actions in industries characterized by either a large number of firms or high concentration levels because the free rider problem becomes more severe. The results from the model also characterize which industries are more likely to reach a settlement agreement with their foreign competitors following the initiation of an antidumping petition.[6] Counterfactual experiments offer strong evidence that changing firm incentives to participate in rent-seeking activities even slightly will dramatically alter the level of trade protection in an economy.

The paper is organized as follows. In the next section I present the economic model. Section 3 provides a brief description of the data. Sections 4 and 5 discuss the estimation procedure and results respectively. Section 6 concludes.

[5] Although many authors have tested for the effect of political influence on the pattern of antidumping protection, the results have been inconclusive. See, for example, Hansen and Prusa [1997] and Finger, Hall and Nelson [1982].

[6] Although Staiger and Wolak [1994] compare the returns to a settled petition versus one which reaches a final government determination, this is the first empirical research that studies which industries are more likely to reach a settlement agreement with their foreign competitors.

2 The Model

In this section, I present a model of firm participation in an antidumping petition in which the firm weighs the costs with the private benefits.

At the beginning of every period, each industry realizes Ω opportunities to file for antidumping protection against an individual country. The number of opportunities depends on the pricing decisions of foreign firms. When an opportunity presents itself, each firm within the industry must decide whether it wants to participate in the antidumping petition.

Petitions have three possible outcomes. The domestic industry may reach a settlement with the foreign industry prior to the government reaching a final decision regarding the case. In this case, the domestic industry withdraws its petition in exchange for a payoff from the foreign industry. If the foreign and domestic industry fail to reach a settlement the petition enters the final investigation stage. The government may make an affirmative decision about the petition and impose an antidumping tariff of τ^* on all imports of the specific good from the targeted country. Alternatively, the government may make a negative determination and dismiss the petition. The decision of the firm to file a petition depends on the probabilities of each outcome, the payoffs associated with each outcome, and the costs of filing the petition. I discuss these factors in turn.

2.1 Benefits from the Imposition of an Antidumping Tariff

In each period, each firm within an industry observes the unconditional expected value of the tariff determination that would be made by the government if the petition is filed. Define a value τ as the sum of two terms, G and $g(N)$. Here G is the impact on the government's decision of economic and political characteristics of the industry and country under investigation and $g(N)$ is a function of the proportion of firms that choose to participate in the petition (N). A positive value of τ indicates an affirmative determination by the government in which a tariff of τ is imposed, while a negative value of τ indicates a negative determination by the government or a tariff of 0. The unconditional expected value of the tariff (τ^*) is thus defined as

$$\tau = G + g(N) \tag{1}$$

$$\tau^* = \begin{cases} \tau, \text{ if } \tau \geq 0 \\ 0, \text{otherwise.} \end{cases}$$

The expected value of the tariff increases with the proportion of firms that participate in the case because more firms can impose more political pressure on the government agencies and, hence, force a higher level of protection.[7]

A successful antidumping petition results in an increase in profits for all firms within that industry. Prior to filing, the expected change in profits accruing to firm i when the antidumping petition reaches the final stage of investigation is equal to the sum of three terms:

$$B_i^\tau(N) = \alpha(N) + \eta + \xi_i^\tau. \tag{2}$$

The sum of the first two terms, α and η, represent the average value to the industry of the government imposing an unconditional expected tariff of τ^* on imports of the good in question from the targeted country. The first term, α, represents the portion of expected benefits that can be attributed to factors that are widely observed by both the domestic and foreign industry, such as the size of the U.S. market and the expected tariff determination. Because α is a function of the expected tariff, it increases with the number of firms that choose to file for antidumping protection (N). The second term, η, represents the portion of expected benefits that is known only to firms within the domestic industry. This value is unobserved by the foreign industry. The η term includes factors such as private information the domestic industry has about potential growth in the market or future cost changes.

The final term, ξ_i^τ, represents profits specifically accruing to firm i when an expected tariff of τ^* is imposed by the government. For example, if firm i produces a large portion of the product targeted by the antidumping petition, then its expected benefits from the petition are higher than other firms within the same industry.

[7] The expected level of protection might increase with the number of participating firms for reasons other than those associated with the political influence of the petitioning industry. Government agencies are required to reject those petitions that do not have the support of at least 50 percent of the industry.

2.2 Benefits from a Settlement Agreement

Both the foreign industry and the domestic industry would prefer a settlement agreement to a tariff. In a settlement agreement, the foreign industry makes a lump sum payment to the domestic industry in exchange for the domestic industry dropping its antidumping petition.[8] The lump sum payment directly benefits the domestic industry and allows the foreign industry to avoid paying tariff revenue to the U.S. government. In a world of perfect information, both the foreign and domestic industry could predict the tariff that would be set by the government and calculate the transfer that maximizes the total net benefits of the agreement to both the foreign and domestic industry. In reality, the foreign and domestic industry have private information about how a tariff will impact their profits, and this asymmetric information influences the likelihood of reaching a settlement agreement and the size of the settlement payment.[9]

To estimate the probability of reaching a settlement agreement and the expected benefits of such an agreement, consider a simple bargaining model in which the foreign industry makes a take-it-or-leave-it offer to the domestic industry of $\widehat{\eta}$. The benefits accruing to firm i under a settlement agreement can be written as the sum of two terms:

$$B_i^S = \widehat{\eta} + \xi_i^S. \tag{3}$$

The first term, $\widehat{\eta}$, is the average value of the lump sum transfer from the foreign to the domestic industry under the settlement agreement. The final term, ξ_i^S, represents profits specifically accruing to firm i when an agreement is reached.

The foreign industry knows that the domestic industry will agree to any $\widehat{\eta}$ in which the domestic industry's average expected benefits from the settlement agreement exceed the average benefits from proceeding to a final government decision. In a world of perfect

[8] The foreign industry may agree to increase its price by a certain amount or reduce its level of exports to the United States. The domestic industry is indifferent between offers of this nature and a cash transfer from the foreign industry.

[9] The bargaining model included here is similar to those developed by Prusa [1992] and Panagariya and Gupta [1998], which suggest that the foreign and domestic industry would always be better off under a negotiated outcome rather than allowing an antidumping petition to reach a final government determination. Panagariya and Gupta [1998] show that any asymmetric information, such as different beliefs about the probability of a successful final outcome, can reduce the likelihood of a negotiated outcome.

information, the foreign industry could set $\widehat{\eta}$ such that $\alpha + \eta = \widehat{\eta}$, and an agreement always would be reached. However, recall that only the domestic industry observes η, the second component of benefits that accrue to the domestic industry when a tariff is imposed on foreign imports. The foreign industry knows only that η has distribution $F(\eta)$. When choosing $\widehat{\eta}$, the foreign industry must consider the effect of $\widehat{\eta}$ on both its profits and the probability of reaching a successful settlement agreement. The foreign industry chooses $\widehat{\eta}$ by maximizing its expected change in profits due to the antidumping petition.

