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Kara M. Reynolds

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Overcoming Free Riding: A Cross Country Analysis of Firm Participation in Antidumping Petitions

Kara M. Reynolds[**]

Abstract

This research is one of the first attempts to investigate the proliferation of antidumping protection from the firm-level and, in particular, to study the reasons why the free-riding problem may be more or less severe in particular countries or industries. Using a panel of data on the number of firms filing antidumping petitions in 10 countries between 1995 and 2005, I study the determinants of the industry's ability to overcome the free-riding problem. I find clear evidence that more firms will participate in antidumping petitions the lower the cost of filing; these filing costs significantly decrease in such variables as the number of countries targeted at one time and the level of development of the country. There is little evidence, however, that firms perceive that the expected benefits of the petition will be higher if they choose to participate, thus alleviating the free-rider problem. A separate statistical evaluation of actual case outcomes suggests that this perception may be valid.

Key words: antidumping, free riding

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[**] American University. Contact: Kara M. Reynolds, Department of Economics, American University, 4400 Massachusetts Avenue, NW, Washington, DC 20016-8029. Email: Reynolds@american.edu.

I. Introduction

There has been an explosion of research in recent years documenting the increase in antidumping protection across the world. Much of this research has focused on the macroeconomic and political determinants of the demand and supply of antidumping protection, such as how changes in the economic growth rate or average tariff rate in the importing country impacts the number of antidumping petitions considered by that country. However, the decision to file for antidumping protection is made by individual firms, thus in order to fully understand the proliferation of antidumping protection one must look at the determinants of the firm-level decision.

Unlike other forms of rent-seeking, all firms within an industry benefit from the imposition of most forms of trade protection, including antidumping protection. However, only those who actively lobby for protection have to pay the costs of such rent-seeking. As a result, trade protection, and antidumping protection in particular, has many of the same characteristics as public goods in the sense that an industry's ability to seek protection will be plagued by the free-rider problem. In other words, firms prefer to let their competitors pay for the costs of filing for antidumping protection; industries in which all of the firms choose to free-ride off of the lobbying efforts of their competitors will not file for antidumping protection.

The extent of the free-rider problem in antidumping filings can be seen in statistics on the number of firms filing individual antidumping petitions. Figure (1) presents a histogram of the number of firms filing antidumping petitions in ten countries between 1995 and 2005. Nearly 50 percent of all antidumping petitions are filed by a single firm, while nearly three-quarters of all petitions are filed by fewer than three firms.[1] This fact could be due to two possible explanations related to the free-rider problem. First, it is possible that the only industries that are able to overcome the free-rider problem to file for antidumping protection are industries with a small number of firms. This possibility has been proposed in a number of theoretical papers of rent seeking such as Magee (2002). Intuitively, in industries characterized by a small number of firms, the firm-specific benefits of protection are higher and concentrated among a few firms, thus increasing the incentives to lobby for protection. In the most extreme case, monopolies are unable to free-ride on their competitors, thus they are guaranteed to file for protection as long as the expected benefits of the petition exceed the costs. The second possibility is that few firms choose to contribute to the filing of antidumping petitions because the rest of the firms within the industry are rationally choosing to free-ride off of their competitors who are willing to pay the costs of the petition.[2]

Clearly the ability to overcome the free-rider problem will vary depending on industry-specific characteristics such as the level of competition within the industry. This heterogeneity across industries can clearly be seen in Figure 2, which graphs the average number of firms participating in antidumping petitions filed by the 27 three-digit ISIC Rev. 2 industries included in this research. There is clearly a large variation in the average number of firms filing petitions

[1] The WTO antidumping agreement specifies that countries can only institute an antidumping investigation if it demonstrates that at least 25 percent of the industry is in support of the petition, or at least 50 percent of those firms in the industry that support or oppose the petition. However, 25 percent of the industry does not actually have to file the petition, just be in favor of the protection requested by those filing the petition.

[2] An alternative explanation not related to free-riding may be that other firms in the industry are more competitive or more integrated in the global marketplace and, thus, are against the imposition of antidumping protection.

across industries, ranging from 1 in the mining industry to 7 in the fishing industry. The total number of petitions filed by each industry, denoted by the numbers at the base of each column, also varies significantly; nearly 30 percent of all antidumping petitions are filed by the industrial chemical industry compared to only a single case by the mining industry. It is reasonable to assume that the free-riding problem is less severe in industries that file a large number of antidumping petitions or in which a large number of firms choose to file for antidumping protection.

Perhaps more surprising is that there appears to be heterogeneity in the ability of industries to overcome the free riding problem across countries. Figure 3 graphs the average number of firms filing antidumping petitions in ten of the leading users of antidumping protection between 1995 and 2005. This average ranges from a low of 1.2 in Australia to a high of 5.7 in the European Union. As has been well documented elsewhere, the total number of petitions filed in each country, which is reported in the base of each column, also varies significantly, with the most petitions filed in India, the United States, and the European Union. As with the industries, one reasonable interpretation of these figures is that the free-riding problem is less severe in countries in which you see a large number of firms filing each petition or in countries that file a large number of petitions. What is not clear from the statistics is what is driving this heterogeneity. It may be possible, for example, that the heterogeneity across countries is driven in the industrial composition of production in the country. Alternatively, the heterogeneity might be explained by characteristics of the antidumping petition process or the political system in the country that alter the costs and benefits of applying for protection.

This research is one of the first attempts to investigate the firm-decision to file for antidumping protection and, in particular, to study the reasons why the free-riding problem may be more or less severe in particular countries or industries. Using a panel of data on the number of firms filing antidumping petitions in 10 countries between 1995 and 2005, I study the determinants of the industry's ability to overcome the free-riding problem. I find clear evidence that more firms will participate in antidumping petitions the lower the cost of filing; these filing costs significantly decrease in such variables as the number of countries targeted at one time and the level of development of the country. There is little evidence, however, that firms perceive that the expected benefits of the petition will be higher if they choose to participate, thus alleviating the free-rider problem. A separate statistical evaluation of actual case outcomes suggests that this perception may be valid.

II. Literature Review

As noted in the introduction, there is an increasing literature studying the determinants of the proliferation of antidumping protection in the world. For example, Knetter and Prusa (2003) and Feinberg (2005) study some of the macroeconomic determinants of the number of petitions filed by individual countries in a given year, including changes in the country's real exchange rate and its gross domestic product. Feinberg and Reynolds (2006, 2007) find that the probability of an industry filing an antidumping petition against a particular trading partner increases if the trading partner filed antidumping actions against it in the previous year (a so called retaliation effect) and with the degree of tariff liberalization in the domestic industry.

However, these papers analyze antidumping filings from the point of view of a country or industry. In fact, antidumping petitions are typically filed by a subset of firms within an industry. In order to fully understand the proliferation of antidumping protection, it is important to understand how individual firms make the decision to file for protection. In other words, it is important to understand why some industries are able to overcome the free-riding problem to file for protection, while others cannot.

