Measuring Industry Specific Protection:

Antidumping in the United States*

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1. Introduction

Do antidumping laws have anti-competitive consequences and restrict trade?[1] These questions arise repeatedly in multilateral and bilateral trade talks. Although there are reasons to suspect that antidumping laws do have such effects, there is little known about the size of these effects in practice, and even less about the mechanism by which they occur. This paper provides estimates of the trade impacts of U.S. antidumping law and the determinants of suit filing activity from 1980-1985.

A simple view of how antidumping law restricts trade is that trade flows are affected only when antidumping duties are imposed. Several researchers have challenged this view, arguing that the threat or mere possibility of duties can also restrict trade. We study three possible channels through which these indirect effects may arise which we believe, when combined with the direct effects of duties, capture most of the trade effects of antidumping law.[2] We refer to the three non-duty effects as the "investigation effect," the "suspension effect," and the "withdrawal effect." Investigation effects occur when an antidumping investigation takes place; suspension effects occur under so-called "suspension agreements" (where an investigation is suspended in exchange for a promise by foreign firms to stop dumping); and withdrawal effects occur after a petition is simply withdrawn without a final determination.

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[1] Dumped imports are defined under U.S. law to be foreign products that are exported to the U.S. market at export prices below "fair value," i.e., either below the prices of comparable products for sale in the domestic market of the exporting country or below costs of production.

[2] There is a growing empirical literature concerned with the determinants and impacts of antidumping petitions. See, for example, Finger (1981), Hernander and Schwartz (1986), Salvatore (1987), Hartigan, Kamma and Perry (1989), Messerlin (1989, 1990), Lichtenberg and Tan (1990), Harrison (1991) and Prusa (1991).

Our empirical analysis gauges the effect of antidumping petitions by measuring the response of imports and domestic output to the filing and resolution of suits. We use data on the timing and outcome of every antidumping investigation in the United States over the period 1980-1985 which covered a manufactured product. We focus on this period because U.S. antidumping law was altered substantially in the Trade Agreement Act of 1979. Our empirical analysis makes three contributions to the existing literature. First, we identify separate trade effects for each phase of the antidumping investigation process, and distinguish among an exhaustive list of post-investigation outcomes. Second, we address aggregation issues that arise when one attempts to assess the impact of investigations covering multiple product categories. Third, we jointly estimate filing, import, and output equations that allow for the joint determination of the decision to file, the level of imports, and domestic output.[3]

Our focus on the broader trade effects of antidumping law allows us to consider the possibility that there are two distinct filing strategies being pursued by firms in our sample. In modelling the determinants of suit filing activity, we allow for the coexistence of "outcome filers" and "process filers." Outcome filers are firms who appear motivated by the expectation that they

[3] The two papers closest in spirit to our work are Lichtenberg and Tan (1990) and Harrison (1991). Lichtenberg and Tan estimate filing, import, and output equations, but do not allow for their joint determination. Moreover, they abstract from investigation effects entirely, focussing instead on the implications of different post-investigation outcomes for import and output levels. Harrison estimates import-price equations with a focus on investigation and duty effects, but abstracts from the filing decision entirely. Neither paper makes an attempt to distinguish among the various phases of the investigation process, nor does either paper attempt to account exhaustively for the various post-investigation outcomes. Finally, neither paper attempts to account for the multiplicity of filings and/or duties that may arise in a given industry-year observation.

can secure a finding of dumping. Alternatively, process filers file petitions largely for the trade-restricting effects generated by the investigation process alone.

Our results suggest that several of the non-duty effects of antidumping law are quite substantial. First, suspension agreements lead to restricted import flows and expanded import-competing domestic output, and these effects are similar in magnitude to the effects of antidumping duties in our sample. Second, we find that investigation effects are substantial, reducing the flow of imports *during* the period of investigation by roughly half the reduction in import flow that would be expected if duties were imposed. Finally, we do not find much evidence of a strong withdrawal effect.

Regarding filing activity, we find that variables used to determine injury in antidumping proceedings are important predictors of filing activity by firms. This suggests that the prospect of a dumping finding (which requires a determination of injury) is an important ingredient in the decision to file. However, we also find evidence of filing activity which appears to be driven largely by a desire to secure the trade-restricting effects generated by the investigation process itself. Coupled with our finding of a substantial investigation effect, we interpret this latter result as suggesting that firms sometimes initiate antidumping procedures for the investigation effects alone.

The paper proceeds as follows. We first describe U.S. antidumping law. Next we elaborate on the three non-duty effects that are the focus of our analysis, and describe two alternative filing strategies which may be used by industries. Our empirical analysis first examines the effect of antidumping duties. We then generalize this model to incorporate our three non-duty effects. Finally, we discuss the implications of our results.

2. U.S. Antidumping Law

We begin by providing a summary of the steps involved in a U.S. dumping investigation, from initiating the investigation to the final determination and assessment of duties.[4] This description motivates our empirical specifications below.

Before describing the actual investigation procedure, we make several preliminary observations. First, there are two findings necessary for a determination of dumping under U.S. law: (i) sales of imports at less-than-fair-value (LTFV); and (ii) material injury to the domestic industry due to these imports. One government agency is assigned to each of these determinations--the International Trade Commission (ITC) determines injury to the domestic industry and the Commerce Department's International Trade Administration (ITA) makes the LTFV determination. Second, for each of these decisions, there is a preliminary and final decision made by each agency. The statutory time allotted for the entire investigation ranges from 10 months to up to 14 months under special circumstances.

We now describe the U.S. antidumping investigation process. Figure 1 summarizes the timing of the various stages of the suit resolution process.

Investigation Procedure

Once an antidumping petition is filed with the Commerce Department's International Trade Administration (ITA) and with the International Trade Commission (ITC), the ITA has 20 days

[4] The Trade Agreement Act of 1979 involved a major rewriting of U.S. antidumping laws. The Trade and Tariff Act of 1984 contains several amendments to the antidumping law of the 1979 Act that, while substantive, are not relevant for the particular issues we consider here.

to make a "petition determination" as to whether the petition is in order and, if so, to commence an investigation.[5]

ITC Preliminary Injury Determination: If the petition determination is affirmative, the ITC then has 45 days to make a preliminary determination of whether the industry under review is "materially injured," "threatened with material injury," or that the establishment of the industry "is materially retarded" as a result of the imports under investigation. If the ITC's preliminary determination is negative, the investigation is terminated as Figure 1 indicates. If the ITC's preliminary determination is affirmative, as it was for 86% of the products investigated over our sample period of 1980-85, then the investigation will run its course unless the petitioner takes action to terminate or suspend the case.

ITA Preliminary LTFV Determination: Provided the ITC's preliminary determination is affirmative, and within 160 days of the initial filing of the suit (or within 90 days if all interested parties agree to a "waiver of verification"), the ITA must make a preliminary determination of whether there is reasonable evidence that merchandise "is being sold, or is likely to be sold at less than fair value."[6] As Figure 1 depicts, a negative preliminary determination by the ITA does not terminate the investigation. However, if the preliminary determination of the ITA is affirmative, as it was on 93% of the products whose investigations made it past the preliminary injury determination over the period 1980-85, then the ITA must provide an estimate

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[5] Petitions can be either "self-initiated" by the ITA or initiated by an "interested party" on behalf of the industry. The former is by far the exception, with the most prominent example being the Trigger Price Mechanism.

[6] In "extraordinarily complicated" cases, the ITA may postpone making its preliminary determination until the 210th day after filing.

of the "dumping margin," and is required to order the "suspension of liquidation" of the affected imported goods and the posting by importers of a cash deposit or bond to cover the estimated dumping duties payable, pending the final outcome of the investigation.

At any point after the ITA's preliminary determination, the investigation may be terminated or suspended, or it may continue on to the final determination. Termination prior to the final determination occurs if and only if the petition is withdrawn by the petitioner, an action that was taken on 42% of the products whose investigations made it past the preliminary injury determination during the 1980-85 period, with a large portion taken in the steel industry. Termination usually comes about as a result of price agreements reached by the domestic industry and foreign firms named in the suit.[7] Suspension occurs if the foreign firms that are the subject of the dumping allegation reach an agreement with the ITA to (i) eliminate LTFV sales to the U.S. market, (ii) cease exporting to the U.S. market completely, or (iii) under "extraordinary circumstances," eliminate the "injurious effect" of their actions, including any margin of "underselling" (i.e., undercutting the price of the domestic product), without necessarily raising price so high as to eliminate the full margin of dumping. Such agreements were negotiated for 2% of the products whose investigations made it past the preliminary injury determination during the 1980-85 period. In the case of suspension, any violation of the agreement will result in automatic renewal of the investigation.

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[7] Agreements between foreign firms and domestic petitioners are permitted under the Noerr-Pennington doctrine which exempts such parties from prosecution under U.S. antitrust law. However, direct conversations between domestic and foreign firms concerning prices or quantities would not be protected. Consequently, settlements are typically negotiated through the Commerce Department (Horlick, 1989). See Prusa (1992) for a thorough analysis of this exemption and its implications for the effects of antidumping law.

ITA Final LTFV Determination: If the case is neither terminated nor suspended, then the ITA must within 75 days of its preliminary determination make a final determination of whether the merchandise under investigation "is being, or is likely to be" sold in the United States at less than fair value.[8]

ITC Final Injury Determination: If the ITA's preliminary determination was affirmative, then as depicted in Figure 1 the ITC must make its final determination of injury within 45 days of the ITA's final determination (or within 120 days of the ITA's preliminary determination, whichever is later). If the ITA's preliminary determination was negative, and its final determination is affirmative, then the ITC has 75 days from the ITA's affirmative final determination to make its final determination of injury. Lastly, if the final determinations of both the ITA and ITC are affirmative, the ITA has 7 days within which to instruct customs officers to assess the appropriate antidumping duties. Assessment of dumping duties occurred for 35% of the products whose investigations made it past the preliminary injury determination over the period 1980-85. If either the ITC or the ITA final determination is negative, the investigation is terminated, an outcome which occurred for 21% of the products whose investigations made it past the preliminary injury determination over the 1980-85 period.

Assessment of Antidumping Duties: Provided that the final determinations of injury and LTFV sales are both positive, the "definitive" dumping margins for purposes of assessing antidumping duties must then be calculated. These calculations are made on the basis of the prices of the imports to which they will apply (as opposed to the margins calculated for the

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[8] The ITA may postpone its final determination until the 135th day after its preliminary determination if requested to do so by either the petitioner or the firms against which the dumping allegations were made.

LTFV determination, which are calculated based on a sample of imports over an historic period which typically covers the six months preceding the initiation of the petition). The final assessment of antidumping duties applies retroactively only if the preliminary LTFV determination was affirmative. In this case, antidumping duties would normally be assessed on the relevant imports from the date of the preliminary LTFV determination forward. However, if the industry alleges "critical circumstances" and the ITA and ITC find evidence both that there are "massive" imports of the relevant product over a "relatively short period" which cause material injury, and that there is either a history of dumping in the industry or that importers were or should have been knowledgeable about ongoing dumping, the dumping duties can be applied retroactively 90 days prior to the preliminary LTFV finding.[9]

Thus, there are, in effect, three possible ranges of imports to which antidumping duties may apply once an affirmative final determination is made. If the preliminary LTFV determination was negative, duties equal to the actual dumping margins will be imposed on the relevant imports entering the United States on or after the date of final determination. If, alternatively, the preliminary LTFV determination was affirmative, antidumping duties reflecting actual dumping margins will be imposed on imports entering the United States (i) on or after the date of the preliminary LTFV determination, or (ii) in the case of critical circumstances, 90 days prior to the date of the preliminary LTFV determination.

Having described the antidumping investigation procedure and possible post-investigation outcomes, we now describe the investigation, suspension, and withdrawal effects identified in the

[9] In practice, however, the conditions for critical circumstances are rarely met.