When making an offer, the foreign industry calculates the probability of reaching a successful settlement agreement, π^*, as the probability that the average benefits to the domestic industry from the settlement agreement are greater than those when the case reaches a final government decision, or $Pr(\widehat{\eta} \geq \alpha + \eta)$. Using the distribution of η, this probability can alternatively be expressed as:

$$\pi^*(\widehat{\eta}) = F(\widehat{\eta} - \alpha). \tag{4}$$

Note that the probability of reaching an agreement is increasing in the value of the settlement offer made by the foreign industry.

Define $B^{\tau *}$ as the foreign industry's expected change in profits that results from the antidumping petition reaching a final government decision, and B^{S*} as the foreign industry's expected change in profits that results from reaching a successful settlement agreement with the domestic industry. These values can be expressed as:

$$B^{\tau *} = \alpha^*(N) \tag{5}$$

$$B^{S*} = \eta^* - \widehat{\eta}. \tag{6}$$

In these equations, α^* denotes the change in foreign industry profits when an expected antidumping duty of τ^* is imposed upon its imports. The η^* term represents benefits accruing to the foreign industry when the case is settled which are unobserved by the domestic industry. For example, the foreign industry undoubtedly has better information about how its pricing decisions would change if a tariff is imposed. The domestic industry knows only that η^* has distribution $F^*(\eta^*)$.

The foreign industry chooses $\widehat{\eta}$ by maximizing the expected change in profits that occurs due to the petition, U^*, which consists of the probability of reaching a settlement agreement and the possible outcomes of the petition. In other words:

$$\max_{\widehat{\eta}} U^*(\widehat{\eta}) = \pi^*(\widehat{\eta})B^{S*}(\widehat{\eta}) + [1 - \pi^*(\widehat{\eta})]B^{\tau*}(N). \tag{7}$$

The optimal $\widehat{\eta}$ is implicitly defined by the first order condition:

$$\frac{\partial \pi^*}{\partial \widehat{\eta}}(B^{S*} - B^{\tau*}(N)) - \pi^*(\widehat{\eta}) = 0. \tag{8}$$

Once a settlement offer is made, the domestic industry knows with certainty whether or not the case will be successfully settled. However, when making the decision to file for antidumping protection, each firm in the domestic industry must estimate the probability of reaching an agreement and the expected benefits conditional on reaching a successful agreement. Because the domestic industry does not observe η^*, the probability of reaching a settlement agreement is calculated using the probability of getting a satisfactory offer based on the distribution of η^*. Once again, the probability of reaching a successful settlement agreement is the probability that the average benefits to the domestic industry of settling are greater than forcing the petition to a final government decision. This is the probability that the settlement proposal, which is a function of η^*, is greater than some threshold value, or:

$$\pi(N) = \Pr[\widehat{\eta}(\eta^*) \geq \alpha(N) + \eta]. \tag{9}$$

The foreign industry's offer $\widehat{\eta}$, which is implicitly determined by Equation [8], is a monotonically increasing function of η^*, therefore Equation [9] is equivalent to the probability that η^* is above a threshold value $\overline{\eta}$ such that the foreign firm's settlement offer is accepted by the domestic industry.[10]

2.3 The Firm's Decision to Participate

Given the payoffs and probabilities described above, the expected rewards to firm i when an antidumping petition is filed are defined by:

$$U_i(N) = \pi(N)B_i^S + [1 - \pi(N)]B_i^\tau(N). \tag{10}$$

[10]More specifically, $\widehat{\eta}$ is a monotonically increasing function of η^* as long as the foreign industry's second order condition holds. A sufficient condition for this to be true is that both the foreign industry and the average domestic industry prefer to settle the case than continue on to a final government decision given the offer $\widehat{\eta}$.

A petition is filed if at least one firm in the industry decides to participate actively in the petition. All firms in the industry benefit from the imposition of a tariff in the case of a successful antidumping petition or a transfer from the foreign industry in case of a settlement agreement, but only those firms that participate in the petition process must contribute to the significant costs. Costs of filing a petition are primarily fixed, and include payments to lawyers, economists, and other consultants to prepare petitions that can be hundreds of pages, testimony to present before government agencies, and responses to comments of opponents of the petition. I allow the costs of participating, C_i, to consist of two terms. The first term, $\kappa(N)$, represents the average cost of participating in the petition. This value is decreasing in the number of firms that decide to contribute because the high fixed costs are divided amongst a larger group of firms. The second term, ξ_i^C, allows contributions to vary across firms.[11]

The high cost of actively participating in the petition may encourage some firms to free ride on others willing to bear these costs. However, as noted above, the expected level of protection awarded due to the petition increases with the number of firms participating in the case, N, because the industry can apply greater political pressure on government agencies. Therefore each firm must compare its private benefits, or the increase in the expected benefits of the petition that would arise if it joined the case, to the per firm costs when deciding whether or not to contribute to the antidumping petition. Approximating the increase in the expected benefits when an additional firm joins the petition as the marginal change (denoted by Δ), firm $i's$ expected net benefits of participating can be written as:

$$A_i^* = \Delta[\pi(N)B_i^S + (1-\pi(N))B_i^\tau(N)] - C_i(N). \tag{11}$$

Each firm has a strategy, A_i, denoted by (0,1), where "0" represents no contribution to the antidumping petition and "1" represents contribution to the case. The strategy vector for the game, A, is an (Ix1) binary vector, where I is the number of firms in the industry. A pure strategy equilibrium occurs when holding the choices of all other firms fixed, all firms choosing to participate have positive expected net benefits of participating and those that do

[11] For example, ξ_i^C allows larger firms or those with in-house counsel to pick up a larger share of costs. It also allows firms to recruit additional firms to participate in the petition at no cost in order to increase the level of protection.

not participate would realize negative expected net benefits. Defining N^* as the equilibrium number of firms participating in the petition, a Nash equilibrium pure strategy vector must satisfy:

$$A_i = \begin{cases} 1, \text{if } A_i^*(N^*) \geq 0 \\ 0, \text{otherwise} \end{cases} \textit{for all } i$$

where

$$N^* = \sum_{i=1}^{I} A_i. \tag{12}$$

To assure the existence of a pure strategy equilibrium, I make the assumption that the expected net benefits of participating, $A_i^*(N)$, are increasing in the number of firms participating in the petition.[12]

One of the problems with equilibrium models of this nature is that there may be multiple Nash equilibria, specifically due to tipping behavior. For example, if the costs of filing a petition are extremely high then there may exist one equilibrium in which nobody chooses to participate in the petition and a second equilibrium in which multiple firms in the industry choose to participate and split the costs of the petition. However, there is a unique equilibrium that Pareto dominates all other equilibria. Intuitively, because the returns to the petition are increasing in the total number of firms participating, all firms benefit when more firms choose to join the petition.