A number of theoretical papers have hypothesized as to why some industries are better able to overcome the free-rider problem and successfully lobby for protection. For example, Grossman and Helpman (1996) find that sunset industries are better able to prevent new entrants and, thus, are better able to overcome the free-rider problem associated with collective actions. Magee (2002) identifies conditions under which increasing the number of firms in an industry makes overcoming the free-rider problem more difficult; specifically, he finds that an increase in the number of firms (or a decrease in industry concentration) makes the free-rider problem more severe as long as the number of firms in the industry is "sufficiently large."

Only a handful of previous studies have developed theoretical models to evaluate the decision of individual firms to contribute to an antidumping petition in the face of free-riding. For example, Herander and Pupp (1991) develop a model of firm decision making in which a representative firm will only voluntarily contribute to an antidumping petition if the expected benefits of contributing exceed the expected costs; in their model, the chief benefit of contributing to the petition is that it may increase the probability that the petition will be successful. The authors hypothesize that the firm is more likely to believe that its contribution will significantly increase the probability of success if (1) it believe its interests are not being adequately represented by other firms or (2) its contribution increases the probability that the petition will be filed at all.

Olson (2004) develops a similar model which hypothesizes that some industries are able to overcome the free-rider problem associated with filing an antidumping petition because the expected level of antidumping protection increases with the number of firms in the industry that actively file the petition. In other words, the government is more likely to impose protection, or impose a higher level of protection, when a greater number of firms in the industry actively file the antidumping petition.

Empirical tests seem to confirm some of these theoretical predictions. Herander and Pupp (1991) find that the number of firms participating in steel antidumping petitions in the United States decreases with the expected costs per firm, as measured by the total number of petitions filed per firm in the industry. They also find that the free-rider problem is less severe for industries where benefits are concentrated among a few large firms, as measured by the percentage of vertically integrated firms, and which are represented by a trade association. Both Herander and Pupp (1991) and Olson (2004) find evidence that the level of protection awarded by the government significantly increases with the number of firms contributing to antidumping petitions in the United States.

This research expands upon previous studies such as Herander and Pupp (1991) and Olson (2004) by investigating the heterogeneity across industries and countries in the ability of industries to overcome the free-riding problem and file for antidumping protection. As described

in more detail in the next section, I study the number of firms actively filing for antidumping protection in a panel of all antidumping petitions filed in 10 countries between 1995 and 2005 to make inferences about what factors make some industries more able to overcome the free-riding problem.

III. Model and Data

Like Herander and Pupp (1991) and Olson (2004), I assume that firms will contribute to an antidumping petition only if the expected benefits from contributing exceed the expected costs. Firms derive benefits from contributing to the petition when the expected level of protection associated with filing the petition increases because of its participation. In other words, define the expected net benefits *(B*)* of contributing to a petition for a representative firm as:

$$B^* = (\pi_C - \pi_{NC})B_C + \pi_C(B_C - B_{NC}) - Costs \tag{1}$$

where π represents the probability that the petition will be successful, *B* represents the increase in profits that would accrue to the firm following a successful petition, and the subscripts indicate whether the firm is choosing to contribute (C) or not contribute (NC) to the petition.

In making their determination, the representative firm will believe that there are positive benefits from participating when (1) their participation significantly increases the likelihood that protection will be awarded, (2) their participation will significantly increase the level of protection that will be awarded by the government, or (3) both. Note that even if the expected benefits of contributing are small, the firm may still contribute to the petition if the costs of participating are small. The more firms that perceive that the benefits of contributing exceed the costs the easier it will be for the industry to escape the free-riding problem and the more firms will file the antidumping petition.

Data

The basis for the dependent variable used in this research, the number of firms filing each antidumping petition, is the list of domestic firms filing the antidumping petitions included in the Global Antidumping Database.[3] The database includes detailed information on all antidumping petitions filed by 19 of the leading users of antidumping, including the harmonized system (HS) codes and foreign firms targeted by each petition, the domestic firms filing each petition, and the petition outcomes. The research presented here uses the petitions filed by ten of the leading users of antidumping since the formation of the World Trade Organization in 1995.[4]

I supplemented the information in the Database when necessary, particularly when the firms filing the petition were missing from the Database or the Database listed a trade association as the petitioner, using case information from each individual country.[5] Unfortunately I was unable to obtain petitioner information for 10.6 percent of the slightly more than 2,000 petitions filed

[3] See Bown (2007) for a complete description of the database.
[4] Countries in this research include: Argentina, Australia, Canada, China, the European Union, India, Mexico, New Zealand, the United States, and South Africa.
[5] This supplemented petitioner information is available from the author upon request.

during my sample period. In some cases, particularly in South Africa, I was unable to find the original case information to obtain the petitioner information. In other cases, the investigating country chose not to release the names of the firms in the trade association filing the petition.[6]

I expect the number of firms participating in each petition to increase with the expected benefits to the representative firm and decrease with the expected costs of the petition. The specific variables included in this research are discussed in more detail below.

Expected Benefits

As indicated in equation (1), the expected benefits of contributing to the filing of a petition *(B*)* are a function of the benefits that accrue to the firm following the imposition of an antidumping duty if the petition is successful *(B)*, the likelihood that the petition will be successful *(π)*, and the firms' perceived impact on the probability of success ($\pi_c - \pi_{NC}$) and level of protection ($B_C - B_{NC}$).

Unfortunately, there is no clear way of measuring the firm's perceived impact on the probability of success or the level of protection. Instead, I include a number of variables that have been found to impact the probability of success in previous research as well as other variables that I expect impact the benefits accruing to the firm following imposition of a duty. In this model, insignificant coefficients on these variables have two possible interpretations. First, the variables may not impact the probability of success or the benefits accruing to the firm as surmised. Alternatively, these variables impact the probability of success or the level of benefits, but firms believe that their contribution to the petition would have little impact on the expected benefits from the petition. If the later, the insignificant coefficients can be interpreted as an indication that firms within the industry have an incentive to free-ride.

As shown in a number of previous studies, the likelihood of an affirmative injury determination increases in the value of imports of the product from the country under investigation. For example, Reynolds (2009) finds that the likelihood of an affirmative injury determination increases in the targeted country's share of the investigating country's total imports of the product in most investigating countries and with the one-year growth in imports of the product from the targeted country in some investigating countries.[7] I calculate both measures using the commodity codes provided in the Global Antidumping Database and trade data from the United Nations' Commodity Trade Statistics Database, which provides import data at the six digit HS level.[8]

It is possible that macroeconomic conditions in the domestic economy could alter the probability that a petition will be successful. For example, both Knetter and Prusa (2003) and Feinberg

[6] The missing petitioner problem is most pronounced in investigations undertaken by Argentina (29 percent of cases) and the European Union (21 percent of cases). Although the missing value problem could result in a selection bias in the results presented here, I leave investigating the extent of this bias to future research.
[7] Specifically, the share of imports had a significant positive impact on the likelihood of an affirmative determination in five of the nine countries studied in Reynolds (2009), while the one-year growth in imports had a significant positive impact on the likelihood of affirmative determination in the United States and European Union.
[8] I was unable to obtain import data for 66 of the petitions in the sample due primarily to changes in the trade classification system around the time of the petition. These petitions are excluded from the analysis.