Introduction, as well as two distinct filing strategies. We also develop the research hypotheses that guide our empirical investigation.[10]

Investigation Effects

Dale (1980, pp. 85-86) discusses two possible reasons for the existence of investigation effects associated with antidumping petitions. The first focuses on the pricing behavior of exporters. As discussed above, in cases where the final injury and dumping determinations are positive and where the preliminary LTFV determination was also affirmative, duties are typically imposed retroactively on imports that enter the United States after the date of the preliminary LTFV finding. The "definitive" margin on which these duties are based is recalculated to reflect the actual dumping margins for imports entering after this date. Thus, an exporter who receives an affirmative preliminary LTFV determination and expects the final determination also to be affirmative can nonetheless reduce antidumping duties, or even avoid them altogether, by raising its price on goods exported after the preliminary LTFV determination date. Under these circumstances, we expect an affirmative preliminary LTFV finding would lead to a sharp drop in the rate of imports and to a rise in prices, with these effects lasting for the remainder of the investigation. Moreover, the rate of imports might be expected to rise somewhat with the filing of a petition in anticipation of its future fall.[11] A second explanation for investigation effects

[10] In addition to these three non-duty effects, a number of papers, e.g., Prusa (1988), Anderson (1992), and Staiger and Wolak (1992a), have suggested that the mere existence of antidumping law can have trade effects even in periods when no petition is filed. We do not attempt to capture such effects in what follows.

[11] However, as discussed above, a sufficiently large increase in the flow of imports between the date a petition was filed and the date of a preliminary LTFV determination could trigger the "critical circumstances" provisions of U.S. antidumping law which allow duties to be imposed retroactively back to the date of filing.

focuses on the importers of the products under investigation. U.S. law requires that antidumping duties be imposed on the importer rather than on foreign exporters.[12] As such, an affirmative preliminary LTFV finding places the importer at considerable risk in terms of liability for future duty payments on any imports purchased after that date. Again, this suggests that an affirmative preliminary LTFV finding, coupled with an expectation that there is a significant possibility that the final determination will also be affirmative, would lead to a sharp drop in the rate of imports and to a rise in prices, with these effects lasting for the remainder of the investigation.[13] Again, the rate of imports might, if anything, rise when a petition is filed in anticipation of its future fall.

A third alternative to the two interpretations of investigation effects put forward by Dale (1980) is possible if domestic firms use the investigation of pricing and sales practices of foreign firms to dampen competition during times when costly price wars might otherwise erupt (see Staiger and Wolak, 1991, 1992b, and 1994).[14] A formal treatment of the anti-competitive effects

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[12] Exporters are allowed to reimburse importers for duty payments only if the agreement to purchase was made before the preliminary LTFV determination and where the products are exported before the final dumping determination (Dale, 1980, p. 105).

[13] Anecdotal support for the trade-restricting effects of preliminary dumping findings is common. For example, in reference to a U.S. antidumping petition brought by the National Knitwear & Sportswear Association against sweater producers in Hong Kong, South Korea, and Taiwan, **The New York Times** observes:

> The [preliminary dumping] margins were announced as retailers are about to place orders for delivery next fall. Some industry officials said prospects of higher prices, or just the uncertainty over what the new price levels would be, could cause some retailers to switch to domestic suppliers (**The New York Times**, April 24, 1990, p. C1).

[14] It is worth noting that the use of antidumping law as a tool to avoid price wars with foreign rivals has been explicitly documented in at least one instance. In January, 1938, the South African Iron and Steel Corporation filed an antidumping petition against steel producers in the United States for selling steel in the South African market at prices below those agreed upon by the International Steel Cartel. Dumping duties were levied and the Cartel's pricing arrangements restored (see Hexner, 1943). Less direct evidence of firms turning to antidumping

of antidumping investigations centers on four features of antidumping law: (i) the preliminary finding of injury, which is both necessary and sufficient to ensure that the investigation will run its year-long course unless the petitioner chooses to stop it, is relatively easy to secure since the ITC typically relies on information provided by the petitioner at this preliminary stage of the investigation; (ii) price-cutting during the investigation period by foreign firms named in the petition will raise the likelihood that an affirmative dumping determination would result from the investigation; (iii) the prospect that foreign firms will face antidumping duties if they cut prices during the investigation period will reduce their incentive to do so; and (iv) the competition-dampening investigation effect noted in (iii) is only secured by filing the antidumping petition.[15] Under these four points, we have argued (Staiger and Wolak, 1991) that the filing of an antidumping petition can dampen competition and lead to greater market share for domestic firms--and in fact to a fall in imports and a rise in domestic output--during the entire period of investigation. These investigation effects occur because by filing an antidumping petition, the domestic industry is able to diminish the incentives of foreign firms to aggressively pursue

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law to avert price wars is provided by Messerlin (1990) for the European Community chemical industry.

[15] Of these four points, (ii) is the least self-evident, and requires some elaboration here. A crucial step in the ITC's injury determination is establishing a causal link between dumped imports and injury to the domestic industry. Here, the ITC relies heavily on evidence of "underselling," that is, sales of the imported good in the domestic market at a price below that of the domestically produced "like product," and of a relationship between such underselling and increases in foreign market share. Moreover, in its final determination of injury the ITC routinely considers data that become available during the period of investigation. Thus, were a foreign firm to cut its price in the domestic market during the period of investigation and steal market share, this would increase the likelihood of an ITC finding of increased foreign market share by reason of "underselling," and would consequently raise the likelihood of a final determination of injury and the prospect of antidumping duties.

domestic market share while the investigation is proceeding. Hence, with aggressive pricing policies now relatively less attractive for foreign firms, higher domestic prices (and lower imports) can be maintained even as domestic firms increase output.

Suspension and Withdrawal Effects

It should be clear from our discussion of investigation procedures at the beginning of this section that the imposition of antidumping duties is not the only way that antidumping proceedings can have a lasting effect on post-investigation import flows. Suspension agreements, negotiated between the ITA and foreign firms named in the antidumping petition, are clearly meant to have lasting impacts on import prices and volumes, and are monitored and enforced by the ITA to ensure that they do have such effects. Because the intent of a suspension agreement is to provide a non-duty alternative by which previous dumping activities can be halted, it would be surprising if there were not a "suspension effect" in the data. A prominent example involving such a suspension agreement (though not falling in our sample period) was the 1986 U.S.-Japan Semiconductor Trade Arrangement.

On the other hand, petitions which are withdrawn by the domestic industry prior to a final determination are simply terminated, and it might seem *a priori* that a petition withdrawal should allow import flows to continue at (or return to) pre-investigation levels just as in a negative determination. Prusa (1992) has provided a bargaining model which overturns this *a priori* view. According to Prusa, the antidumping investigation process provides the domestic firms with both a threat of antidumping duties against their foreign rivals as well as cover from domestic antitrust laws under the Noerr-Pennington doctrine (see also note 7), allowing them to coordinate on a more trade-restrictive arrangement with foreign firms which is then implemented upon the

withdrawal of the antidumping petition by the domestic firms. This implies that a withdrawn petition could have lasting effects on imports if the investigation process allows foreign and domestic firms to coordinate output or prices in subsequent periods.

Filing Strategies

It would be natural to think of filing activity as reflecting the desire to secure a finding of dumping and the explicit remedies under the law that such a finding would bring forth, i.e., antidumping duties or a suspension agreement in lieu of duties. We will call firms that pursue such a filing strategy "outcome filers." However, the potential for investigation and withdrawal effects as described above leads to the possibility of another filing strategy: Firms might knowingly file "meritless" antidumping petitions just to trigger the process that leads to these latter effects. We will call firms that pursue this second filing strategy "process filers." For the process filing strategy to make sense, two logical conditions must hold. First, the antidumping investigation process itself must be obtainable even when a full investigation would not be warranted on the merits of the case. And second, the significant possibility of a dumping finding can not be a prerequisite for the sought-after investigation and/or withdrawal effects.

Because the investigation process is secured once an affirmative preliminary injury determination is made, the first condition above is likely to be met given the strict 45-day time limit within which the ITC must make this determination, a time constraint which forces the ITC to rely heavily at this stage of the investigation on information provided by petitioners. Thus, firms that want the antidumping investigation process should find it relatively easy to obtain, regardless of the merits of their dumping claims.

However, what the process itself is worth when the case against foreign firms is weak is less clear. Dale's (1980) interpretations of the investigation effect imply that petitions which were known by the industry to have little chance of resulting in a finding of dumping would be unlikely to have strong trade-restricting effects associated with the investigation process, since the explanations underlying these interpretations presume a significant probability of a final affirmative dumping determination. In contrast, the significant possibility of a dumping finding is not a prerequisite for the investigation effects under the third interpretation offered above. This is because the investigation effect under this third interpretation comes in the form of a threat to "punish" foreign firms with an antidumping duty if they should "misbehave" and compete too aggressively during the investigation period. Such a threat is made credible by filing the petition; because it is credible, the threatened duties need never be implemented. Thus, under this interpretation, domestic firms may value the price-competition-dampening effects of antidumping investigations discussed above for their own sake. Hence, these firms may file such petitions with no expectation that they would actually result in duties or other remedies, but only to ensure that the foreign firms do not engage in aggressive pricing behavior during the investigation phase. Finally, neither is the significant probability of a dumping finding necessarily a prerequisite for the withdrawal effect, if domestic firms value Noerr-Pennington exemption from antitrust sufficiently for its own sake, presumably because of the coordination benefits offered by such an exemption.

We will therefore consider the possibility of both outcome and process filers in our empirical work. Outcome filers file antidumping petitions when their chances of securing a dumping determination are sufficiently strong. The investigation effect associated with such filers

should correspond to the first two interpretations depicted above: the flow of imports should rise upon filing and fall at the point of an affirmative preliminary LTFV determination, remaining low until the conclusion of the investigation. Process filers file antidumping petitions without regard to their chances of securing a dumping determination, but rather when the risks of competitive price wars are sufficiently severe. In Staiger and Wolak (1991), we argued that this occurs when capacity utilization falls below a critical level, and thus we will consider the role of capacity utilization as a predictor of the filing activity of process filers. The investigation effects associated with process filers should correspond to the third interpretation depicted above: the flow of imports should fall upon filing and remain low until the conclusion of the investigation. Finally, the withdrawal effect could be associated with either filing strategy, with no a priori difference across outcome or process filers.

3. The Effects of Antidumping Duties Alone

We begin our empirical investigation into the effects of antidumping law by focusing on the duty effects alone. This is a natural starting point for assessing the impacts of antidumping law, and it will provide a benchmark for results of the broader investigation that follows.

To investigate the impact of the imposition of duties on the flow of imports and domestic output, we must first describe the data sources used for all of the empirical work reported in this paper. We then describe the econometric framework used to measure these impacts. Finally, we present a model of industry-level antidumping suit filings and estimates of the import-restricting effects and output-promoting effects of the imposition of antidumping duties.

Data Sources

The source of data for the industry-level economic magnitudes is the National Bureau of Economic Research Trade Data File. Abowd (1990) gives a detailed description of this data set. It contains domestic shipments, imports and exports information for 450 U.S. manufacturing industries by 4-digit 1972 Standard Industry Code (SIC) from 1958 to 1985. It also contains information on various industry-level economic aggregates such as the level of employment and the size of the capital stock, as well as an industry-level output price deflator. We use this price deflator to convert all nominal dollar magnitudes to 1972 dollars.

