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THE OTHER SIDE OF THE COIN: EFFECTS OF ANTI-DUMPING DUTIES ON TARGETED FIRMS

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Abstract

This dissertation is composed of three chapters studying the economic effects of Anti-Dumping duties on the targeted firms. The first chapter analyzes the risk of products targeted by these duties ceasing to export to their destination markets. The second chapter investigates the effects of these duties on the export revenue of the targeted firms, both at the firm level and the firm-country level. The third chapter builds on the previous two by examining the impact of these duties on the labor market outcomes of the targeted firms.

Chapter 1 examines the effects of anti-dumping (AD) duties on Brazilian firms from 1989 to 2001. Using a survival analysis methodology and controlling for selection into AD, the study finds that the largest impact of AD duties occurs during the investigation phase. Specifically, products named in an AD investigation are 4 times more likely to exit the market compared to the same products from non-targeted firms; additionally, if the firm received final AD duties, the targeted products are 3 times more likely to exit the destination market.

Chapter 2 studies how anti-dumping (AD) duties imposed on Brazilian firms during the period between 1989 and 2001 affect, separately, the targeted firm's total export revenue and the export revenue received from the country imposing the duties. I construct a propensity score and mixed panel methodology to find that anti-dumping duties sharply decrease the total export revenue of the targeted firm and the export revenue received from the country imposing the duties during the investigation phase and after the duties are approved.

Chapter 3 estimates the effects of anti dumping duties on targeted Brazilian firms' employment, average wages, total wage bill and the distribution of high versus low skilled

workers from 1989 to 2001. I construct propensity scores and use a mixed panel methodology to find that firms that are targeted with AD duties experience a long term decrease in their average wage level, total wage bill and number of high skilled workers when they received final AD duties. On the other hand, I find that AD duties have no significant effects on these targeted firms employment level and in their number of low skilled workers.

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Chapter 1

End of Trade: Exports After Anti-Dumping

1.1 Introduction

This paper analyzes the effects of anti-dumping (AD) duties on the hazard rate and the probability of exiting the destination market of products from targeted Brazilian firms between 1989 and 2001. By conducting a survival analysis methodology at the firm-country-product level and controlling for selection into AD, I find that AD duties significantly increase the likelihood of these targeted products to leave their destination markets. This effect is significant for every stage of the AD process. These findings align with existing AD literature, which suggests that firms are most likely to adjust their behavior to avoid large and restrictive tariffs during the investigation phase (Blonigen and Prusa, 2016).

An antidumping duty is a tariff imposed by a government on foreign imports that are priced below fair market value, typically below the cost of production or the price in the exporter's home market. These duties are designed to protect domestic industries from unfair competition by foreign companies that engage in dumping, which is the practice of selling

goods at an unfairly low price in the international market[1].

Most AD studies have focused on the effects on the country filing for AD duties to protect their domestic industry, finding that these duties effectively reduce imports, increase domestic output, domestic employment, and profits, but overall create welfare losses (Besedes and Prusa, 2016). These welfare losses result from worsening the terms of trade for industries, reducing imports from the targeted country, which also suffers welfare loss. The duties are treated by the exporter as endogenous and create an incentive to raise prices to avoid them, generating a welfare loss for the importer (Feenstra, 2015). Besedeš and Prusa (2017) conclude that AD duties have a long-run deterrence effect on the behavior of affected suppliers, and that AD effects are larger at the beginning of the investigation compared to when the final duties are set. Mazzucco and Bittencourt (2022) argue that AD duties may force the departure of foreign firms from domestic markets permanently.

This paper follows Besedeš and Prusa (2017), who find that AD investigations often drive export suppliers entirely out of the US market, and that countries affected by US-imposed AD duties are less likely to return to the US market. This paper, however, turns the analysis toward the targeted Brazilian firms and how they adapt to these duties. Unlike Besedeš and Prusa (2017), this paper analyzes the effects of AD duties initiated by every country that Brazil exports to. A similar paper by Mazzucco and Bittencourt (2022) quantifies the effect of AD duties on the likelihood of an exporter being excluded from the domestic market in Brazil. They find that during the course of an AD investigation, products from targeted countries have, on average, a 33% higher probability of ending a spell of trade compared to non-targeted countries. This paper is different in two ways; first, I study the effects of AD duties on the exported products of Brazilian firms to other countries; second, and most relevant, I determine the exact country-firm-product relationship that is being targeted with AD duties. Unlike Mazzucco and Bittencourt (2022), who uses a country-product pair variable as their unit of observation, this study accurately considers that AD

[1]See Blonigen and Prusa (2016) for a survey on antidumping policy.

duties target specific "agents": product, firm, and country. It is often the case that not all firms from a country are targeted with AD duties, nor are all products from a firm targeted. I take advantage of a rich Brazilian dataset to determine the exact firm-product-country combination that is being targeted with AD duties.

As in the aforementioned studies, I use a survival analysis methodology to estimate the duration of trade of Brazilian exports under AD duties. The first paper to use this methodology was Besedeš and Prusa (2006b), in which the authors estimate a Cox proportional hazard model and conclude that differentiated products have lower hazard rates than homogeneous goods, and that within each product type, the larger the value of the initial trade flow, the longer the duration of trade. Hess and Persson (2012) build on their model by discussing three main problems when using continuous time to represent trade flows in a Cox model and suggest using a discrete time specification instead. They compare the results using a logit, probit, and cloglog estimation of their hazard model. I present the results using these three specifications and compare them with previous studies.

I construct an empirical model by linking firm-level data from the SECEX (Secretaria de Comercio Exterior), which gathers yearly export reports at the firm-country level, with the Annual Social Information Report (RAIS), an administrative dataset from Brazil. RAIS covers 97% of the Brazilian formal market. Finally, I match AD duties targeting Brazilian firms from the Global Anti-dumping Database (GAD) (Bown, 2011). Given the availability of the datasets, I create a panel from 1989 to 2001 with firm-product-country level information.

This paper also controls for selection into AD, a problem inherent in this literature, by constructing two different control groups to analyze the results. The first group includes all the firms that exports the targeted products (at the 4-digit Harmonize System (HS)), but are not named in an AD process. The second group corresponds to all the products (at the 4-digit HS) from the targeted firms that are exported to the countries initiating an AD process. In other words, the first control group includes the non-targeted firms exporting the targeted products to the same country, and the second control group includes the non-

targeted products from the targeted firms. The decision to include only the products at the 4-digit HS is to compare similar products along the targeted product lines.

The results from the first control group indicate that the most significant impact of AD duties occurs during the investigation phase. During this phase, targeted products are 4.47 times more likely to exit the market compared to similar products from firms not subject to AD duties, but exporting similar products. For firms that decided to stay in this market and absorb the final AD duties, the effect is slightly smaller but still negative and significant. Products from targeted firms that received final AD duties are 3.21 times more likely to exit the market compare to similar products from non-targeted firms.

Similarly, for the second control group, which is comprised of similar products (same 4 digit HS code) from the same targeted firms, the results indicate that targeted products are 3.2 times more likely to exit the market compared to similar products from targeted firms that are not named in an AD investigation. Once the targeted products receive final AD duties, the targeted products are 2.3 times more likely to exit the market compare to similar products from the same targeted firms.

Brazil is the largest economy in Latin America with a strong manufacturing sector and is a regular target and user of AD investigations from both developing and developed countries. Recent studies found that most new AD activity is initiated by developing countries targeting other developing countries (Blonigen and Prusa, 2016). Bown and Reynolds (2017) proposed that the increase in AD activity could be attributed to the proliferation of global value chains and the exploitation of labor-intensive countries by manufacturing economies. They also argue that these labor-intensive developing economies have pursued a "growing by exports" development model, characterized by lower wages, low prices, and massive increases in export volumes. Brazil is a prime example of this type of development model with a strong presence and influence in international markets.

The paper is structured as follows: Section 2 presents a literature review on AD duties for both the imposing and the targeted country. Section 3 presents and discusses the datasets.

Section 4 describes the model and the methodology. Section 5 presents the results, and Section 6 concludes.

1.2 Literature Review

As previously mentioned, the effects of AD duties on the imposing country are well-documented by Blonigen and Prusa (2016). Valdebenito (2024a) discusses that most studies on AD policy focus on the effects on the country filing the AD, whereas a smaller strand of studies examines how AD affects the targeted country. Chandra and Long (2013) use detailed Chinese firm-level data and find that U.S. AD duties reduced labor productivity of targeted Chinese firms. They find that Chinese firms with the highest initial export intensity experienced the biggest drop in productivity due to the U.S. AD duties. Lu, Tao, and Zhang (2013) find that AD duties from the U.S. to China cause a substantial decrease in total export volume, primarily due to a significant decrease in the number of exporters, with a modest decrease in the export volume per surviving exporter.

Besedeš and Prusa (2006) and Besedeš and Prusa (2017) discuss the timing implications of data for studying AD duties, arguing that yearly data is problematic since AD duties, particularly during the investigation period or after the imposition of preliminary duties, are usually active for a few quarters of the year. Given that only yearly export data is available, it is necessary to include time lag variables in the analysis to proxy for the monthly effects of the tariffs. Besedeš and Prusa (2017) also argue that industry-level data is too aggregated to study AD protection, which is levied at the tariff line level. Each industry comprises hundreds or thousands of tariff codes, most of which are not protected.

Regarding AD duties imposed by the Brazilian government to foreign firms, Avsar (2013) demonstrates that AD duties lead to a significant increase in the unit values of exported products, forcing firms to raise their unit export prices to reduce the dumping margin and avoid retaliation by the targeted countries. A more recent study by De Souza and Li (2022) uses a

difference-in-differences approach to estimate the effects of AD duties on trade, domestic suppliers, and related sectors, finding that imports decrease while employment in the protected sector increases. Some additional studies using the same datasets are: Labanca, Molina and Muendler (2013); Menezes-Filho, Muendler and Ramey (2008); Hirakawa, Muendler and Rauch (2010); Aguayo-Tellez, Muendler and Poole (2010); Menezes-Filho and Muendler (2011); Muendler, Rauch and Tocoian (2012); Muendler and Rauch (2018); Arkolakis, Ganapati and Muendler (2021); Bazzi, Muendler, Oliveira and Rauch (2023); Ma, Muendler and Nakab (2023); and Valdebenito (2024b).

The literature on trade duration finds that the hazard rate decreases over time (Besedeš and Prusa, 2006; Campos and Cavaletti, 2016; Hess and Persson, 2011). Both Besedeš and Prusa (2017) and Mazzucco and Bittencourt (2022) find that AD duties increase the hazard risk of imports and often completely stop them. This paper finds similar results when studying the targeted firms; AD duties increase the risk that a product will exit the market when its targeted with AD duties.

1.3 Data

This paper use data from the Secretariat of Foreign Trade (SECEX) in the Ministry of Development, Industry and Foreign Trade of Brazil, which gathers yearly firm-level information on the firm's export revenue from the destination country, the number of products, the firm's individual identification number and the industry identifiers for each firm from 1989 to 2001. This data set does not provide information on volumes or product prices.

To control for firm size and industry, this paper uses the Annual Social Information Report (RAIS)[2]. As discussed in Valdebenito (2024a): "The RAIS is an administrative employer-employee matched data set from Brazil, similar to the employee data from the United States and Germany covering 97% of the Brazilian formal labor market between 1985-2019". Finally, this paper connects the previous datasets with the World Bank's Global Anti-

[2]I am grateful to Dr. Marc Muendler at U.C. San Diego for providing access to this data.

dumping Database (GAD). The GAD compiles information on temporary trade barriers such as antidumping duties, countervailing duties, and safeguard measures by all WTO members from 1985 to 2019[3].

The matching procedure is similar to Valdebenito (2024a) where: "I begin by matching the AD duties targeting Brazilian product-firms from the Global Antidumping Database (GAD) with the Brazilian firms listed in the SECEX (export database). This matches each AD duty to the 6-digit Harmonized System (HS) product from the named firm targeted by a specific country". Table 1 is also borrowed from Valdebenito (2024a) and offers a comparative analysis of Brazilian firms, highlighting key characteristics of those that were subjected to AD duties, those that were never targeted, and all Brazilian firms (including non-exporters). In general, firms facing AD duties tend to be larger, have higher export revenues, export to a larger number of countries, and produce a wider variety of products.

Figure 1 presents a description of the consecutive years Brazilian products are exported to the rest of the world. Out of a total of 22,716 country-product pairs, 57.1% are only exported for fewer than two consecutive years; 16.6% are exported for two consecutive years, and 9.1% are exported for three consecutive years during the period from 1989 to 2001. This analysis creates a benchmark to measure the length of time products are consecutively exported. It is common in trade data for products to be exported with gaps between years or to be exported every other year.

Table 2 provides summary statistics for the average duration of trade when AD duties are initiated for different products. This table displays the average number of years a product category (2-digit HS) is exported from a Brazilian firm. It focuses on products that were targeted by AD duties during the period from 1989 to 2001. Column 3 (Products No-AD) shows the average number of years a product category not targeted with AD duties is exported. Column 4 (Products with AD) shows the average number of years a product category targeted with AD duties at any time in the future is exported. For example,

[3]For a detailed description of each dataset, see Valdebenito (2024a).

products in the Iron and Steel category (HS 72) that received AD duties at any point during the period are exported, on average, for 4.77 years; similar products that were never targeted with AD duties survive, on average, for 3.31 years. For products named in an AD investigation but not receiving final AD duties (column 5, AD Investigation Phase only), the survival rate is 4.49 years. If these same products receive final AD duties, their survival decreases to an average of 2.77 years. A missing value in column 5 indicates that all products named in an AD investigation always received final AD duties.

Table 2 also shows that, on average, products targeted with AD duties during the period (Column 4) have a longer "life span" than products that are never targeted. This could be because products that get targeted with AD duties are more likely to come from larger firms with more established trade relations and have been exported for a longer time. An important takeaway from column 5 is that, on average, the investigation phase lasts between one and two years, and AD duties are active for five years (if the duty is not renewed in a sunset review). Therefore, if a product has a duration of trade longer than six to seven years, it may imply that it survived the AD duty. Only products in the Inorganic Chemicals category (HS 28) survive, on average, for more than five years.

Table 3 provides the same analysis as in Table 2 but for the countries that imposed AD duties against Brazilian products. Overall, the largest duration of trade for products under the category that received AD duties, are sent to Peru (7.0 years), USA (5.96 years), Mexico (5.25 years) and Argentina (4.99). But, Peru has only filled one AD action against Brazil. It is interesting to notice that Argentina, USA, Mexico and Canada have not always been successful at imposing final AD duties against Brazilian products.

1.4 Methodology and Empirical Model

Following Besedes and Prusa (2017), the objective of this paper is to determine the probability (hazard ratio) that a product ceases to be exported to a country after that country

initiates an AD investigation against the product from a particular Brazilian firm. Unlike these authors, I can take advantage of the very rich Brazilian data set and construct a more precise trade relationship by matching the Brazilian firm-country-product named in the AD process. Hess & Persson (2012), Besedes & Prusa (2017) and Mazzucco & Bittencourt (2022) construct a trade relationship as a country-pair, which implicitly assumes that an antidumping action is set on all the products from the named country. Instead, I construct the trade relation as country-firm-product triplet for all Brazilian exports with at least one observation in the sample period. This triple relation ensures an accurate estimation of the AD effects on the hazard function.

Some of the data limitations that this paper phases are discussed in Valdebenito (2024a), mainly: there is no information on product prices, and most of the AD duties against Brazil are value-specific rather than ad-valorem; no information on preliminary duties, which act as a strong signal for whether the firms will receive final duties and how large they will be; and the data only records year-to-year information.

Specifically for this paper, the dataset does not contain information on export volumes; it only provides information on the export revenue that the firm receives from the destination country and lists the products exported to that country in a particular year. This makes it impossible to control for the importance of the product to the firm, but it is likely that the products named in an AD process are responsible for a large share of the firm's revenue from that country given the fact that it was targeted.

1.4.1 Endogenenity and selection

One important consideration in the AD literature is the presence of endogeneity. Essentially, AD duties are not random events; therefore, they are not exogenous to the model, which implies that the estimation could be biased. AD duties are imposed on specific products from specific firms in specific countries. AD duties are most about protection than about fair trade (Nelson, 2006). Therefore, larger firms that export a large quantities of products at, allegedly,

cheaper prices are more likely to be targeted with AD duties. In Valdebenito (2024a), I address selection into AD by employing a propensity score methodology to determine the probability that a firm is targeted with AD duties. This propensity score considers the disproportionate size of the treatment group (the small number of firms named in an AD investigation) compared to the control group and compares treatment effects with firms possessing similar characteristics, thus mitigating the selection problem.

In this paper, implementing a propensity score is unnecessary because the level of observation is at the product-country-firm level. Therefore, I can isolate the specific product receiving the AD duty and compare it with the other products from the same firm being exported to the same country but not subject to the AD duty. Hence, I can narrow the sample to firms exporting to countries imposing AD duties, where the treatment group comprises the targeted products (at the 6-digit HS level) and the control group consists of other products exported by the same firm to the same country but not involved in an AD process. To further refine the sample for relevant analysis, the methodology only includes countries initiating AD processes against Brazilian firms, disregarding the study of trade diversion as it is beyond the scope of this paper.

Lastly, a firm-country random effect parameter captures unobserved heterogeneity specific to each firm-country combination. This parameter encapsulates variability among different firms that export to the same country and allows for correlations among observations within the same firm-country unit. Utilizing a firm-country random effect accommodates unobserved factors unique to each firm-country pair and helps address issues related to clustering and correlation within firm-country units (Valdebenito, 2024a).

1.4.2 Stages of the AD process

The timeline of a product under an AD process can be represented in the diagram of Figure 2, which details four relevant periods. The red box 1 represents the baseline scenario for the hazard rate of products that were not named in AD investigations and survived the

entire period of analysis. The red box 2 represents the period from when the product enters the market until it is named in the AD investigation. The red box 3 represents the period between the AD investigation and the imposition of final AD duties. The red box 4 represents the period when the products have received final AD duties and remain in the market. The product could exit the market at any point during these periods. I construct each treatment variable as a different AD stage.

This study uses the same structure to categorize the AD process as in Valdebenito (2024a), but at the firm-country-product relation as the observation variable. As described in Valdebenito (2024a): "I construct a categorical variable that separates the AD stages in 4 different categories: Before antidumping, Investigation stage, Approve stage and After antidumping. Firms in the "Before antidumping" category have not yet been targeted with an AD duty; "Investigation stage" are firms that are under an investigation process; "Approve stage" are firms that have active and final AD duties in force; and "After antidumping" are firms that had the investigation dropped or the duties expired and were not renewed. Firms that are never named in an AD investigation are in the "No AD" group; most of the firms are in this group."

1.4.3 Treatment and Control

The treatment group is constructed as the firm-country-product (6-digit HS code) trade relation that is named in an AD process at some point during 1989 to 2001. I construct two different control groups for analysis: The first represents all the firms that exports the targeted products at the 4-digit HS code to the country initiating an AD process on the firm. The second group corresponds to all the products (at the 4-digit HS) from the targeted firms that are exported to the countries initiating an AD process. In other words, the first control group includes the non-targeted firms exporting the targeted products to the same country; and the second control group includes the non targeted products from the targeted firms. To ensure comparability of the results, I also restrict both control groups to

the firm-country-product relation that has been exporting for at least 5 years.

Table 4 shows the number of observations in each stage of the AD process for the full sample, the first and second control groups. The control groups are represented in Table 4 in the "No AD" category and the treatment group is each stage of the AD process. Its clear from this table that performing an analysis on the full sample will generate biased results, due to the disproportional size of the treatment and control groups.

Table 5 shows that, on average, the control firms are smaller than the treated firms in terms of the number of workers employed and in their average export revenue. These two characteristics could suggest the presence of selection bias in the sample. Larger firms are more likely to receive AD duties. AD duties are set on firms that "flood" the domestic market. Figure 3 compares the hazard rate of the treatment group and the AD and Non-AD Firms (1st Control Group) over the period of analysis. The red line in the top graph represents the treatment group, indicating that the risk of leaving the market is lower for the targeted products compared to the same products from firms not involved in an AD process.