(2005) find that countries are more likely to file petitions following a real appreciation of a country's currency or a fall in the country's GDP growth, at least in Australia, Canada, European Union, and the United States. The authors hypothesize that both factors make it more likely that the government will find that the domestic industry has been injured by imports from the foreign country, resulting in the imposition of antidumping duties. To account for these macroeconomic determinants I include variables measuring the two year appreciation of the country's exchange rate and growth in real GDP.[9]

The final variable that I include that could alter the probability of success is the average size of the industry, as measured by the log of the industry's average value added over the period 1995 to 2004. Empirical studies of the likelihood of success of U.S. antidumping petition, such as Hansen (1990), have found some evidence that larger industries have more political sway and are better able to secure antidumping protection. I calculate this variable using data from the World Bank's Trade, Production and Protection Database.[10] Unfortunately, this variable suffers from a large miss-measurement problem. Specifically, I have data not on the size of the specific industry filing the antidumping petition, but rather of the three-digit ISIC Rev. 2 industry

I include two additional variables that I hypothesize could impact the benefits that would accrue to the firm following a successful petition. One might also expect that the benefits of the petition would increase with the total value of imports from the country targeted in the petition. Like the import-related variables discussed above, the UN's Commodity Trade Statistics Database provides the import data for the six digit HS product targeted in the petition. Finally, one might expect that the per firm benefits of the petition will fall with the total number of firms in the industry, or the more competitive the industry. Although I do not observe the total number of firms in the industry, I include the number of establishments in the three-digit ISIC Rev. 2 industry from the World Bank's Trade, Production and Protection database to proxy for this possibility.[11]

Expected Costs

The costs associated with filing an antidumping petition are primarily legal costs that are fixed in the number of domestic firms filing the petition. The industry must demonstrate the presence of less than fair value pricing on the part of the foreign industry, as well as that these unfair pricing strategies are causing injury to the domestic industry. Typically an industry filing an antidumping petition will hire a single representative or counsel to assemble a petition on behalf of the entire industry. Although I do not observe the actual costs of filing the petitions, the variables described below serve as proxies for the per firm costs of the petition as well as the coordination costs associated with organizing the industry to file the petition.

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[9] These variables are calculated using the real effective exchange rate index and constant GDP data, respectively, from the World Bank's World Development Indicators.

[10] See Nicita and Olarreaga (2006) for more information on this database. I use the average over the period rather than the year-specific values because of the large number of missing values in the database. Note that I take the average over just the non-missing values. Unfortunately, the number of missing values, and the years for which the data is missing, does vary by country and industry but the resulting values should still serve as a proxy for the relative size of the industry within the investigating country.

[11] Like the value added variable, I use the average for the industry over the 1995-2004 period in order to minimize the number of missing values in the final dataset.

In many instances, firms will file antidumping petitions against multiple countries at a time. Although each country targeted by the industry is counted as a separate petition, the average costs of filing against each additional country likely decreases with the number of countries targeted. For example, in antidumping filings targeting multiple countries, firms submit pricing and cost information for each individual country but the information describing the economic conditions in the domestic industry only needs to be submitted once. Previous research such as Hansen and Prusa (1996) and Tharakan et al. (1998), among others, have found that the likelihood an affirmative injury determination significantly increases if the government chooses to cumulate the imports from multiple countries when making their decision.[12] Given that the per petition filing costs are decreasing, while the expected benefits of the petition are increasing, in the number of countries targeted, one would expect the number of firms filing the petition to increase with the number of countries targeted simultaneously, as measured by the variable *Multiple Cases*. I calculated this variable using the case information from the Global Antidumping Database.

Contributions to non-firm entities such as labor unions would reduce per firm filing costs. Almost 5 percent of the petitions of the sample were filed in part by a labor organization. While these entities are not included in the count of *firms* filing the petition, I include as an explanatory variable a dummy variable measuring whether the petition was filed by a labor organization.

I also include whether the firms filed the petition as a trade association. Firms who are already members of a trade association may find it less expensive to coordinate the firms within the industry to file an antidumping petition. They may also find it easier to coerce firms within the industry to participate, thus avoiding the free riding problem. Although in many cases the associations were formed long before the antidumping petition was filed, it is possible that in other cases the association was formed specifically with the intent of filing the antidumping petition.

Finally, I include two country-specific factors that may impact the per firm costs of filing antidumping petitions. First, one might expect the costs of filing for protection to vary by the level of democracy in the country. For example, firms in highly democratic countries may have better access to legal representatives or be more familiar with compiling legal documents, thus reducing their filing costs. I proxy for this possibility using the "Polity" variable from the Polity IV Project on Political Regime Characteristics and Transitions. As explained in Marshall and Jaggers (2009), the polity variable is constructed by subtracting an index measuring the level of autocracy in the country from an index measuring the level of democracy in the country. The resulting measure ranges from +10 (strongly democratic) to -10 (strongly autocratic).

For similar reasons, one might expect the per firm filing costs to be a function of the level of development of the country. The more developed countries in my sample, including the United

[12] The WTO's Antidumping Agreement allows investigating authorities to cumulatively assess the impact of imports from multiple countries targeted by simultaneous antidumping petitions on the domestic industry as long as such cumulation is appropriate under the conditions of competition between the imported products and domestic producers. This cumulation procedure was used by both the United States and European Union prior to passage of the WTO's Antidumping Agreement.

States, Canada, European Union, and Australia, also have a longer history of using antidumping protection than the less developed countries such as India and China, which could result in lower filing costs for the firms within these countries. I measure the level of development using GDP per capita data from the World Bank's World Development Indicators.

Table 1 includes summary statistics of the explanatory variables included in this research.

Empirical Strategy

As illustrated in Figure 1, the number of firms choosing to actively participate in antidumping petitions ranged from 0 to 17. Nearly 50 percent of all petitions were filed by a single firm, while the average number of firms filing these petitions was 2.86. This data can clearly be described as a discrete count of the number of participating firms, which by definition must be truncated at zero. As a result of this distribution, treating the data using linear regression models would result in biased estimates. Instead, I estimate the parameters of the model using a panel count model.