The data source for information on the filing date for all antidumping suits and the dates for the subsequent stages of the suit resolution process is the National Technical Information Service's Trade Action Monitoring System (TAMS) Pending Investigation Report. This publication is produced by the Department of Commerce and is issued on a monthly basis. It tracks all petitions having to do with the 1974 Trade Act, such as escape clause (section 201), antidumping (section 731), countervailing duties (section 303) and unfair practices in import trade (section 337). Each month it lists the current disposition of each petition until its final determination. Firms file antidumping petitions alleging dumping of specific imported products. For purposes of the investigation, the ITC then links the products under investigation to Tariff Schedules of the United States (TSUS) product codes. Thus, for each petition the TAMS dataset records the TSUS codes for the products which are allegedly being dumped and the petition's disposition in the current month. We explicitly account for filing at the TSUS product code level in our econometric model of the suit filing process and in our model of the impacts of antidumping suits on imports and domestic output flows.

As noted above, our industry-level data is available at the 4-digit 1972 SIC level. Consequently we must have a concordance between the TSUS codes and the 4-digit 1972 SICs both to assign antidumping suits to SIC industries and to determine the total number of TSUS product codes in each SIC industry. We obtain a year-by-year concordance between TSUS product codes and 1972 SICs from the Commerce Department's Foreign Trade Division Imports Extract Master Concordance. This concordance allows us to assign each antidumping suit filed to a 4-digit SIC industry. Because TSUS codes are based on traded products and SIC code assignments are based on a firm's principal productive activities, several SIC industries do not have any TSUS codes associated with them during our sample. Consequently, a necessary requirement for an SIC-industry to appear in our dataset is that it contains at least one TSUS product code for each year during our sample. Only four industries were deleted from the sample because they had no TSUS code in them for only a portion of the sample time period. Most of the industries omitted had no TSUS codes in them for all years. This concordance procedure left a total of 338 industries for our time period of 1980-1985.

Our empirical work focuses on 1980 to 1985, because major changes in the structure of U.S. antidumping law occurred with the passage of The Trade Agreement Act of 1979. Modifications of this act were made by The Trade and Tariff Act of 1984, but none of these are directly relevant to the aspects of the administrative process we consider in our research.

Econometric Model

There are several aspects of the economic environment we are modeling that our econometric model should capture. The first is the joint determination of the decision to file an antidumping suit with the level of imports and domestic output. We model the contemporaneous

correlation between the level of imports and domestic output and the decision to file an antidumping suit by the presence of an unobservable industry characteristic which affects the mean of each of these three variables. Our econometric model allows for contemporaneous correlations among these three variables as well as correlation over time among these three variables. Because our model uses functions of lagged values of the levels of imports and domestic output as regressors to predict antidumping suit filing activity, we must account for the correlation between these functions of lagged dependent variables and the autocorrelation in the error terms of the suit filings model, or the resulting parameter estimates will be inconsistent.

The suit filing process has several characteristics which we attempt to capture in our econometric model. First is the fact that antidumping suits are filed at the TSUS code level although all of our remaining data is at the 4-digit SIC level. Consequently, we must construct a model which will allow us to recover information about the TSUS code-level filing process using SIC industry-level data as regressors for the filing rate process. The number of filings in a given TSUS code is a non-negative discrete-valued random variable which is zero for most time periods, but in the periods in which it is nonzero, it can take on large values. We select a discrete distribution for the TSUS code-level number of antidumping suit filings which allows for this large positive skew in the distribution of filings for a given industry. There are both observable and unobservable reasons for high levels of filing activity which persist over time. For this reason, we include an unobservable industry-specific propensity to file suits which also affects the level of imports and output from the competing domestic industry. In addition, to match the industry-level aggregation of our import and domestic output data, we need a

distribution for TSUS level filings which can be aggregated to the 4-digit SIC level in an empirically tractable manner.

Although the suit filing equation is necessary to account for the correlation between suit filing activity and both imports and domestic output, this equation is of independent interest. At the most basic level, because several characteristics of the industry's health are used to determine injury in an antidumping proceeding, one would expect that these variables should also predict whether or not a firm files a suit. Consequently, our first motivation for estimating the filing equation is to determine if variables used to assess injury to an industry also predict filing by this industry. A second motivation is the relative importance of each of these variables in the decision to file an antidumping suit. A final motivation for estimating our filing equation is the potential existence, as outlined in the preceding section, of two distinct antidumping suit filing strategies. These strategies each imply a different set of predictors of future filing activity and different impacts of the various stages of the suit resolution process on domestic output and imports. In Section 5 we investigate the plausibility to these two filing strategies by imposing the appropriate exclusion restrictions on the two filing equations and allow for the impacts of the suit resolution process on imports and domestic output to differ across the two filing strategies.

As discussed earlier, we would like to measure the impacts of various stages of the antidumping suit resolution process on the flow of imports and domestic output. To do this in a consistent manner, several characteristics of the suit resolution process must be accounted for. As is evident from our description of the investigation process in Section 2, a single antidumping investigation can straddle more than a single year, while each of the various stages of the process last only a fraction of a year. In addition, several antidumping suits can be simultaneously active

in a single TSUS code because of filing against the same product imported from different countries. Finally, we face the difficulty that our data on imports and domestic output are only available on an annual basis at the 4-digit SIC level. Consequently, we must specify a model which will allow us to recover the TSUS code-level impacts on the flows of imports and domestic output from stages of the suit resolution process which may run over adjacent years or for a fraction of a year, accounting for the possibility of multiple filings from the same TSUS code, using data which is time-aggregated to annual magnitudes and cross-sectionally aggregated to the 4-digit SIC industry level. Our TSUS code-level, within-year flow model provides a framework for us to recover within-year effects from annual import and domestic output levels using indexes of suit activity in that year.

Our SIC industry-level model of the filing rate process and the impacts of the suit resolution process can be interpreted without reference to the underlying TSUS code-level processes. However, our bottom-up approach, starting with a TSUS code-level model which has not been time-aggregated to the annual magnitudes, specifies an econometric model at the level of both time and product aggregation at which the true underlying processes are occurring. It is then both time- and product-aggregated to an industry-level model. This modeling strategy allows the recovery of both TSUS code and industry level impacts because the industry-level model is obtained from the explicit aggregation of the TSUS code-level model.

We now describe the details of our econometric model of dumping suit filing behavior and its impacts on the level of imports and domestic output. Let f_{git} be the number of antidumping suits filed in industry i for good g in period t, where $g=1,...,G_{it}$, $t=1,...,T$ and

i=1,...,N. Because antidumping suits are filed at the TSUS code level, for the purposes of this paper a good is defined to be TSUS product code.

Let λ_{git} denote the rate at which suits are filed in industry i for good g in period t. We assume that the distribution of f_{git} given λ_{git} is Poisson ($\mathbf{P}(\lambda)$) with parameter $\lambda=\lambda_{git}$. We denote this fact using the notation

$$f_{git} \mid \lambda_{git} \sim P(\lambda_{git}). \tag{1}$$

These assumptions are consistent with f_{git} being a Poisson point process for the time interval t to t + 1.

We further assume that λ_{git} possesses a gamma distribution $\Gamma(\mu_{it}, \sigma)$, where $\mu_{it} = \exp(X_{it}'\gamma + \theta_i)$. The vector X_{it} contains the observable characteristics of industry i as of the beginning time t which affect its filing rate; the vector γ and the scalar σ are parameters to be estimated. The variable θ_i is the unobservable propensity of firms in industry i to file antidumping suits. There are many unobservable or non-quantifiable reasons why one industry may have a larger number of filings than another industry. We account for this unobservable difference in behavior across industries by θ_i. We assume that θ_i is independently and identically distributed across industries and remains constant over time. Using our above notation we have:

$$\lambda_{git} \mid X_{it},\theta_i \sim \Gamma(\exp(X_{it}'\gamma + \theta_i),\sigma). \tag{2}$$

Assumption (2) implies that each product class within industry i and in time period t has a different mean rate of filing (λ_{git}), although all of these filing rates are drawn from the same gamma distribution.

Combining assumptions (1) and (2), we have

$$f_{git} \mid X_{it}, \theta_i \sim P(\lambda_{git}) \bigcirc_{\lambda_{git}} \Gamma(\exp(X_{it}'\gamma + \theta_i), \sigma), \tag{3}$$

where $\bigcirc_{\lambda_{git}}$ denotes compounding or mixing the parameter λ_{git} of the Poisson distribution with a gamma distribution $\Gamma(\exp(X_{it}'\gamma + \theta_i), \sigma)$. Results from Johnson and Kotz (1969, Chapter 5), imply that f_{git} has a negative binomial distribution with parameters σ and $\mu_{it} = \exp(X_{it}'\gamma + \theta_i)$. We abbreviate this as $f_{git} \sim NB(\sigma, \mu_{it})$. This discrete density takes the following form:

$$pr[f_{git} = k] = \binom{\sigma + k - 1}{\sigma - 1} (\mu_{it}^f)^k (1 + \mu_{it}^f)^{-(\sigma + k)}. \tag{4}$$

We assume that conditional on θ_i, f_{git} is independent of f_{hjs} for all $g \neq h$, $i \neq j$, and $s \neq t$.

This distribution for f_{git} has the following properties. The mean is $\sigma\mu_{it}$ and the variance is $\sigma\mu_{it}(1+\mu_{it})$. The parameter σ effects shape the density of f_{git}. If $\sigma\mu_{it} < (1 + \mu_{it})$, then the mode of f_{git} is zero. A sufficient condition for this inequality to hold is $\sigma < 1$. The smaller σ becomes, the greater the probability associated with the event $f_{git} = 0$. Larger values of μ_{it} increase the relative probability associated with larger values f_{git}. The mode of the density is increasing in $\sigma\mu_{it} - (1 + \mu_{it})$ for $\sigma\mu_{it} > (1 + \mu_{it})$. Because antidumping filings are a relatively rare event, we expect σ to be substantially less than one, reflecting the fact that $f_{git} = 0$ is a highly probable event.

Our data generation process captures the following logic. In each period t, λ_{git} the filing rate for product class g in industry i is drawn from a $\Gamma(\exp(X_{it}'\gamma + \theta_i),\sigma)$ distribution. Conditional on this draw of λ_{git} and the value of θ_i, the actual filing behavior for an individual product class evolves according to a Poisson process with rate λ_{git}. This compound distribution model allows for differences in filing rates across product classes within an industry while at the same time imposing the restriction that, on the average, all products within an industry file at the same rate. From our estimation procedure we can recover estimates of the parameters of both the distribution $\Gamma(\exp(X_{it}'\gamma + \theta_i),\sigma)$ and the filing Poisson process conditional on the realized value of λ_{git}.

The filing of an antidumping suit is a rare event, but when it occurs there tends to be clustering in the number of filings. For our sample of 2028 industry and year observations (338 industries times 6 years), only 122 have non-zero values of antidumping suit activity. However, there can be large amounts of product-level filing activity, on the order of hundreds of TSUS product codes, in a given industry and year. Within the context of our econometric model we can think of this clustering of suits as caused by the positive skewness in the gamma distribution for λ_{git}, so that most realizations of the rate of the Poisson process are very small. However, a large realization occurs very rarely, which in turn implies a large number of observed filings. In addition, the unobserved heterogeneity across industries represented by θ_i allows for a much larger (or smaller) level of filing activity from a given industry than is predicted by its observable characteristics. Both the stochastic nature of the mean filing rate and the unobservable industry-level heterogeneity in the filing rate allow for a substantial amount of variability in the TSUS code product-level filing rates across industries.

To compute f_{it}, the total number of suits filed within industry i during period t, we sum f_{git} from g=1 to G_{it}, the total number of TSUS product codes within industry i in period t. This summation yields

$$f_{it} = \sum_{g=1}^{G_{it}} f_{git} \tag{5}$$

This industry-level annual amount of filing activity is the observable dependent variable used to estimate the parameters γ and σ and the across-industry distribution of heterogeneity $f(\theta)$.