In the bottom graph of Figure 3, the hazard rate for the same control group (1st control group) is depicted at different stages of the AD process. The red line illustrates the hazard rate for products during the investigation phase, where the risk of exiting the market is higher. Conversely, the green line represents products that opted to remain in the market after receiving final AD duties, showcasing a hazard rate below 0.1%. This suggests that firms choosing to remain in the market despite the imposition of final AD duties are willing to absorb the associated costs and price increases to maintain their market presence, even at the expense of reduced competitiveness. It is important to note that during the investigation phase, targeted firms often receive preliminary duties, which serve as a clear signal regarding the likelihood and potential size of final AD duties. Therefore, if a firm continues to operate in the market after receiving final AD duties, it can be assumed that it has a strategic plan to mitigate the impact of these duties. Additionally, the blue line represents products from targeted firms that are not subject to AD duties. This line indicates that the more these

products are exported to a market, the less likely they are to exit it.

Figure 4 compares the hazard rate of the treatment group with that of the AD and Non-AD Products (2nd control group) over the period. In the top graph, the red line represents the treatment group, indicating a higher risk of exiting the market for targeted products compared to non-targeted products from the same firms. This suggests that AD duties increase the risk that a product will exit the market. Notably, in this control group, the treated firms remain the same, and the variation arises from differences in the products, thereby eliminating the selection bias by larger firms.

The second graph of Figure 4 illustrates the hazard rate for the same control group at various stages of the AD process. The red line signifies the hazard rate for products during the investigation phase, where the risk of exiting the market is higher. Conversely, the green line represents products that opted to remain in the market after receiving final AD duties, displaying a hazard rate below 0.1%. This graph shows the same behavior for targeted and non targeted products from the same firms, as in the products from targeted and non targeted firms (in the Figure 3). Furthermore, the blue line represents products from targeted firms not subject to AD duties, which are less likely to exit the market as times passes.

1.4.4 Censoring

Defining censored observations is fundamental for survival models. A censored observation occur when the event of interest is not observed for some subjects before the study is terminated. It is important to distinguish between left or right censoring. Left censoring occurs when the observation enters the sample and already has the treatment in place, i.e., when the AD is imposed before the product enter the sample. This can occur if AD duties are set before the time period of this paper or if the AD duties are set on "All the firms" which is common to find in the GAD database, meaning that the firm enters the market knowing that they will have to pay the AD duty. I follow the literature and delete the observations

that are left censored, keeping only the firm-country relations that begin in stage 0 (never targeted) or stage 1 (will be targeted in the future).

Right censoring, on the other hand, is when the product stops been exported before the end of the analysis period, which can be recorded as export revenue is equal to zero or if it drops out of the data. Survival analysis models deal with right censoring recording the disappearing of the sample as a failure event (exit the market). Thus, there is no need to control for it. After controlling for all the previous cases, I am left with 253 unique firm-country-product relations that were named in an AD process.

1.4.5 Empirical Discrete Hazard Model

As discussed in the literature, the most appropriate model for analyzing the duration of trade uses a discrete time hazard rate, which is the probability that an individual will experience an event at time t while that individual is at risk of suffering such event. Thus, the hazard rate is the unobserved rate at which events occur. It is important to realize that the hazard rate is an unobserved variable yet it controls both the occurrence and the timing of the events (Mazzucco & Bittencourt, 2022).

The hazard function can be specified in several ways, with the most common functional forms being the normal, logistic, and extreme-value minimum distributions. These lead to probit, logit, and cloglog models, respectively. The cloglog model, when used with period-specific intercepts, is closely aligned with the Cox proportional hazards model and maintains the assumption that hazard ratios are proportional over time. In contrast, the logit and probit models do not impose this proportionality. The logit model is similar to the cloglog model but allows for slight deviations from proportionality, making it more flexible. The probit model, on the other hand, does not assume constant hazard ratios over time, but its assumption of normally distributed error terms can be more restrictive (Hess & Persson, 2012). One advantage of the logit model is that its coefficients are interpreted as odds ratios, offering a more intuitive understanding compared to the probit model, where coefficients

relate to Z-scores in a cumulative normal distribution. Following the approach of Mazzucco & Bittencourt (2022), I estimate the hazard function using all three functional forms to compare the results, using the logit model as the preferred specification.

Another characteristic of the model is the parametric and non-parametric assumption for the baseline hazard function. A parametric baseline hazard function implements a particular functional form for the hazard rate over time. Examples of these functional forms include the exponential model, which assumes a constant hazard rate, and the Weibull model, which allows the hazard rate to either increase or decrease over time (Klein & Moeschberger, 2003). Parametric models are efficient and can provide better predictive power if the chosen functional form closely matches the true hazard function. However, they can lead to biased estimates if the model is misspecified (Kalbfleisch & Prentice, 2011). On the other hand, a non-parametric baseline hazard function does not assume any specific functional form for the hazard rate. Instead, it estimates the hazard function directly from the data, providing greater flexibility. Non-parametric models are robust to misspecification and can adapt to the actual shape of the hazard function, thus, allowing for more flexibility in the model (Kalbfleisch & Prentice, 2011).

The results present a sensitivity analysis between the assumptions of proportionality (probit, logit, and cloglog models) and functional form (parametric and non-parametric). Following Hess & Persson (2012) and Mazzucco & Bittencourt (2022), I estimate a discrete-time hazard model using a logit specification with non-parametric discrete baseline hazard as:

$$\begin{aligned} h_{jpct} = \exp(&\beta_2(\text{Stage=2})_{jct} + \beta_3(\text{Stage=3})_{jct} + \beta_4(\text{Stage=4})_{jct} + \\ &\beta_5\text{Firm}_{jt} + \beta_6\text{Firm}_{jct} + \theta_t + \theta_i + \theta_{survival} + v_{jc} + \varepsilon) \end{aligned} \tag{1.1}$$

where h_{jpct} is the probability that firm j exporting product p to country c terminates at time t; Φ is the standard normal cumulative distribution; $(\text{Stage=g})_{jcpt}$ is the stage of the AD process of firm j exporting product p to country c at time t, where g takes the values 2, 3, 4 representing Investigation phase, Approved phase and After AD phase, respectively;

$Firm_{jt}$ are firm level characteristics; $Firm_{jct}$ are firm-country level characteristics; θ_{time} are calendar year fixed effects, θ_i are industry fixed effects; and $\theta_{survival}$ are the duration dummies; and v_{jc} are country-firm random fixed effects. To estimate the parametric models, it is only necessary to replace the duration dummies with the $\ln(t)$ (Mazzucco & Bittencourt, 2022).

1.5 Results

This section examines the effects on the hazard rate of products targeted with AD duties between 1989 and 2001. The tables present both parametric (Column A) and non-parametric (Column B) specifications using probit, logit and cloglog models. The distinction between the two columns lies in the assumption and imposition of a logarithmic distribution for the baseline hazard rate ($\ln(t)$) in the parametric models. Non-parametric models, on the other hand, relax this assumption and include time dummies which don't imposing a structural form for the survival function, allowing for more flexibility in the model.

Consistent with the literature and the methodology outlined earlier, the preferred specification for each table is the non-parametric (Column B) logit model. The estimated coefficients of the treatment variables in Tables 6 and 8 offer insights into the changes in the log odds of the likelihood of the event occurrence (exiting the destination market). For a more intuitive interpretation, Tables 7 and 9 present the predicted probabilities of the event occurrence (market exit) influenced by the treatment variables (each stage of the AD process). If the coefficient is positive, there is an increased likelihood of the product leaving the market compared to the control group, while a negative coefficient decreases the likelihood.

Lastly, the inclusion of the firm-country random effect parameter addresses unobserved heterogeneity and correlation within each firm exporting to a country, resulting in more accurate estimates of the model parameters and better predictions of the outcome variable. The significance of the coefficients of σ_u and ρ in Tables 6 and 8 is utilized to test this

heterogeneity assumption, with a detailed discussion of the coefficients presented in each section. The control variables are: $N\ Products\ Cat_{jt}$ as the number of products the firm exports to a country in the same HS category; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports the products in the same HS category; $N\_Products\_Country_{jct}$ as the number of all the products exported to a country; and $Firm\ Size(ln)_{jt}$ as the size of the firm in terms of workers.

1.5.1 Hazard rate on the AD and Non-AD Firms (1st control group)

This section presents the estimation of the hazard rate caused by AD duties on the targeted products compared to the first control group. The first control group comprises all firms exporting these targeted products at the 4-digit HS code to the country initiating an AD process, encompassing both targeted and non-targeted firms. As discussed previously, targeted firms exhibit larger size in terms of the number of workers and export revenue, export a greater variety of products, and distribute their exports across more countries. Consequently, these results may be influenced by selection bias.

Across all specifications in Table 6, the coefficients of σ_u and ρ are significant and distinctly different from zero. This suggests that incorporating a firm-country random effect parameter is appropriate to accommodate firm-country heterogeneity. Table 7 provides the predicted probability of exiting the market for each specification corresponding to Table 6.

The preferred specification is the non-parametric (column B) logit model. If a product is named in an AD investigation, the log odds of exiting the market increase by 1.497 compared to firms not under an AD investigation. These findings suggest that products subject to AD investigations are 4.47^4 times more likely to exit the market compare to products in the control group. According to the associated results from Table 7, the average predicted probability of a product exiting the market is 17.21% higher if it is in the AD investigation

[4]Odds Ratio= exp(1.497)=4.470.

phase, relative to a product in the control group.

The second result indicates that if a product received final AD duties, the log odds of exiting the market increase by 1.165 compare to firms that have no AD duties in action. This suggest that if a product received final AD duties, the odd of exiting the market are 3.206[5] higher than a product in the control group. The results from Table 7 suggest that the average predicted probability of a product exiting the market is 18.01% higher if it has received final AD duties compare to a product in the control group.

The third result suggest that if a product is no longer in an AD process (Investigation or Approved phase), the log odds of exiting the market increase by 0.8563 compare to products that have never been named in an AD process; This result is significant at the 5% and only significant at the 10% level in the probit and cloglog specifications. The interpretation suggest that if a product is no longer targeted in an AD process, the odd of exiting the market are 2.354[6] higher than a product in the control group. The results from Table 7 suggest that the average predicted probability of a product exiting the market is 17.51% higher if it has received final AD duties compare to a product in the control group.

All three models present similar coefficients in terms of sign and significance, and even thought the magnitude of the coefficients varies, Table 7 show that the predicted probabilities of a targeted product to exit the market are similar in the three specifications.

In the parametric specification (column A), the estimation results show that the baseline hazard (ln(t)) is positively and significantly associated with the risk of exiting the market, indicating that this risk increases over time. Several economic factors may explain this outcome. As previously discussed, Brazil experienced a significant export surge in the 1990s due to trade liberalization policies. This surge likely shifted products toward more attractive markets, intensifying competition in certain areas, reducing market share, and squeezing profits. Additionally, factors such as changes in consumer preferences over time, supply chain disruptions, and a loss of competitiveness in key markets may have contributed to the

[5]Odds Ratio= exp(1.165)=3.206.
[6]Odds Ratio= exp(0.8563)=2.354.

increased risk of market exit over time.

For each model, the comparison between columns A and B show similar results with slight differences in the magnitude of the coefficients. Lastly, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) indicate that the non-parametric specification (column B) is preferable to the parametric specification (column A) based on the goodness of fit of both models. Lower values of these criteria indicate better model fit.

Regarding the control variables in the preferred specification, all of the coefficients are negative and significant. Economically, this suggests that products from firms exporting more products in the same HS category ($N\ Products\ Cat_{jt}$), firms exporting the same products to more countries ($N\_Countries\_Cat_{jt}$), firms sending a larger quantity of products to the destination country ($N\_Products\_Country_{jct}$), and firms with a greater number of workers ($Firm\ Size(ln)_{jt}$) are less likely to exit the destination markets.

1.5.2 Hazard rate on the AD and Non-AD Products (2nd control group)

This section presents the estimation of the hazard rate caused by AD duties on the targeted products compared to the second control group. The second control group includes all the products (at the 4-digit HS) from the targeted firms that are exported to the countries initiating an AD process. This group includes targeted and non targeted products from targeted firms. As discussed before, targeted firms are larger in terms of size (number of workers) and export revenue, they export more products and export to more countries. Thus, this control group addresses the potential selection bias issues suggested for the first control group.

The analysis of Table 8 and 9 are the same as in the previous section, as well as the variables in the regression. Again the preferred specification is the non-parametric (column B) logit model. If a product is named in an AD investigation the log odds of exiting the market increase by 1.163 compared to firms not under an AD investigation. These findings

suggest that products subject to AD investigations are 3.199[7] times more likely to exit the market compare to products in the control group. According to the associated results from Table 9, the average predicted probability of a product exiting the market is 18.5% higher if it is in the AD investigation phase, relative to products from the same targeted firms that are not named in an AD investigation.

The second result indicates that if a product received final AD duties, the log odds of exiting the market increase by .8378 compare to firms that have no AD duties in action. This suggest that if a product received final AD duties, the odd of exiting the market are 2.311[8] higher than a product in the second control group. The results from Table 9 suggest that the average predicted probability of a product exiting the market is 18.15% higher if it has received final AD duties compare to a product in the second control group.

The third result suggest that if a product is no longer in an AD process (Investigation or Approved phase), the log odds of exiting the market are not significant in any of the different specifications.

Regarding the control variables in the preferred specification, most of the coefficients are negative and significant (except for ($N\_Products\_Country_{jct}$)). Economically, this suggests that products from firms exporting more products in the same HS category ($N\ Products\ Cat_{jt}$), firms exporting the same products to more countries ($N\_Countries\_Cat_{jt}$), and firms with a greater number of workers ($Firm\ Size(ln)_{jt}$) are less likely to exit the destination markets.

1.6 Conclusion

This paper examines the hazard rate of Brazilian products subjected to AD duties between 1989 and 2001. Employing a discrete hazard model, it evaluates probit, logit, and cloglog specifications to ensure robustness in the analysis. To address selection into AD, the study narrows down the sample to firms exporting similar products (HS code) to similar countries.

[7]Odds Ratio= exp(1.163)=3.199.
[8]Odds Ratio= exp(.8378)=2.311.

Furthermore, it refines the sample into two distinct control groups to better account for this selection bias. The most reliable results comes from the logit model with a non-parametric specification, where the control group comprises products not targeted by AD duties but exported by the affected firms (second control group).

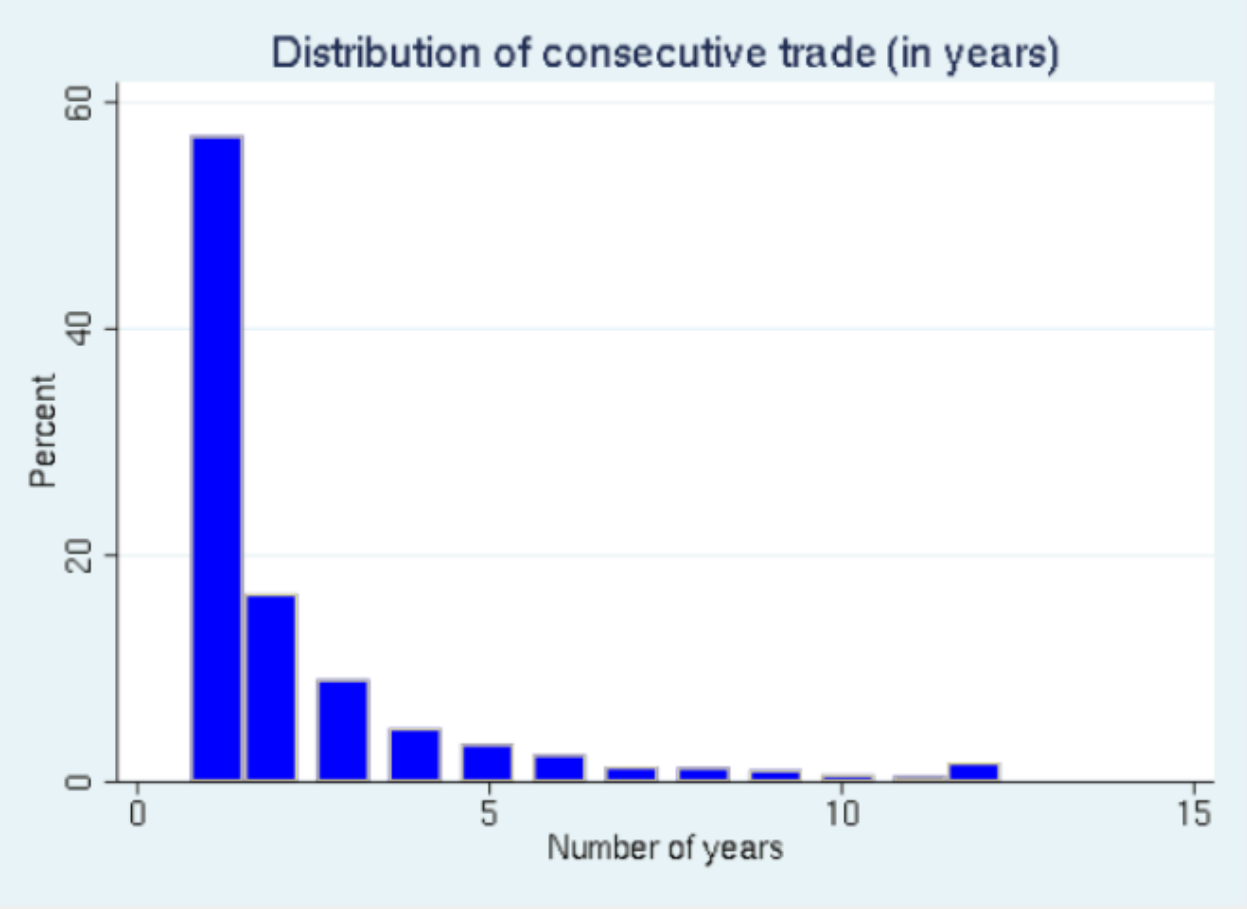
The results from the first control group indicate that the most significant impact of AD duties occurs during the investigation phase. During this phase, targeted products are 4.47 times more likely to exit the market compared to similar products from firms not subject to AD duties, but exporting similar products. For firms that decided to stay in this market and absorb the final AD duties, the effect is slightly smaller but still negative and significant. Products from targeted firms that received final AD duties are 3.21 times more likely to exit the market compare to similar products from non-targeted firms.

Similarly, for the second control group, which comprise of similar products (same 4 digit HS code) from the same targeted firms, the results indicate that targeted products are 3.2 times more likely to exit the market compared to similar products from targeted firms that are not named in an AD investigation. Once the targeted products receives final AD duties, the targeted products are 2.3 times more likely to exit the market compare to similar products from the same targeted firms.

During the investigation phase the targeted products are most likely to receive preliminary AD duties, which are a clear indication of whether firms will receive final AD duties and how large they will be. Therefore, a firm that decides to keep the targeted products in the destination market after the investigation phase could have some economic reasons to stay, which could be related to maintaining their market share, movements in the intensive margin or strategical commercial reasons. The late exit of products during the approved phase, could be related to the high level of the final duties the firm could received lowering their competitiveness and eventually forcing them to exit the market.