As discussed above, the number of firms filing each petition will increase as the expected net benefits of filing, modeled in equation (1), increase. Define the dependent variable y_{ijp} as the number of firms in country j and industry i filing petition p and μ_{ijp} as the expected number of firms that will file this petition.[13] These variables can be defined by the expressions:

$$E(y_{ijp}) = \mu_{ijp} \tag{2}$$

$$\ln(\mu_{ijp}) = \delta_{ij} + w_{ij}\gamma + x_{ijp}\beta \tag{3}$$

where δ_{ij} includes all unobserved factors about country i and industry j that alter the net benefits of filing the petition, w_{ij} and x_{ijp} are vectors of observed country and industry-specific factors and case-specific factors, respectively, that alter the net benefits of filing, and γ and β are vectors of parameters to be estimated. In the Poisson regression model, the dependent variable is assumed to follow a Poisson distribution with parameter μ_{ijp}, which results in the following probability for each observation:

$$\Pr(y_{ijp}|w_{ij}, x_{ijp}) = \frac{\exp(-\mu_{ijp})\mu_{ijp}^{y_{ijp}}}{\Gamma(y_{ijp}+1)}. \tag{4}$$

One problem with the Poisson count model is that it assumes that the mean of the dependent variable equals the variance, or $E(y_{ijp})=var(y_{ijp})=\mu_{ijp}$. Both the summary statistics and statistical tests suggest that the data in this sample exhibits over dispersion, or that $var(y_{ijp})>E(y_{ijp})$.[14] One

[13] In this research, the industry i is defined by the three digit ISIC Rev. 2 category of the more specific industry filing the petition.

[14] The variance of the number of firms filing antidumping petitions is 7.25, compared to the mean of 2.86. Goodness of fit tests on the pooled sample rejects the use of the Poisson model in favor of a model that accounts for over dispersion.

potential solution to this problem is to introduce a gamma distributed error to account for the over dispersion; the resulting model is known as the negative binomial model.

The unobserved heterogeneity in the model, as captured in the variable δ_{ij}, further complicates estimation. As in most panel regressions, unobserved heterogeneity can be modeled as a fixed effect or a random variable that follows some known distribution. Although random effects can be more efficient in some cases, if the unobserved component δ_{ij} is correlated with the explanatory variables use of the random effects model will result in biased coefficient estimates. Hausman tests suggest in this case that random effects are inappropriate.

The fixed effects negative binomial model included in many statistical packages such as Stata is one formulated in Hausman, Hall and Griliches (1984). The following equations represent one way to describe their proposed model:

$$\ln(\mu_{ijp}) = w_{ij}\gamma + x_{ijp}\beta$$

$$E(y_{ijp}) = \theta_{ij}\mu_{ijp} \tag{5}$$

$$var(y_{ijp}) = (1 + \theta_{ij})\theta_{ij}\mu_{ijp}$$

Hausman, Hall and Griliches (1984) propose estimating the model by conditioning on the total number of firms filing all petitions within a particular industry and country, thereby eliminating the fixed effects. As discussed in both Allison and Waterman (2002) and Greene (2007), the problem with this model is that the country-industry specific fixed effects do not act as a fixed effect as we traditionally think of them—they do not represent unobserved factors that alter the average number of firms filing each petition as the other explanatory variables do. Instead the fixed effects in this model measure unobserved heterogeneity in the variance of the number of firms.

Instead, I follow the suggestion in Allison and Waterman (2002) and Greene (2007), and estimate an unconditional fixed effects negative binomial estimator. Specifically, I estimate a negative binomial model with the mean and variance defined by:

$$\ln(\mu_{ijp}) = \delta_{ij} + w_{ij}\gamma + x_{ijp}\beta + \varepsilon_{ijp}$$

$$E(y_{ijp}|w_{ij}, x_{ijp}) = \mu_{ijp}$$

$$Var(y_{ijp}|w_{ij}, x_{ijp}) = \mu_{ijp}(1 + \kappa\mu_{ijp}) \tag{6}$$

In this model, the error ε_{ijp} is a gamma distributed error with a mean of one and a variance equal to $\kappa = \frac{1}{\theta}$. The probability of each observation is defined as:

$$\Pr(y_{ijp}|w_{ij}, x_{ijp}) = \frac{\Gamma(y_{ijp}+\theta) r_{ijp}^{\theta} (1-r_{ijp})^{y_{ijp}}}{\Gamma(y_{ijp}+1)\Gamma(\theta)}, r_{ijp} = \frac{\kappa}{\kappa+\mu_{ijp}} \tag{7}$$

As in other fixed effects models, one of the main drawbacks of this approach is that it is impossible to estimate the parameters on the petition-invariant variables included in the vector w_{ij}. Because I am particularly interested in country and industry specific factors that might mitigate the free rider problem, in alternative specifications I present a random effects model with country and industry specific variables despite the fact that Hausman tests suggest that correlation between the random effect and the explanatory variables may result in biased results. The parameter estimates are for the most part fairly stable across specifications.

Other Empirical Problems

In a perfect world, the empirical model described above would provide reliable estimates of what drives firms to participate in antidumping petitions. In particularly, I hypothesize that the free-riding problem is less severe in those industries in which we see more firms choosing to actively participate in antidumping petitions. Thus if the parameter estimates indicate that an increase in the explanatory variable will increase the expected number of firms participating in the antidumping petition, I can interpret this to mean that an increase in the variable increases the net benefits of participating, thus diminishing the free-rider problem. Unfortunately, this hypothesis, and the proposed empirical model, suffers from two major short comings.

Perhaps the biggest problem with the analysis is that I do not observe one of the most important determinants of the number of firms choosing to file for antidumping protection—the total number of firms in the industry.[15] To better illustrate how this omitted variable alters the interpretation of my results, consider the two following extreme examples. First, assume that there are 10 firms in all of the industries filing antidumping petitions in the sample; the more firms that I observe filing the antidumping petitions, the fewer free-riders in the industry. In this example, the parameters of the model estimate the impact of the explanatory variables on the ability of the industry to prevent free-riders, as I hypothesize. The industry/country fixed effects control for unobserved factors that influence the ability to overcome the free-rider problem.

In contrast, assume that all firms opt to participate in all of the antidumping petitions in the sample; in other words, there are no free-riders. In this case, the parameter estimates from the empirical model are really measuring the impact of the explanatory variables on the total number of firms in industries filing for antidumping protection. For example, the total number of firms might be lower in those industries with a great deal of import competition.

A second and related problem with the analysis is that the parameter estimates may suffer from a significant selection bias issue. In other words, the sample used in this analysis includes only those industries that have actually filed for antidumping protection; it excludes all those industries that were unable to overcome the free-rider problem or those that failed to file for protection. The parameter estimates could be biased if the explanatory variables are correlated with some common, unobserved characteristics associated with the industries in this sample that lead them to apply in the first place. For example, it is highly likely based on theoretical models of rent seeking that all of industries filing antidumping petitions are characterized by a small

[15] A better empirical model to analyze what factors allow firms to overcome the free rider problem, for example, might measure the impact of various explanatory variables, including the total number of firms in the industry, on the proportion of firms in the industry choosing to file for antidumping protection.

number of firms. If the total number of firms in the industry is correlated with particular explanatory variables, such as whether the industry is represented by a trade association, then the parameter on this explanatory variable will be biased.