To construct the conditional density of f_{it} given θ_i, we utilize the fact that the sum of two independent NB(α,β) random variables is NB(2α,β). This implies that f_{it} possesses a negative binomial distribution with parameters $G_{it}\sigma$ and $\mu_{it} = \exp(X_{it}'\gamma + \theta_i)$, conditional on the value of θ_i. Consequently, the conditional distribution of f_{it} given θ_i observation is

$$pr[f_{it}|\theta_i] = \frac{\Gamma(G_{it}\sigma + f_{it})}{\Gamma(f_{it} + 1)\ \Gamma(G_{it}\sigma)} \exp(f_{it}(X_{it}'\gamma + \theta_i))\ (1 + \exp(X_{it}'\gamma + \theta_i))^{-(G_{it}\sigma + f_{it})} \tag{6}$$

where $\Gamma(\alpha)$ is the gamma function $\Gamma(\alpha) = \int_0^\infty t^{\alpha-1} e^{-t} dt$.

We have also made use of the relationship $\Gamma(\alpha+1) = \alpha!$. The joint density function of $f_i = (f_{1980,i}, f_{1981,i}, \ldots, f_{1985,i})'$ is

$$pr(f_i \mid \theta_i) = \prod_{t=1980}^{1985} pr[f_{it} \mid \theta_i], \tag{7}$$

where $pr[f_{it}|\theta_i]$ is defined in (6). Henceforth let t=1,...,T=6, denote the years 1980-1985.

We now turn to our model of the impact of antidumping duties on industry-level imports and output which is linked to the model of filing activity through the unobserved industry propensity for filing, θ_i. We first specify the product class import equation and output prediction equations and then aggregate these to obtain the industry-level equations. Let IMP_{git} denote the level of imports for product class g in industry i in time period t. Let OUT_{git} denote the level of output produced domestically in product class g in industry i in time period t. We treat time period t as the interval of time [t, t + 1).

As discussed above, because our goal is to measure the within-year effects of the stages of the antidumping suit resolution process from annual magnitudes, we first specify a model for the rate of imports within any given year which incorporates how each of the stages of the suit resolution process impacts the rate of imports and domestic output. We then aggregate these two within-year flow equations to obtain the annual level of imports and domestic output. This aggregation process produces indexes of annual suit activity consistent with our model of import and domestic output flows. Aggregating these TSUS code-level annual level equations over all products in each 4-digit SIC yields equations which can be estimated using our industry-level data. This across-product aggregation process clarifies precisely how our industry-level annual indexes of dumping suit activity are constructed from the product-level indexes.

Our within-year model of the impacts of antidumping duties assumes that for any year (t) and industry (i), the following linear differential equations characterize the instantaneous annual rate of change in the real value of imports and domestic output at the TSUS code-level:

$$\frac{dIMP_{git}}{ds} = \beta^{m}\theta_{i} + \xi_{t}^{m} + \beta_{1}^{m} I_{git}^{OGD}(s) + e_{git}(m) \tag{8}$$

$$\frac{dOUT_{git}}{ds} = \beta^{o}\theta_{i} + \xi_{t}^{o} + \beta_{1}^{o} I_{git}^{OGD}(s) + e_{git}(o), \tag{9}$$

where β^{k}, (k=m,o) are coefficients quantifying the impact of the unobservable industry heterogeneity on the rate of change of the real value of imports and output in industry i for all time and ξ_{t}^{k}, (k=m,o) are fixed time effects for the two rates of change for year t. The variable $I_{git}^{OGD}(s)$ counts the number of currently ongoing antidumping duties (OGD) for all $s \in [t,t+1)$ in product class g in industry i and time period t. The coefficients β_{1}^{k}, (k=o,m) quantify the impact of a one unit change in these count variables on the annual rate of imports and domestic output for good g in industry i during time period t. The variables $e_{git}(k)$, (k=o,m) are independent identically distributed shocks to the rate of imports and output for product class g, in industry i, in period t. We assume that the disturbance vector $e_{git} = (e_{git}(m), e_{git}(o))'$ possesses a bivariate normal distribution with mean zero and covariance matrix Σ. We assume that e_{git} is independently and identically distributed across goods, industries and over time.

As discussed in the previous section, the ITA must find sales at less than fair value and the ITC must find injury due to dumped imports in order for a dumping duty to be imposed and,

hence, in order for $I_{git}^{OGD}(s)$ to take on a positive value. Both of these decisions are made by established administrative procedures which do not depend on the specific domestic industry under consideration. Consequently, we would not expect the treatment of individual firms by these administrative procedures to depend on θ_i, the unobserved propensity of firms in industry i to file antidumping suits. For the purposes of our econometric model this neutrality of the resolution process with respect to the specific domestic industry under consideration implies that θ_i, industry i's unobserved filing propensity, is independent of $I_{git}^{OGD}(s)$, which reflects the joint decision of the ITA and ITC to impose antidumping duties. Although the actual operation of the suit resolution process favors this econometric assumption, to specify a model which allows for the possible correlation between the decision of ITC and ITA to impose duties and θ_i would require specifying and estimating a model of the various stages of suit resolution process of these two agencies. Such a model would have to predict both outcome and the duration of each stage of the suit resolution process because both of these factors enter into the construction of the annual indexes of industry-level antidumping suit activity used in our econometric model of imports and domestic output. Given the complex nature of each of these administrative processes, we leave this difficult task to future research.

To clarify how the imposition of antidumping duties impacts the quantity of imports and domestic output, consider the following example. Suppose that no antidumping duties are currently imposed on imports from product class g in industry i during year t. In this case the rate of imports in product class g in industry i is

$$\frac{dIMP_{git}}{ds} = \beta^{m}\theta_{i} + \xi_{t}^{m} + e_{git}(m). \qquad (10)$$

Suppose that antidumping duties are imposed on imports in this product class sometime during period t. The variable $I_{git}^{OGD}(s)$ will then take on the value 1 for all $s \in [t,t+1)$ such that antidumping duties are currently active. Consequently, the rate of imports will increase by the value of β_1^m because duties are currently active for that product class. Should another set of duties be imposed on imports within this product class during the same time interval, then $I_{git}^{OGD}(s)$ will take on the value 2 for as long as both sets of duties are active; it will return to the value of 1 when a single set of duties is again active and zero when no duties are active.[16]

Continuing with the derivation of our TSUS product code-level import and output equations, we integrate (8) and (9) with respect to s from t to t + 1 to obtain

$$IMP_{git} = \beta^m \theta_i + \xi_t^m + \beta_1^m OGD_{git} + e_{git}(m) \tag{11}$$

$$OUT_{git} = \beta^o \theta_i + \xi_t^o + \beta_1^o OGD_{git} + e_{git}(o) \tag{12}$$

[16]Our discussion in Section 2 characterized the impacts of the duties and other stages of the suit resolution process in terms of the quantity of imports and domestic output at the 7-digit TSUS level. Our data on imports, domestic output, and the industry-level output price deflator are at the 4-digit SIC level. Thus, data limitations preclude us from deriving an index of the quantity of output at the 4-digit SIC level. To do this would require prices and revenue shares for all of the 7-digit TSUS products in each of the 4-digit SIC industries. As a result, our estimates reflect real value effects as opposed to quantity effects. So long as the elasticity of demand for each of these products is larger than one in absolute value, the quantity effects and value effects should go in the same direction. The assumption of elastic demand for goods produced by these domestic industries and their foreign competitors is consistent with available empirical evidence. Consequently, our empirical results are useful to test the sign predictions of our theories concerning impacts of the various stages of the suit resolution process on the quantity of imports and domestic output in spite of our use of the real value of imports and output data.

where $OGD_{git} = \int_{t}^{t+1} I_{git}^{OGD}(s)ds$. In order to compute industry-level import and output equations

from these product-level equations, we must aggregate over all of the product classes g within industry i in period t. Summing over all g yields:

$$IMP_{it} = \beta^{m}\theta_{i}G_{it} + \xi_{t}^{m}G_{it} + \beta_{1}^{m}OGD_{it} + \eta_{it}(m) \tag{13}$$

$$OUT_{it} = \beta^{o}\theta_{i}G_{it} + \xi_{t}^{o}G_{it} + \beta_{1}^{o}OGD_{it} + \eta_{it}(o) \tag{14}$$

where

$$IMP_{it} = \sum_{g=1}^{G_{it}} IMP_{git}, \quad OUT_{it} = \sum_{g=1}^{G_{it}} OUT_{git}, \quad OGD_{it} = \sum_{g=1}^{G_{it}} OGD_{git} \quad \text{and} \quad \eta_{it}(k) = \sum_{g=1}^{G_{it}} e_{git}(k),$$

for k = m,o. This aggregation procedure implies that $\eta_{it} = (\eta_{it}(m),\eta_{it}(o))'$ is $N(0,G_{it}\Sigma)$ so that η_{it} is heteroscedastic conditional on G_{it}. Dividing (13) and (14) by G_{it} yields a model more amenable to estimation. This form of the model is analogous to the conventional fixed time-effects, random individual effects panel data model. The model is

$$IMP_{it}/G_{it} = \mu_{it}^{m} + \eta_{it}(m)/G_{it} \quad and \quad OUT_{it}/G_{it} = \mu_{it}^{o} + \eta_{it}(o)/G_{it} \tag{15}$$

where $\mu_{it}^{m} = \beta^{m}\theta_{i} + \xi_{t}^{m} + \beta_{1}^{m} OGD_{it}/G_{it}$ *and* $\mu_{it}^{o} = \beta^{o}\theta_{i} + \xi_{t}^{o} + \beta_{1}^{o} OGD_{it}/G_{it}$. (16)

The variables μ_{it}^{m} and μ_{it}^{o} are the conditional means of the normalized annual imports and output from industry i in period t. The normalized duty count variable can now be interpreted as an intensity of suit activity. The normalized error vector η_{it}/G_{it} is still heteroscedastic because of the distribution for η_{it} given above. Consequently, we apply the appropriate weighting scheme in the construction of the likelihood function.

Several comments are in order about the structure of our econometric model. First, an assumption implicit in equations (15) and (16) is that β_1^m and β_1^o, the coefficients measuring the impact of the imposition of a duty on the flow of imports and domestic output, are the same across all products and industries. We experimented with random coefficient assumptions for these impact coefficients, where the coefficient for each industry is assumed to be a drawn from an unknown distribution. However, we did not find that this modeling strategy resulted in statistically superior description of the data. An alternative strategy to constructing OGD_{it}, our index of dumping duty activity within an industry, would be to weight OGD_{git} by the share of industry level imports or domestic output which is made up of each specific TSUS code product. However, value weighting in this manner is inconsistent with our underlying TSUS code within-year model of the impacts of antidumping duties. We would be weighting each OGD_{git} by a function of either IMP_{git} or OUT_{git}, both of which are functions of θ_i and e_{git}. Hence, within the context of our model, this would imply contemporaneous correlation between the regressors, the

import- or output-weighted indexes of duty activity, and the error terms in the import and output equations thus rendering our coefficient estimates inconsistent.[17]

Because we assume that G_{it} is known at the beginning of each year, aggregating over the number of TSUS codes within a given 4-digit SIC does not impart any correlation between OGD_{it} and θ_i or OGD_{it} and e_{git}. So long as we assume that the probability that duties are imposed given that a suit has been filed does not depend on θ_i, our estimation procedure will yield consistent estimates of β_1^m and β_1^o.