3 Data

I compiled data on 157 countries and 447 four-digit 1987-SIC industries in the manufacturing sector for the years 1980 through 1996. These years were chosen to avoid discontinuities that could result from the major change in the administration of antidumping law in 1980 and the change from the Standard Industrial Classification System to the North American Industry Classification System in 1997. Sources include U.S. Bureau of the Census surveys, including the Annual Survey of Manufacturers and Economic Census, as well as the

[12] Other models that have similar characteristics include Berry's [1992] model of entry and Gowrisankaran and Stavins' [1999] model of network externalities. These models also need to make assumptions about the monotonicity of benefits or profits in order to ensure a Nash equilibria.

NBER's U.S. Import and Export Data and the World Bank's World Development Indicators. Variables include the value of domestic shipments, imports and exports, costs of production, and measures of industry concentration. To avoid selection bias, it is important to include all U.S. trading partners and industries within the manufacturing sector in the estimation of the model.[13]

I merged the resulting panel with antidumping petition information. The U.S. Antidumping Database includes information such as the date of initiation and outcome of petitions filed between 1980 and 1994. I supplemented this database with the information from Federal Register Notices associated with petitions filed in 1995 and 1996. I collected the data on the proportion of firms filing the antidumping petitions for the entire sample period from Federal Register notices and International Trade Commission reports.

Between 1980 and 1996, U.S. industries filed a total of 795 antidumping petitions. Approximately 20 percent of the cases filed during the sample period were settled prior to reaching a final government determination. Of the remaining cases, the government made affirmative decisions in slightly over half of the remaining cases. The average antidumping tariff imposed during the period was 49.4 percent. The average number of firms participating in a particular petition was 33, although the majority of petitions were filed by one to five companies. This translates to an average participation rate of approximately one-third of the firms in an industry.

Sixty-eight countries had at least one case filed against them between 1980 and 1996. However, over 60 percent of all antidumping petitions were filed against the top ten targets of antidumping petitions, including Japan, China, Germany, Taiwan, Korea, and Brazil. Not surprisingly, the leading targets also rank as the United States' most important trading partners during the period and are primarily highly industrialized countries. The average dumping margin imposed upon these countries varies considerably; for example, the average

[13]The country-specific data contained approximately 500 missing values. I used the simulation technique developed in Lavy, Palumbo and Stern [1998] to estimate the missing values. The Economic Census is released every five years (in 1982, 1987, 1992, and 1997). Therefore, the four-firm concentration ratio and total number of firms in the industry were imputed for non-Census years. A complete description of the dataset is available from the author upon request.

antidumping duty imposed upon China is nearly twice that of other countries.[14]

Of the 450 domestic industries, 121 filed at least one antidumping petition during the sample period. Most antidumping petitions, however, are filed by a small group of extremely price-sensitive industries. The steel works industry filed by far the most petitions at 197, followed by the steel pipe and tube industry and the ball bearings industry. Most of the antidumping petitions filed between 1980 and 1996 were against intermediate products rather than consumer goods. The annual number of petitions filed by an industry against a specific country ranged from zero to ten.

4 Empirical Specification and Estimation

This section first discusses the empirical specification, and then outlines the estimation strategy. Simulation techniques used to overcome unique problems in the course of estimation are described in Section 4.3.

4.1 Specification

Recall that at the beginning of every period, each industry realizes a fixed number of opportunities to file for antidumping protection against country k. Define Ω_{kjt} as the number of opportunities industry j has to file for antidumping protection against country k in period t. Let λ_{kjt} denote the rate at which these opportunities arise. I assume that the distribution of Ω_{kjt} given λ_{kjt} is Poisson with parameter λ_{kjt}, where $ln\lambda_{kjt} = X_{Fkt}\beta_F + \ln \zeta_{kj}$. Here, X_{Fkt} includes characteristics about country k in period t that may effect the pricing decisions of foreign firms. The term ζ_{kj} is a gamma-distributed error with parameter θ associated with the unobserved factors about industry j in country k that may effect the rate of opportunities.

Under these assumptions, the unconditional distribution of Ω_{kjt} can be written as a negative binomial random variable. In other words, the probability of industry j realizing $\widehat{o}$

[14] Critics of the antidumping regulations charge that dumping margins in cases involving non-market economies such as China are inherently biased because in cost-based analysis the government uses costs in a comparable third market rather than costs in the non-market economy itself.

opportunities to file for antidumping protection against country k in period t can be written as:

$$\Pr(\Omega_{kjt} = \widehat{o}) = \frac{\Gamma(\theta + \widehat{o})}{\Gamma(\widehat{o} + 1)\Gamma(\theta)} \left(\frac{e^{X_{Fkt}\beta_F}}{e^{X_{Fkt}\beta_F} + \theta}\right)^{\widehat{o}} \left(1 - \frac{e^{X_{Fkt}\beta_F}}{e^{X_{Fkt}\beta_F} + \theta}\right)^{\theta}. \tag{13}$$

The average benefits associated with the government imposing an antidumping tariff on country k to foreign and domestic firms in industry j are respectively defined by

$$\alpha^*_{kjt} = -\tau^*_{kjt} \exp(X^*_{Bkjt}\beta^*_B)$$

$$\alpha_{kjt} = (\tau^*_{kjt} + \gamma\tau^{*2}_{kjt}) X_{Bkjt}\beta_B \tag{14}$$

where X^*_{Bkjt} and X_{Bkjt} include industry characteristics that effect the value of benefits and τ^*_{kjt} is the unconditional expected tariff.[15] Characteristics contained in X^*_{Bkjt} include such variables as the value and growth of the industry's exports to the United States and the total size of the U.S. market. The domestic counterpart, X_{Bkjt}, includes these variables in addition to others such as a proxy of the average markup by the domestic industry. One would expect, for example, that the domestic industry's benefits, and the cost to the foreign industry, would increase with the value of targeted imports. The parameter γ allows for the possibility of diminishing marginal returns from the value of the dumping margin. Intuitively, if the tariff increases beyond a certain level, all imports from country k would be eliminated; increasing the antidumping tariff beyond this level would result in no additional benefits to the domestic industry.[16]

The expected antidumping tariff imposed upon imports from country k, τ^*_{kjt}, depends upon the decisions of government agencies. The domestic industry forms expectations about this τ^*_{kjt} according to

$$G_{kjt} = X_{Gkjt}\beta_G + \omega_{kjt} \tag{15}$$

$$\omega_{kjt} \sim iid\ N(\mu_w, \sigma^2_w)$$

[15] The specification for foreign benefits was chosen to ensure that the foreign industry experiences a loss when a tariff is imposed, as suggested by theory.