Data limitations currently prevent me from correcting for either of these problems. Thus the results presented below must be viewed with these potential problems in mind.

IV. Results

Incidence rate ratios (IRR) from the unconditional negative binomial fixed effects model are presented in Column 1 of Table 2. Similar to a marginal effect, the IRR is the ratio of the counts predicted by the model when the variable is one unit above its mean (and all other variables are at their means) to the count when all variables are at their means. Thus an incident rate ratio of 1.1 indicates that a one unit increase in the variable results in a 10 percent increase in the number of firms filing the petition, while an IRR of 0.9 indicates that a one unit increase in the variable results in a 10 percent decrease in the number of firms filing the petition. The z-statistics are reported for a test of the null hypothesis that the IRR=1, which would indicate no relationship between the variable and the number of filing firms.

A number of the variables that I hypothesized would impact the probability that the antidumping petition would be successful are statistically significant. Recall that I proposed that this theoretically indicates that firms believe that their individual contributions will significantly increase the benefits from the petition.

Complicating this analysis, however, is the fact that the variables do not have the expected sign. In other words, if firms believe that their contribution will significantly increase the benefits accruing to the firm from a successful antidumping petition ($(B_C - B_{NC})$ in equation (1)), then one would expect the number of firms to increase with those factors that increase the probability that the petition will be successful, such as the targeted countries share of or growth in imports. Instead, the empirical results suggest that the number of firms significantly decreases in these variables. For example, the results suggest that a one percentage point increase in the targeted country's share of imports decreases the number of participating firms by nearly 30 percent. One possible explanation for this seemingly contradictory result is that the higher the expected probability that the petition will be successful, the less likely it is that firms will believe that their individual contribution will increase the expected benefits of the petition, or the more likely it is that firms will free-ride off of their competitors.[16]

Knetter and Prusa (2003) and Feinberg (2005) both find that countries are more likely to file antidumping petitions (i.e. the total number of antidumping petitions filed in a country increases) following an appreciation of a country's currency. Both papers hypothesize that this result is due to the fact that the probability that an antidumping petition will be successful increases as the country's currency appreciates. The results from this research seem to support this conclusion, as a one percentage point increase in the country's exchange rate results in a 40 percent increase in the number of firms filing for protection.

[16] This result is similar in nature to the result in Herander and Pupp (1991), who found a negative (but insignificant) impact of the import penetration ratio on the number of participating firms.

Neither the GDP growth rate not the total value of imports proved to be significant determinants of the number of firms participating in antidumping petitions.

Two of the variables that I include to proxy for the costs of filing for antidumping protection prove to be significant determinants of the number of firms participating in antidumping protection. As expected, industries represented by a trade association have 63 percent more firms contributing to their antidumping petitions. The number of firms choosing to contribute to an antidumping petition increases by 2.7 percent for every additional country targeted by the industry at a given time—in other words, the number of firms increases as the cost of the country-specific petition falls. The other case-specific variable that I proposed may change per firm costs, participation by a union, was insignificant.

Although statistical tests of the pooled dataset suggested that the data exhibited over dispersion, thus requiring the use of a negative binomial count model, the results from this estimation instead indicate that the negative binomial parameter which measures the degree of over dispersion is insignificant. In fact, the results from an unreported fixed effect Poisson model are virtually identical to the negative binomial results presented here. A visual inspection of the data confirms this dichotomy. Although there is over dispersion in the sample as a whole, the number of firms participating in antidumping petitions filed by individual industries and countries does not exhibit over dispersion. Thus, once unobserved industry and country characteristics are accounted for in the panel estimation, use of a negative binomial proves unnecessary.

As mentioned above, although the fixed effect model presents consistent and unbiased results, the downfall of the model is that I am unable to include industry and country specific characteristics that may prove interesting. I have not yet found a statistical method of estimating these case-invariant characteristics while still using fixed effects. Thus, in columns 2 through 4, I explore possible causes for heterogeneity using the results from a random effects Poisson model, where the random effects are modeled as a log gamma distributed error.

Column 2 includes identical explanatory variables as the negative binomial specification included in Column 1. Although the results are slightly different from the unbiased results from the negative binomial regression, most of this analysis is qualitatively the same as discussed above.

Column 3 includes the results of the random effects Poisson model using the same sample but with the addition of two country-specific variables, the GDP per capita and the level of democracy of the country. While the level of democracy proves to be insignificant, the results suggest that the number of firms participating in antidumping petitions significantly increases in the level of development of the country. Specifically, I find that a one hundred percent increase in the country's GDP per capita (or a one unit increase in the log of the GDP per capita) increases the number of participating firms by 12.6 percent. As noted above, the more developed countries in the sample have a longer history of use of antidumping protection; this result could indicate simply that industries with more experience using antidumping have lower costs of filing. Alternatively, it may be that more developed countries are characterized by firms with

more legal knowledge, thus reducing the costs of filing. Most of the other parameters exhibit the same qualitative results as discussed above.

Finally, the specification presented in Column (4) includes two industry-specific variables, the size of the industry as measured by its value added and the number of establishments in the three digit ISIC Rev. 2 industry. Unfortunately, inclusion of these two variables significantly reduces the sample due to the large number of missing values; sample differences could be driving the large number of differences from previous specifications. Although I still find that participation in a trade association increases the number of firms participating in antidumping petitions, none of the other variables that were significant in Specifications 1- 3 prove to be significant here.

Instead, I find that the number of firms increases in both the size of the industry and the number of establishments in the industry. Recall that I hypothesized that the probability of a successful antidumping petition would increase with the size of the industry, but that the benefits accruing to the firm would decrease in the number of establishments as the benefits are spread over a larger number of firms. Although these results seem to confirm my hypothesis regarding the size of the industry, they also suggest that the probability of a successful petition may increase with the number of establishments in the industry. Whether these results are being driven by sample selection bias or correlation of the random effect with the added explanatory variables remains to be explored.

Free-Riding and the Supply of Protection

The results presented above provide only weak evidence that firms believe that the probability that a petition will be successful, or the level of protection that will result from a successful petition, will increase with their participation. For example, I hypothesized that an appreciation of the exchange rate increases the probability that the petition will be successful; this will increase the number of firms filing the petition if firms believe that their contribution will increase the level of protection resulting from the successful petition. Parameter estimates indicate that the number of firms participating in antidumping petitions increases with an appreciation of a country's exchange rate.