Using our distributional assumptions we can construct the joint density of $IMP_i^* = (IMP_{i1}/G_{i1},...,IMP_{iT}/G_{iT})'$ and $OUT_i^* = (OUT_{i1}/G_{i1},...,OUT_{iT}/G_{iT})'$ conditional on θ_i as follows. Conditional on the value of θ_i, the joint density of the two-dimensional vector $(IMP_{it}/G_{it},OUT_{it}/G_{it})'$ is

$$\phi(IMP_{it}/G_{it},\ OUT_{it}/G_{it}|\theta_i\ ) = \frac{1}{2\pi}|G_{it}^{-1}\Sigma\ |^{-1/2}\exp(-1/2(\nu_{it}'(G_{it}^{-1}\Sigma)^{-1}\nu_{it})), \qquad (17)$$

where $\nu_{it} = ((IMP_{it}/G_{it} - \mu_{it}^m),\ (OUT_{it}/G_{it} - \mu_{it}^o))'$. This implies that the joint density of $(IMP_i^*,OUT_i^*)'$ conditional on θ_i is

[17] We have also estimated normalized import and output equations analogous to (15) but with the import-penetration ratio and the capacity utilization rate on the left-hand-side rather than imports and output. Although there is no consistent method of aggregation from the product-code level that would generate such models, the results from their estimation are qualitatively similar to the results we report here.

$$h(IMP_i^*, OUT_i^* \mid \theta_i) = \prod_{t=1}^{T} \phi(IMP_{it}/G_{it},\ OUT_{it}/G_{it} \mid \theta_i). \tag{18}$$

Combining this joint density with the joint density of filings over the sample period yields the following joint density of filings, output and imports over our sample period conditional on θ_i:

$$g(f_i, IMP_i^*, OUT_i^* \mid \theta_i) = h(IMP_i^*, OUT_i^* \mid \theta_i) pr(f_i \mid \theta_i). \tag{19}$$

To complete the construction of the unconditional joint density of filings, output, and imports over our sample period for any industry we must integrate this conditional density with respect to the density of the of θ. We choose a discrete factor approximation to this unknown density. Recent Monte Carlo work by Mroz and Guilkey (1991) has found these discrete factor structures are able to model a wide-variety of potential heterogeneity distributions. For many models involving discrete and continuous endogenous variables the parameters of the conditional distribution of interest estimated from these models were found to dominate those obtained from the maximum likelihood estimator in terms of mean squared error loss for sample sizes considered. Integrating with respect to this discrete density of θ, (π_k, θ_k) k=1,...,K, where K is the number of points of support of the discrete density and π_k the probability associated with the point of support θ_k, yields

$$p(f_i, IMP_i^*, OUT_i^*) = \sum_{k=1}^{K} \pi_k g(f_i, IMP_i^*, OUT_i^* \mid \theta_k). \tag{20}$$

Taking the log of $p(f_i,IMP_i^*,OUT_i^*)$ and summing from i=1 to N yields the log-likelihood function for our model. For all of our estimation results we found that past K = 2, the parameter estimates of the three conditional mean functions and their standard error estimates did not change appreciably. Consequently, all results reported in this paper are conditional on the value K = 2 for the number of points of support of the assumed discrete distribution for θ_i. In their Monte Carlo study, Mroz and Guilkey (1991) also found that only a small number of points of support are necessary to adequately estimate the parameters of economic interest.

We summarize by describing the essential features of the joint density of f_i, IMP_i^*, and OUT_i^* captured by our econometric modeling framework. This model allows correlation over time between all six elements of each these three vectors and between any element of these three vectors and all other elements in the remaining two vectors. Consequently, a fairly rich class of correlation structures between these 18 variables (3 vectors of 6 elements) can be accounted for in estimating the parameters of the conditional mean functions of these three variables using our modeling framework.

We now discuss the variables entering X_{it}, the vector of observable industry characteristics shifting the conditional mean of the filing rate of industry i and time period t. Our main objective in selecting variables for inclusion in X_{it} follows from the logic that if a variable is used to determine injury in an antidumping suit proceeding and industries are aware of this, then these variables should be predictors of future dumping suit activity. As discussed in Section 2, although the domestic industry must concern itself with the establishment of injury, a determination of LTFV sales by the foreign firm is also necessary for dumping to be found. Moreover, the margin by which the Commerce Department finds that final sales to the domestic market are

made at less than fair value determines the magnitude of the antidumping duties that the petitioning industry can expect. Nevertheless, the Commerce Department's final LTFV margin is extremely unpredictable and there are biases inherent in the process used to determine its level which favor finding a positive margin. This uncertainty is due in part to the different methodologies, sometimes for a single suit, that can be used to determine this margin. Boltuck and Litan (1991) contains several papers which discuss the large amount of uncertainty inherent in the dumping margin determination process. In addition, a conclusion which is fairly consistent throughout most of the papers in this volume is that there are strong biases in the process towards finding a positive dumping margin. The two papers by Francois, Palmeter, and Anspacher and Boltuck, Francois, and Kaplan in the Boltuck and Litan (1991) volume are particularly persuasive in this regard. For all of these reasons, we hypothesize that firms file primarily based on the observable industry characteristics that determine injury, and allow for a sufficiently rich stochastic structure for our model to account for unobservable differences in filing behavior across industries.

A major indicator of injury to the petitioning firms is the import penetration ratio $IMPEN_{it} = IMP_{it}/(IMP_{it} + OUT_{it})$. A large value of IMPEN is indicative of a large foreign presence in the domestic market which may be injurious to the domestic firms. A second variable which is used to assess injury is the domestic firm's capacity utilization rate, which we represent at the industry level by $CAPU_{it} = OUT_{it}/CAP_{it}$ (where OUT_{it} is real shipments and CAP_{it} is real capital stock). We compute OUT_{it} as the nominal value of annual shipments divided by the industry specific shipments price index. All real magnitudes are in 1972 dollars. We include $IMPEN_{it-1}$ and $CAPU_{it-1}$ in X_{it}, because they are both predetermined as of the beginning of year t. We also

include time fixed effects in X_{it} to account for any trends in filing activity not accounted by changes in observable or unobservable industry characteristics.

Finally, we include several additional variables to account for the fact that the magnitude of IMPEN and CAPU necessary to find harmful dumping may vary with the size and the structure of the domestic industry. We measure the size of an industry by EMP_{it}, aggregate employment for industry i in period t, and expect that a given level of IMPEN and CAPU is more likely to be associated with a finding of injury the larger the size of the industry. We attempt to proxy for the (vertical) structure of an industry by value-added per dollar of output in the industry, $VADD_{it}/OUT_{it}$, and expect that a given level of IMPEN and CAPU is more likely to be associated with a finding of injury to the domestic industry the lower is VADD/OUT, i.e., the farther downstream the domestic industry is located, and thus the smaller the share of primary factor payments in total industry cost and the more sensitive those factor payments will be to industry price changes. Because they are predetermined at the beginning of year t, lagged values of VADD/OUT and EMP (their values for period t - 1) are included in X_{it}.

Before describing our results, we should note some properties of our econometric model. Three of the variables in X_{it} are functions of lagged values of IMP_{it} and OUT_{it}. The presence of θ_i in the IMP_{it-1} and OUT_{it-1} equations implies that $IMPEN_{it-1}$, $CAPU_{it-1}$ and $VADD_{it-1}/OUT_{it-1}$ which are elements of X_{it} in $\mu_{it} = \exp(X_{it}'\gamma + \theta_i)$, are each functions of θ_i. However, the Jacobian of the transformation from the vector of composite disturbances to the f_i, IMP_i^*, and OUT_i^* equations (each of which contain θ_i) to the vector (f_i, IMP_i^*, OUT_i^*) is triangular with 1's along the diagonal, its determinant is equal to one. Consequently, our likelihood function correctly accounts for this correlation between the regressors and error term

in the filing rate equations, so that the maximum likelihood estimates are consistent estimates of the true parameter values.

Table 1 contains the sample means and standard errors for all of the variables used in our analysis. The most noticeable aspect of this table is the large, relative to their means, standard errors associated with the number of filings and the various indexes of suit activity given in the lower rows of the table. This is consistent with the "rare event" nature of antidumping suit activity. Another aspect of note is the large amount of across-industry variability in the number of TSUS codes per industry. Although the mean number of TSUS codes in 33.63, the standard error indicates a substantial amount of variability in this number across industries and over time. As mentioned above, all dollar magnitudes are in real 1972 dollars.

Results

The first column of Table 2 presents estimates of the parameters of the filing rate equation. The first column of Tables 3 and 4 presents estimates of the parameters of the conditional mean functions given in (16) which are used assess the impact of duties on the flow of both imports and domestic output. Consistent with our "outcome filer" strategy, we find that the conditional mean of filings changes in the predicted manner due to changes in any of the four regressors. For example, higher filing rates are associated with industries that exhibit higher import penetration ratios, lower capacity utilization, higher employment, and lower shares of primary factor payments in total costs. As indicated by the very small value of σ, the density of filing implied by our model is extremely positively skewed. Recall that in our mixture model interpretation of the density of filings, the filing rate λ_{git} is drawn from a $\Gamma(\exp(X_{it}'\gamma + \theta_i),\sigma)$ distribution. The estimated value of σ implies a very positively skewed distribution of filing

rates, where for most goods and time periods, the filing rate is very small, but with a small probability a very large λ_{git} can be drawn which results in a high level of filing activity during that period. Because $E(f_{git}) = \exp(X_{it}'\gamma)E(\exp(\theta))\sigma$ implies $\ln(E(f_{git})) = X_{it}'\gamma + \ln(E(\exp(\theta)) + \ln(\sigma)$, the elements of γ, when multiplied by the corresponding element of X_{it}, have the interpretation of elasticities of the expected number of filings with respect to that element of X_{it}. Evaluating these elasticities for IMPEN and CAPU at the sample means given in Table 1 yields values of 0.43 and -0.98. In other words, if the value of $IMPEN_{it-1}$ is 1 percent higher for one industry relative to another, then expected number of filings in the current year should be 0.43 percent higher for this industry, assuming the value of $IMPEN_{it-1}$ for other industry is the sample mean of IMPEN. This same elasticity calculation for EMP and VADD/OUT yields 0.38 and -1.53.

Turning to the effects of antidumping duties on imports and domestic output, the coefficient associated with OGD in Table 3 implies that the imposition of an antidumping duty on a single TSUS code predicts a reduction of 10.55 million 1972 dollars in the annual rate of imports. This same antidumping duty predicts an increase of 7.13 million 1972 dollars in the annual rate of domestic output in this import-competing product, although this output effect is too imprecisely estimated to place much confidence in this value.

4. Investigation, Suspension, and Withdrawal Effects

While the results reported in Tables 2-4 provide estimates of the import and domestic output effects of antidumping duties, we have argued above that this yields an understanding of

the trade effects of antidumping law which is incomplete at best. We now develop an expanded econometric framework which will allow us to analyze the broader effects of antidumping law.

Econometric Model

To quantify the magnitudes of the effects on imports and domestic output of the various stages of the antidumping suit filing process we characterize the joint distribution of f_i, IMP_i^* and OUT_i^* with the same framework used to assess the impact of duties only. However, the conditional mean functions for the industry level imports and outputs now include accumulated index variables similar to OGD_{it} for the other stages of the antidumping suit filing process. In light of the discussion in Section 2 we quantify the impacts of (i) filing an antidumping suit, (ii) an affirmative preliminary LTFV determination, and (iii) the various post-investigation outcomes. In particular, we attempt to quantify the differential impact on imports and domestic output from suits ending in (a) duties, (b) suspension, and (c) withdrawal. Suits ending in a negative determination are taken to have no lasting impact on subsequent imports and domestic output.