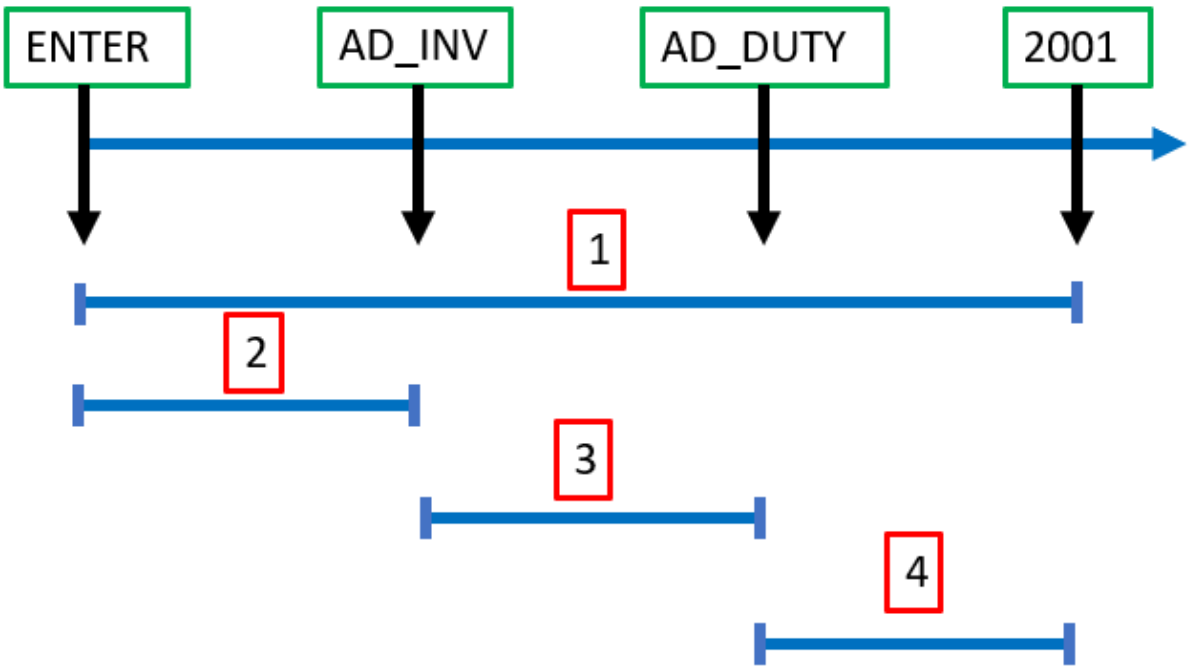
1.7 Figures

Figure 1.1: Distribution of trade measure in consecutive years (from 1986 to 2001)



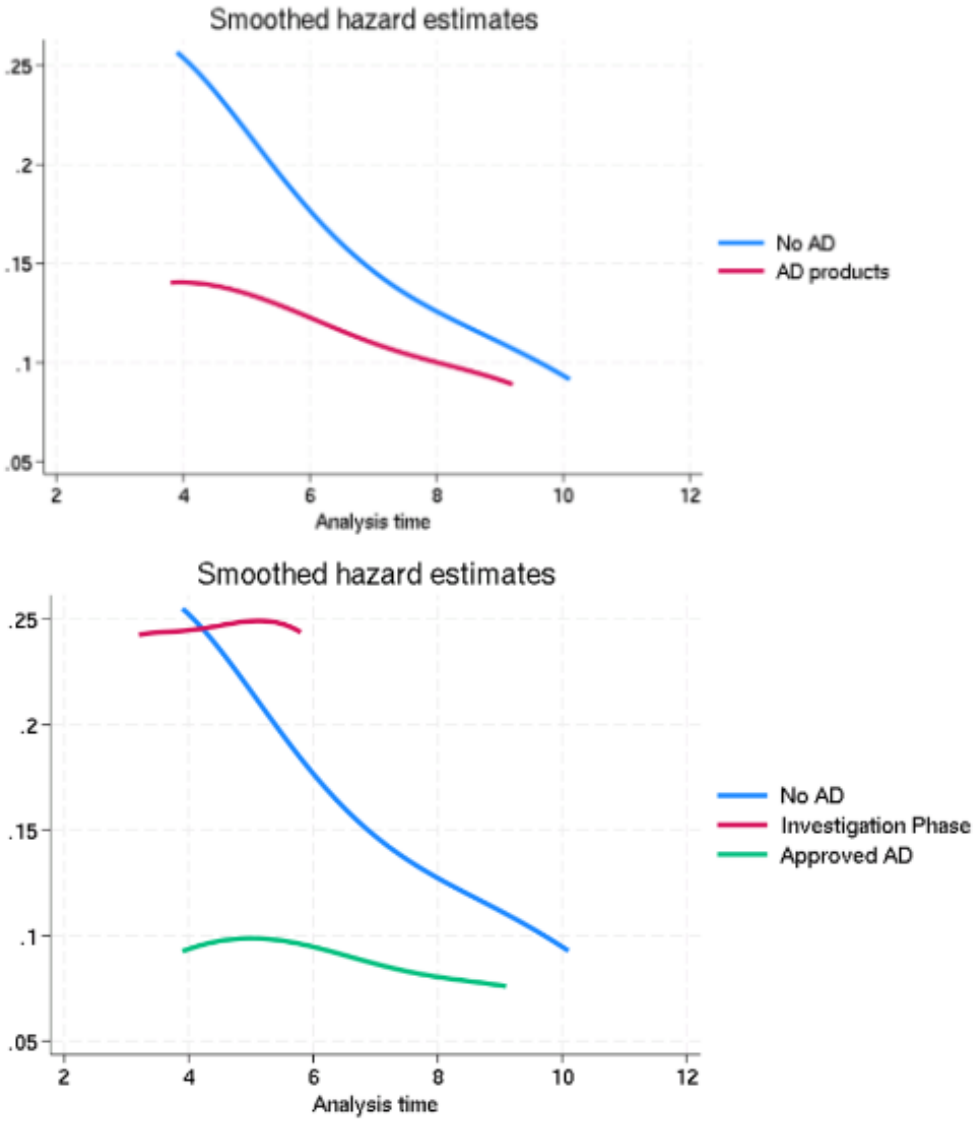
Notes: This figure presents a description of the consecutive years Brazilian products are exported to the rest of the world. Out of a total of 22,716 country-product pairs, 57.1% are only exported for fewer that two consecutive years; 16.6% are exported for two consecutive years, and 9.1% are exported for three consecutive years during the period from 1989 to 2001.
Source: Author's work.

Figure 1.2: Survival Timeline of the Antidumping



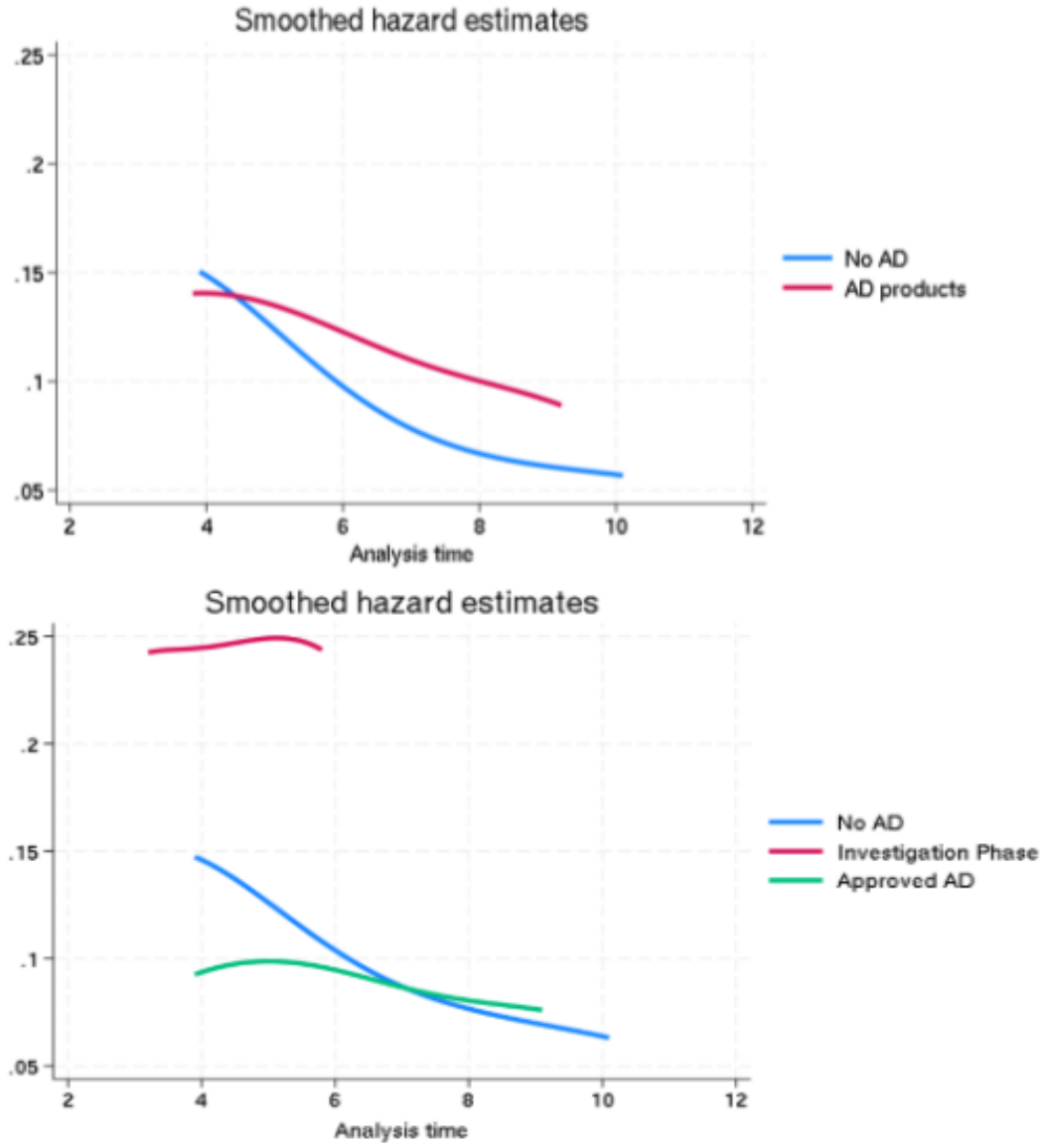
Notes: This shows the different stages of an AD process separated by red boxes. The red box 1 represents the baseline scenario for the hazard rate of products that were not named in AD investigations and survived the entire period of analysis. The red box 2 represents the period from when the product enters the market until its named in an AD investigation. The red box 3 represents the period between the AD investigation and the imposition of final AD duties. The red box 4 represents the period when the products have received final AD duties and remain in the market.
Source: Author's own work.

Figure 1.3: Hazard rate for AD and Non-AD Firms (1st Control Group)



Notes: This figure compares the hazard rate of the treatment group and the AD and Non-AD Firms (1st Control Group) over the period of analysis. The red line in the top graph represents the treatment group, indicating that the risk of leaving the market is lower for the targeted products compared to the same products from firms not involved in an AD process. In the bottom graph, the hazard rate for the same control group (1st control group) is depicted at different stages of the AD process. The red line illustrates the hazard rate for products during the investigation phase, where the risk of exiting the market is higher. Conversely, the green line represents products that opted to remain in the market after receiving final AD duties. The green blue line represents product that are never targeted with AD duties.

Figure 1.4: Hazard rate for Treatment and AD and Non-AD Products (2nd control group)



Notes: This figure compares the hazard rate of the treatment group and the AD and Non-AD products (2st Control Group) over the period of analysis. The red line in the top graph represents the treatment group, indicating that the risk of leaving the market is lower for the targeted products compared to the same products from firms not involved in an AD process. In the bottom graph, the hazard rate for the same control group (2st control group) is depicted at different stages of the AD process. The red line illustrates the hazard rate for products during the investigation phase, where the risk of exiting the market is higher. Conversely, the green line represents products that opted to remain in the market after receiving final AD duties. The green blue line represents product that are never targeted with AD duties.

1.8 Tables

Table 1.1: Description of Brazilian firms (on average)

	AD Firms	Exporting Firms (Non AD)	All Firms
Size (# Workers)	1,654.7	401.5	13.9
Export Revenue (US$ Millions)	51.4	5.3	-
Number of Destination Countries	7.8	4.01	-
Number of Exported Products	49.0	14.9	-
Number of Firms	117	10,444	2,535,979

Notes: This table provides a description of Brazilian firms. "AD Firms" are those that are named in an AD process. "Exporting firms" are those that export but are not target in AD investigations. "All Firms" includes all firms in the dataset, including non-exporting firms. The size is measured by the number of workers, export revenue is in US dollars, the number of destination countries indicates the average number of countries firms export to, and the number of exported products indicates the average number of products firms export.
Source: Valdebenito (2024a).

Table 1.2: Average duration of trade in years of tariffs lines that received AD duties

Products	HS-Code	Products No-AD	Products with AD	AD Investigation Phase only	AD Final Phase only
Iron and steel	72	3.31	4.77	4.49	2.77
Footwear	64	3.07	4.25	-	3.93
Electrical mach. and equipment	85	2.79	3.25	1.2	3.21
Articles of iron or steel	73	2.63	2.8	0.67	1.71
Inorganic chemicals	28	3.79	12.33	-	9.83
Paper and paperboard	48	3.34	5.36	-	5.0
Boilers and mech. appliances	84	2.96	7.25	-	4.57
Cotton	52	3.09	9.0	-	7.5
All Products	-	3.10	4.81	3.44	3.50

Notes: This table provides summary statistics for the average duration of trade when AD duties are initiated for different Brazilian products (2-digit HS code) during 1989 to 2001. Column 3 (Products No-AD) shows the average number of years a product category not targeted with AD duties is exported. Column 4 (Products with AD) shows the average number of years a product category targeted with AD duties at any time in the future is exported. Column (5) and (6) shows the average number of years a product category targeted with AD duties in each of the two AD stages (Investigation and Approve), respectively.
Source: Global Anti-dumping Database (GAD) and SECEX.

Table 1.3: Average duration of trade in years of AD action against Brazil

Complainant Countries	Products No-AD	Products with AD	AD Investigation Phase only	AD Final Phase only
Argentina	3.37	4.99	2.61	3.12
USA	3.15	5.96	5.08	4.14
Mexico	3.21	5.25	1.6	4.25
Australia	3.27	3.67	-	2.57
Canada	3.22	3.71	1.75	3.34
EU	2.90	4.33	-	6.0
Peru	2.99	7.0	-	5.00
South Africa	3.09	4.67	-	2.33
World	3.10	4.93	3.44	3.50

Notes: This table provides summary statistics for the average duration of trade when AD duties are initiated in each country targeting Brazilian products during 1989 to 2001. Column (2) (Products No-AD) shows the average number of years a product category not targeted with AD duties is exported. Column (3) (Products with AD) shows the average number of years a product category targeted with AD duties at any time in the future is exported. Column (4) and (5) shows the average number of years a product category targeted with AD duties in each of the two AD stages (Investigation and Approve), respectively.
Source: Global Anti-dumping Database (GAD) and SECEX.

Table 1.4: Number of observations in each stage of the AD process

	Full Sample		AD and Non-AD Firms (1st Control Group)		AD and Non-AD Products (2nd Control Group)	
AD stage	Frequency	Percent	Frequency	Percent	Frequency	Percent
No AD	220,062	99.5	12,847	92.16	1,813	62.4
Before AD	429	0.19	429	3.08	429	14.8
Investigation AD	214	0.09	214	1.54	214	7.4
Approve AD	354	0.16	354	2.54	354	12.2
After AD	95	0.04	95	0.68	95	3.3
Total	221,154	100	13,939	100	2,905	100

Notes: This Table shows the number of observations in each stage of the AD process for the full sample, the first and second control groups. The first control group includes the non-targeted firms exporting the targeted products to the same country; and the second control group includes the non targeted products from the same targeted firms.

Table 1.5: Characteristic of the treatment and AD and Non-AD Firms (1st Control Group)

Groups	Number Obs	Percent Total (%)	Ave. Export (M$)	Ave. # Workers
Treatment	1,092	7.8	22.1	6,022
Control	12,847	92.3	14.9	2,679
Total	13,939	100	14.6	2,926

Notes: This Table shows the number of observations on the treatment and control group for the first control group; it also shows descriptive statistics for each sample measuring, on average, their export revenue and their number of workers.
Source: GAD, RAIS and SECEX

Table 1.6: Odds Ratio of AD duties at AD and Non-AD Firms (1st control group)

	Odds Ratio of AD duties					
Exit the	**Probit**		**Logit**		**Cloglog**	
market	(A)	(B)	(A)	(B)	(A)	(B)
ln(t)	.4743***	-	.9289***	-	.8156***	-
	(.0423)	-	(.0844)	-	(.0755)	-
$Investigation\ AD_{jckt}$	.6494***	.7797***	1.319***	1.497***	1.140***	1.218***
	(.1556)	(.1542)	(.2924)	(.2949)	(.2495)	(.2467)
$Approve\ AD_{jckt}$	.4998***	.5743***	1.055***	1.165***	.9465***	1.017***
	(.1336)	(.1363)	(.2603)	(.2619)	(.2301)	(.2282)
$After\ AD_{jckt}$	.3688*	.4519**	.7222*	.8563**	.6474*	.6984*
	(.2171)	(.2241)	(.4097)	(.4205)	(.3650)	(.3700)
$N\ Products\ Cat_{jt}$	-.0688***	-.0651***	-.1309***	-.1217***	-.1105***	-.1002***
	(.0093)	(.0091)	(.0180)	(.0174)	(.0153)	(.0145)
$N\ Countries\ Cat_{jct}$	-.0113***	-.0112***	-.0254***	-.0235***	-.0235***	-.0214***
	(.0037)	(.0038)	(.0074)	(.0075)	(.0065)	(.0065)
$N\ Products\ Country_{jct}$	-.0309***	-.0331***	-.0506***	-.0534***	-.0346**	-.0375***
	(.0079)	(.0081)	(.0158)	(.0156)	(.0138)	(.0136)
$Firm\ Size(ln)_{jt}$	-.3962***	-.3958***	-.7137***	-.7099***	-.5839***	-.5742***
	(.0194)	(.0199)	(.0360)	(.0369)	(.0281)	(.0285)
σ_u	1.131***	1.120***	2.046***	2.008***	1.653***	1.598***
	(.0716)	(.0727)	(.1347)	(.1347)	(.1097)	(.1076)
ρ	.5611***	.5566***	.5601***	.5507***	.6243***	.6083***
	(.0311)	(.0320)	(.0324)	(.0332)	(.0311)	(.0321)
Observations	13,369	11,731	13,369	11,731	13,369	11,731
Duration dummies	NO	YES	NO	YES	NO	YES
Calendar Years dummies	YES	YES	YES	YES	YES	YES
LR test for ρ=0	677.9	627.8	620.4	578.0	577.2	534.3
AIC	6,493.5	6,136.1	6,415.3	6,073.8	6,327.5	5,995.6
BIC	6,643.5	6,349.9	6,565.3	6,287.5	6,477.5	6,209.3

Notes: This table shows how each stage of the antidumping process impact the probability (probit), odds ratios (Logit) and risk (cloglog) of exiting the market for products compared to non-AD firms (first control group). The results are reported for Probit, Logit, and Cloglog models, with both parametric (Column A) and non-parametric (Column B) specifications for the structure of the survival function. The variables include $Investigation\_AD_{jckt}$ which indicates the investigation phase of AD, $Approve\_AD_{jckt}$ indicating the approval phase, $After\_AD_{jckt}$ for post-AD implementation effects; $N\ Products\ Cat_{jt}$ as the number of products the firm exports to a country in the same HS category; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports the products in the same HS category; $N\_Products\_Country_{jct}$ as the number of all the products exported to a country; and $Firm\ Size(ln)_{jt}$ as the size of the firm in terms of workers. Firm-Country random-effects parameters are shown where applicable. Standard errors are in parentheses. The test statistics for ρ indicate the level of within-firm correlation in the random effects. The AIC and BIC provide measures of model fit, with lower values indicating better fit. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 1.7: Average Predicted Probability of Exit the market caused by AD duties AD and Non-AD Firms (1st control group)

	Probability of Exit the Market					
Exit the	**Probit**		**Logit**		**Cloglog**	
market	(A)	(B)	(A)	(B)	(A)	(B)
$Investigation\ AD_{jckt}$	.1644	.1719	.1693	.1721	.1717	.1685
$Approve\ AD_{jckt}$	.1680	.1706	.1791	.1801	.1876	.1871
$After\ AD_{jckt}$	.1695	.1711	.1737	.1751	.1805	.1766

Notes: This table shows the estimated probabilities of exiting the market for products subject to antidumping Investigation, Approved, and After, compared to a control group of non-AD firms (first control group). The estimates are derived from Probit, Logit, and Cloglog models, with both parametric and non-parametric specifications for time. A: Parametric (ln(t)); B: Non-Parametric (duration dummies).