In contrast, none of the other variables that I use to proxy for the expected benefits of the petition proved to be significant and of the hypothesized sign. The majority of parameter estimates, therefore, suggest instead that firms do not believe that their contribution will significantly alter the outcome of the petition. To further explore the accuracy of these beliefs, I use a probit model to estimate the economic and political determinants of injury decisions in antidumping cases in a pooled sample of case outcomes in seven of the countries in my sample.[17]

The explanatory variables and methodology are identical to those used in Reynolds (2009), which studies country-specific differences in antidumping injury determinations. However, to explore whether individual firms can alter the likelihood that a petition will be successful, I also include the number of firms filing the petition as an explanatory variable.

[17] The seven countries included in this sample are those countries that are included in both Reynolds (2009) and this research, including Argentina, Australia, Canada, the European Union, India, Mexico, and the United States.

The coefficient and elasticity estimates from the pooled sample are included in Table 3. Like Reynolds (2009), to account for common, unobserved determinants of the injury decision in each country, I use a random effects probit model and include year-specific dummy variables to account for global macroeconomic conditions. Surprisingly, the results suggest that instead of increasing the likelihood that a petition will be successful, the likelihood that the petition is successful decreases with each additional firm that contributes to the petition. Specifically, the elasticity estimates suggest that a one percent increase in the number of firms filing the petition results in a 0.6 percent decrease in the likelihood that the petition will be successful.

Country-specific regressions such as those carried out in Reynolds (2009) result in similar elasticity estimates.[18] Specifically, the number of petitions firms was an insignificant factor in petition outcomes in five of the seven countries in my sample. In the remaining two countries, Australia and the United States, the number of petition firms had a negative and significant impact on the likelihood of an affirmative injury determination. Note that this result is in direct contrast to the result in Herander and Pupp (1991), which found a positive and significant impact of the number of firms on case outcomes in those cases filed by the steel industry between 1982 and 1986.[19] It is unclear what could be driving this contradictory result. One possibility is the suggestion of other political economy studies of trade protection which suggest that more concentrated industries have more political power and, thus, are better able to secure trade protection.

The other parameters prove to be qualitatively the same as those discussed in Reynolds (2009). On average the likelihood that a petition will be successful increases in market share of the targeted country, the number of cumulated cases, and the economic growth rate in the targeted country. Cases filed against non-market economies are more likely to be successful.

Although I hypothesized that an appreciation of a country's currency would increase the likelihood that a petition would be successful, both the analysis presented here and the analysis discussed in Reynolds (2009) instead suggests that the likelihood that a petition will be successful decreases with an appreciation of the currency. This result calls into question what little evidence this research found that firms may believe that their individual contribution could significantly alter the outcome of the petition.

V. Conclusion

This research is one of the first attempts to investigate the proliferation of antidumping protection from the firm-level and, in particular, to study the reasons why the free-riding problem may be more or less severe in particular countries or industries. Using a panel of data on the number of firms filing antidumping petitions in 10 countries between 1995 and 2005, I study the determinants of the industry's ability to overcome the free-riding problem.

I find clear evidence that more firms will participate in antidumping petitions the lower the cost of filing. I show that filing costs significantly decrease in such variables as the number of countries targeted at one time and whether or not the industry is represented by a trade

[18] Results from these regressions are available from the author upon request.
[19] Limiting my sample to U.S. steel cases filed between 1995 and 2005 fails to significantly change the results.

association. I also find some indication that there may be some heterogeneity in filing costs across countries. Specifically, the results suggest that filing costs decrease in the level of development of the country. This may be due to the fact that more developed countries have a longer history of antidumping use, thus firms farther along the antidumping "learning curve" have lower costs. Alternatively, more developed countries may have a more developed legal structure that results in lower costs.

In contrast, I find little evidence that firms perceive that the expected benefits of the petition will be higher if they choose to participate, which would alleviate the free-rider problem. A separate statistical evaluation of actual case outcomes suggests that this perception may be valid. Using a sample of injury determinations in seven countries, I find that on average the likelihood that an antidumping petition will be successful decreases in the number of firms that file the petition. This result is particularly pronounced in Australia and the United States.

Econometric problems make further analysis difficult, but heterogeneity in the firm-level filing decisions across countries and industries remains to be explored.

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Figure 1
Number of Firms Filing Antidumping Petitions