In this case the conditional mean of our industry level output and import equations are based on the additional indicator variables $I_{git}^{k}(s)$, (k=OGP, OGPLFV, OGSUS, and OGWD) which count, respectively, the number of currently ongoing antidumping petitions (OGP), ongoing affirmative preliminary LTFV determinations (OGPLFV), ongoing suspended suits (OGSUS), and ongoing withdrawn suits (OGWD) for all $s \in [t,t+1)$ in product class g in industry i and time period t. The indicator variable $I_{git}^{OGP}(s)$ turns on at the filing date of the suit and remains on until the suit's final disposition date. The indicator variable $I_{git}^{OGPLFV}(s)$ remains on from the date of the affirmative preliminary LTFV decision until the suit's final disposition date. The final

disposition of the suit is determined by one of the following four events: (1) a negative final determination, (2) the imposition of duties, (3) the suspension of the investigation, or (4) the withdrawal of the suit by the petitioner. Using this variable we can construct the integrated, industry-aggregate indexes of activity in each of these portions of the suit filing process for year t. For the same reasons given for $I_{git}^{OGD}(s)$ in Section 3, we maintain the assumption that θ_i, industry i's unobserved filing propensity, is independent of $I_{git}^{k}(s)$ for the additional indicator variables (k=OGP, OGPLFV, OGSUS, and OGWD) as well.

In terms of this new notation the normalized conditional mean import and output functions become:

$$\mu_{it}^{m} = \beta^{m}\theta_i + \xi_t^{m} + \beta_1^{m} OGP_{it}/G_{it} + \beta_2^{m} OGPLFV_{it}/G_{it} + \beta_3^{m} OGSUS_{it}/G_{it} + \beta_4^{m} OGWD_{it}/G_{it} + \beta_5^{m} OGD_{it}/G_{it} \tag{21}$$

$$\mu_{it}^{o} = \beta^{o}\theta_i + \xi_t^{o} + \beta_1^{o} OGP_{it}/G_{it} + \beta_2^{o} OGPLFV_{it}/G_{it} + \beta_3^{o} OGSUS_{it}/G_{it} + \beta_4^{o} OGWD_{it}/G_{it} + \beta_5^{o} OGD_{it}/G_{it} \tag{22}$$

where

$$OGP_{git} = \int_t^{t+1} I_{git}^{OGP}(s)ds, \quad OGPLFV_{git} = \int_t^{t+1} I_{git}^{OGPLFV}(s)ds,$$

$$OGSUS_{git} = \int_t^{t+1} I_{git}^{OGSUS}(s)ds \quad OGWD_{git} = \int_t^{t+1} I_{git}^{OGWD}(s)ds.$$

Each of these four variables without the g subscript given in (21) and (22) is the sum of that variable over the G_{it} TSUS products in industry i for year t. The coefficients β_j^k, (j=1,2...5 and k=o,m) quantify the impact of a one unit change in these count variables on the rate of imports and output in industry i during time period t. Assuming the same distribution for η_{it} defined earlier, the likelihood function for this model is identical to the one given in (20) except for the expanded set of regressors in the conditional mean function for the normalized level of imports and domestic output.

Results

The estimates of the parameters of the filing equation obtained from jointly estimating this equation with our expanded model for the conditional mean of imports and domestic output do not differ very much from the estimates in the first column of Table 2 in terms of their signs and magnitudes or the precision with which they are estimated. Consequently, we omit these results, and simply note that they are again consistent with our "outcome filer" interpretation of filing behavior. The elasticities of the expected number of filings with respect to changes in any of the four variables evaluated at the sample mean of the vector of regressors are: IMPEN, 0.455; CAPU, -0.876; EMP, 0.376, and VADD/OUT, -1.66.

The results in the second column of Tables 3 and 4 shed some light on the importance of the non-duty impacts of antidumping law discussed earlier. In particular, in the second column of Table 3, we find fairly precisely estimated import effects for the stages of the investigation process included in our estimation. Consistent with the "outcome filer" interpretation of investigation effects, we find a slight acceleration of imports with the filing of an antidumping petition. The major reduction in the flow of imports occurs with the finding of a positive

preliminary LTFV determination. This affirmative determination is predicted to reduce the annual flow of imports relative to the pre-suit base rate of imports by 25.36 million 1972 dollars (33.81 - 8.45). If the petition is suspended, then the annual rate of imports as a result of the suspension agreement is predicted to be 29.57 million 1972 dollars below the pre-petition base rate. The imposition of duties predicts a similar reduction in the annual rate of imports (24.95 million 1972 dollars) to that accompanying a suspension agreement. However, a suit ending in withdrawal predicts no statistically significant change in the flow of imports relative to the base level of imports for that industry and time period. The output effects in the second column of Table 4 are largely opposite in sign and smaller in absolute value, but less precisely estimated than those for the import equation. Together, these results are consistent with the view that temporary protection from imports and a proportionately smaller increase in domestic output is a typical outcome of an affirmative preliminary LTFV determination, even if the suit does not end in duties. The first column of Figure 5 reports the point estimate of this net (sum of imports and domestic output) effect obtained by adding analogous suit activity coefficients in the second column of Tables 3 and 4.

Figures 2 through 5 provide depictions of the import, output, and the sum of imports and output effects of various hypothetical petitions according to our estimation results. The figures, which are meant only to be suggestive of the kind of import and output effects that might accompany an antidumping investigation, are constructed under the assumption that the preliminary LTFV determination occurs 5 months into the investigation, suspensions (if they occur at all) occur 10 months into the investigation, and final determinations (if they occur at all) occur at the end of the 12th month of the investigation. These timing assumptions approximate

the statutory limits imposed on the different phases of the investigation process in the absence of "extraordinary complications" (see note 6). We use the coefficient estimates given in the second columns Tables 3, 4, and 5 to compute the cumulative impact on imports, output and the sum of imports and domestic output. Because the coefficient estimates for $OGWD_{it}/G_{it}$ were never significantly different from zero, we do not use our point estimates to illustrate the effects of a withdrawn petition. All hypothetical petitions depicted in the figures are filed in month 6 and, if they run the full course of the investigation, have a final determination 1 year later in month 18. All import and output effects are measured as deviations from zero.

Figure 2 depicts the case of an investigation which had an affirmative preliminary LTFV determination and a duty imposed after the final determination. According to our estimates in Table 3, filing would lead imports to rise above their baseline until the date of preliminary LTFV determination, at which point imports begin falling. By the seventh month of the investigation, the import level is back down to its baseline level, and continues to drop below baseline for the remaining 5 months of the investigation. Duty imposition at the end of 12 months then leads essentially to a continuation of the level of protection afforded over the last seven months of the investigation. Thus, as Figure 2 makes clear, our point estimates suggest that the investigation effects restrict trade from the date of an affirmative preliminary LTFV determination forward as if the expected antidumping duties were put in place on that date. Given that this accounts for a bit more than half of the statutory investigation period, and that the first five months of the investigation see a small rise in imports, we conclude that a petitioning firm can expect to receive roughly half the import relief during the period of investigation that it would have received if antidumping duties had been imposed from the date of filing. This is illustrated by comparing

Figure 3, which depicts the import effects of a petition whose preliminary LTFV determination is affirmative but whose final determination is negative, with Figure 4, which depicts the effect on the level of imports if an antidumping duty had been imposed on the date of filing. Figure 5 depicts the import effects of a suspension agreement. As noted above, our point estimates suggest that suspension agreements are at least as restrictive of imports as would be the imposition of antidumping duties. These same figures paint qualitatively the exact opposite picture with respect to domestic output.

For the sum of both imports and domestic output, Figures 2-5 all show that although the domestic output is enhanced by the same stages of the suit resolution process that restrict imports and is restricted by those stages that enhance imports, the net effect on the sum of imports and domestic output is, for the most part, dominated by the import effect. For example, in Figure 2, the net effect of the filing of a petition is a slight acceleration in the sum of imports and domestic output, because the surge in imports is larger in absolute value than the drop in domestic output, although the standard error estimates in the second column of Table 5 shown that this net effect is imprecisely estimated. However, the net effects of both an affirmative preliminary LTFV decision and the imposition of a dumping duty are fairly precisely estimated to be negative, with the trade restricting effect dominating the domestic output enhancing effect in both cases. The net effect of a suspension agreement is also precisely estimated to be negative. Consequently, the net effect of the various stages of the suit resolution process and suit outcomes in Figures 2-5 is a reduction in the sum of imports and domestic output. These net results are consistent with the view that the suit resolution process, the presence of suspension agreements, and the imposition of duties all result in net losses in domestic consumer welfare.

5. Investigation Effects with Both Process and Outcome Filers

The results of the previous section appear to favor the outcome filing strategy over the process filing strategy. However, one would expect the process filing strategy to be the far less common strategy which, if used, should be used by industries which are able to maintain "orderly competition" in their domestic market and can coordinate (either through a strong industry association or small numbers) to agree to file antidumping suits in periods of sufficiently low capacity utilization. We would expect this filing strategy to be more difficult to pursue by industries characterized by large numbers of firms without a strong industry association. Such necessary conditions for the use of the process filing strategy imply that if this strategy is used by any industries in our sample, it is likely to be a small number of them. Consequently, we would expect the outcome filing effects to dominate in a model that does not simultaneously allow for the possibility of outcome and process filers.

In this section we examine whether it is possible to find evidence consistent with the use of the process filing strategy by a subset of industries in our sample. Because the filing strategy used by a firm is unobservable, we must account for this possibility in our econometric model of filings, imports, and output. However, for the reasons just discussed there are also observable variables that we believe should increase the probability a given industry is using the process filing strategy rather than the outcome filing strategy.

Our general modeling approach is to specify the filing strategy used by an industry for our entire sample time period as a latent indicator (0-1) random variable y_i, where $y_i = 1$ if the industry uses the process filing strategy and $y_i = 0$ if the industry uses the outcome filing strategy. The probability that y_i takes on the value 1 is assumed to depend on observable and

unobservable industry characteristics at the beginning of our sample period. Conditional on each one of these filing strategies we hypothesize a conditional distribution of filings, imports and output for our sample period for each industry which embodies the restrictions on the mean function of industry-level filings implied by each of the filing strategies.

The unrestricted form of our two-strategy model allows for the existence of two separate joint distributions of filings, imports, and domestic output, conditional on the unobservable latent variable y_i. It places no restrictions on which variables enter the filing rate function for either strategy. It also places no restrictions on signs and relative magnitudes of the coefficients on the five indicator variables in the mean function for imports and domestic output for either strategy. Finally, our unrestricted model places no restrictions on how observable characteristics of the industry affect the probability it is using either of the two filing strategies. If certain restrictions can be imposed on this unrestricted two-strategy model, then we can conclude that there is evidence for the simultaneous existence of both outcome and process filers.

The restrictions on our econometric model are guided by the theoretical results discussed in Section 2. These results imply that process filers decide to initiate antidumping suits based purely on the level of capacity utilization in their industry. Consequently, the filing rate function for the joint distribution of filings, imports, and output for the process filing strategy should contain only capacity utilization. The theory gives no guidance concerning the dynamics of the impact of capacity utilization on filing. We included lags of capacity utilization up to the point where the null hypothesis of excluding further lags could not be rejected. This lead to the inclusion of $CAPU_{it-1}$ and $CAPU_{it-2}$. On the other hand, according to our discussion in Section 2, the filing rate function for outcome filers should contain all the variables used to determine

injury described in Section 3--$IMPEN_{it-1}$, $CAPU_{it-1}$, EMP_{it-1}, and $VADD_{it-1}/OUT_{it-1}$. Although the same five indicator variables--OGP, OGPLFV, OGSUS, OGWD, OGD--enter the mean functions for imports and output for both filing strategies, the coefficients associated with these variables should differ across the two filing strategies in the manner predicted in our discussion of the outcome and process filing strategies in Section 2. Evidence consistent with the co-existence of outcome and process filers is that: (1) the restrictions on which variables enter into the process and outcome filing equations are not rejected by the data; and (2) the sign restrictions on the coefficients associated with our five petition-stage variables are not rejected for the import and domestic output equations.