[16] This general specification could apply to a variety of market structures. For example, Herander and Pupp [1991] use the small country and perfect competition assumption to derive the change in producer surplus due to a tariff as $\tau REV(1 + \frac{1}{2}\varepsilon\tau)(\%IMP)$, where REV is the value of domestic sales, ε is the elasticity of domestic supply, and $\%IMP$ is the percentage of total imports affected by the government's decision.

Variables in X_{Gkjt} include economic factors that government agencies are required to consider under the antidumping statute when making their decisions, such as the change over the period of investigation in domestic industry shipments and capacity utilization. Also included in X_{Gkjt} are political factors that may influence government decisions, such as the total size of the industry as measured by employment. The error term ω_{kjt} captures influences on government decisions that are unobserved.

To complete the specification of the benefits of filing an antidumping petition, I assume that the firm-specific benefits and private-information terms used to determine the lump sum payment in the event of a settlement agreement are distributed according to

$$(\xi_j^\tau - \xi_j^S) \sim iid\ N(0, \sigma_\xi^2)$$
$$\eta_{kjt} \sim iid\ N(0, \sigma_\eta^2)$$
$$\eta_{kjt}^* \sim iid\ N(0, \sigma_{\eta*}^2).$$

Assume that the average cost of participating in the petition, κ, is defined by

$$\kappa = X_{Ckjt}\beta_C + c(N) + \nu_k. \tag{16}$$

In this equation, X_{Ckjt} includes a constant that captures the average cost of filing an antidumping petition across industries. It also includes industry-specific variables such as the number of firms in the industry and the four-firm concentration ratio. As the costs of participating increase, the free rider problem becomes more severe and fewer firms choose to file antidumping petitions. The parameter estimates associated with the costs of participating, therefore, reveal the characteristics of those industries more prone to the free rider problem. The term $c(N)$ is a function of the number of firms actively participating in the case. The random variable v_k allow costs to vary by country. For example, it may be less expensive to collect information about production in a country with a low-cost of living or more stringent tax regulations. This random variable and the firm-specific portion of costs are distributed according to

$$v_j \sim iid\ N(0, \sigma_v^2)$$
$$\xi_i^C \sim iid\ N(0, \sigma_{\xi C}^2).$$

4.2 Estimation Strategy

I estimate the parameters of the model using Maximum Simulated Likelihood (MSL). The likelihood contribution of industry j and country k in period t is defined by one of two possible outcomes: (1) at least one firm in the industry chooses to file one or more petitions against country k or (2) no firms in industry j choose to file a petition against country k. Define F_{kjt} as an indicator variable that equals 1 when industry j files at least one petition against country k in period t, Ψ_{1kjt} as the likelihood contribution when industry j fails to file an antidumping petition against country k, and Ψ_{2kjt} as the likelihood contribution when the industry files one or more petitions. Then conditional on the unobserved country- and industry-specific factors, the likelihood function can be expressed as:

$$L = \int_{\omega} \int_{v} \int_{u} \int_{\xi} \prod_{t} \prod_{j} \prod_{k} [\Psi_{1kjt}]^{(1-F_{kjt})} [\Psi_{2kjt}]^{F_{kjt}} f_{\xi}(\xi) f_u(u) f_v(v) f_{\omega}(\omega) d\xi du dv d\omega. \tag{17}$$

Recall that Ω_{kjt} is the number of opportunities industry j has to file an antidumping petition against country k in period t, and the probability of observing a specific number of opportunities is defined by equation [13]. Define N^*_{okjt} as the observed number of firms participating in opportunity o. Therefore when no petition is filed, the likelihood contribution is the joint probability that, while Ω_{kjt} opportunities existed, no firms chose to participate in these opportunities. This is written as

$$\Psi_{1kjt} = \prod_{o=1}^{\widehat{o}} \int_{\eta} \Pr(N^*_{okjt} = 0) f(\eta) \partial\eta \Pr(\Omega_{kjt} = \widehat{o}). \tag{18}$$

The contribution of an industry that files at least one petition, Ψ_2, includes the probability of observing the outcome of the petition. More specifically, it includes the probability of observing the industry reaching or not reaching a settlement agreement and, conditional on not reaching a settlement agreement, the probability of observing a particular decision by the U.S. government. Define P_{kjt} as the number of petitions actually filed by industry j against country k in period t, and S_{okjt} as an indicator variable that equals 1 when case or opportunity o is settled. The likelihood contribution when a petition is filed is defined by:

$$\Psi_{2kjt} = \prod_{o=1}^{P_{kjt}} [\Pr(S_{okjt} = 0 | N^*_{okjt}) \Pr(\tau^*_{okjt} = \tau | N^*_{okjt})]^{(1-S_{okjt})} \tag{19}$$

$$[\Pr(S_{okjt} = 1 | N^*_{okjt})]^{S_{okjt}} \int_{\eta} \Pr(N^*_{okjt}) f(\eta) \partial\eta \tag{20}$$

$$\prod_{P_{kjt}+1}^{\widehat{o}} \int_{\eta} [\Pr(N^*_{okjt} = 0)] f(\eta) \partial\eta \Pr(\Omega_{kjt} = \widehat{o}). \tag{21}$$

In brief, when a case is filed by $N^* > 0$ firms, that case may either reach a final government decision as expressed in 19, or be settled prior to reaching the final stage of the investigation as expressed in 20. The final line (21) consists of those opportunities in which no firms chose to participate, similar to what is captured in equation [18].