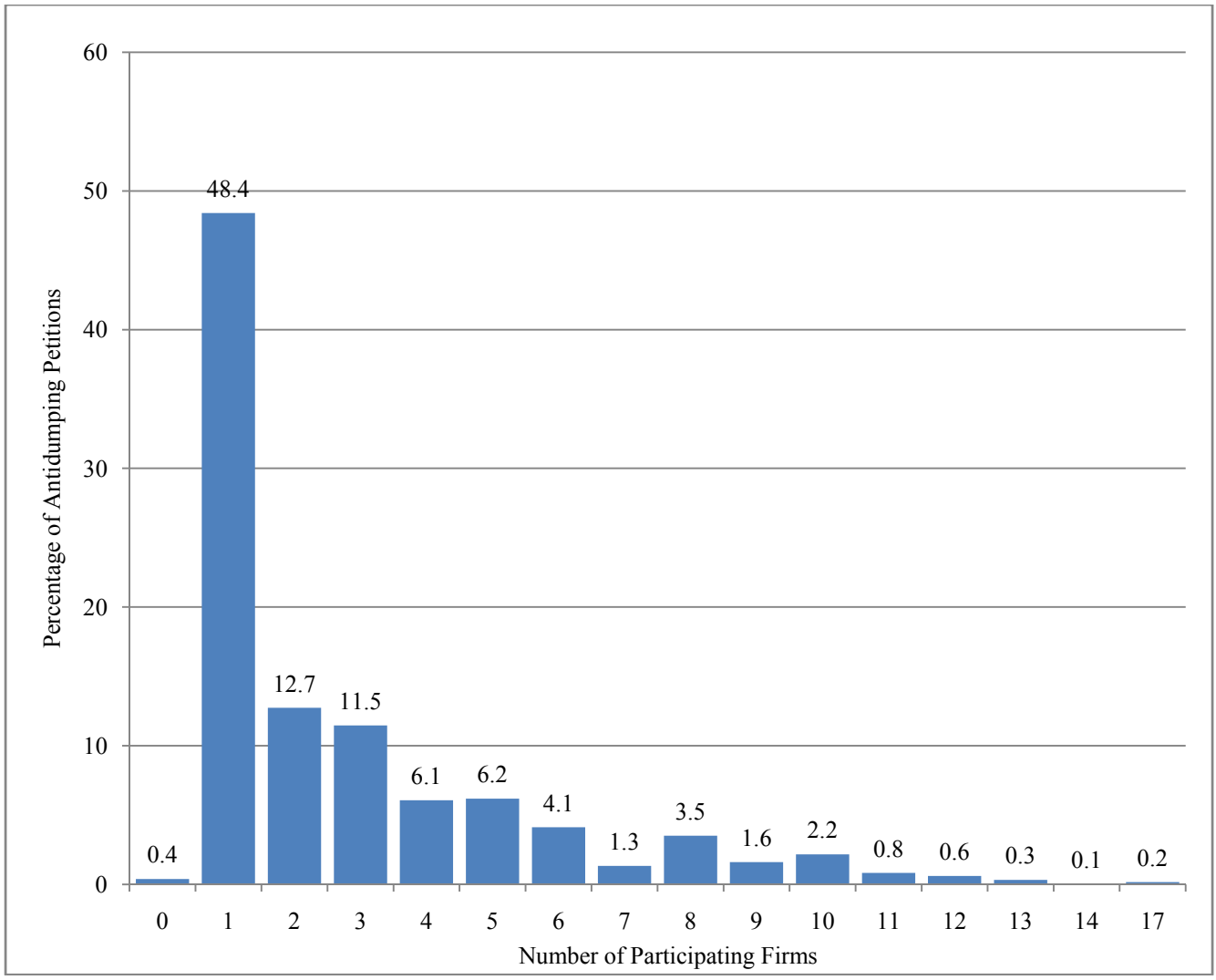
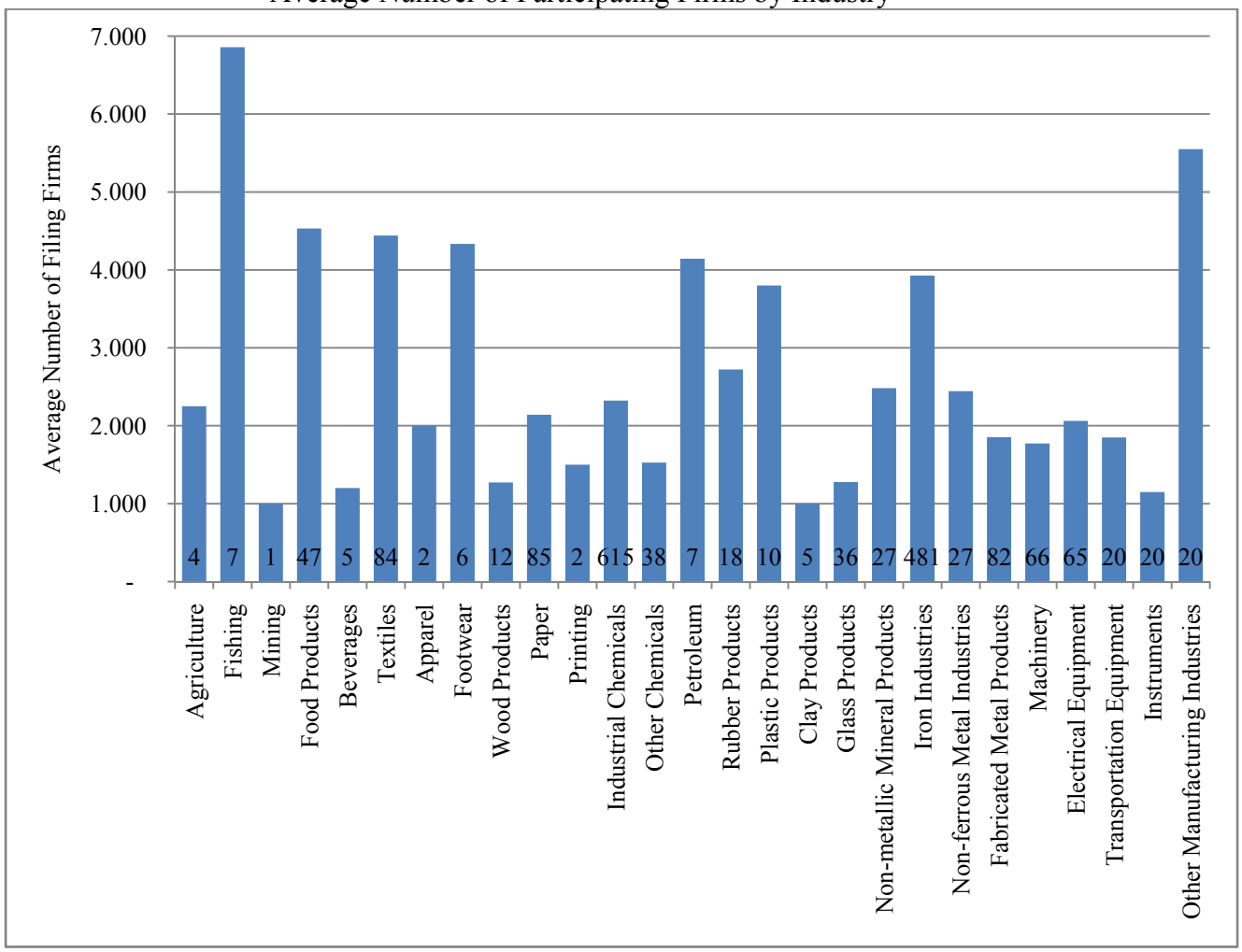
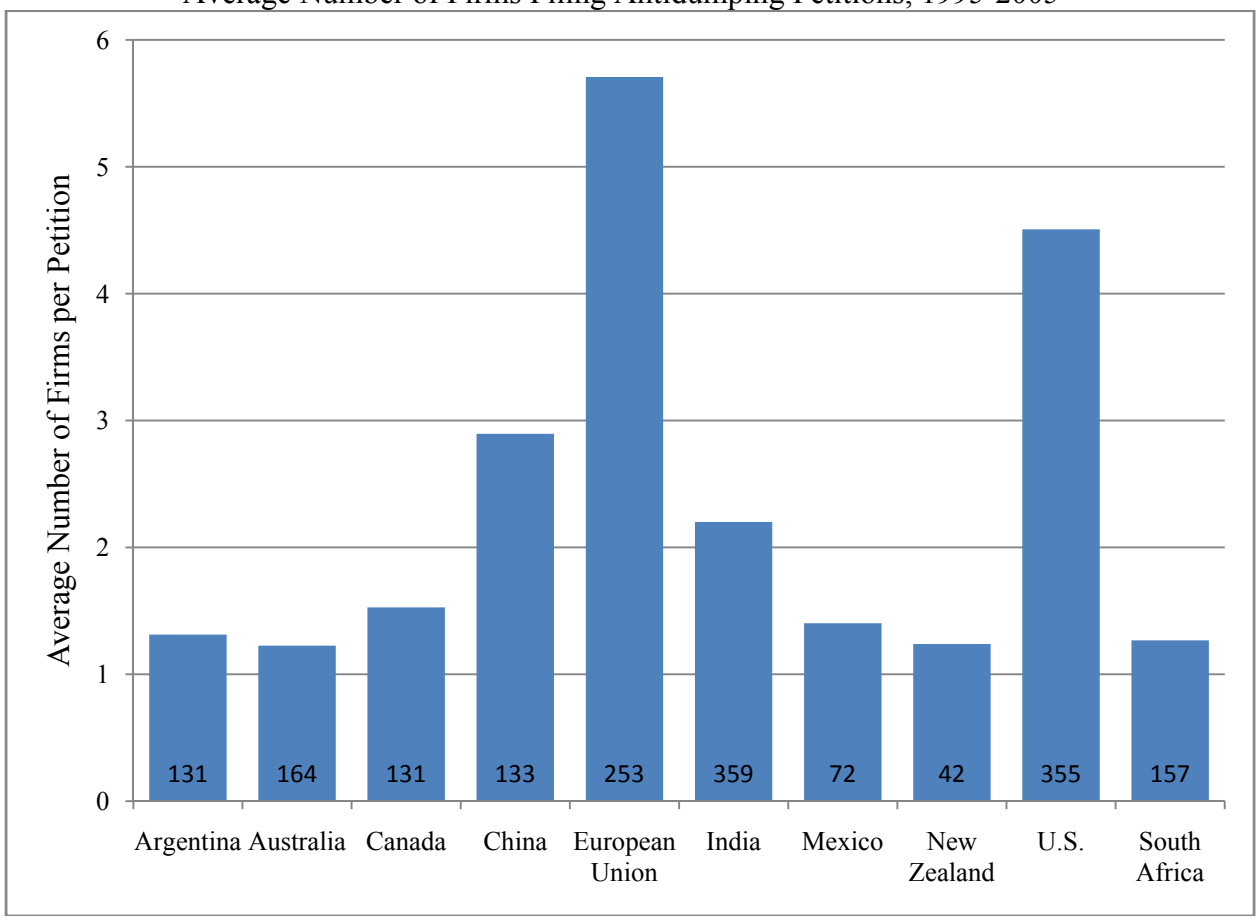