Although the true filing strategy used by an industry is unobservable, there are several observable industry characteristics which may increase the probability that it is using this strategy. We account for this by specifying the probability an industry is using the process filing strategy as a function of observable industry characteristics. Several of these characteristics are meant to reflect variation in the cost of using antidumping law across industries and capture the notion that the process filing strategy--whose benefits are relatively short-lived--is less likely to be chosen by industries with high filing costs. The first characteristic is the beginning of the sample degree of unionization in the industry. All firms in an industry benefit from the protection provided by an antidumping suit, but only those firms filing the suit bear the costs. We expect more highly unionized industries to have higher probabilities of being process filers because a strong union presence in an industry provides an additional across-firm organization to assist in overcoming the coordination and cost-sharing problems associated with filing an antidumping suit on behalf of the industry. The second factor is the size of industry, which we

measure by the beginning of the sample level of employment. Because there is a substantial fixed cost component to filing an antidumping suit, a large industry can share these fixed costs over a greater number of firms and employees and therefore reduce the per firm and per employee suit filing cost. This in turn means that less per firm expected benefits are necessary to trigger an antidumping suit petition, making process filing more likely. The final variable is the beginning of sample import penetration ratio. We expect larger values of this variable to be associated with higher probabilities of process filing, for the reason that unless firms are faced with substantial import competition there is very little reduction in domestic output due to these imports and therefore only a small benefit to reducing the flow of these imports. Consequently, the firms in the industry will have little incentive to concern themselves with pursuing temporary protection through antidumping law.

Econometric Model

The econometric model which we use to estimate the impacts of antidumping law on imports and output while allowing for the possibility of both process and outcome filers extends the basic econometric model of the joint distribution of filings, imports, and output developed and utilized in previous sections. We will outline the additions to this framework necessary to construct the likelihood function in this case.

First, we specify a distribution for the filing strategy regime indicator y_i. In this case we hypothesize that

$$\text{pr}(y_i = 1 \mid \theta_i) = \Phi(z_i'\alpha + \rho\theta_i), \tag{23}$$

where $\Phi(t)$ is the standard normal distribution function, z_i is a vector of beginning-of-the-sample observable industry characteristics which predict the filing strategy used by an industry, and θ_i

is the unobservable industry characteristic defined earlier, which also influences the filing strategy used by an industry.

The conditional mean of the filing rate for the outcome strategy is

$$\mu_{it}^{f,O} = \exp(\gamma_{1t} + \gamma_2^0 IMPEN_{it-1} + \gamma_3^O CAPU_{it-1} + \gamma_4^O EMP_{it-1} + \gamma_5^O (VADD_{it-1}/OUT_{it-1}) + \theta_i) \qquad (24)$$

where γ_{1t} denotes the set of fixed time-effects. The conditional mean for the process strategy is

$$\mu_{it}^{f,P} = \exp(\gamma_{1t} + \gamma_2^P CAPU_{it-1} + \gamma_3^P CAPU_{it-2} + \delta\theta_i) \qquad (25)$$

where δ is a parameter which accounts for how θ_i impacts the filing rate under the process filing strategy. Following the procedure to derive the density of f_i given in (7), one can derive the density of f_i conditional on y_i and θ_i, by substituting the strategy-specific conditional mean function into $pr(f_i \mid \theta_i)$. This yields $pr_j(f_i \mid \theta_i, y_i)$ for j=O,P.

Let the conditional mean function for IMP_{it}/G_{it} and OUT_{it}/G_{it} for the outcome (O) and process (P) strategies be defined as:

$$\begin{aligned}\mu_{it}^{k,j} = \beta^{k,j}\theta_i + \xi_t^m + \beta_1^{k,j} OGP_{it}/G_{it} + \beta_2^{k,j} OGPLFV_{it}/G_{it} + \beta_3^{k,j} OGSUS_{it}/G_{it} \\ + \beta_4^{k,j} OGWD_{it}/G_{it} + \beta_5^{k,j} OGD_{it}/G_{it}\end{aligned} \qquad (26)$$

where k=m,o (for imports and output) and j=O,P (for outcome and process filers), so that we allow for different β_i-coefficients for each filing regime. We assume that the disturbances to the conditional mean function for the process filing regime (η_{it}^P) and for the outcome regime (η_{it}^O) each possess the $N(O,G_{it}\Sigma)$ distribution defined earlier. By substituting the process strategy or

outcome strategy conditional mean vector for imports and output into (18), we can derive $h_j(IMP_i^*,OUT_i^*|\theta_i,y_i)$, the density of imports and output conditional on y_i (the filing strategy j being followed by the industry) and θ_i.

Following the logic used to derive the joint density of filings, imports, and output for the sample period given in (19) we can derive this same joint distribution condition on the filing regime and θ_i. Let

$$g_j(f_i,IMP_i^*,OUT_i^* \mid \theta_i,y_i) = h_j(IMP_i^*,OUT_i^* \mid \theta_i,y_i)pr_j(f_i \mid \theta_i,y_i). \tag{27}$$

where j=O or P. Then the density of (f_i,IMP_i^*,OUT_i^*), conditional on θ_i only, can be derived by "integrating" with respect to the density of the indicator variable y_i:

$$\begin{aligned} g_{O,P}(f_i,IMP_i^*,OUT_i^* \mid \theta_i) &= g_P(f_i,IMP_i^*,OUT_i^* \mid \theta_i,\ y_i = 1)\Phi(z_i'\alpha + \rho\theta_i) \\ &+ g_O(f_i,IMP_i^*,OUT_i^* \mid \theta_i,\ y_i = 0)(1 - \Phi(z_i'\alpha + \rho\theta_i)). \end{aligned} \tag{28}$$

To obtain the unconditional distribution of filings, imports and output, we integrate with respect to the discrete factor approximation for $f(\theta)$ in the same manner as is done to derive (20). This yields:

$$p_{O,P}(f_i,IMP_i^*,OUT_i^*) = \sum_{k=1}^{K} \pi_k g_{O,P}(f_i,IMP_i^*,OUT_i^* \mid \theta_k). \tag{29}$$

Taking the log of $p_{O,P}(f_i,IMP_i^*,OUT_i^*)$ yields the likelihood function which we maximize to compute the estimates of the parameters of the three conditional mean functions for the two filing strategies and the parameters of the filing strategy probability function.

Results

Table 6 presents the coefficient estimates for the Probability of Process Filer equation given in (23). Because we assume that $pr(y_i = 1) = \Phi(z_i'\alpha + \theta_i)$ the elements of α have the same interpretation as those from a probit model. They are proportional to the increase in the probability of the event $y_i = 1$ (the industry is a process filer) brought about by a one unit increase in the variable associated with that coefficient. Consequently, these estimates imply that the probability an industry is a process filer is increasing in the percentage of all workers in the industry that are unionized in 1979, the level of industry-wide employment in 1979, and the import penetration ratio for this industry in 1979. To provide magnitudes which are more amenable to interpretation we compute the average, over all 338 industries in our sample, percentage increase in the probability that industry i is a process filer brought about by a one percent increase in that element of z_i. These average probability elasticities are reported in the second column in Table 6. For example, a one percent increase in the number of employees in the industry predicts a 0.43 percent average increase in the probability that the industry is a process filer.

The second and third columns of Table 2 present the filing equation estimates for the outcome and process filing strategies. The outcome filing results are consistent with the earlier two filing equation estimations. All of the variables enter in qualitatively the same manner as for the two models estimated above. The filing equation for the process filing strategy excludes

all variables but two lags of CAPU. According to our discussion of the process filing strategy, only capacity utilization should enter this filing equation. The addition of the remaining three regressors, IMPEN, EMP, and VADD/OUT, to this equation does not add any statistically significant explanatory power to the model (the likelihood ratio test does not reject the null hypothesis that these three coefficients are jointly zero), which lends some support to the presence of two distinct filing strategies.

The third and fourth columns of Tables 3-4 present the import and output equations for the outcome and process filing strategies, respectively. For the outcome filing strategy, the third column of Tables 3 and 4 yield investigation effects similar to the effects estimated for the single filing strategy import and output equations presented in the previous section. The major difference between these two sets of results is the slightly decreased estimated precision for the estimates in the third column of Tables 3 and Table 4. The results in the fourth column of Tables 3 and 4 present a different story of the impacts of antidumping suits on imports and output. All of the investigation effects beyond simply the filing of an antidumping suit are considerably smaller in absolute value and quite imprecisely estimated. The only investigation effect which seems present under the process filing strategy is the suit filing impact. Under this strategy, the filing of antidumping suit predicts an immediate reduction in the rate of imports and an increase in the rate of domestic output. The remaining stages of the process appear to have little impact on the rate of imports or domestic output. Even the impact of antidumping duties, although estimated to be trade-restricting, is not very precisely estimated.

To provide a comparative view of the accumulated trade restricting effects of these different filing strategies we present figures depicting the estimated accumulated trade distortions

from a hypothetical suit filing, analogous to Figures 2 through 5. Figure 6 depicts the effect on the levels of imports, output, and the sum of imports and output of a petition that is filed by an outcome filer in month 6, receives an affirmative preliminary LTFV determination in month 11, and a negative final determination in month 18. Figure 7 depicts the import, output and net import and output effect for the same investigation history when filed by a process filer. As the figures depict, there appears to be a striking difference in the pattern of import, output and net response to the various phases of the investigation process across the two filing strategies in a way that is consistent with our outcome and process filer interpretations.

The net effect results for outcome filers, presented in column 3 of Table 5, are consistent with those obtained for the single filing strategy model. Although all but the $OGPLFV_{it}/G_{it}$ and OGD_{it}/G_{it} net coefficients are essentially zero, these two coefficients indicate significant net import and output reductions from these stages of the suit resolution process under the outcome filing strategy, and hence net domestic consumer welfare losses. The net effect results for process filers, presented in column 4 of Table 5, imply that the only nonzero net effect is the large OGP_{it}/G_{it} effect. This effect indicates substantial net import and output reductions from the filing of a petition under the process filing strategy. Consequently, there are also welfare losses to domestic consumers under the process filing strategy. More importantly these welfare losses result from the filing of an antidumping petition which is evidently motivated by a desire to secure the trade restricting effects of the investigation alone.

Although as emphasized at the beginning of this section, the filing strategy pursued by a given industry is a unobservable, our model does allow the computation of the probability that

an industry is a process filer given the estimated parameters of our econometric model and the vector z_i from the equation:

$$pr(y_i = 1 \mid z_i) = \sum_{k=1}^{K} \pi_k \Phi(z_i'\alpha + \theta_k). \tag{30}$$

The sample average of these probabilities gives an estimate of the proportion of industries pursuing the process filing strategy. For our parameter estimates, the sample average of the probability that an industry is a process filer is 3.5 percent. Assuming the validity of our two strategy model, this implies that approximately 10 industries are process filers, with the vast majority being outcome filers. This is consistent with our initial view that outcome filing is major use of antidumping law.

To further investigate the implications of our two filing strategy model we computed the value of (30) for all observations in our sample and ranked industries by the probability of being a process filer. The three highest probability process filer industries are: SIC-3312, Blast Furnaces, steel works, and rolling mills; SIC-3714, Motor vehicle parts and accessories; and SIC-3711, Motor vehicles and passenger car bodies. Other notable industries in the top ten highest probability process filer category are: SIC-3721, Aircraft; and SIC-3662, Radio and television

transmitting, signaling and detection equipment and apparatus.[18] Once we move outside the ten highest probability process filer industries, the probability that any of the remaining industries is a process filer falls rapidly from less than 10 percent to 0.7 percent. Consequently, all of the remaining industries have a very low estimated probability of following the process filing strategy.