Table 1.8: Odds Ratio of AD duties at AD and Non-AD Products (2nd control group)

	Odds Ratio of AD duties					
Exit the	**Probit**		**Logit**		**Cloglog**	
market	(A)	(B)	(A)	(B)	(A)	(B)
ln(t)	.2940***	-	.6383***	-	.5985***	-
	(.0904)	-	(.1833)	-	(.1678)	-
$Investigation\ AD_{jckt}$	.5692***	.5845***	1.147***	1.163***	1.038***	1.033***
	(.1596)	(.1624)	(.3099)	(.3131)	(.2728)	(.2705)
$Approve\ AD_{jckt}$	.3952***	.4380***	.7780***	.8378***	.7190***	.7537***
	(.1402)	(.1437)	(.2780)	(.2790)	(.2522)	(.2476)
$After\ AD_{jckt}$	.2783	.3470	.6154	.7114	.5904	.6320
	(.2288)	(.2397)	(.4385)	(.2288)	(.3964)	(.4003)
$N\ Products\ Cat_{jt}$	-.0512***	-.0503***	-.1041***	-.1006***	-.0983***	-.0927***
	(.0107)	(.0110)	(.0210)	(.0212)	(.0187)	(.0185)
$N\ Countries\ Cat_{jct}$	-.0134**	-.0130**	-.0368***	-.0320**	-.0367***	-.0310**
	(.0062)	(.0065)	(.0134)	(.0135)	(.0126)	(.0124)
$N\ Products\ Country_{jct}$	.0204**	.0176*	.0417**	.0357**	.0388**	.0332**
	(.0091)	(.0091)	(.0173)	(.0172)	(.0150)	(.0145)
$Firm\ Size(ln)_{jt}$	-.2129***	-.2053***	-.3995***	-.3845***	-.3559***	-.3400***
	(.0360)	(.0363)	(.0669)	(.0674)	(.0553)	(.0555)
σ_u	.7142***	.6870***	1.442***	1.355***	1.333***	1.218***
	(.1100)	(.1081)	(.2183)	(.2116)	(.1950)	(.1846)
ρ	.3378***	.3206***	.3873***	.3584***	.5194***	.4746***
	(.0689)	(.0685)	(.0718)	(.0718)	(.0730)	(.0755)
Observations	2,817	2,468	2,817	2,468	2,817	2,468
Duration dummies	NO	YES	NO	YES	NO	YES
Year, Industry F.E.	YES	YES	YES	YES	YES	YES
LR test for ρ=0	60.5	58.0	62.5	59.0	65.2	59.7
AIC	1,289.2	1,226.8	1,269.9	1,212.3	1,256.9	1,201.2
BIC	1,408.0	1,395.3	1,388.8	1,380.9	1,375.7	1,369.7

Notes: This table shows how each stage of the antidumping process impact the probability (probit), odds ratios (Logit) and risk (cloglog) of exiting the market for products compared to non-AD products (second control group). The results are reported for Probit, Logit, and Cloglog models, with both parametric (Column A) and non-parametric (Column B) specifications for the structure of the survival function. The variables include $Investigation\_AD_{jckt}$ which indicates the investigation phase of AD, $Approve\_AD_{jckt}$ indicating the approval phase, $After\_AD_{jckt}$ for post-AD implementation effects; $N\ Products\ Cat_{jt}$ as the number of products the firm exports to a country in the same HS category; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports the products in the same HS category; $N\_Products\_Country_{jct}$ as the number of all the products exported to a country; and $Firm\ Size(ln)_{jt}$ as the size of the firm in terms of workers. Firm-Country random-effects parameters are shown where applicable. Standard errors are in parentheses. The test statistics for ρ indicate the level of within-firm correlation in the random effects. The AIC and BIC provide measures of model fit, with lower values indicating better fit. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 1.9: Probability of Exit the market caused by AD duties at Firm-Country-Product (4 digit-HS)

	Probability of Exit the Market					
Exit the market	**Probit** (A)	(B)	**Logit** (A)	(B)	**Cloglog** (A)	(B)
$Investigation\ AD_{jckt}$	.1782	.1820	.1828	.1850	.1889	.1887
$Approve\ AD_{jckt}$	.1781	.1738	.1903***	.1815	.2043	.1905
$After\ AD_{jckt}$	.1716	.1618	.1875	.1720	.2028	.1786

Notes: This table shows the estimated probabilities of exiting the market for products subject to antidumping Investigation, Approved, and After, compared to a control group of non-AD products (second control group). The estimates are derived from Probit, Logit, and Cloglog models, with both parametric and non-parametric specifications for time. A: Parametric (ln(t)); B: Non-Parametric (duration dummies).

1.9 Bibliography

Bibliography

Avsar, V. (2013). antidumping, retaliation threats, and export prices. the world bank economic review, 27(1), 133-148.

Besedeš, T., & Prusa, T. J. (2006). Ins, outs, and the duration of trade. Canadian Journal of Economics/Revue canadienne d'économique, 39(1), 266-295.

Besedeš and Prusa (2017), "The Hazardous effects of antidumping". Economic Inquiry (ISSN 0095-2583) Vol. 55, No. 1, January 2017, 9–30.

Blonigen and Prusa (2016), "Chapter 3: Dumping and antidumping Duties". Handbook of Commercial Policy. Volume 1, Part B, 2016, Pages 107-159.

Bown (2008): "The WTO and antidumping in developing countries". Economics & Politics, 20: 255-288.

Bown, Chad P. 2011. "Taking Stock of antidumping, Safeguards and Countervailing Duties, 1990-2009," The World Economy.

Bown, C. P., & Reynolds, K. M. (2017). Trade agreements and enforcement: evidence from WTO dispute settlement. American Economic Journal: Economic Policy, 9(4), 64-100.

Campos, C. F. S., & Cavaletti, M. B. (2016). Importações Brasileiras: Um Estudo Empírico sobre Duração e Fatores de Sobrevivência. Revista Brasileira de Economia, 70(3), 281–303.

Chandra, P., & Long, C. (2013). VAT rebates and export performance in China: Firm-level evidence. Journal of Public Economics, 102, 13-22.

De Souza, G., & Li, H. (2022). The employment consequences of anti-dumping tariffs: Lessons from Brazil.

Feenstra, R. C. (2015). Advanced international trade: theory and evidence. Princeton university press.

Hess, W., & Persson, M. (2012). The duration of trade revisited. Empirical Economics, 43(3), 1083-1107.

Kalbfleisch, J. D., & Prentice, R. L. (2011). The statistical analysis of failure time data. John Wiley & Sons.

Klein, J. P., & Moeschberger, M. L. (2003). Semiparametric proportional hazards regression with fixed covariates. Survival analysis: techniques for censored and truncated data, 243-293.

Labanca, C., Molina, D., & Muendler, M. A. (2013). Preparing to export (No. w18962). National Bureau of Economic Research.

Lu, Y., Tao, Z., & Zhang, Y. (2013). How do exporters respond to antidumping investigations?. Journal of International Economics, 91(2), 290-300.

Mazzucco, B., & Bittencourt, M. (2022). Does antidumping drive exporters out of the market? Some evidence from Brazil. The World Economy, 45(12), 3833-3857.

Nelson, D. (2006). "The political economy of antidumping: A survey". European Journal of Political Economy, 22(3), 554-590

Prusa, T. J. (2001). On the spread and impact of anti-dumping. Canadian Journal of Economics/Revue canadienne d'économique, 34(3), 591-611.

Valdebenito, J. (2024a). Distributional effects of antidumping duties on the workforce of targeted firms. (Working Paper)

Valdebenito, J. (2024b). How strong is the Anti-dumping punch?. (Working Paper)

WTO (2019). AD initiations: by reporting member. Available at `http://www.wto.org/`.

Chapter 2

How Strong is the Anti-Dumping Punch?

2.1 Introduction

This paper studies how anti-dumping (AD) duties imposed on Brazilian firms during the period between 1989 and 2001 affect, separately, the targeted firm's total export revenue and the export revenue received from the country imposing the duties. To control for selection into AD, the paper uses a propensity score methodology to compare firms with similar characteristics that export similar products to similar countries. The paper also estimates the effects of these duties in each of the stages of an AD process: before AD, investigation phase, final duties and when duties are dropped or revoked.

Anti-dumping duties are trade defense measures implemented by governments to protect their domestic industries from the detrimental effects of unfair pricing practices by foreign exporters. These duties are generally determined by calculating the difference between the export price and the domestic market price of the goods in the exporting country. They can be either temporary or extended and are often subject to periodic reviews, known as sunset

reviews, to assess whether they remain necessary[1].

The literature on anti-dumping duties agrees that this trade barrier is effective at restricting trade, increasing import prices, decreasing import volumes and protect the domestic industry (Blonigen and Prusa, 2016). Several studies have analyzed the effects of these duties on the country that imposed them and how it benefits their domestic industry: Bown (2011); Bown (2013); Lu, Tao, and Zhang (2013); Chandra & Long (2013); Bown & Tovar (2011); and Vandenbussche & Zanardi (2010). Other studies like Prusa (2001) and Durling and Prusa (2006) found evidence of trade destruction by studying the effects of AD duties from the U.S. on Japanese and Chinese exports. Liu and Shi (2019) shows positive effects of AD duties on trade diversion, in which the country that is charged with AD duties reroutes its exports to a third country. Konings, Vandenbussche, and Springael (2001), and Romalis (2007) have also investigated this effect finding mixed results. Based on panel data analysis over the period 1960–2001, Egger and Nelson (2011) found negative and modest effects of AD duties on trade volume and welfare.

However, little work exists that studies the empirical effects of anti-dumping duties from the perspective of the exporting firms. This paper is in fact, one of the first studies that analyzes the effects of these duties on the targeted firms. Chandra & Long (2013); and Lu, Tao & Zhang (2013) have looked at U.S. AD duties on Chinese firms but only at the industry level. These authors find that U.S. AD duties reduce the labor productivity and the Transformation Productivity Frontier (TPF) and that they caused a substantial reduction in total export volume due to a significant decrease in the number of exporters.

This paper estimates the effects of AD duties on the export revenue of targeted Brazilian firms. The analysis construct an empirical model by linking firm-level data from the SECEX (Secretaria de Comercio Exterior), which gathers yearly export reports at the firm-country level, with the World's Bank Global Anti-dumping Database (GAD) (Bown, 2011) which collects information on the use of temporary trade barriers across all WTO members since

[1]See Blonigen and Prusa (2016) for a review of the literature

1985 through 2019. Given the availability of the data, this paper constructs an unbalanced panel with firm-country level information from 1989 to 2001.

The results suggest that firms that are targeted with AD duties experience, during the AD investigation phase, a sharp decrease in export revenue from the country that imposed the duties. This decrease is also present after the firm has received final AD duties, which are usually set for a minimum of five years. There is no significant effect of AD duties on the export revenue after the AD process is over. These results are consistent with the findings of the literature about the restrictive effect of AD duties; firms that are targeted with AD duties on at least one of their products are most likely to severely decrease their exports, hence reducing the export revenue received from the AD imposing country.

The second result of the paper finds that firms that are targeted with AD duties experience a strong decrease in their total export revenue. This negative effect remains during the AD investigation and after the duties are approved, reinforcing the long term negative effects of these duties on the targeted firms.

To account for selection into AD, a central problem in the study of temporary trade policies, I construct a propensity score methodology based on the probability to be named in an AD investigation depending on firm characteristics and destination country's experience in starting an AD investigation. Including this destination country variable was first proposed by Lourenco et al. (2021), who argue that the probability that a firm receives final AD duties is correlated with how experienced the destination country is in the use of these duties. I test four different matching procedures and compare them based on the balance and significance of their covariates. After successfully matching the treated and control firms, I use a panel data methodology to estimate the effects of the duties on both the total export revenue and the revenue received by the country imposing the duties for each stage of the AD process. Recognizing that export data does not generate a balanced panel given the entry and exit of firms at different years, I follow Baltagi, Song and Jung (2001) who argue that using a mixed panel methodology is preferred when dealing with unbalanced panels and propose a

mixed model with random intercepts within firms and firm-country pairs.

This study sets itself apart from prior research by examining the effects of foreign AD duties on Brazilian firms, with a focus on linking specific targeted firm-products from the Global anti-dumping Database to the Brazilian firm-product export database. In contrast, Avsar (2013) and DeSouza and Li (2022) investigated Brazilian AD policy but concentrated on AD duties imposed by Brazil on importing firms at the sector level. Avsar (2013) used product-level data from the UN COMTRADE and determined that AD duties led to a 23 percent price increase for Brazilian exporting firms in the duty-imposing country for the targeted products. On the other hand, DeSouza and Li (2022) utilized monthly import data at the product level to explore the impact of Brazilian AD duties on foreign imports, examining the effects on trade, Brazilian suppliers, and associated sectors.

The paper is structured in the following way: Section 2 presents the literature on AD duties for both the imposing and the targeted country. Section 3 presents and discusses the data sets. Section 4 describes the empirical strategy and methodology. Section 5 presents the results and Section 6 concludes.

2.2 Literature Review

This paper aims to contribute to the literature on trade policy by focusing on the impact of anti-dumping duties. Specifically, it examines how AD duties affect the export revenue of targeted Brazilian firms. While Blonigen and Prusa (2016) provide a detailed analysis of the effects of AD duties on the country imposing the duties, including their impact on the local domestic market and in the protected industries, this study shifts the focus to the targeted firms. It investigates the consequences of AD duties on the export revenue of these Brazilian firms, offering a different perspective on the broader implications of such trade policies.

Anti-dumping duties, unlike normal trade tariffs, are often prohibitively large. Besedes and Prusa (2016) show that, on average, US anti-dumping duties are set between 150% to

200% above the price of the exporting product. Similar levels are recorded for AD duties against Brazilian firms. This large "tariff" increase causes the targeted product to lose its competitiveness in the destination market and force exporting firms to diminish and/or stop exports to the country imposing the duties (Besedes and Prusa, 2017).

The literature has argued that regular tariffs can lead to a decrease in firm-level exports, with a large portion of this impact affecting the exporters' product mix (Berthou & Fontagné, 2016). For example, Jiao et al. (2022) found that Chinese firms' exports to the USA decreased significantly after the USA imposed tariffs on their products. Besedes and Prusa (2017) find that AD investigations often drive export suppliers out of the U.S. market entirely and that countries which were affected by AD measures imposed by the U.S. are less likely to return to the U.S. market. They conclude that AD has a long-run deterrence effect on the behavior of affected suppliers. They also find that AD effects are larger at the beginning of the investigation, versus after the AD duty is levied. Looking at Spanish exporters, Minondo (2024) found that firms that were affected by a tariff increase were able to neutralise this price effect by substituting Spanish products with products originating in countries unaffected by these tariffs and also by shifting to varieties not affected by these tariffs. Sandkamp (2019) argues that unlike normal tariffs, AD duties theoretically raise producer prices (Blonigen and Haynes, 1999; Blonigen and Park, 2004; Feenstra, 2008). This implies a worsening of the terms of trade of the importing country, accompanied by a shift in rents from the customs authority of the importer towards exporters.

Moreover, the predictability of tariffs compared to other factors like real exchange rates can significantly influence export revenue (Fitzgerald & Haller, 2018). Firms may adjust their customer base and investment strategies in response to tariffs, impacting their export revenue. Additionally, the number of firms in the exporting industry can also play a role, as tariff rates may vary based on market concentration (Kalinowski, 2020). Research has indicated that firm-level tariff pass-through can be incomplete due to variable markups, as firms may adjust their prices in response to tariff changes (Ludema & Yu, 2016). Analysing the

US-China trade war on Chinese exporters, Yang et al. (2022) shows that firms' exports to the USA dropped significantly, exports to the EU increased moderately and domestic sales or exports to other foreign markets were barely affected. Particularly for Brazil, Avsar (2013) shows that AD duties resulted in a significant and dramatic increases in the unit value of the products that firms export to duty-imposing countries. This effect also increases their unit export prices at the industry level, in order to try to decrease the dumping margin. Some additional studies describing the Brazilian export and labor market are: Labanca, Molina and Muendler (2013); Menezes-Filho, Muendler and Ramey (2008); Hirakawa, Muendler and Rauch (2010); Aguayo-Tellez, Muendler and Poole (2010); Menezes-Filho and Muendler (2011); Muendler, Rauch and Tocoian (2012); Muendler and Rauch (2018); Arkolakis, Ganapati and Muendler (2021); Bazzi, Muendler, Oliveira and Rauch (2023); and Ma, Muendler and Nakab (2023).

Looking at trade barriers, studies have shown that anti-dumping measures can reduce exports and affect both the extensive (variety of products exported) and intensive (quantity of each product exported) margins of trade (Schiavo et al., 2020). Moreover, the net effects of anti-dumping policies on employment and exports can be strongly negative (Jabbour et al., 2019). Other studies found that anti-dumping duties have a statistically significant and negative effect on total exports, both n the extensive and intensive margins, and the increase of variable cost is the mechanism of negative effect between anti-dumping and exports (Li, 2018). Overall, when a country imposes anti-dumping duties on another country, it can lead to trade deflection, where the targeted country increases its exports to other markets to compensate for the reduced exports to the imposing country (Bown & Crowley, 2007). The imposition of anti-dumping duties can result in trade destruction, causing a decrease in imports of the targeted products from the country facing the duties (Liu & Shi, 2018).

2.3 Data and Stylized Facts

This study utilizes data from the Secretariat of Foreign Trade (SECEX) under the Ministry of Development, Industry, and Foreign Trade of Brazil. The dataset compiles annual firm-level information on export revenue by destination country, the number of products exported, the firm's unique identification number, and industry identifiers for each firm spanning the years 1989 to 2001. However, this dataset does not include details on export volumes or product prices.

The second dataset is the labor market data from the Annual Social Information Report (RAIS)[2] to control for firm size and industry. The RAIS is an administrative data set from Brazil, similar to the employee data from the United States and Germany covering 97% of the Brazilian formal labor market[3] between 1985-2019[4].

In this study, I combine Brazilian export and labor market data with the World Bank's Global Anti-dumping Database (GAD), which compiles information on the use of temporary trade barriers, including anti-dumping duties, countervailing duties, and safeguard measures, across all WTO members from 1985 to 2019. Most anti-dumping actions against Brazilian firms took place during the 1990s and 2000s, a period when tariff reductions and increased foreign capital inflows boosted the competitiveness of Brazilian exports in global markets (Baumann, 2002). This heightened AD activity against Brazilian firms underscores the significance of the study period (1989-2001) (Valdebenito, 2024a). Figure A.1 in the Appendix illustrates the number of AD actions initiated by other countries against Brazilian firms from 1985 to 2015.

2.3.1 Description of Brazilian Exporting Firms

I start by matching the anti-dumping (AD) duties targeting Brazilian product-firms from the GAD Database with the Brazilian firms listed in the SECEX export database. This process

[2]I am grateful to Dr. Marc Muendler at U.C. San Diego for providing access to this data.
[3]Paz (2014) estimate that the Brazilian formal labor market is 40-50% of the total employment.
[4]See Valdebenito (2024a) for complete description of the RAIS

aligns each AD duty with the specific 6-digit Harmonized System (HS) product from the named firm targeted by the specific country. Table 1 is borrowed from Valdebenito (2024a) and provides a description of the Brazilian firms comparing some of the main characteristics of firms that received AD duties, firms that are never targeted and all the Brazilian firms (including non-exporting firms). Overall, firms that received AD duties tend to be larger, record higher export revenues, export to more countries and produce more products.

2.3.2 Export Market Description

Table 2 compares Brazil's most important trading partners in terms of the share of export revenue in US$ in 1990 and in 2000. This table include all Brazilian exporting products, where Brazil's largest trading partner is the European Union with 31.9% in 1990 and 30.8% in 2000. The second largest destination is the US with 24.6% in 1990 and 24.3% in 2000 of the total export share. Japan is Brazil's third largest trading partner in 1990 with 7.5% of the total share, but in 2000 this spot is taken by Argentina with 11.3% of the total export share.

Figure 1 shows the distribution of Brazilian products that received AD duties between 1989 to 2001. The sector aggregation is at the 2 digit CNAE[5] making the Electrical Machinery and Equipment the sector that receives the most number of AD actions with 42% of the total. Second is Footwear with 25% of the total. The third most targeted sector is Iron and steel (14%) and Articles of Iron and steel (3%) that together represent 17% of the total.

Figure 2 presents the distribution of Brazilian exporting sectors as a percentage of the export revenue in the year 2000. Comparing with Figure 1, Electrical Machinery and Equipment represents 13% of the export revenue in the year 2000. Footwear, which is the second most targeted sector, represents 3% of the total export share in 2000. The Metals and Minerals sector, which is the third most targeted sector, represents 17% of the total export revenue. The sector Others, which represents 49% of the total Brazilian exports in 2000,

[5]Following Labanca et. al (2013).

is composed mostly by food products (HS code: 16,17,18,19,20,21,22,23,24), vegetables (HS code: 06,07,08,09,10,11,12,13,14,15) and transportation (HS code: 86,87,88,89). Both Figures 1 and 2 aimed to show the importance of the sectors that are targeted by AD actions in Brazil. Table A.1 from the Appendix shows the Brazilian products targeted by AD duties as a percentage of the total.