In order to calculate the probability of observing N^* firms joining a petition, I introduce a petition-specific error ϵ_{okjt} on the net benefits of participating, where ϵ_{okjt} is an iid normally-distributed error with a standard deviation of σ_ϵ.[17] With the introduction of this error, the probability that firm i will participate in an antidumping petition filed by N^* firms is defined as the probability that the expected net benefits of participating are positive, or:

$$\Pr[A_i = 1] = \Pr[A^*_i(N^*) + \epsilon \geq 0] = 1 - \Phi(\frac{-A^*_i(N^*)}{\sigma_\epsilon}). \tag{22}$$

The probability of observing an N^* firm equilibrium is the probability that ϵ_{okjt} falls within a range such that exactly N^* firms choose to participate in the petition. If I order the firms in the industry from those with the highest to lowest net expected benefits, this is equivalent to saying that while the N^{*th} firm in the market has positive net expected benefits of participating when $N^* - 1$ other firms choose to file a petition, the $(N^* + 1)^{th}$ firm would have negative net expected benefits if it joined the petition given that N^* other firms are participating. Specifically, this probability is

$$\Pr(N^* = N) = \Phi(\frac{-A^*_{N+1}(N^* + 1)}{\sigma_\epsilon}) - \Phi(\frac{-A^*_N(N^*)}{\sigma_\epsilon}). \tag{23}$$

[17] Although I considered using the density of the industry-specific errors or country-specific errors to calculate the probability of industry j filing a petition against country k, the only way to fully account for the observed data is with an opportunity-specific error.

The probability of observing no firm in the industry choosing to file a petition is the probability that ϵ_{okjt} falls within a range such that there exists no Pareto dominant equilibrium in which a positive number of firms choose to file a petition:

$$\Pr(N^* = 0) = 1 - \sum_{N=1}^{I_{jt}} \Phi(\frac{-A^*_{N+1}(N^*+1)}{\sigma_\epsilon}) - \Phi(\frac{-A^*_N(N^*)}{\sigma_\epsilon})$$

$$= \Phi(\frac{-A^*_1(1)}{\sigma_\epsilon}) \quad (24)$$

The probability that a petition is settled is the probability of observing a combination of η_{okjt} and η^*_{okjt} such that the foreign industry makes an settlement offer acceptable to the domestic industry. Recall that the settlement offer $\widehat{\eta}_{okjt}$ is an increasing function of the foreign industry's private information, η^*_{okjt}. Define $\overline{\eta}(\eta)$ as the threshold value of η^*_{okjt}, conditional on η, such that if $\eta^*_{okjt} \geq \overline{\eta}(\eta)$ then the foreign firm makes an acceptable settlement offer to the domestic industry and a settlement agreement is reached. Then the probability of reaching a settlement agreement can be expressed as

$$\int_{-\infty}^{\infty} [1 - \Phi(\frac{\overline{\eta}(\eta)}{\sigma_{\eta*}})] \frac{1}{\sigma_\eta} \phi(\frac{\eta}{\sigma_\eta}) \partial\eta. \quad (25)$$

[18]

4.3 Simulation

The integrals in equation [17]cannot be evaluated. I therefore use antithetic acceleration techniques as described in Geweke [1988] to simulate the values of these integrals. I must also simulate the number of opportunities to file, Ω. Simulation is used because the data does not allow me to distinguish whether the industry did not have an opportunity to file an antidumping petition from the case where an opportunity to file for protection existed, but no firm chose to participate in the opportunity. Note that it is important to allow the number of opportunities to vary across observations. Alternative specifications in which each industry has a fixed number of opportunities to file for antidumping protection would likely overestimate the free rider problem. Details of the procedure are provided in Appendix A.

For many observations, I simulate the number of firms eligible to participate in a given opportunity. While I observe the number of firms in industry j, not all firms may be eligible

[18] A closed form solution to the integral does not exist. Instead, a quadrature formula is employed to approximate the integral.

Table 1

Poisson Model Estimates of the Number of Firms in an Industry

Variable	
Constant	3.633*
	(0.15)
Concentration Ratio	-0.019*
	(0.003)
Gamma shape parameter	0.654*
	(0.080)

Standard errors are in parentheses. Asterisks indicate those parameters significant at the 5 percent significance level.

to participate because petitions are filed against very specific product categories produced by country k. These product categories are typically produced by only a subset of firms within industry j. When a petition is filed, I observe the number of eligible firms, but when an industry chooses not to file a petition the number of eligible firms is unobserved. I simulate the number of eligible firms by assuming it is a Poisson random variable, where the mean is a function of the four-firm concentration ratio in industry j and a gamma-distributed industry-specific error. Prior to simulation, I estimate a Poisson model with industry-specific random effects using the number of firms eligible to participate in petitions actually filed. The results are presented in Table [1]. I then use these coefficients to simulate the number of firms eligible to participate in a given opportunity from a Poisson distribution with the mean indicated for industry j.

The net benefit of participating in a petition (A^*) is a function of the expected value of the settlement offer ($\widehat{\eta}$) and the derivative of the expected settlement offer conditional on reaching a settlement agreement. Recall that $\overline{\eta}$ is defined as the threshold value of η^* such that the domestic industry will accept the foreign industry's offer and a settlement agreement will be reached. Then the conditional expected value of the settlement offer and the change in the settlement offer with respect to the number of participating firms can be written as

$$\int_{\overline{\eta}}^{\infty} \widehat{\eta}(\eta^*) f(\eta^*) \partial\eta^* \text{ and} \tag{26}$$

$$\int_{\overline{\eta}}^{\infty} \frac{\partial\widehat{\eta}(\eta^*)}{\partial N^*} \widehat{\eta}(\eta^*) f(\eta^*) \partial\eta^*. \tag{27}$$

Closed form solutions do not exist to either the expected settlement offer or the derivative of the expected settlement offer. I therefore calculate these expected values using a variant of Simpson's Rule to approximate the indefinite integrals.[19]

5 Results

The parameters associated with the opportunity to apply for protection are given in Table [2]. In each table, the (asymptotic) standard errors are given in parentheses. The average number of opportunities an industry has to file against a specific country in a given year is 0.55, with a standard deviation of 0.86. The number of opportunities is higher for more developed, faster growing countries and for those countries that are more important sources of U.S. imports. These results are consistent with the characteristics of the leading targets of antidumping petitions, such as Japan, China, and the countries of the European Union. The number of opportunities increases with a depreciation of a country's currency relative to the dollar.[20] Intuitively, exchange rate depreciation results in a fall in import prices; the fall in prices gives U.S. industries the opportunity to file more antidumping petitions.[21]

The parameters associated with the level of protection awarded by the government are given in Table [3]. U.S. antidumping statutes direct government agencies to consider the growth in domestic shipments, the growth in the domestic capacity utilization rate, and the market share of the country under investigation, among other factors, in deciding whether

[19]The method deviates from Simpson's Rule in that I must define a value for infinity in order to calculate the value of the approximation. This should result in a close enough approximation as long as "infinity" is sufficiently large. Throughout the course of the estimation procedure, I define infinity as six-times the standard deviation of η^*.

[20]I calculate the growth of the exchange rate using the dollars per unit of foreign currency exchange rate. Thus, a positive growth rate actually represents a depreciation of the currency relative to the dollar.