Finally, recall that as we have defined them, outcome filers initiate suits primarily to obtain the protection that comes with a finding of dumping and the explicit remedies that follow (duties or suspension agreements). On the other hand, process filers are primarily interested in the temporary protection afforded by the antidumping suit resolution process, and do not file with the intent of eventually obtaining explicit remedies. Thus, a final implication of the process filing strategy is that the rate of duties per suit filed should be substantially lower for the process filers relative to the outcome filers. To investigate this hypothesis we took the ten highest probability process filer industries and computed the sum of OGD_{it} over these industries for all six years in our sample. We then divided this sum by the sum of f_{it} over these same industries for all six years in our sample. This ratio gives the per-suit level of duty activity for this process filer sample. We repeated this same calculation for the remaining observations in our sample to

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[18] Although we would like to caution that these probabilities are conditional on the validity of both our underlying process filer theory and our econometric model, anecdotal evidence seems to supports the plausibility of these results. For example, concerning the filing behavior of the steel industry (the industry most likely according to our results to be a process filer) **The Economist** writes:

> One lawyer who specializes in international trade says that, for a struggling mill, $400,000 to bring an antidumping suit is money well-spent, even without a final ruling; the process gums up the trade gears sufficiently to steer buyers back to domestic steel (**The Economist**, May 16, 1992, p. 98).

compute the per-suit level of duty activity for this outcome filer sample. Dividing the process filer ratio by the outcome filer ratio yields 5.5. This indicates that, for our sample, a product level antidumping suit is 5.5 times more likely to end in duties for an outcome filer than for one of our ten highest probability process filers. This result is consistent with the view that process filers file less for the eventual protection provided by duties than do outcome filers.

6. Conclusion

We summarize our empirical findings as follows. First, we find strong evidence that antidumping law effects imports and import-competing output in important ways other than through the imposition of duties. In particular, we find that suspension agreements lead to outcomes which are comparable in their restrictiveness to the imposition of antidumping duties. Moreover, there appear to be important investigation effects associated with antidumping petitions: our results suggest that petitioning firms may enjoy import relief during the investigation period which amounts to about half of what they might expect from a positive final determination and duty imposition. We also find evidence of two kinds of filing strategies: "outcome" filers who file petitions for the possibility of seeing duties imposed, and "process" filers who file for the trade-restrictive effects of the investigation process alone. Finally, we find little evidence that withdrawn petitions lead to restricted trade.

To provide some idea of the magnitude of these within-investigation and post-investigation effects of antidumping suits, we have made some rough calculations of the trade distorting effects of all of the antidumping suits that occur over our sample period using our single strategy

parameter estimates given in the second column of Tables 3 and 4. To compute the total sample distortions to imports and output from the suit resolution process we compute:

$$D_{INV}^{m} = \sum_{i=1}^{N}\sum_{t=1}^{T} \beta_1^m OGP_{it} + \beta_2^m OGPLFV_{it} \quad and \quad D_{INV}^{o} = \sum_{i=1}^{N}\sum_{t=1}^{T} \beta_1^o OGP_{it} + \beta_2^o OGPLFV_{it}.$$

To compute the entire sample distortions to imports and output from the post-investigation effects, we compute:

$$D_{END}^{m} = \sum_{i=1}^{N}\sum_{t=1}^{T} \beta_3^m OGSUS_{it} + \beta_5^m OGD_{it} \quad \text{and} \quad D_{END}^{o} = \sum_{i=1}^{N}\sum_{t=1}^{T} \beta_3^o OGSUS_{it} + \beta_5^o OGD_{it}.$$

We exclude the effects due to withdrawn suits because the coefficients associated with $OGWD_{it}/G_{it}$ in both the import and output equations are never statistically different from zero. We then compute IMPTOT and OUTTOT, which are the sum of total imports and output over all industries and years in our sample, and express D^m_{INV} and D^m_{END} as a percentage of IMPTOT, and D^o_{INV} and D^o_{END} as a percentage of OUTTOT. We find that over our sample of industries for the six years of available data, the total amount of import reductions due to all investigation effects is approximately -0.26 percent of total imports over the sample period. On the other hand, the total distortions due to post-investigation effects is -4.37 percent of IMPTOT. Both the total investigation and post-investigation effects are a very small percentage of OUTTOT, 0.0008 percent and 0.42 percent respectively. To compute the net import and output effects for our sample period we compute $D^m_{INV} + D^o_{INV}$ as a percentage of OUTTOT + IMPTOT, and D^m_{END}

+ D^{o}_{END} as a percentage of OUTTOT+IMPTOT. The investigation and post-investigation net distortions percentages are -0.03 and -0.14.

An obvious question that arises if one takes seriously the investigation effects we have found is: Why don't more industries file antidumping suits? There are two factors which work against more industries pursuing this form of protection. The first has to do with the design of antidumping law. As mentioned earlier, suits must be filed by either an interested party on behalf of the industry, or are self-initiated by the ITA. Although the interested party is usually an industry association or a large fraction of firms in the industry, there still is a cost of organizing and coordinating to take the necessary action to file a suit. The second factor is the explicit economic cost of hiring the necessary legal and administrative expertise to file an antidumping suit. This cost can easily amount to a half-million dollars or more, and the protection provided, assuming neither duties nor a suspension agreement is eventually imposed, lasts roughly one year. Consequently, the expected annual benefits to the petitioning party should at least exceed these costs in order for filing to be rational. This circumstance does not seem likely for most of the industries in our sample.

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Table 1: Means and Standard Errors of Variables			
2028 Year-Industry Observations (i=1,...,N=338 industries and t=1,...,T=6 years)			
Variable	Definition	Mean	Standard Error
f_{it}	Total Filings	0.928	13.69
Git	Total TSUS Codes	33.63	131.86
IMP_{it}	Real Imports in 10^6 1972 dollars	291.14	1151.19
OUT_{it}	Real Output in 10^6 1972 dollars	2168.61	4161.81
EMP_{it}	Industry Level Employment x 10^3	40.86	62.18
$VADD_{it}/OUT_{it}$	Value-Added per Dollar of Real Output	0.482	0.134
$CAPU_{it}$	Capacity Utilization Rate	2.799	1.899
$IMPEN_{it}$	Import Penetration Ratio	0.119	0.149
OGP_{it}	Ongoing Antidumping Petition	0.547	8.556
$OGPLFV_{it}$	Ongoing Preliminary Less Than Fair Value	0.159	2.711
$OGSUS_{it}$	Ongoing Suspension	0.177	3.418
$OGWD_{it}$	Ongoing Withdrawal	0.558	12.047
OGD_{it}	Ongoing Duties	0.300	3.312
$UNION79_i$	Percent of Industry's Workers Unionized in 1979	32.47	12.43

Table 2: Filing Rate Equations Estimates			
N = 338 Industries for T = 6 Years			
Variable	Coefficient Estimate (Standard Error)		
	Single Filing Strategy Model	Two Filing Strategy Model	
	Duties only Model	Outcome Filing Strategy	Process Filing Strategy
Constant	3.538 (1.157)	3.510 (1.102)	
$IMPEN_{it-1}$	3.659 (1.599)	1.700 (0.534)	
$CAPU_{it-1}$	-0.349 (0.086)	-0.425 (0.139)	-0.250 (0.117)
$CAPU_{it-2}$			-0.140 (0.063)
EMP_{it-1}	0.009 (0.003)	0.009 (0.003)	
$VADD_{it-1}$ /OUT_{it-1}	-3.171 (1.806)	-2.404 (1.723)	
$\sigma \times 10^4$	8.213 (1.173)	8.959 (2.045)	
YEAR81	-0.472 (0.092)	-0.518 (0.221)	
YEAR82	-0.019 (0.033)	0.041 (0.213)	
YEAR83	0.594 (0.234)	0.406 (0.192)	
YEAR84	0.281 (0.262)	0.271 (0.093)	
YEAR85	0.802 (0.394)	0.805 (0.285)	

Table 3: Import Equations Estimates				
N = 338 Industries for T = 6 Years				
Variable	Coefficient Estimate (Standard Error)			
	Single Filing Strategy Models		Two Filing Strategy Model	
	Duties Only Model	Full Investigation Effects Model	Outcome Filer Model	Process Filer Model
OGP_{it}/G_{it}		8.45 (4.23)	12.58 (6.973)	-32.58 (12.39)
$OGPLFV_{it}/G_{it}$		-33.81 (10.32)	-48.59 (20.39)	-3.25 (2.29)
$OGSUS_{it}/G_{it}$		-29.57 (8.93)	1.33 (4.03)	-1.93 (3.09)
$OGWD_{it}/G_{it}$		-17.06 (11.89)	-0.04 (2.14)	-3.22 (2.98)
OGD_{it}/G_{it}	-10.55 (4.43)	-24.95 (9.32)	-24.69 (11.20)	-14.94 (9.03)
YEAR81	-0.052 (0.184)	0.090 (0.123)	0.065 (0.012)	
YEAR82	-0.060 (0.238)	0.970 (0.632)	0.823 (0.603)	
YEAR83	2.310 (1.032)	2.988 (1.323)	2.483 (0.948)	
YEAR84	6.023 (1.843)	7.673 (2.232)	5.707 (2.394)	
YEAR85	9.056 (4.493)	11.53 (4.393)	8.783 (4.203)	

Table 4: Output Equations Estimates				
N = 338 Industries for T = 6 Years				
Variable	Coefficient Estimate (Standard Error)			
	Single Filing Strategy Models		Two Filing Strategy Model	
	Duties Only Model	Full Investigation Effects Model	Outcome Filer Model	Process Filer Model
OGP_{it}/G_{it}		-7.30 (4.23)	-3.25 (4.30)	16.94 (10.38)
$OGPLFV_{it}/G_{it}$		24.95 (10.92)	9.74 (4.23)	3.69 (6.39)
$OGSUS_{it}/G_{it}$		25.57 (12.93)	21.44 (9.49)	3.02 (7.83)
$OGWD_{it}/G_{it}$		14.32 (11.46)	10.09 (11.44)	-4.47 (4.81)
OGD_{it}/G_{it}	7.13 (5.31)	15.97 (6.32)	15.55 (9.49)	12.46 (8.32)
YEAR81	-2.04 (2.794)	-7.04 (7.21)	1.27 (2.10)	
YEAR82	-7.32 (5.84)	-13.50 (6.20)	-6.43 (8.20)	
YEAR83	-6.03 (3.04)	-7.42 (8.23)	-8.29 (10.93)	
YEAR84	6.32 (7.50)	6.23 (8.02)	7.85 (4.74)	
YEAR85	7.93 (8.94)	4.76 (5.94)	8.19 (5.75)	

Table 5: Output and Import Net Effects				
Sum of Suit Activity Index Coefficient Estimates Given in Tables 3 and 4				
Variable	Coefficient Estimate (Standard Error)			
	Single Filing Strategy Models		Two Filing Strategy Model	
	Duties Only Model	Full Investigation Effects Model	Outcome Filer Model	Process Filer Model
OGP_{it}/G_{it}		1.15 (0.85)	9.33 (6.14)	-15.63 (6.38)
$OGPLFV_{it}/G_{it}$		-8.86 (3.45)	-38.85 (15.37)	0.45 (3.29)
$OGSUS_{it}/G_{it}$		-4.00 (1.28)	22.77 (17.82)	1.09 (3.84)
$OGWD_{it}/G_{it}$		-2.74 (2.81)	10.05 (12.03)	1.26 (4.32)
OGD_{it}/G_{it}	-3.42 (1.02)	-8.98 (3.17)	-9.14 (4.36)	-2.49 (2.13)

Table 6: Probability of Process Filer Model (Two Filing Strategy Model)		
N = 338 Industries		
Variable	Coefficient Estimate (Standard Error)	Sample Average Probability Elasticity (Standard Error)
UNION79	0.012 (0.006)	0.85 (0.32)
EMP79	0.004 (0.001)	0.36 (0.05)
IMPEN79	1.297 (0.531)	0.27 (0.08)