2.4 Empirical Model and Estimation Strategy

I study the effects of AD duties on two different measures of a firm's export revenue: at the firm and at the country-level. The economic intuition suggests that AD duties will strongly diminish the export revenue that the firm receives from the country imposing these duties. The literature also supports this claim by showing that AD duties diminish the export level and increase the prices of targeted products (Besedes and Prusa, 2016). There is no conclusive research on the effects of AD duties on the targeted firm's export revenue, making the study the first to analyse the effects of AD on the targeted firms. The firm level analysis will provide insights into the ability of firms to adapt to these increases in prices and loss of competitiveness from one or more destination countries and see the overall effect of these duties. A more detailed firm level analysis on the targeted firms' labor market outcomes is found in Valdebenito (2024a).

It is important to acknowledge some data limitations. First, during the AD investigation phase, preliminary AD duties are often imposed within the first 3 to 6 months, accurately signaling whether firms will receive final duties and their magnitude. This explains why the literature often finds that the strongest effects of AD duties occur during the investigation phase (Besedes and Prusa, 2016). However, the SECEX dataset only provides end-of-year information, making it impossible to distinguish periods before and after the imposition of preliminary duties. Second, there is no information on product prices, and most anti-dumping duties against Brazilian products are value-specific rather than ad valorem.

Consequently, I cannot determine whether the AD duty level is high or low compared to the original product price. Lastly, the dataset does not provide information on export volumes; it only includes the export revenue received by the firm from the destination country and lists the products exported to that country in a given year.

2.4.1 AD stages

The analysis of this paper starts by using the same description for the AD process as in Valdebenito (2024a) but focusing on the effects of AD duties on the targeted firms' export revenue. As described in Valdebenito (2024a): "I construct a categorical variable that separates the AD stages in 4 different categories: Before anti-dumping, Investigation stage, Approve stage and After anti-dumping. Firms in the "Before anti-dumping" category have not yet been targeted with an AD duty; "Investigation stage" are firms that are under an investigation process; "Approve stage" are firms that have active and final AD duties in force; and "After anti-dumping" are firms that had the investigation dropped or the duties expired and were not renewed. Firms that are never named in an AD investigation are in the "No AD" group; most of the firms are in this group."

Table 3 shows the number of observations in each stage of the AD process for both the firm and firm-country level pairs. Each observation represents an exporting firm (firm-country relation for the firm-country level analysis) in a particular year. It is clear that for both firm and firm-country level analysis the number of treated variables (AD stages) is similar, but the non treated observations (AD stage =0) differs because a firm could be exporting to several countries at different times, then it will only appear in the data when the particular country is filing an AD duty. The difference in the number of observations between the firm level and the firm-country level could be a consequence of the double counting of the AD duties; i.e. a firm could be targeted several times by different countries, but it would only appear once in the firm level data. At the firm-country level the disparities could be a consequence of a firm entering a market at different times and receiving AD duties at different times. The

table is showing the number of country-firm observations over the years.

Finally, it is important to control for left censoring. Left censoring occurs when the observations enter the sample and already have the treatment in place, leading to biased and inconsistent estimates. This can occur if AD duties are set before the time period of this paper or if the AD duties are set on "All the firms" which is common to find in the GAD database, meaning that the firm enters the markets knowing that they will have to pay the AD duty. To avoid this, the paper only includes the firm-country relations that begin in stage 1 for the treated and in stage 0 for the controls, which is when a firm-country pair has not being targeted with AD duties yet (stage 1) and it is different from firms that are never targeted (stage 0).

This analysis does not separate the actions that were dropped versus the ones that are revoked and not renewed in a sunset review. The reason is the small sample of observations that are in each subdivision, compare to the total number of observations in the other groups.

2.4.2 Propensity Score Matching

The literature consistently highlights that the study of anti-dumping duties is subject to selection bias. By their nature, AD duties are imposed on specific products from specific firms exported to specific countries that consider these imports a threat to their domestic industries. Consequently, the imposition of these duties on a particular firm is not a random event, and failing to control for this can lead to biased estimates. To address this econometric issue, I first estimate a propensity score to compare firms with similar characteristics that also export similar products to the same countries. Additionally, I narrow the sample to firms exporting products classified under the same 4-digit HS code, rather than including all products from each firm. This approach aims to avoid comparing products that are never targeted by AD duties, thus ensuring a more accurate analysis.

The first step in constructing this methodology is to identify an appropriate selection variable. I follow the same approach as in Valdebenito (2024a). I construct two propensity

score matching models at the firm and at the firm-country level. The model is based in Valdebenito (2024a) and follows the same structure comparing for different matching methods: Mahalanobis, 1:1 nearest neighbor, 1:10 nearest neighbor and Kernel. The Mahalanobis method balances all covariates simultaneously by considering the multivariate distance between treated and control units, leading to better balance across multiple covariates. In contrast, the Kernel method assesses each covariate individually but assigns weights to each observation, resulting in a disproportionately large number of controls compared to the small number of treated units. The 1:1 matching method pairs each treated unit with the most similar control unit, while the 1:10 method pairs each treated unit with its ten closest neighbors (Imbens and Rubin, 2015). The following sections present the matching results and various tests to determine adequate balance and statistical significance between the covariates for both the firm-country and firm-level analyses.

Firm-Country Level Matching

The calibration procedure includes firm-level characteristics such as the total number of countries the firm exports to and the total number of products inside the 4 digit-HS categories the firm exports to all its trading partners; the firm-country level characteristics include the number of products in the 4 digit-HS the firm is sending to the destination country; the number of consecutive years the firm is exporting to that country; and how important the firm is to the export of Brazilian products to each destination country (in terms of the export revenue). As mentioned before, the model only includes firms that export similar products to the ones that are targeted, based on their 4 digit-HS. The intuition behind this method is to construct a control sample of similar products and similar countries to account for selection into AD.

Equation 1 presents the logistic model that estimates the probability of firm j being named in an AD process initiated by country c in the future (stage 1). As in Valdebenito (2024a), the selection variable ($AD\_Experience_{cT}$) is adapted from Lourenco et al. (2021),

representing the cumulative experience of country c at initiating AD investigations until time T. If a country has initiated AD investigating in the past, then it is likely that it will initiate a new AD at time t, but this is not relate to the exporting firm' export revenue at time t.

The rationale for matching in stage 1 is that it serves as the pre-treatment phase, occurring before any formal complaint is launched. At this stage, firms are comparable, and there is no clear signaling of which firms will be named in the subsequent investigation phase. After establishing matches in stage 1, the effects of the following stages (investigation, approved duties, and revoked duties) will be analyzed by comparing the initially matched firms over time.

$$(\text{AD Stage=1})_{jct} = \beta_1 + \beta_2 \text{Firm}_{jt} + + \beta_3 \text{Firm}_{jct} + \beta_4 \sum_{t=1}^{T=t-1} \text{AD\_Experience}_{cT} + \varepsilon \qquad (2.1)$$

where $AD\ Stage = 1_{jct}$ is a binary variable that takes the value of 1 if at time t firm j has not been named in an AD process from country c, but will be in the following years; $Firm_{jt}$ is a vector of firm j's characteristics at time t; $Firm_{jct}$ is a vector of firm j and country c characteristics at time t; and $(AD\_Experience_{cT})$ represents the cumulative experience of country c at initiating AD investigations until time T. Table 4 displays the number of observations in the treated and control groups for each matching method. The matching process is conducted at the firm level, but the observation count encompasses the entire time period that the treated and control firms are present in the sample. Therefore, there are 2,026 firm-country-year observations.

As discussed in Valdebenito (2024a): "The validity of the matching methodology is assessed by examining the balance of covariates, which reflects the mean difference between the treatment and control groups. A balanced sample confirms that the treatment and control groups exhibit similarities, thus ensuring that any observed causal effects can be attributed to the treatment rather than preexisting differences". This study evaluates the balance of covariates both graphically (Figure 3) and statistically (Table 5).

Graphically, balance in the matched sample is represented by how closely the matched observations align with the dashed line at 0 on the horizontal axis (Figure 3). The graph demonstrates that the discrepancies between matched samples are almost negligible when compared to the unmatched sample (i.e., the full dataset).

Table 5 assesses the balance of the Mahalanobis method by presenting the results from the Hosmer-Lemeshow chi2 test, which performs a two-sample t-test. This test is done for all four matching methods and it is available in the Appendix 7.2. This test compares the mean of each variable between treatment and control groups for both the entire (unmatched) and matched samples showing that the propensity score methodology effectively matches firms with similar covariates. The significance of the difference between the matched and unmatched sample is showed in column p>$||t||$, in which large values (close to 1) indicate that there is no significant difference between both groups and the samples are balanced.

Therefore, the Mahalanobis method is the preferred specification as it achieves the best balance of covariates among the four alternatives while maintaining similar sample sizes.

Firm Level matching

This section aggregates the firm-country level characteristics to the firm level and uses the same methodology as in the firm-country section. Equation 2 presents the logistic model that estimate the probability that firm j is be named in an AD action in stage 1 of the AD process. The intuition for matching in stage 1 is the same as in the previous section, but aggregate it at the firm level.

$$\text{AD Stage}=1_{jt} = \beta_1 + \beta_2 \text{Firm}_{jt} + \beta_3 \text{AD\_Experience}_{jt} + \varepsilon \tag{2.2}$$

where $ADStage = 1_{jt}$ is a binary variable that takes the value of 1 if firm j is named in an AD process in the following years, but it is not named in year t. $Firm_{jt}$ is a vector of firm j's characteristics at time t; ($AD\_Experience_{jT}$) represents the sum of all the cumulative

experiences of countries that firm j export to that initiate AD investigations until time T.

Table 6 presents the size of the treated and control groups for each matching method. The calibration, balance, common support and significance tables supporting the Mahalanobis matching at the firm level are available in the Appendix 7.2. The matching methodology at the firm level is explained in detailed in Valdebenito (2024a).

2.4.3 Econometric strategy: Mixed Panels

Working with AD duties and trade data presents challenges due to missing information, which often arises when firms cease exporting to a market or cease operations altogether. This missing data leads to an unbalanced panel, and employing balanced or standard panel data techniques can introduce bias into the estimation process. Kwak (2011) suggests that standard panel methods can be applied to unbalanced data if the Missing Completely at Random (MCAR) assumption holds. Under MCAR, panel methods yield valid and unbiased estimations. However, the MCAR assumption necessitates that the missing information is unrelated to other variables; if there is differential missing information in the data, estimates may be biased. In the context of AD duties, arguing that missing information is random, particularly when examining product and firm exit rates, is challenging. Besedes and Prusa (2017) demonstrated that AD duties imposed by the U.S. often lead to suppliers exiting the U.S. market entirely, and that AD duties have a lasting deterrent effect. Consequently, AD duties may contribute to the missing data, rendering the MCAR condition unsatisfied.

Baltagi and Song (2006) highlighted that attrition in panel data, caused by individuals leaving the dataset, can disrupt the random design of the data and complicate the representativeness of the observed sample for drawing population inferences. To address this issue, Baltagi, Song, and Jung (2001) proposed a two-level mixed model incorporating random intercepts, nesting states within regions. In a similar vein, I implement a two-level mixed model with random intercepts at the firm level within the panel. Additionally, I compare the results with those obtained from assuming random missing data using balanced panel

techniques (fixed effects model).

To assess the suitability of mixed panels in the model, it is crucial to examine whether the estimated variance of the constant per individual-level random effect is non-zero (and statistically significant). A non-zero variance indicates that the random effect contributes meaningfully to the model. Furthermore, the coefficients are interpreted similarly to those in a linear regression, albeit with the consideration that each coefficient controls for the structure introduced by the random effects parameters.

2.4.4 Effects on Export Revenue

As previously mentioned, this paper measures the effects of AD duties on the export revenue of Brazilian firms on two levels: Total firm revenue and revenue from the each destination country. The paper begins by matching the AD duties targeting Brazilian product from the GAD Database with the Brazilian firms listed on the SECEX (export database). This matches each AD duty to the 6-digit HS product from the named firm that is targeted by the specific country. As discussed above, AD duties are set on a particular product line (HS line) from a particular firm that exports to a particular country. Therefore, it is not correct to assume that every product of that firm gets targeted with an AD duty.[6] I present the results by calculating a higher bound for the effects of each stage of the AD process on the export revenue. Economically, this states that if a firm is named in an AD action, then all the products the firm is exporting to that country are considered under AD duties or under AD investigation, therefore the interpretation of the coefficients is not entirely an accurate representation of the effects of AD duties on these targeted firms.

To address the zeros in the dependent variable, a hyperbolic inverse transformation is used, which has the advantage of including these zero within its domain, unlike the conventional logarithmic transformation. This is particularly useful for the empirical methodology, which incorporates zero export revenue into the model. In instances where a firm ceases

[6]Besedes and Prusa (2017) discussed this problem in detail.

exporting to a particular country, the model assigns a value of zero for the years when the AD duty is active, thereby controlling for the prohibited and long term effects of these duties. As AD duties are effective in restricting trade and forcing firms out of the market (Besedes and Prusa, 2017), omitting the zeros from the model would introduce bias into the results by dropping these observations for the sample. However, it should be noted that the hyperbolic inverse transformation complicates the interpretation of coefficients compared to the logarithmic function, although it follows a similar trajectory for positive numbers. A comparison with the logarithmic transformation is provided in Appendix 7.3, offering a more straightforward interpretation of the coefficients for each table.

Effects of AD duties on the export revenue by country

This section looks to determine the effects of AD duties on firm j's export revenue from country c at time t. The explanatory variable is the stage g of the AD processes ($Stage_{jtg}$) of firm j at time t, where g takes the values 0,1,2,3,4. The estimating equation for the effects of AD duties the export revenue is the same as in the previous sections.

$$\begin{aligned}\text{Export\_Revenue}_{jct} = \beta_1 + \beta_2(\text{Stage=2})_{jct} + \beta_3(\text{Stage=3})_{jct} + \beta_4(\text{Stage=4})_{jct} + \\ \beta_5\text{Firm}_{jt} + \beta_6\text{Firm}_{jct} + \theta_t + \theta_{jc} + \theta_{\text{years exporting}} + \varepsilon\end{aligned} \tag{2.3}$$

where $Export\_Revenue_{jct}$ is the export revenue (hyperbolic inverse transformation) of firm j from country c at time t; $Firm_{jt}$ are firm level characteristics; $Firm_{jct}$ are firm-country level characteristics; θ_{time} are calendar year fixed effects, $\theta_{firm-country}$ are firm-country fixed effects and $\theta_{\text{years exporting}}$ are years exporting fixed effects. The coefficients of interest are β_2, β_3 and β_4, which represent the marginal effect of moving between the different stages of the AD process compares to the control group.

Feenstra (2015) argues that an AD duty increases prices of the targeted products to avoid the imposition of final tariffs. Indeed, Avsar (2013) finds that AD duties on Brazilian firms raised the price of the products targeted by AD duties, during the investigation period. Such

increases in prices will have a negative effect on the firm's competitiveness. Therefore, the expected coefficient of the treatment variables will be negative, indicating that AD duties decrease the export revenue received from the countries imposing AD duties.

Effects of AD duties on the total export revenue

This section looks to determine the effects of AD duties on firm j's export revenue at year t, after aggregating the variables of the previous section at the firm level. The estimating equation for the effects of AD duties the export revenue is the same as in the previous section aggregated at the firm level.

$$\begin{aligned} \text{Export\_Revenue}_{jt} = \beta_1 + \beta_2(\text{Stage=2})_{jt} + \beta_3(\text{Stage=3})_{jt} + \beta_4(\text{Stage=4})_{jt} \\ \beta_5 \text{Firm}_{jt} + \theta_t + \theta_j + \theta_{\text{years exporting}} + \varepsilon \end{aligned} \tag{2.4}$$

where $Export\_Revenue_{jt}$ is the export revenue (hyperbolic inverse transformation) of firm j at time t. The rest of the variables are the same as in the previous section aggregated at the firm level.

2.5 Results

This section presents the empirical analysis of the effects of anti-dumping duties on the export revenue of Brazilian firms between 1989 and 2001. The analysis uses mixed panel data techniques to take advantage of the rich data set of the unbalanced panel. The random effect parameter, in the mixed panel model, is the firm-country relation (firm for the firm level analysis). The inclusion of this random effect parameter allows to account for firm and firm-country heterogeneity in the estimation. To test whether the inclusion of the random parameter is appropriate, it is necessary that the coefficient (Columns (2) and (4)) be statistically significant and different from zero.

The estimation tables throughout this section follows the same structure. Each table

presents the results of the estimation model for the full sample (Columns (1) and (2)) and the matched sample (Columns (3) and (4)) using the Mahalanobis method. Each group is comparing the estimation results using a saturated fixed effects model that includes calendar year, years exporting and firm-country (firm level) fixed effects and a mixed model methodology where the random parameters is the firm-country and firm, parameter, respectively. The results of the logarithmic transformation are provided in the Appendix 7.3 for each section.

2.5.1 Effects of AD duties on the export revenue by country

This section presents the estimation results from the effects of AD duties on the firm's export revenue received from the country that imposes AD duties on the firm. The main control variables in the model are: $N\_Countries\_Cat_{jt}$ which represents the number of countries a firm exports to; $N\_Products\_Country_{jct}$ as the number of products exported to country c y firm j at time t; $N\_Products\_Cat_{jt}$ as the number of products in firm j exports in the same category (4-digit HS code); and $AD\_Experience_{jct}$ which is the selection variable used in the matching procedure and it is included as further control for any residual confounding after the matching procedure.

Table 7 shows that the firm-country random effect parameter is significant and clearly different that zero for columns (2) and (4), therefore, it is appropriate to include it in the model to allow for firm-country heterogeneity and controlling for the unbalanced panel bias. The preferred specification is column (4), which uses a matched sample with a mixed panel methodology. The estimated coefficients for columns (3) and (4) are similar in sign, magnitude and significance for all the variables in the model.

Column (4) shows that if a firm is named in an AD investigation the effects on the export revenue received from the country imposing AD duties are significant and negative, compare to the control group (never received AD duties). This effect slightly increases once the firm receives final AD duties compare to the investigation phase. Finally, there

is no significant effect on the export revenue once the AD duties are revoked or dropped. Column (3) presents similar results for the fixed effects model, in which the magnitude of the coefficients are slightly higher for both the Investigation and the Approve phase, but their effects remain significant.

As discussed in the methodology section, if the targeted firm stopped exporting to a country, the model is assigning a value of zero for the years when the AD duty is active, to control for the prohibitive and long term effects of these duties. This could be the reason for the high magnitude of the coefficients. The results confirm the strong effects of AD duties found in other studies, in which firms could decide to leave the market, increase prices, change the product mix and/or decrease exports volumes. The negative effects once the duties are approved can be related to the loss of competitiveness of the firm after it decides to stay in the market and its forced to pay higher prices and face stronger competition.

The effects observed in stage 3 (Approve AD) suggest a decrease in export revenue, reflecting the impact of AD duties throughout the entire period (5+ years) that these duties are in effect. By this stage, firms have likely adapted their export strategies and made the decision to remain in the market. Firms that choose to continue exporting to a country imposing AD duties on one or more of their products may have adjusted their product mix to include items not targeted by these duties. However, on average, this does not appear to be enough to offset the negative effects of AD duties.

The commercial strategy a firm adopts depends on both the relevance of the destination country to the firm and the importance of the targeted product in that market. It is reasonable to assume that the imposing country will target the larger firms that export the highest volumes. Consequently, the targeted products are likely those that are most crucial to the firm, given their substantial export volumes, which makes them prime candidates for being targeted by AD duties.

An argument for the proposed conclusion is that AD duties are effective at disrupting trade relations between firms and countries. Besedes and Prusa (2017) found that AD duties

imposed by the US forced foreign firms outside the US market; Valdebenito (2024) found that AD duties imposed on Brazilian products, significantly increase the risk for these targeted firms to terminate the exports of the targeted products to such countries. Therefore, when firms are under an investigation period, they need to adapt their export strategy towards new markets or the development of new products to avoid these high tariffs. The literature finds increases in trade disruption and trade shifting at the sector level in the extensive and intensive margin when AD duties are imposed (Besedes and Prusa, 2016).