[21]Knetter and Prusa [2003] also find strong positive impact of currency depreciation on the number of antidumping petitions filed.

Table 2

Parameter Estimates: Opportunity to Apply for Protection

Variable	
Constant	-1.951*
	(0.015)
Growth in GNP	0.645*
	(0.149)
GNP per capita (in thousands of dollars)	0.015*
	(0.001)
Growth in exchange rate	-0.051*
	(0.014)
Total imports (in billions of dollars)	0.022*
	(0.001)
θ : Gamma shape parameter	0.983*
	(0.041)
$\overline{\Omega}$: mean number of opportunities	0.551
σ^2_{Ω}: variance of the number of opportunities	0.859

Standard errors are in parentheses. Asterisks indicate those parameters significant at the 5 percent significance level.

the domestic industry has been injured by unfair imports. However, only the market share of the targeted country proves to have a significant effect on the value of the antidumping tariff.[22]

The estimates reveal that Chinese industries face higher antidumping tariffs than industries in other countries. This could represent either a bias in antidumping regulations or more actual dumping on the part of Chinese firms. On average, petitions filed against Chinese industries result in antidumping tariffs approximately 19.1 percent higher than those filed against other countries.

The degree of political influence on the outcomes of antidumping petitions has been widely studied, with mixed results. For example, Finger, Hall and Nelson [1982] found no evidence of political influence on the size of the antidumping tariffs but some evidence that the size of the industry can influence whether protection is awarded at all. While Moore [1992] found evidence that the size of the industry has a positive influence on whether protection is awarded, Hansen and Prusa [1996, 1997] found no evidence that either the size or the concentration of the industry effected outcomes. In contrast, I find evidence that political factors have an impact on the level of protection. The expected antidumping tariff increases with the size of the industry, as measured by domestic employment.

The proportion of firms participating in the case has a significant positive effect on the level of protection, albeit with a diminishing rate of return. On average, when the percentage of firms participating in a petition rises from 25 to 50 percent, the expected antidumping tariff increases by 5.9 percent. When the participation rate increases from 50 percent to 100 percent, the additional boost in the tariff is 3.7 percent. This result shows that there is a real private benefit to participating in this rent seeking activity, which diminishes the free rider problem.

Parameter estimates associated with the domestic industry's benefits and foreign industry's costs due to the imposition of an antidumping tariff are presented in Table [4].[23] Column 2 of Table [4] presents the parameters associated with domestic benefits and column

[22] The results are consistent with Hansen and Prusa [1996] and [1997].

[23] Data limitations prevent me from separately identifying firm-specific errors for both costs and benefits. The specification presented here arbitrarily fixes the standard deviation such that $\exp(\sigma_\xi)$ equals 2.0, or σ_ξ equals 7.4.

Table 3

Parameter Estimates: Expected Antidumping Tariff

Variable	
Growth in domestic shipments	-0.207
	(0.207)
Growth in capacity utilization rate	-0.093
	(0.184)
Market share of country under investigation	3.538*
	(0.419)
Domestic employment (in 1,000s)	0.001*
	(0.0002)
Four-firm concentration ratio	0.116
	(0.089)
Country is China	0.535*
	(0.076)
Proportion of firms participating	1.027*
	(0.036)
Proportion^2	-0.504*
	(0.014)
μ_ω : Mean	-0.563*
	(0.044)
σ_ω : Standard deviation	0.738*
	(0.026)

Standard errors are in parentheses. Asterisks indicate those parameters significant at the 5 percent significance level.

3 presents the those associated with the foreign industry's costs.

Most of the parameter estimates associated with the benefits accruing to the domestic industry and costs accruing to the foreign industry due to the imposition of a tariff are significant at the five percent level and have a reasonable economic interpretation. The parameter estimates suggest that domestic firms within high-growth industries have larger gains from a tariff which restricts the level of imports than firms in low-growth industries. The foreign industry is hurt more when the tariff is imposed upon larger, faster growing industries.[24] Results also suggest that domestic industry benefits increase with the total value of imports and the average mark-up.

Further analysis of the parameters in Table [4] show that the most important determinant in a domestic industry's ability to reach a settlement agreement with their foreign competitors is the level of asymmetric information. A one standard deviation increase in the amount of private information held by the domestic industry (η) decreases the probability of reaching a settlement agreement by 56.9 percent. This is consistent with the theoretical predictions in Panagariya and Gupta [1998]. However, other characteristics of the industry also effect the likelihood of a settlement agreement. Most significantly, for each million dollar increase in the size of the domestic market, the probability of reaching a settlement agreement increases by one percentage point. The domestic industry is slightly less likely to reach a settlement agreement the higher the expected level of protection; a one percentage point increase in the expected antidumping tariff results in a 0.3 percentage point decrease in the probability of reaching a settlement agreement.

Parameters associated with the cost of filing for protection are presented in Table [5]. The conventional wisdom since Olson's [1965] seminal work on collective actions has been that the free rider problem becomes more severe as the number of the firms in the industry rises. However, more recent models of collective actions result in slightly different predictions about industry structure and the ability to overcome the free rider problem. For example, Pecorino [1998] finds that the number of firms in the industry will not necessarily change its

[24] Recall that I specify the foreign industry's change in benefits as $B_1^* = -\tau^* \exp(XB)$ to ensure that the foreign industry experiences a loss when a dumping margin is imposed. Therefore, a positive parameter estimate indicates that the loss suffered by the foreign industry increases with the variable under consideration.

Table 4

Parameter Estimates: Benefits of Filing a Petition

Variable	Domestic	Foreign
Imports from target country (in millions of dollars)	$9.56x10^{-9}$	-0.001
	(0.007)	(0.001)
Growth in imports from target country		0.164*
		(0.043)
Domestic market size (in millions of dollars)	-9.294*	0.845*
	(4.646)	(0.042)
Growth in domestic market	100.403*	6.118*
	(48.479)	(0.845)
Percent markup	276.556*	
	(45.742)	
Total imports (in millions of dollars)	0.004*	
	(0.002)	
Growth in total imports	$-6.353x10^{-7}$	
	(40.319)	
Gamma	$6.862x10^{-9}$	
	(0.045)	
σ_η: Domestic-opportunity error standard deviation	47.419*	
	(6.457)	
$\sigma_{\eta*}$:Foreign-opportunity error standard deviation		4.387*
		(2.008)
σ_ϵ: Opportunity error standard deviation	69.962*	
	(15.334)	

Standard errors are in parentheses. Asterisks indicate those parameters significant at the 5 percent significance level.

ability to maintain cooperation and engage in lobbying. However, Magee [2002] concludes that an increase in the number of firms makes the free rider problem more severe as long as the number of firms in the industry is sufficiently large. The parameter estimates support the conventional wisdom that per firm costs, and thus the ability to overcome the free rider problem, increase with the number of firms in the industry. However, the parameter estimates also indicate that holding the number of firms in the industry constant, the free rider problem becomes more severe the greater the level of concentration in the industry. This suggests that the free rider problem is at its worst for perfectly competitive industries and oligopolies with a few strong competitors.