Figure 2
Average Number of Participating Firms by Industry[a]



[a] Industries defined by three-digit ISIC Rev. 2 descriptions. Values at base of column measure the total number of petitions filed by the industry.

Figure 3
Average Number of Firms Filing Antidumping Petitions, 1995-2005[a]



[a] Values at base of column measure the total number of petitions filed by the industry.

Table 1
Summary Statistics

Variable	Mean	Std. Dev	Min	Max
Number of Firms	2.92	2.71	0.00	17.00
Association	0.10	0.30	0.00	1.00
Union	0.05	0.22	0.00	1.00
Cumulated Cases	4.35	3.45	1.00	20.00
Log(Imports)	14.20	4.58	0.00	22.97
Target's Share of Imports	0.14	0.19	0.00	1.32
Target's One-Year Import Growth	-0.11	3.33	-17.23	21.72
GDP Growth	0.08	0.05	-0.16	0.20
Exchange Rate Appreciation	0.03	0.14	-0.26	1.12
Log(GDP per Capita)	8.76	1.63	5.92	10.52
Polity	8.07	4.50	-7.00	10.00
Log(Value Added)	15.40	1.50	11.45	18.68
Log(Number of Establishments)	7.74	1.71	2.77	12.06

Table 2
Determinants of the Number of Filers (IRR)[a]

Variable	(1)[b]	(2)[c]	(3)[c]	(4)[c]
Benefits				
Target's Share of Imports	0.748**	0.665**	0.676**	0.807
	(2.42)	(3.48)	(3.35)	(1.42)
Target's One-Year Import Growth	0.991*	0.990**	0.991	0.991
	(1.71)	(1.75)	(1.64)	(1.26)
GDP Growth	3.508	2.485	3.637*	0.302
	(1.54)	(1.32)	(1.76)	(0.96)
Exchange Rate Appreciation	1.408*	1.166	1.277	0.887
	(1.75)	(0.83)	(1.31)	(0.40)
Log(Imports)	1.007	1.011**	1.010**	1.003
	(1.64)	(2.48)	(2.30)	(0.52)
Log(Value Added)				1.153**
				(2.97)
Log(Number of Establishments)				1.155**
				(2.45)
Costs				
Association	1.630**	1.674**	1.677**	2.388**
	(9.15)	(10.04)	(10.07)	(12.19)
Union	1.070	1.100	1.089	
	(0.98)	(1.41)	(1.25)	
Cumulated Cases	1.027**	1.028**	1.028**	1.001
	(5.23)	(5.55)	(5.54)	(0.11)
Log(GDP per Capita)			1.126**	1.025
			(2.91)	(0.46)
Polity			0.981	0.972
			(1.15)	(1.56)
θ	0.000	0.367**	0.330**	0.174**
	(0.00)	(7.27)	(7.02)	(4.97)
Number of observations	1,662	1,662	1,662	985
Number of groups	142	142	142	90
Fixed Effects	Yes	No	No	No

[a] Z-statistics reported in parentheses. *, ** denote those parameters significant at the 10 and 5 percent level, respectively.
[b] Incident Rate Ratios from the estimation of a non-conditional, fixed effects negative binomial regression. Fixed Effects not reported.
[c] Incident Rate Ratios from the estimation of a random effects Poisson regression with a log-gamma distributed error with parameter θ.

Table 3
Determinants of Injury Decisions

Variable	Parameter	Elasticity
Number of Petitioning Firms	-0.3073***	-0.5911*
	(0.1024)	(0.3134)
Exporter's Share of Imports	0.9581***	1.8428*
	(0.3279)	(0.9684)
One-Year Growth in Imports	0.0671	0.1291
	(0.2985)	(0.5765)
Cumulated Cases[a]	0.6023***	1.1584***
	(0.1051)	(0.4942)
Nonmarket Economy[a]	0.4522***	0.8697***
	(0.1322)	(0.4244)
Exporter's GDP per Capita	-1.8374	-3.5339
	(4.6645)	(9.0870)
Exchange Rate Change	-0.4977*	-0.9572
	(0.2895)	(0.6605)
Importer's GDP Growth	-0.4856	-0.9340
	(1.9827)	(3.8589)
Exporter's GDP Growth	1.8258***	3.5118*
	(0.8329)	(2.1254)
Developing Country[a]	0.1611	0.3099
	(0.4277)	(0.8336)
Industry's Share of Total Employment	-0.1181	-0.2271
	(0.1839)	(0.3711)
Five-Year Decrease in Tariffs	-1.3358	-2.5711
	(1.1072)	(2.3572)
Year Fixed Effects	Yes	
No. of Observations	1,056	

Notes: Standard Errors reported in parentheses. *, **, and *** denote p-values less than 0.10, 0.05 and 0.01, respectively. [a] Reported elasticities measure the percent change in the likelihood of an affirmative injury determination for a discrete change in the dummy variable.