Columns (1) and (2) display the estimation results from the full sample, not controlling for selection into AD or the highly disproportional size of the treatment and control groups. The effects of each stage of the AD process are similar to the matched sample in terms of sign, significance and magnitude. The only difference occurs in the period After the duties are revoked or dropped, in which the effects becomes significant, but this can be caused by selection bias in the sample.

The coefficients of the control variables in column (4) are significant and similar in sign and magnitude to the fixed effects model in column (3). The interpretation of these coefficients is presented using the logarithmic transformation from Table A.6 in the Appendix, to assist with the economic interpretation of the coefficients and in parenthesis the coefficients from Table 7. As mentioned, the preferred specification is column (4) where an increase in experience of the firm imposing AD duties to its trading partner increase the export revenue by 21.6% (.2254); sending exports to one more country, increases the export revenue by 14.7% (.1578); increasing one more product to the same 4 digit HS category the firm produces increase the export revenue by 122.8% (1.274); and finally, increasing the number of products firm j exports to country c, increases the export revenue by 65.5% (.6797).

2.5.2 Firm-level Export Revenue

This section estimates the effects of AD duties on the total export revenue of the targeted firms. The structure of Table 8 is the same as before. In this section, the random effect

parameter is also significant and clearly different than zero for columns (2) and (4). Therefore, it is appropriate to be include it in the model, allowing for firm heterogeneity. The preferred specification is column (4), which display the matched model with a a mixed effects methodology. The results are similar for columns (3) and (4).

Column (4) shows that when a firm is named in an AD investigation, the effects on the total export revenue are strongly negative and significant in each of the three stages of the AD process. This effects are still negative, but they are smaller in magnitude than the effects on the export revenue from just the country that imposes the duty. The strongest effects are felt during the investigation phase, in which the targeted firms experienced a strong decrease in total export revenue. Firms that stayed in the market and received final AD duties, that on average are imposed for five or more years, experienced a large and significant decrease in their export revenue. This effect is felt after the duties are removed. The sign and significance of the coefficients is similar to the fixed effects model (Column (3)), except for the $After\_AD$ coefficient which is not significant.

Before going into the analysis, its important to recall a few key facts: First, the previous section showed that firms that get targeted with AD duties experience a large decrease in their export revenue from the country imposing the duties. Second, the literature on AD policy agrees that AD duties are effective at forcing firms out of the destination markets (Besedes and Prusa, 2017 and Valdebenito (2024b); Third, AD duties are effective at raising prices of the targeted products (Avsar, 2013); Fourth, AD policy creates trade diversion to other countries (Besedes and Prusa, 2016). Therefore, the negative effects of these duties on the targeted firms is affecting the entire firms revenue, and causing an important decrease in export revenue.

These four facts can explained the effects of AD duties in the firm's total export revenue. First, AD duties are set on firms that "flood" the domestic market with cheap products, therefore it is a fair assumption to argue that an important part of the targeted firms' export revenue is received from these countries; and large decrease in revenue would come

if those exports stop. Second, the firm will suffer a large decrease in revenue if the country imposing the duties forced the targeted products out of their markets. Third, if AD duties are effective at raising prices of the targeted products, then such products will suffer a loss of competitiveness and a decrease in demand. Fourth, the redistribution of products to other countries is expensive as well as entering in new markets which may have stricter regulations ad stronger competitors.

As in the previous section, Columns (1) and (2) display the estimation results from the full sample, not controlling for selection into AD or the highly disproportional size of the treatment and control groups. The effects of each stage of the AD process are similar to the matched sample in terms of sign, significance and magnitude. The only difference occurs in the period After the duties are revoked or dropped, in which the effects are not significant for the mixed model and the magnitude is considerably lower, but this could be an effect of the selection bias of the full sample.

The coefficients of the control variables in Columns (4) are significant and similar in sign and magnitude to the coefficients of the fixed effect model (column 3). The interpretation of the coefficients is presented using the logarithmic transformation from Table A.7 in the Appendix and in parenthesis the coefficients from Table 8. As mentioned, the preferred specification is column (4) where an increase of 1.0% in the share of revenue from the country imposing AD duties increases the export revenue by 5.2% (.0536); exporting to one more extra country increases the total export revenue by 28.6% (.2759); adding one more product to the same 4 digit HS product category increases the total export revenue by 104.9% (1.008). Overall, firms that export to more countries and export a larger variety of products have higher export revenues.

2.6 Conclusion

This paper studies how AD duties imposed on Brazilian firms during the period between 1989 and 2001 affect, separately, the targeted firms' total export revenue and the export revenue received from the country imposing the duties. To control for selection into AD, the paper uses a propensity score methodology to compare firms with similar characteristics that export similar products to similar countries. The paper also estimates the effects of these duties in each of the stages of an AD process: before AD, investigation phase, final duties and when duties are dropped or revoked.

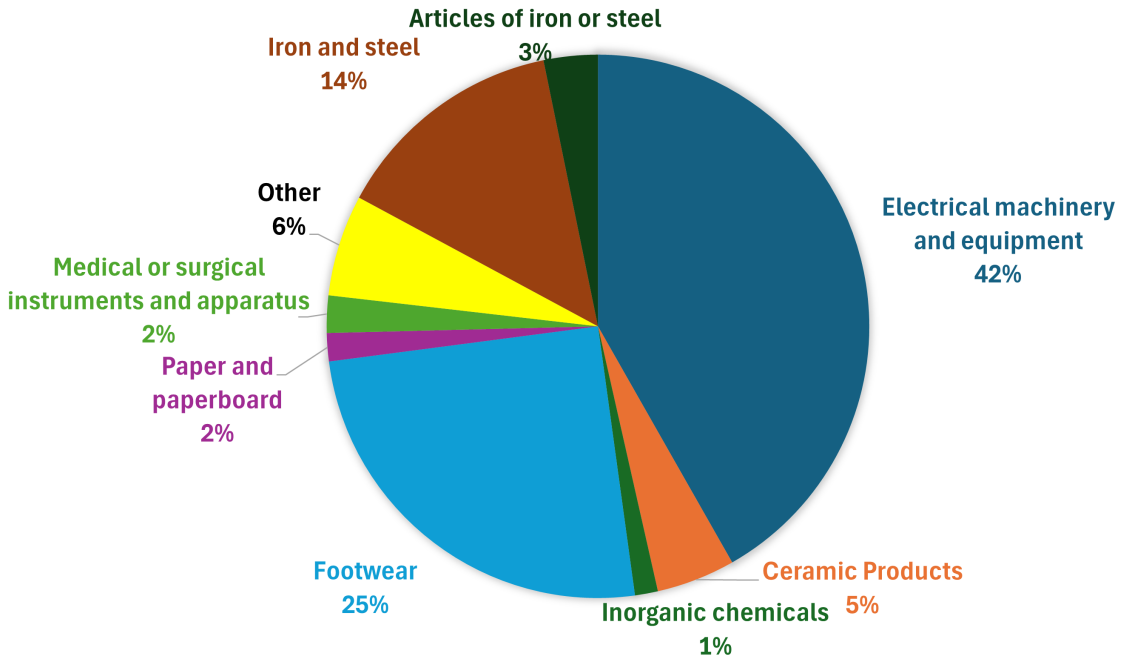
The results suggest that firms that are targeted with AD duties experience, during the AD investigation phase, a sharp decrease in the export revenue from the country that imposed the duties. This decrease is also present after the firm has received final AD duties, which are usually set for a minimum of five years. There is no significant effect of AD duties on the export revenue after the AD have been removed. These results are consistent with the findings of the literature about the prohibitive and restrictive effect of AD duties; firms that are targeted are most likely to cease exporting the targeted products or leave the imposing country completely.

The second result of the paper finds that firms that are targeted with AD duties experience a strong decrease in their total export revenue. This negative effect remains during the AD investigation, after the duties are approved and even after the AD process is over. The economic interpretation of this result is interesting because it's consistent with the literature of trade diversion, which states that AD duties force the named firms to redistribute their products towards countries that do not impose AD duties or to change their export behavior by either decreasing export volumes or raising prices.

This trade diversion effect could encompass both the significant decrease in revenue from the country imposing the AD duties and the decrease in total export revenue caused by the redistribution strategy of the firm.

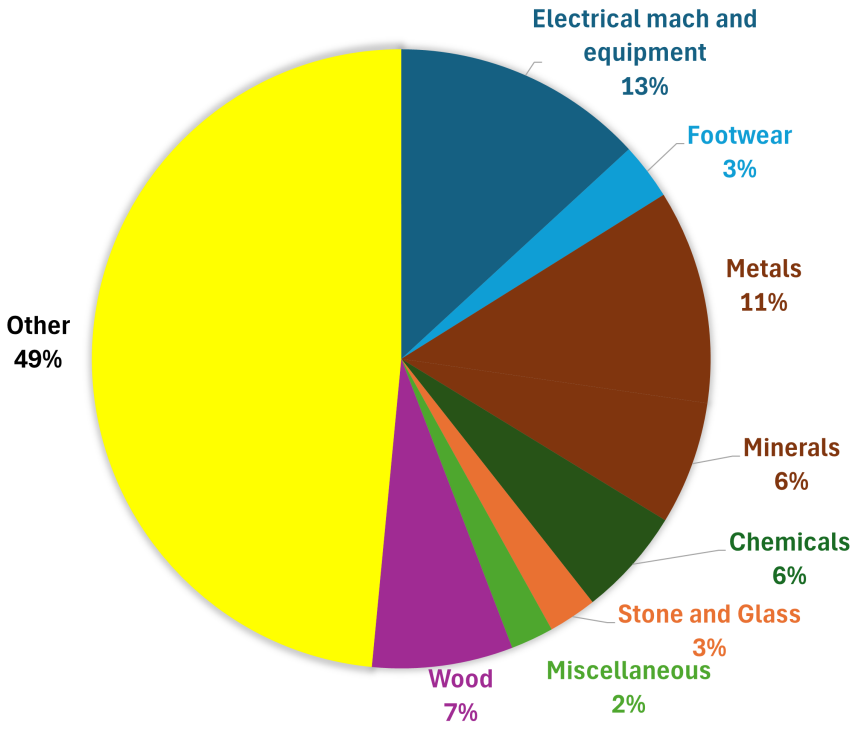
2.7 Figures

Figure 2.1: Brazilian products targeted with AD duties from 1989 and 2001



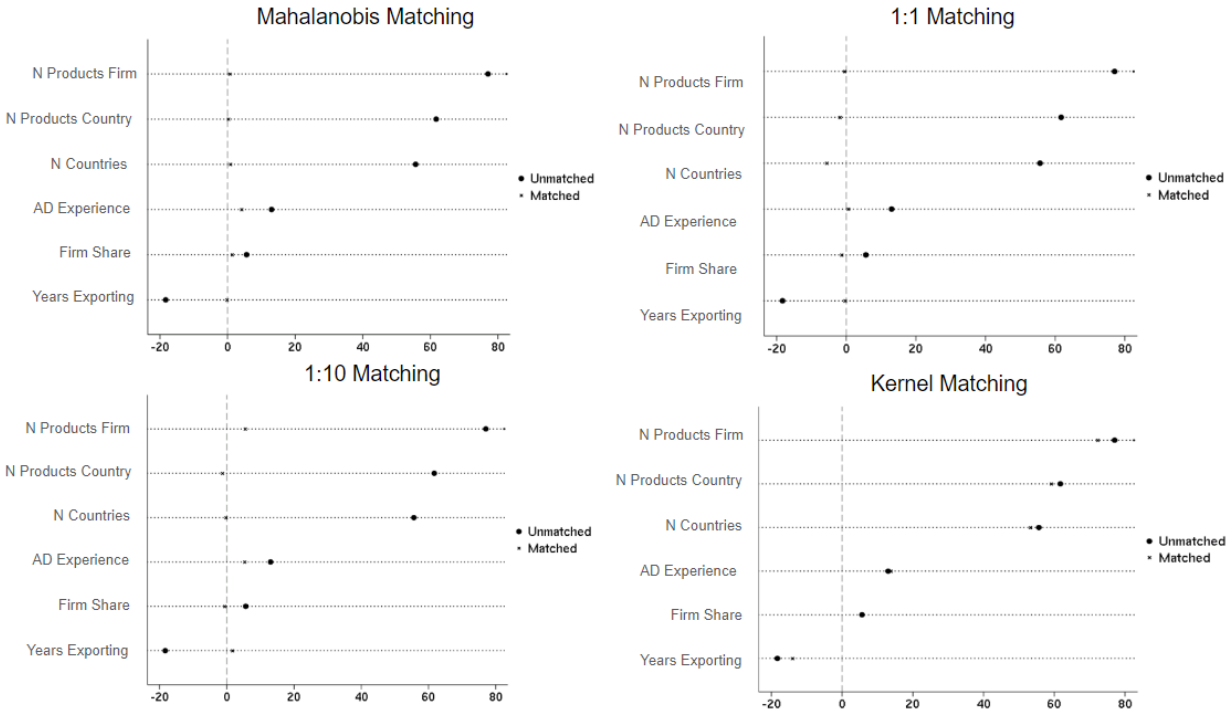
Notes: This chart shows the share of Brazilian products targeted with AD duties between 1989 and 2001 at the product level (2-digit HS code).
Source: GAD, SECEX.

Figure 2.2: Brazilian Export Share (%) by sector in 2000



Notes: This chart shows the distribution of the export revenue (%) that Brazil received from each industry that its targeted with AD duties in the year 2000. "Other" refers to sectors that are not targeted with AD duties and include mostly vegetable and animal products.
Source: World Integrated Trade Solution (WITS).

Figure 2.3: Balance comparison four methods for firm-country level



Notes: This figure presents the difference in means for each covariate for the matched (small dots) and unmatched (large dots) samples in each of the matching methodologies. Values close to zero indicate that the difference in means of the treated and control samples are similar.
Source: Author's own work.

2.8 Tables

Table 2.1: Description of Brazilian firms (on average)

	AD Firms	Exporting Firms (Non AD)	All Firms
Size (# Workers)	1,654.7	401.5	13.9
Export Revenue (US$ Millions)	51.4	5.3	-
Number of Destination Countries	7.8	4.01	-
Number of Exported Products	49.0	14.9	-
Number of Firms	117	10,444	2,535,979

Notes: This table provides a description of Brazilian firms. "AD Firms" are those that are named in an AD process. "Exporting firms" are those that export but are not target in AD investigations. "All Firms" includes all firms in the dataset, including non-exporting firms. The size is measured by the number of workers, export revenue is in US dollars, the number of destination countries indicates the average number of countries firms export to, and the number of exported products indicates the average number of products firms export.
Source: Valdebenito (2024a).

Table 2.2: Brazilian total Export Revenue (share) US$ in 1990 and 2000

	Export Revenue US$ (%)	
Country	1990	2000
EU	31.9	30.8
USA	24.6	24.3
Japan	7.5	4.5
Argentina	2.1	11.3
Korea, Rep	1.7	1.1
Canada	1.7	1.0
Mexico	1.6	3.1
Chile	1.5	2.3
China	1.2	20
Others	26.2	19.7
Total	100	100

Notes: This table compares the Export Revenue (US$) received by Brazil from its main exporting partners as a percentage of the total in 1990 and 2000.
Source: World Integrated Trade Solution (WITS).

Table 2.3: Number of observations in each stage of the AD process

	Firm Level		Firm-Country Level	
AD stage	Frequency	Percent	Frequency	Percent
No AD	43,025	96.32	234,759	99.23
Before AD	503	1.13	647	0.27
Investigation AD	274	0.61	259	0.11
Approve AD	412	0.92	484	0.20
After AD	455	1.02	424	0.18
Total	44,669	100	236,573	100

Notes: This table shows the number of observations in each stage of the AD process. The level of observations is firm-year (for Firm level) and firm-country-year (for Firm-Country level). The stages of the AD are divided in: "Before anti-dumping" category are firms that have not yet been targeted with an AD duty; "Investigation stage" are firms that are under an investigation process; "Approve stage" are firms that have active and final AD duties in force; and "After anti-dumping" are firms that had the investigation dropped or the duties expired and were not renewed. Firms that are never named in an AD investigation are in the "No AD" group.

Table 2.4: Treatment and control groups with different specifications for firm-country level analysis

Matching Method	Treatment	Control	Total
Mahalanobis	2,026	4,215	6,241
1:1	2,026	4,365	6,391
1:k (10)	2,026	35,669	37,695
Kernel	2,026	234,757	236,783

Notes: This table shows the number of observations (firm-country-year level) in the treated and control groups for each of the four matching methodologies.

Table 2.5: Two-sample t-test for Mahalanobis matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
AD Experience (%)	Unmatched	5.446	4.114	13.0		3.14	0.002
	Matched	5.446	5.022	4.1	68.2	0.70	0.482
Years Exporting	Unmatched	2.328	2.691	-18.3		-3.80	0.000
	Matched	2.328	2.331	-0.2	99.0	-0.04	0.971
N Countries Category	Unmatched	10.618	4.693	55.6		15.82	0.000
	Matched	10.618	10.53	0.8	98.5	0.12	0.901
N Products Category	Unmatched	3.435	1.140	77.1		24.60	0.000
	Matched	3.435	3.416	0.6	99.2	0.09	0.928
N Products Country	Unmatched	1.533	.6711	61.7		15.66	0.000
	Matched	1.533	1.530	0.2	99.6	0.04	0.968
Firm Share	Unmatched	.2071	.1214	5.6		1.18	0.237
	Matched	.2071	.1868	1.3	76.3	0.27	0.784

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 2.6: Treatment and control groups with different specifications for firm level analysis

Matching Method	Treatment	Control	Total
Mahalanobis	1,688	3,625	5,313
1:1	1,688	3,354	5,042
1:k (10)	1,688	18,123	19,811
Kernel	1,688	43,025	44,713

Notes: This table shows the number of observations (firm-year level) in the treated and control groups for each of the four matching methodologies.