Surprisingly, the estimates reveal that per firm costs actually increase slightly when additional firms participate, albeit at a diminishing rate. On average, the inclusion of one additional firm in a petition increases the firm's average cost of participating in the petition by 0.6 percent.[25] This increase may be associated with increased coordination costs. Nevertheless, firms within industries filing petitions find that the marginal benefit gained from joining the petition and gaining a higher level of protection exceeds the additional costs associated with its participation.

5.1 Specification Tests

To see how well the model fits the data, I conduct a series of chi-square goodness of fit tests.[26] The results from these tests indicate that the model predicts the industry's decision to file and settle a petition, as well as the government's decision regarding the level of protection, quite accurately.

[25]Per firm costs are maximized when the number of firms participating reach 217. Because 98 percent of all petitions are filed by fewer than 100 firms, it is reasonable to conclude that costs increase with the number of participating firms.

[26]In general, for each outcome of the model I want to test, I divide the outcome into N mutually exclusive and exhaustive events. For example, to test how well the model predicts the industry's decision to file a petition, I divide the outcome variable into two mutually exclusive events (file and not file). Test statistics are calculated for each event by first dividing the probability of observation i choosing event n into quintiles. The test statistic compares the actual number of observations to choose event n within the quintile with the predicted number, and has a χ^2 distribution with four degrees of freedom.

Table 5

Parameter Estimates: Costs of Applying for Protection

Variable	
Average cost	180.673*
	(39.362)
Four-firm Concentration Ratio	38.827*
	(11.088)
Number of Firms in Industry	0.012*
	(0.003)
Concentration Ratio * Firms	$8.629x10^{-8}$
	(0.006)
Number of Firms Participating	1.314*
	(0.312)
Number of Firms Participating^2	-0.003
	(0.003)
σ_ν: Country-specific error standard deviation	25.508*
	(5.649)
σ_ξ: Firms-specific error standard deviation	16.650*
	(3.844)

Standard errors are in parentheses. Asterisks indicate those parameters significant at the 5 percent significance level.

Table 6

Chi-Square Goodness of Fit Test:Proportion of Firms Filing Petition

Proportion Range	Actual Number	Predicted Number	χ^2 Statistic
$\frac{N^*}{Firms}$ =0.00	452,418	452,223	0.21
0.00< $\frac{N^*}{Firms}$ ≤0.25	226	346	63.82
0.25< $\frac{N^*}{Firms}$ ≤0.50	189	175	16.82
0.50< $\frac{N^*}{Firms}$ ≤0.75	57	68	32.42
0.75< $\frac{N^*}{Firms}$ ≤1.00	107	159	25.81

I first test how well the model predicts the industry's decision to file a petition.[27] The model over predicts the number of observations choosing to file a petition during the sample period. Between 1980 and 1996, only 544, or 0.12 percent, of the observations filed at least one petition where an observation is an industry, country, year combination. In contrast the model predicts that 747 observations, or 0.17 percent of the sample, filed at least one petition during this time period. I statistically reject the null hypothesis that the model correctly predicts the decision to file a petition.[28]

To further investigate this decision, I next conduct tests to study how well the model predicts the proportion of firms filing a petition. Although I statistically reject the null hypothesis that the model predicts the same proportion of firms filing a petition as observed in the data for all ranges but the decision not to file, in general the model is better able to match petitions filed by more than 25 percent of the industry than those filed by a smaller proportion.

I next test how well the model predicts the outcome of antidumping petitions filed in the United States. As noted above, between 1980 and 1996 approximately 20.0 percent of all petitions were settled prior to reaching a final government decision. Of those petitions not

[27] To avoid needless complications associated with single observations filing multiple petitions, I define my "event" as the decision of the industry to file *at least* one petition against country k in period t. The probability of the industry choosing not to file a petition is the probability that either one or more opportunities existed and no firms chose to partake in those opportunities or no opportunities existed.

[28] In contrast, the test statistic associated with the decision not to file a petition is 0.31, therefore I fail to reject the null hypothesis that the model correctly predicts the decision not to file a petition.

Table 7

Chi-Square Goodness of Fit Test: Tariff Rate

Tariff Range	χ^2 Statistic
$\tau^* = 0.00$	13.76
$0.00 < \tau^* \leq 0.20$	60.32
$0.20 < \tau^* \leq 0.40$	2.60
$0.40 < \tau^* \leq 0.60$	6.62
$0.60 < \tau^* \leq 0.80$	5.03
$\tau^* \geq 0.80$	23.88

settled, slightly over half were successful during the sample period. In contrast, the model predicts a slightly lower settlement rate of 17.4 percent of the petitions actually filed and success rate for the rest of the petitions of 47.9 percent. I fail to reject the null hypothesis that the model predicts a settlement agreement between the foreign and domestic industries and the null hypothesis that the model accurately predicts the success of the remaining petitions.

The results from a chi-square goodness-of-fit test for the level of protection awarded by the government, or τ^*, are included in Table [7].[29] In general, the test statistics indicate that the model is able to predict tariffs between 20 and 80 percent much more accurately than those under 20 percent or above 80 percent.

5.2 Counterfactual Experiments

One of the primary benefits of estimating a structural model of this nature is that the parameter estimates are invariant to policy changes and thus can be used to conduct counterfactual policy experiments. This section discusses the results of two such experiments designed to alter an industry's ability to overcome the free rider problem. The first counterfactual experiment increases the per firm cost of filing a petition by 10 percent, while the

[29] The test is similar to those used to test other aspects of the model in that I first divide the expected level of protection into n discrete ranges.

second increases the benefits to firms that participate in a successful petition by 10 percent.[30] In the discussion below, I compare the outcome of the counterfactual experiment with the outcome of a baseline simulation of the model. Outcomes of interest include the number of firms participating in each petition, as well as the outcome of the petition.

When the average per firm cost of filing a petition increases by 10 percent the number of petitions filed falls dramatically by 49.1 percent. The average number of firms participating in each petition also decreases slightly to 3.7, or 38.8 percent of all firms in the industry. As the private costs of joining the petition increase fewer firms are willing to invest in the rent-seeking activity and the free rider problem is exacerbated. The distribution of case outcomes does not change significantly when the cost of filing a petition increases. For example, it continues to be the case that slightly over half of those petitions not settled out of court are successful. It is true that when the costs of filing a petition are higher, only those petitions with higher returns will be filed. The results from the simulation, therefore, suggest that there are often significant returns to filing a petition even when it is unsuccessful.[31]

The second experiment rewards firms that participate in successful antidumping petitions with additional private benefits. The experiment is intended to mimic a change in U.S. antidumping law that was passed in 2000 known as the "Continued Dumping and Subsidy Offset Act," or the "Byrd Amendment," which requires the government to distribute the tariff revenue collected due to successful antidumping petitions to the firms that supported these petitions.[32] Critics of the law charge that it will increase the number of antidumping petitions filed in the United States.[33]

The results of the experiment confirm the accuracy of this criticism. When the private benefits to those firms participating in a successful antidumping petition are increased by

[30] In each experiment, I use the structural parameter estimates and draws of the model's errors to simulate the number of firms choosing to participate in each opportunity; if the industry chooses to file a petition, I also simulate the outcome of the petition. Choices are simulated for six draws of the error terms.

[31] This result mirrors the results from other studies of the "investigation effects" of petitions. For example, Staiger and Wolak [1994] find that antidumping petitions reduce the flow of imports during the period of investigation by half of the reduction that would be expected if the petition is successful.

[32] In September 2002, the World Trade Organization ruled that the law violates the international agreement on subsidies. However, the United States has yet to repeal the law.

[33] Elizabeth Olson, "U.S. Law on Trade Fines is Challenged Overseas," *New York Times,* July 14, 2001.

10 percent, the number of petitions filed over the sample period increases by 9.3 percent. Moreover, more firms choose to actively participate in these petitions; the average proportion of eligible firms filing antidumping petitions increases by 1.6 percentage points under the counterfactual experiment. On the whole these petitions are more successful, suggesting that not only will more petitions be filed but the total level of antidumping protection will rise when the private benefits of participating are increased. Under the experiment, the percentage of cases settled out of court falls by 1.4 points because firms only receive the additional private benefits if the government imposes a tariff. Of the remaining petitions, however, the percentage of successful cases increases by 5.3 percentage points and the average antidumping tariff increases by 12.1 percent from the baseline model. Because firms are only awarded additional private benefits when a petition is successful, and these benefits increase with the tariff, the policy change increases the number of successful petitions filed by firms but the number of unsuccessful petitions remains the same. In total, the number of successful petitions filed by firms increases by 30.3 percent from the baseline model.

6 Conclusion

This research develops and estimates a model of a firm's decision to engage in the rent-seeking activity of filing an antidumping petition. The model hypothesizes that industries are able to overcome the free rider problem associated with lobbying for trade protection because firms who choose to actively lobby will receive private benefits in the form of an increase in the level of protection. The parameter estimates support this hypothesis. The results also support predictions that industries characterized by either high concentration levels or large numbers of firms are less likely to overcome the free rider problem.

The results from the model confirm theoretical predictions about the distribution of trade protection in an economy. For example, parameter estimates indicate that the level of antidumping protection provided by the government is a function of both economic and political factors, as suggested by the theoretical research on the political economy of trade policy and bureaucratic decision-making. The parameter estimates also confirm that the larger the amount of private-information held by the domestic and foreign industries, the less-likely these parties will be able to reach a welfare-enhancing negotiated settlement following the initiation of an antidumping investigation.

Policy experiments suggest that even small changes in antidumping law can dramatically change the number of antidumping petitions filed each year. For example, a 10 percent increase in the cost of filing a petition results in a nearly 50 percent decrease in the number of petitions filed. In contrast, increasing the private benefits of participating in a successful petition by only 10 percent increases the number of successful antidumping petitions filed by industries by slightly over 30 percent. In general, the results indicate that the level of trade protection in an economy is strongly influenced by policies that help or hinder industries overcome the free rider problem.

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A Simulation Details

The model described in Section 2 makes a distinction between situations in which the industry has no opportunity to file against country k and situations in which an opportunity to file exists but no firms choose to actively participate in the petition. Unfortunately, I cannot distinguish between these two events in the data. Because I do not observe the number of antidumping petitions each industry has the opportunity to file against country k in period t, I need to simulate this number of opportunities. The simulator must be constructed in such a way that it guarantees that the number of opportunities each industry has to file exceeds the number of petitions actually filed by the industry in period t.

Allowing the number of opportunities to vary as I update my parameter values causes discontinuities in the likelihood function. In order to ensure that the estimation procedure is continuous in the parameter space, I keep the number of opportunities to file constant throughout the estimation procedure. As I update my parameter values, the term in the likelihood function that incorporates the probability of observing a particular number of opportunities is smoothed in the parameter space using the probability of observing those opportunities based on the initial parameter choice.

Define P_{kjt} as the number of petitions actually filed by industry j against country k. Consider the following algorithm[34]:

1. Choose an initial value of the parameters, θ_o.

2. For each industry/country combination, draw a random variable ζ_0^R from a Gamma (θ_o^F) distribution, and calculate the rate at which opportunities arise $\lambda_{kjt} = \exp[X_{Fkjt}\beta_F + \ln \zeta_o^R]$.

3. For each industry, country and year combination, draw a random variable (o_{kjt}^o) from a Poisson(λ_{kj}) distribution, conditional on the fact that $o_{kjt}^o \geq P_{kjt}$. Define o_{kjt}^o as the number of opportunities industry j has to file against country k in period t.

[34]This algorithm uses the multiplication method to draw random variables from a Poisson distribution. The multiplication method has been shown to be a preferred simulation method when λ_{kjt} varies for each observation.

As noted above, I keep the number of opportunities (o^o_{kjt}) constant throughout my estimation procedure. As the parameter values, θ, are updated, I calculate the probability of observing o^o_{kjt} opportunities based on the new parameter values, and smooth this probability in the parameter space using the probability of observing o^o_{kjt} based on the initial parameter values. Mathematically, this can be written as:

$$\frac{\Pr(\Omega_{kjt} = o^o_{kjt}|\theta)}{\Pr(\Omega_{kjt} = o^o_{kjt}|\theta_o)}.$$

This algorithm can be interpreted as an importance sampling simulator by rewriting the probability of observing a particular number of opportunities as:

$$\Pr(\Omega_{kjt} = o\ |\theta) = \frac{\Pr(\Omega_{kjt} = o|\theta)}{\Pr(\Omega_{kjt} = o|\theta_o)} \Pr(\Omega_{kjt} = o|\theta_o)$$