Table 2.7: Effects of AD duties Firm-Country level Export Revenue

	Firm-Country level Export Revenue			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Export\_Revenue(arc)_{jct}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jct}$	-4.972***	-4.906***	-4.707***	-4.592***
	(.4460)	(.5655)	(.4298)	(.5391)
$Approve\_AD_{jct}$	-5.469***	-5.448***	-5.272***	-5.272***
	(.3274)	(.4376)	(.3428)	(.4797)
$After\_AD_{jct}$	-.8318***	-.8436*	-.3434	-.3050
	(.3069)	(.4771)	(.3117)	(.4580)
$AD\_Experience_{ct}$	.1841***	.1894***	.2310***	.2254***
	(.0012)	(.0020)	(.0125)	(.0198)
$N\_Countries\_Cat_{jt}$	.2267***	.2173***	.1872***	.1578***
	(.0023)	(.0038)	(.0132)	(.0179)
$N\_Products\_Country_{jct}$	1.874***	1.804***	1.406***	1.274***
	(.0235)	(.0436)	(.0771)	(.1284)
$N\_Products\_Cat_{jt}$	.9299***	.8998***	.6635***	.6797***
	(.0116)	(.0189)	(.0349)	(.0519)
Firm-Country RE	-	3.162***	-	3.861***
	-	(.0423)	-	(.2190)
Observations	234,045	236,573	6,389	6,397
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm-Country FE	YES	NO	YES	NO
R-square (within)	0.639	-	0.526	-

Notes: This table reports the effects of anti-dumping (AD) duties on the firm-country level export revenue. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jct}$ which indicates the investigation phase of AD, $Approve\_AD_{jct}$ indicating the approval phase, $After\_AD_{jct}$ for post-AD implementation effects, $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports to, $N\_Products\_Country_{jct}$ as the number of products exported to a country, and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm-Country random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

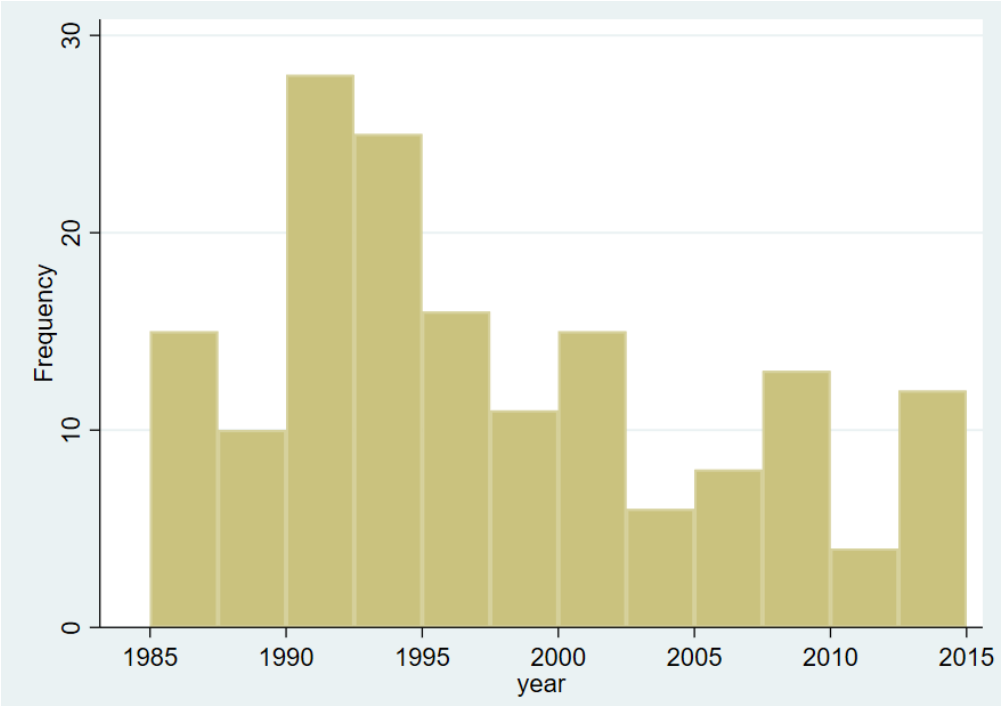
Table 2.8: Effects of AD duties on Firm-level Export Revenue

	Firm-level Export Revenue			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Export\_Revenue(arc)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-1.378***	-2.589***	-1.024***	-1.454***
	(.4039)	(.4665)	(.2862)	(.3249)
$Approve\_AD_{jt}$	-1.157***	-2.403***	-.8447***	-1.388***
	(.3764)	(.5876)	(.2777)	(.4221)
$After\_AD_{jt}$	-.0844	-1.459**	-.1578	-.8352**
	(.3579)	(.5753)	(.2632)	(.3894)
$AD\_Revenue_{jt}$	.0470***	.0427***	.0533***	.0536***
	(.0048)	(.0057)	(.0048)	(.0053)
$N\_Countries\_Cat_{jt}$	.4069***	(.3918)	.2935***	.2759***
	(.0167)	(.0309)	(.0183)	(.0298)
$N\_Products\_Cat_{jt}$	2.589***	2.559***	1.006***	1.008***
	(.0708)	(.1399)	(.0546)	(.1000)
Firm RE	-	3.723***	-	4.012***
	-	(.1133)	-	(.2471)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.419	-	0.324	-

Notes: This table reports the effects of anti-dumping (AD) duties on the firm level export revenue. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects, $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports to; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

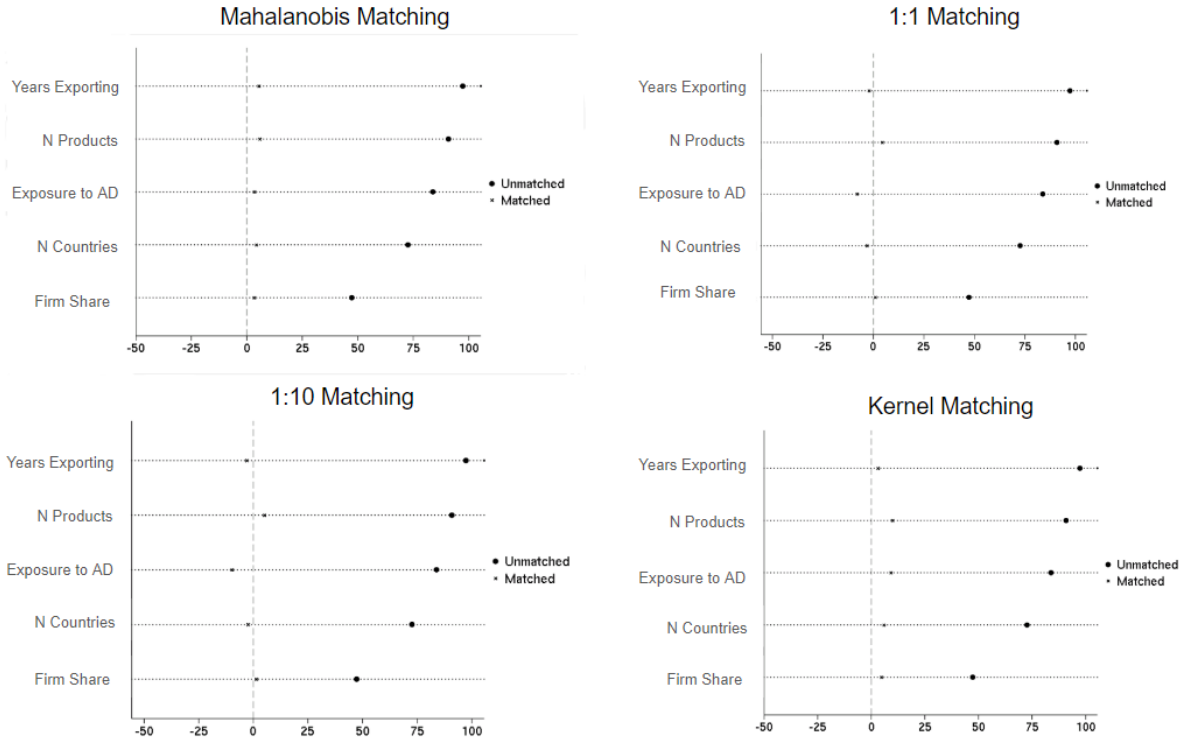
2.9 Appendix Figures and Tables

Figure 2.A.1: AD actions against Brazil from 1985 to 2015



Notes: This graph shows the products that were targeted by AD actions, aggregated by industry using 2 digit HS-code. The most targeted product are the 2-digit HS line 72 of "Iron and Steel" with 1,637 products targeted, representing 52.3% of the total. Second is "footwear", 2-digit HS line 64, with 645 products (20.1% of the total). Third is "cotton" (2-digit HS line 52) with 153 products targeted (4.9% of the total).
Source: Valdebenito (2024a).

Figure 2.A.2: Balance comparison four methods for firm-country level



Notes: This figure presents the difference in means for each covariate for the matched (small dots) and unmatched (large dots) samples in each of the matching methodologies. Values close to zero indicates that the difference in means of the treated and control samples are similar.
Source: Author's own work.

Table 2.A.1: AD filed against Brazilian Products

Product Category	**HS Code**	**Export Value (in million USD)**	**Percentage**
Electrical machinery and equipment	85	1,620	41.8
Footwear	64	974	25.1
Iron and steel	72	540	13.9
Ceramic Products	69	182	4.7
Articles of iron or steel	73	125	3.2
Medical or surgical instruments and apparatus	90	86	2.2
Paper and paperboard	48	65	1.7
Inorganic chemicals	28	53	1.4
Other	-	234	6.0
Total	-	3,879	100

Notes: This table shows the number of AD actions initiated against Brazilian products between 1989 and 2001, distributed by 2-digit HS code, and the export revenue (in million US$) that Brazil received from exporting these products during this period.
Source: Global Anti-dumping Database and SECEX.

Table 2.A.2: Two-sample t-test for 1 to 1 matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
AD Experience (%)	Unmatched	5.446	4.114	13.0		3.14	0.002
	Matched	5.446	5.387	0.6	95.5	0.10	0.922
Years Exporting	Unmatched	2.328	2.691	-18.3		-3.80	0.000
	Matched	2.328	2.335	-0.3	98.1	-0.07	0.946
N Countries Category	Unmatched	10.618	4.694	55.6		15.82	0.000
	Matched	10.618	11.214	-5.6	89.9	-0.82	0.414
N Products Category	Unmatched	3.435	1.140	77.1		24.60	0.000
	Matched	3.435	3.451	-0.5	99.3	-0.07	0.944
N Products Country	Unmatched	1.533	.6711	61.7		15.66	0.000
	Matched	1.533	1.560	-1.9	97.0	-0.29	0.770
Firm Share	Unmatched	.2071	.1214	5.6		1.18	0.237
	Matched	.2071	.2273	-1.3	76.4	-0.21	0.836

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 2.A.3: Two-sample t-test for 1 to 10 matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
AD Experience (%)	Unmatched	5.446	4.114	13.0		3.14	0.002
	Matched	5.446	4.904	5.3	59.3	0.93	0.350
Years Exporting	Unmatched	2.328	2.691	-18.3		-3.80	0.000
	Matched	2.328	2.295	1.7	90.9	0.34	0.737
N Countries Category	Unmatched	10.618	4.694	55.6		15.82	0.000
	Matched	10.618	10.645	-0.3	99.5	-0.04	0.969
N Products Category	Unmatched	3.435	1.140	77.1		24.60	0.000
	Matched	3.435	3.272	5.5	92.9	0.76	0.445
N Products Country	Unmatched	1.533	.6711	61.7		15.66	0.000
	Matched	1.533	1.552	-1.3	97.9	-0.21	0.833
Firm Share	Unmatched	.2071	.1214	5.6		1.18	0.237
	Matched	.2071	.2164	-0.6	89.1	-0.08	0.934

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 2.A.4: Two-sample t-test for Kernel matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
AD Experience (%)	Unmatched	5.446	4.114	13.0		3.14	0.002
	Matched	5.446	4.039	13.8	-5.6	2.36	0.019
Years Exporting	Unmatched	2.328	2.691	-18.3		-3.80	0.000
	Matched	2.328	2.606	-14.0	23.3	-2.44	0.015
N Countries Category	Unmatched	10.618	4.694	55.6		15.82	0.000
	Matched	10.618	4.951	53.2	4.4	8.95	0.000
N Products Category	Unmatched	3.435	1.140	77.1		24.60	0.000
	Matched	3.435	1.283	72.3	6.2	11.77	0.000
N Products Country	Unmatched	1.533	.6711	61.7		15.66	0.000
	Matched	1.533	.7069	59.2	4.1	10.03	0.000
Firm Share	Unmatched	.2071	.1214	5.6		1.18	0.237
	Matched	.2071	.1228	5.5	1.7	0.94	0.348

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 2.A.5: Two-sample t-test for Mahalanobis matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
Exposure to AD (%)	Unmatched	28.241	9.454	83.8		38.33	0.000
	Matched	28.241	27.476	3.4	95.9	0.80	0.424
Years Exporting	Unmatched	6.365	3.326	97.3		38.59	0.000
	Matched	6.365	6.195	5.4	94.4	1.41	0.160
N Countries Category	Unmatched	8.473	2.010	72.6		49.46	0.000
	Matched	8.473	8.092	4.3	94.1	0.90	0.368
N Products Category	Unmatched	3.508	.813	90.9		66.64	0.000
	Matched	3.508	3.335	5.8	93.6	1.22	0.223
Firm Share	Unmatched	15.219	4.275	47.3		24.02	0.000
	Matched	15.219	14.448	3.3	92.9	0.74	0.458

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 2.A.6: Effects of AD duties on Firm-Country level Export Revenue (ln)

	Firm-Country level Export Revenue			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Export\_Revenue(ln)_{jct}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jct}$	-4.728***	-4.647***	-4.501***	-4.382***
	(.4267)	(.5433)	(.4116)	(.5189)
$Approve\_AD_{jct}$	-5.212***	-5.176***	-5.052***	-5.039***
	(.3131)	(.4187)	(.3280)	(.4595)
$After\_AD_{jct}$	-.7919**	-.7850*	-.3381	-.2857
	(.2930)	(.4546)	(.2981)	(.4387)
$AD\_Experience_{ct}$	.1742***	.1792***	.2219***	.2160***
	(.0012)	(.0019)	(.0120)	(.0192)
$N\_Countries\_Cat_{jt}$	.2138***	.2049***	.1729***	.1472***
	(.0022)	(.0036)	(.0121)	(.0165)
$N\_Products\_Country_{jct}$	1.792***	1.725***	1.355***	1.228***
	(.0222)	(.0412)	(.0737)	(.1220)
$N\_Products\_Cat_{jt}$	.8841***	.8562***	.6402***	.6550***
	(.0111)	(.0179)	(.0331)	(.0494)
Firm-Country RE	-	2.989***	-	3.675***
	-	(.0396)	-	(.2054)
Observations	234,045	236,573	6,393	6,401
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm-Country FE	YES	NO	YES	NO
R-square (within)	0.640	-	0.527	-

Notes: This table reports the effects of anti-dumping (AD) duties on the firm-country level export revenue using a logarithmic transformation. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jct}$ which indicates the investigation phase of AD, $Approve\_AD_{jct}$ indicating the approval phase, $After\_AD_{jct}$ for post-AD implementation effects, $Years\_Exporting_{jct}$ as the number of consecutive years a firm has been exporting, $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports to, $N\_Products\_Country_{jct}$ as the number of products exported to a country, and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm-Country random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 2.A.7: Effects of AD duties on Firm-level Export Revenue

	Firm-level Export Revenue			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Export\_Revenue(ln)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-1.360***	-2.491***	-.9922***	-1.405***
	(.3875)	(.4407)	(.2763)	(.3106)
$Approve\_AD_{jt}$	-1.142***	-2.323***	-.8023***	-1.332***
	(.3613)	(.5630)	(.2681)	(.4077)
$After\_AD_{jt}$	.0397	-1.268**	-.0074	-.6657*
	(.3438)	(.5536)	(.2539)	(.3766)
$AD\_Revenue_{jt}$	.0466***	.0422***	.0521***	.0520***
	(.0046)	(.0055)	(.0046)	(.0051)
$N\_Countries\_Cat_{jt}$	.4158***	.4004	.3000***	.2869***
	(.0159)	(.0295)	(.0175)	(.0282)
$N\_Products\_Cat_{jt}$	2.586***	2.551***	1.047***	1.049***
	(.0675)	(.1332)	(.0521)	(.0956)
Firm RE	-	3.555***	-	3.887***
	-	(.1065)	-	(.2357)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.410	-	0.320	-

Notes: This table reports the effects of anti-dumping (AD) duties on the firm level export revenue. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects, $Years\_Exporting_{jt}$ as the number of consecutive years a firm has been exporting, $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports to; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Bibliography

Avsar, V. (2013). anti-dumping, retaliation threats, and export prices. the world bank economic review, 27(1), 133-148.

Berthou, A., & Fontagné, L. (2016). Variable trade costs, composition effects and the intensive margin of trade. The World Economy, 39(1), 54-71.

Besedeš and Prusa (2017), "The Hazardous effects of anti-dumping". Economic Inquiry (ISSN 0095-2583) Vol. 55, No. 1, January 2017, 9–30.

Baumann, R. (2002). Brazil in the 1990s: an economy in transition. En: Brazil in the 1990s: an economy in transition-London: Palgrave/St. Antony's College, 2002-p. 1-38.

Blonigen, B., & Haynes, S. E. (1999). anti-dumping investigations and the pass-through of exchange rates and anti-dumping duties.

Blonigen, B. A., & Park, J. H. (2004). Dynamic pricing in the presence of anti-dumping policy: Theory and evidence. American Economic Review, 94(1), 134-154.

Blonigen and Prusa (2016), "Chapter 3: Dumping and anti-dumping Duties". Handbook of Commercial Policy. Volume 1, Part B, 2016, Pages 107-159.

Bown, C. P., & Crowley, M. A. (2007). Trade deflection and trade depression. Journal of International Economics, 72(1), 176-201.

Bown (2008): "The WTO and anti-dumping in developing countries". Economics & Politics, 20: 255-288.

Bown, Chad P. 2011. "Taking Stock of anti-dumping, Safeguards and Countervailing Duties, 1990-2009," The World Economy.

Bown, C. P., & Tovar, P. (2011). Trade liberalization, anti-dumping, and safeguards: evidence from India's tariff reform. Journal of Development Economics, 96(1), 115-125.

Bown, C. P. (2013). Emerging economies and the emergence of south-south protectionism. Journal of World Trade, 47(1).

Bown, C. P., & Crowley, M. A. (2014). Emerging economies, trade policy, and macroeconomic shocks. Journal of Development Economics, 111, 261-273.

Bown, C. P., & Reynolds, K. M. (2017). Trade agreements and enforcement: evidence from WTO dispute settlement. American Economic Journal: Economic Policy, 9(4), 64-100.

Chandra, P., & Long, C. (2013). VAT rebates and export performance in China: Firm-level evidence. Journal of Public Economics, 102, 13-22.

De Souza, G., & Li, H. (2022). The employment consequences of anti-dumping tariffs: Lessons from Brazil.

Durling, J. P., & Prusa, T. J. (2006). The trade effects associated with an anti-dumping epidemic: The hot-rolled steel market, 1996–2001. European Journal of Political Economy, 22(3), 675-695.

Egger, P., & Nelson, D. (2011). How bad is anti-dumping? Evidence from panel data. Review of Economics and Statistics, 93(4), 1374-1390.

Feenstra, R. C. (1995). Estimating the effects of trade policy. Handbook of international economics, 3, 1553-1595.

Feenstra, R. C., & Taylor, A. M. (2008). International trade. Macmillan.

Feenstra, R. C. (2015). Advanced international trade: theory and evidence. Princeton university press.

Felbermayr, G., & Sandkamp, A., 2020. "The trade effects of anti-dumping duties: Firm-level evidence from China", European Economic Review, Volume 122, 2020, 103367, ISSN 0014-2921.

Fitzgerald, D., & Haller, S. (2018). Exporters and shocks. Journal of International Economics, 113, 154-171.

Helpman, E., Itskhoki, O., Muendler, M. A., & Redding, S. J. (2017). Trade and inequality: From theory to estimation. The Review of Economic Studies, 84(1), 357-405.

Imbens, G. W., & Rubin, D. B. (2015). Causal inference in statistics, social, and biomedical sciences. Cambridge University Press.

Jabbour, L., Tao, Z., Vanino, E., & Zhang, Y. (2019). The good, the bad and the ugly: Chinese imports, European Union anti-dumping measures and firm performance. Journal of International Economics, 117, 1-20.

Kalinowski, S. (2020). Game of tariffs: the impact of market concentration on international trade. Journal of International Studies, 13(4), 248-258.

Konings, J., Vandenbussche, H., & Springael, L. (2001). Import diversion under European anti-dumping policy. Journal of Industry, Competition and Trade, 1, 283-299.

Konings, J., & Vandenbussche, H. (2008). Heterogeneous responses of firms to trade protection. Journal of International Economics, 76(2), 371-383.

Labanca, C., Molina, D., & Muendler, M. A. (2013). Preparing to export (No. w18962). National Bureau of Economic Research.

Li, R. (2018). The Research on Anti-dumping, Cost and Chinese Export: Based on Multilateral Resistance Term of Gravity Model. International Journal of Business and Management, 13(4), 210-210.

Liu, X., & Shi, H. (2019). Anti-dumping duty circumvention through trade rerouting: Evidence from Chinese exporters. The World Economy, 42(5), 1427-1466.

Lourenco, L., Silveira, D., Oliveira, G., & Vasconcelos, C. (2021). Do anti-dumping Measures Increase Market Power? Evidence From Latin American Countries. *The International Trade Journal*, 1-27.

Lu, Y., Tao, Z., & Zhang, Y. (2013). How do exporters respond to anti-dumping investigations?. Journal of International Economics, 91(2), 290-300.

Ludema, R. D. and Yu, Z. (2016). Tariff pass-through, firm heterogeneity and product quality. Journal of International Economics, 103, 234-249.

Minondo, A. (2024). How exporters neutralised an increase in tariffs. The World Economy, 47(3), 1274-1296.

Muendler, M. A. (1986). Trade, technology and productivity: a study of Brazilian manufacturers 1986-1998. *Technology and Productivity: A Study of Brazilian Manufacturers, 1998*.

Muendler, M. A. (2007). Trade and workforce changeover in Brazil.

Muendler, M. A. (2010). Trade reform, employment allocation and worker flows. In *Trade Adjustment Costs in Developing Countries: Impacts, Determinants and Policy Responses*, World Bank, Washington, DC, *1*(858), 103-141.

Muendler, M. A., Rauch, J. E., & Tocoian, O. (2012). Employee spinoffs and other entrants: Stylized facts from Brazil. *International Journal of Industrial Organization*, *30*(5), 447-458.

Muendler, M. A., & Rauch, J. E. (2018). Do employee spinoffs learn markets from their parents? Evidence from international trade. *European Economic Review*, *105*, 159-173.

Pierce, J. R., & Schott, P. K. (2016). The surprisingly swift decline of US manufacturing employment. American Economic Review, 106(7), 1632-1662.

Prusa, T. J. (2001). On the spread and impact of anti-dumping. Canadian Journal of Economics/Revue canadienne d'économique, 34(3), 591-611.

Romalis, J. (2007). NAFTA's and CUSFTA's Impact on International Trade. The review of Economics and Statistics, 89(3), 416-435.

Schiavo, S., Tomasi, C., & Zhu, M. (2021). Anti-dumping activities against China: patterns and effects. Economia Politica, 38, 7-30.

Valdebenito, J. (2024a). Distributional effects of anti-dumping duties on the workforce of targeted firms. (Working Paper)

Valdebenito, J. (2024b). How strong is the Anti-dumping punch?. (Working Paper)

Vandenbussche, H., & Zanardi, M. (2010). The chilling trade effects of anti-dumping proliferation. *European Economic Review*, *54*(6), 760-777.

Yang, J., Liu, Z., & Wang, X. (2022). The impacts of the u.s. trade war on Chinese exporters. The Review of Economics and Statistics, 1-34.

Chapter 3

Distributional Effects of Anti-Dumping Duties on the Workforce of Targeted Firms

3.1 Introduction

Over the last 20 years, anti dumping (AD) activity has increased considerably among WTO members and so has the empirical literature studying the implications of this common policy tool e.g., Bown (2008); Lu, Tao, and Zhang (2013); Chandra & Long (2013); Bown & Tovar (2011); Ganguli (2008); and Vandenbussche & Zanardi (2010). These authors show that AD duties reduce the volume of exports from the targeted country, increase prices on the targeted products and are effective at protecting the domestic industry of the country imposing the duties (Baghdadi et al., 2019). However, little work exists that studies the empirical effects of anti dumping duties from the perspective of the targeted firms and the effects these duties have on the labor market. In fact, this is one of the first studies analyzing the effects that AD duties have on the targeted firms.

An anti dumping duty is a unilateral tariff that a domestic government imposes on foreign

imports that it believes are priced below the "fair value" of a like product in the exporting country, also called dumping.[1] GATT/WTO rules specify two criteria that must be met in order for an AD measure to be applied. The first is the presence of dumping. The second requires agencies to examine whether the dumping activity, if found, has materially injured the domestic industry or threatened to cause material injury (Blonigen and Prusa, 2016). Both of these criteria are included in Article VI of GATT 1994.[2] All member countries of the World Trade Organization (WTO) are subject to the antidumping agreement of the WTO that governs the application of anti dumping measures by its members.[3] According to a WTO report, 57 countries initiated 5,725 anti dumping investigations against 106 countries during the period from 1995 to 2018 (WTO, 2019).

Along with AD duties, safeguard mechanisms are also a valid option for protectionism allowed by the WTO (under certain conditions), but AD duties are preferred as a policy tool for most countries. They are politically more attractive than a safeguard mechanism because they have lower injury thresholds, are easier to implement and are proven to be successful at lowering import levels (Niels and Kate, 2006). At the same time, Blonigen and Prusa (2016) find that AD duties impose welfare costs as large (or larger) than any other current commercial policy.

This paper estimates the effects of AD duties on Brazilian exporting firms that are targeted by the duties. I focus on their average wages, employment, wage bill and their distribution of high versus low skilled workers during the period between 1989 and 2001. I construct an empirical model by linking firm-level data from the SECEX (Secretaria de Comercio Exterior), which gathers yearly export reports at the firm-country level, with the Annual Social Information Report (RAIS), which is an administrative data set from Brazil that covers 97% of the Brazilian formal market. Finally, I match AD duties targeting

[1]Fair value is the price charged for the same good in the exporter's own market, after backing out transportation costs, border costs, exchange rate translations, etc., so that one is ultimately comparing the two prices for the product (the observed price in the import market and fair value) just as they leave the factory (i.e., ex-factory prices) (Blonigen and Prusa, 2016).

[2]`https://www.wto.org/english/tratop_e/adp_e/adp_info_e.htm`

[3]`https://www.trade.gov/trade-guide-antidumping`

Brazilian firms from the Global anti dumping Database (GAD) (Bown, 2011). Given the availability of the data sets, I create a panel from 1989 to 2001 with firm level information and their respective AD duties, including the timing of the investigation, the result of the process, the targeted product and the years the duty is active (if approved).

The results suggest that firms that are targeted with AD duties experience a decrease in their average wage level, total wage bill and number of high skilled workers when they received final AD duties. On the other hand, I find that AD duties have no significant effects on these targeted firms' employment levels and in their number of low skilled workers. I do not find significant effects of AD duties during the investigation phase on these variables, suggesting that the labor market adjustments are recorded over the medium term.

AD duties are typically set on large firms that export to several countries and export a large variety of products. The level of these duties is, generally, above 100% the price of the product. AD duties are effective at restricting and decreasing trade and keeping firms out of the market, as found in Besedes and Prusa (2017) for the USA and in Valdebenito (2024b) for Brazil. Therefore, the economic interpretation of these results suggest that when firms are targeted with AD duties, they absorbs the negative effect on the their export revenue (as found in Valdebenito (2024a)), which eventually forces them to decrease their number of high skilled workers, causing a decrease in average wages and in the total cost of workers. These delayed effects could be related to the strength of labor unions and the co-existence of formal and informal labor markets on large exporting firms.

Besedes and Prusa (2016) argue about the fundamental selection bias problem in studies about AD policy. AD duties are often imposed on larger firms that export a wider variety of products to numerous countries, making them more likely to be named in an AD process. Ignoring this bias in the empirical model creates an unbalanced control group where firms are not generally comparable. To address this selection bias, I construct a propensity score methodology based on the probability of being named in an AD investigation, depending on firm characteristics and the destination country's experience in initiating AD processes.

Using the destination country's experience in imposing AD actions as the selection variable was first proposed by Lourenco et al. (2021), who argued that the likelihood that a firm receives AD duties is correlated with how experienced the destination country is in the use of these duties, but not with the outcome variables used in this paper. I implement four different matching procedures and compare their balance, common support, and the significance of their matched covariates.

After successfully matching the treated and control firms, I use a panel data methodology to estimate the effects of the duties on firm's average wages, employment, wage bill and their distribution of high and low skilled workers for each stage of the AD process. Recognizing that export data generally do not generate balanced panels due to the entry and exit of firms in different years, this paper follows Baltagi, Song, and Jung (2001), who argue that using a mixed panel methodology is preferred when dealing with unbalanced panels. The paper implements a mixed model with random intercepts within firms. The results also include a fixed effects model as a benchmark for comparison and robustness of the results.

Brazil is the largest economy in Latin America with a strong manufacturing sector, and is a regular target and user of AD investigations both from developed and developing countries. Recent studies found that most of the new overall AD activity is initiated by developing countries targeting other developing countries (Blonigen and Prusa, 2016). Bown and Reynolds (2017) proposed that the increase in AD activity could be blamed on the proliferation of global value chains and the exploitation of labor-intensive countries from manufacturing economies that have pursued a "growing by exports" development model, which is characterized by lower wages, low prices and massive increases in export volumes. Brazil is a perfect example of this type of development model, given its strong presence and influence in international markets.

This study differs from previous literature by examining how foreign AD duties affect Brazilian firms targeted by linking specific targeted firm-products from the GAD to the Brazilian firm-product export database. While Avsar (2013) and DeSouza and Li (2022)

explored Brazilian AD policy, they focused on AD duties imposed by Brazil on importing firms at the sector level. Avsar (2013) uses product-level data from the UN COMTRADE and finds that AD duties lead to a 23 percent increase in the price charged by Brazilian exporting firms in the duty-imposing country for the targeted products. He also argues that AD duties resulted in Brazilian exporting firms increasing their unit export prices for the named industries' products. In comparison, DeSouza and Li (2022) used monthly import data at the product level to investigate the effects of Brazilian AD duties targeting foreign imports on trade, Brazilian suppliers, and related sectors. They found that Brazilian AD policy increased employment by 0.06 percent but decreased welfare by 2.4 percent. However, both studies analyzed the effects of AD duties on the local market when implemented by the Brazilian government at the industry level, rather than at the firm level.

The paper is structured in the following way: Section 2 presents the literature review on AD duties for both the imposing and the targeted country. Section 3 presents and discusses the data sets. Section 4 describes the empirical strategy and methodology. Section 5 presents the results and Section 6 concludes.

3.2 Literature Review

This study contributes to four strands in the literature. First, it analyzes the effects of AD policy on the firms receiving AD duties, marking the first study to examine these effects on targeted firms at the firm level. Second, it studies the effects of a trade shock on labor outcomes while controlling for selection into anti dumping measures. Third, it adds to the literature on developing countries and trade protection mechanisms. Finally, it constructs a mixed domestic employer-employee matched database capable of linking workers and labor market outcomes with AD duties at the firm level.

3.2.1 Effects of anti dumping duties

As previously mentioned, the effects of AD duties on the country imposing the duty are well documented by Blonigen and Prusa (2016). This literature finds that AD duties significantly reduce imports, increase domestic output, domestic employment and profits, but creates welfare losses overall. These welfare losses are due to the worsening in the terms of trade, caused by the reduction of imports from the targeted country, which also suffers welfare loss (Feenstra, 1995). Sandkamp (2019) argues that unlike normal tariffs, AD duties theoretically raise producer prices (Blonigen and Haynes, 1999; Blonigen and Park, 2004; Feenstra, 2008). This implies a worsening of the terms of trade of the importing country, accompanied by a shift in rents from the customs authority of the importer towards exporters. Intuitively, the duties being imposed are treated by the exporter as endogenous and create an incentive to raise prices so as to avoid them, generating a welfare loss for the importer (Feenstra, 2015).

Most of the AD studies have focused on the effects on the country initiating AD investigations, finding that the duty is effective at diminishing import volumes and raising import prices. Liu and Shi (2019) argued that there are two direct effects of an AD measure. The first is trade destruction, which is a decrease in the level of imports from the targeted country to the one imposing the AD. Prusa (2001) and Durling and Prusa (2006) found evidence of this phenomenon by studying the effects of AD measures from the U.S. on Japanese and Chinese exports. The second direct effect identified by Liu and Shi (2019) is trade diversion, in which the country that is charged with AD duties reroutes its exports to a third country. Durling and Prusa (2006), Konings, Vandenbussche, and Springael (2001), and Romalis (2007) have investigated this effect and found mixed results. Based on panel data analysis over the period 1960–2001, Egger and Nelson (2011) found negative and modest effects of AD duties on trade volume and welfare. Vandenbussche and Zanardi (2010) found that frequent users of AD would experience a decline in the total imports from other countries, not just the targeted countries, but the degree varies across sectors. Liu and Shi (2019) suggest this effect could be caused by trade rerouting and increased imports of anti dumping-using

countries from third countries. Blonigen and Haynes (2002) found that the pricing behavior of U.S. iron and steel exporters is substantially altered by the imposition of AD duties.

There is an important discussion in the literature regarding valid identification strategies that are able to manage the endogeneity and selection bias that comes from studying AD policy. Besedes and Prusa (2017) point out that industry level data is far too aggregated to study AD duties, which is levied at the tariff line level; each industry is comprised of hundreds (or even thousands) of tariff lines codes, most of which are not protected. Prusa (2001) and Bown and Crowley (2007) argue that industry level data is a very noisy measure of actual product level protection. Considering these studies, my identification strategy is at the firm-level, where the treatment group is constructed as the firm-country pair that is targeted in an AD investigation and the control groups are firm-country pairs with similar characteristics that are not targeted.

Most of the previous studies into this subject have focused on the country imposing the AD duty; one of a few studies that look at the effects of AD duties on the targeted country are Chandra and Long (2013), who use detailed Chinese firm level data and find that U.S. AD duties reduced labor productivity and the Transformation Productivity Frontier (TPF) of targeted Chinese firms. They found that Chinese firms with the highest initial export intensity experienced the biggest drop in productivity due to U.S. AD duties. Lu, Tao, and Zhang (2013) find that AD duties imposed by the U.S. on China cause a substantial decrease in total export volume. This trade-dampening effect is primarily due to a significant decrease in the number of exporters, despite a modest decrease in the export volume per surviving exporter. Felbermayr and Sandkamp (2020) use Chinese customs data to construct a firm-level gravity model, finding that AD duties imposed on Chinese firms reduce their exports volumes and induce firm exit but do not affect producer prices.

3.2.2 Labor market effects of trade shocks

The second string of literature to which this paper contributes is the effects of trade shocks on local labor markets. Pierce and Schott (2016) found that granting China Permanent Most Favoured Nation (PMFN) status was linked to a strong decline in U.S. manufacturing employment after the year 2000. Berman, Bound and Griliches (1994) study the shifts in demand away from unskilled and toward skilled labor in U.S. manufacturing over the 1980s. Gaston and Trefler (1994), find a strong positive correlation between exports and wage premia across U.S. manufacturing industries, which would suggest that an expansion of exports would increase the premia. Also for the U.S., Klein et al. (2003) use establishment panel data to analyze how the pattern of gross job flows is affected by the path of the real exchange rate. They find that changes in the trend of the real exchange rate affect reallocation but not net employment. In another study, Klein et al. (2004) investigate the joint impact of tariff and real exchange rate changes in the U.S., with particular reference to NAFTA. They argue that the way in which the reduction in tariffs impacted job flows is similar to the effect of a shift in the real exchange rate curve, inducing appreciation of the currency.[4]

Although the effects of trade liberalization on domestic wages have been extensively explored in the literature, there is little empirical evidence of the effects of AD duties on the targeted country's domestic labor market and its effects on average wages, employment level and the distribution of workers.

3.2.3 Antidumping in developing countries

The third topic to which this paper makes a contribution is AD policy in developing countries, particularly, in Brazil. Niels and Kate (2006) find that the demand for AD protection in developing countries by domestic industries appears to be largely driven by macroeconomic factors, which bear little relation with the behavior of foreign exporters on domestic

[4]See Haltiwanger et al. (2004) for a review.

markets. The authors conclude that adverse macroeconomic conditions increase the likelihood of filing an AD complaint. Knetter and Prusa (2002) find that, also for developing countries, periods of poor GDP growth and strong currency are positively correlated with increased country-level AD activity; in other words, macroeconomic forces (i.e., business cycles) and exchange rate movements affect filings of AD petitions and the likelihood of successful AD decisions (Blonigen and Prusa, 2016). Bown and Crowley (2014) find that emerging economies implement temporary trade barriers (TTB) import protection during periods when a greater number of their imported products have become subject to the WTO disciplines that constrain a country's ability to raise applied Most Favored Nation (MFN) tariff rates. Vandenbussche and Zanardi (2010) analysed the overall trade impacts of AD duties by new adopters from 1980 to 2000 and found that the biggest users experienced a decline in total imports from other countries, though the degree varies across sectors.

Besedes and Prusa (2017) find that AD investigations often drive export suppliers out of the U.S. market entirely and that countries which were affected by AD measures imposed by the U.S. are less likely to return to the U.S. market. They conclude that AD duties have a long-run deterrence effect on the behavior of affected suppliers. They also find that AD duties effects are larger at the beginning of the investigation, versus after the AD duty is levied.

In terms of the effects on particular developing countries, Bown and Tovar (2011) studied India's tariff reform using the Grossman–Helpman model and observed that AD duties and safeguards mechanisms were used in a way that brought India's overall level of protection back to a new (post-reform) political–economy equilibrium. Using Turkish firm-level data, Avsar and Sevinc (2019) find that AD duties imposed by the Turkish government significantly increase fixed investment and R&D expenditures and that AD duties are effective in terms of increasing domestic sales. Niels and Kate (2006) showed that, for Mexico, exporters from Latin America, East Asia and Eastern Europe are the primary AD targets and that AD duties are applied even more aggressively against other developing countries than against

developed countries.

Turning to Brazil, Avsar (2013) and DeSouza and Li (2022) focused on AD duties imposed by Brazil on importing firms at the sector level. Avsar (2013) demonstrates that AD duties lead to a significant increase in the unit values of exported products, forcing firms to raise their unit export prices to reduce the dumping margin and avoid retaliation by the target countries. DeSouza and Li (2022), on the other hand, uses a difference in differences approach to estimate the effect of AD duties on trade, the national supplier and sectors linked to it, finding import decreases and employment increases in the protected sector. These authors use a domestic database that records the AD investigations initiated in Brazil, which is different from the World Bank's Global anti dumping Database used in this study. While these authors analyze the effects of AD duties imposed by Brazilian firms, this paper examines the effects of AD duties imposed on Brazilian firms.

3.2.4 Employer-employee matched data of Brazil

An important contribution of this paper comes from linking the very rich administrative employer-employee data from Brazil (RAIS) with the Brazilian export database (SECEX) and the World Bank's anti dumping Database (GAD). The merging of these three data sets provides information on the firm's export behavior, the hiring and firing of workers, the firm and industry characteristics and the details of the AD actions against these firms.

Studies that worked with this Brazilian data sets include Helpman et al. (2017), who discuss models of firm heterogeneity and trade and suggest two sets of reasons for wage variation across firms: competitive labor markets and assortative matching of heterogeneous workers and firms and labor market frictions such that workers with the same characteristics can be paid different wages by different firms. Engbom et al. (2022) document a series of facts on earnings inequality and dynamics in Brazil, finding that both inequality and volatility of earnings have declined significantly in Brazil's formal sector. Also, relative to the formal sector, the informal sector is associated with a significant earnings penalty

and higher earnings volatility for identical workers. Labanca, Molina and Muendler (2013) show that firms act on favorable export market conditions by hiring workers with prior experience from incumbent exporters in preparation to export. Other studies using this data include: Menezes-Filho, Muendler and Ramey (2008); Hirakawa, Muendler and Rauch (2010); Aguayo-Tellez, Muendler and Poole (2010); Menezes-Filho and Muendler (2011); Muendler, Rauch and Tocoian (2012); Muendler and Rauch (2018); Arkolakis, Ganapati and Muendler (2021); Bazzi, Muendler, Oliveira and Rauch (2023); and Ma, Muendler and Nakab (2023).

3.3 Data and Stylized Facts

This paper use data from the Secretariat of Foreign Trade (SECEX) in the Ministry of Development, Industry and Foreign Trade of Brazil, which gathers yearly firm-level information on each firm's export revenue from each destination country, the number of products, the firm's individual identification number and the industry identifiers for each firm from 1989 to 2001. This data set does not provide information on volumes or product prices.

For the labor market information, the paper uses the Annual Social Information Report (RAIS)[5], which is an administrative data set from Brazil, akin to the employee data from the United States and Germany. RAIS covers 97% of the Brazilian formal labor market[6] between 1985-2019. This dataset includes information on industry classification, labor force movement (hiring and firing) and demographic, occupational and income characteristics of employees. The RAIS covers all manufacturing firms and workers in the formal sector, which Goldberg and Pavcnik (2005) estimates accounts for almost 84% of manufacturing employment. Given the data covered by the RAIS and the SECEX, I have available information from 1989 to 2001.

Finally, the paper links the Brazilian export market and labor market data to the World

[5]I am grateful to Dr. Marc Muendler at U.C. San Diego for providing access to this data.
[6]Paz (2014) estimate that the Brazilian formal labor market is 40-50% of the total employment.

Bank's Global anti dumping Database (GAD), which collects information on the use of temporary trade barriers in the form of antidumping duties, countervailing duties, and safeguard measures across all WTO members since 1985 through 2019. These policy measures are implemented by government authorities against imports likely to have an adverse effect on national production, either by dumping, subsidies, or import surges by foreign sellers. Table A.5 shows the number of AD duties actions filed by every country during 1982 and 2015. Table A.6 shows the number of AD actions initiated against Brazil during 1982 to 2015.

Figure 1 shows the distribution of AD actions targeting Brazilian products during 1985 to 2015. The largest increase in AD duties against Brazilian firms occurred during the 1990s, which could be a consequence of Brazil's financial instability, poor macroeconomic indicators and trade liberalization reforms looking to boost Brazilian competitiveness in international markets (Baumann, 2002). In particular, the decrease in tariffs and the inflows of foreign capital made Brazilian exports more competitive in international markets[7], which increases the probability of receiving AD duties from trading partners. Figure 1 shows evidence of the relevance of the period of analysis (1989-2001) of this study.

3.3.1 Description of Brazilian Exporting Firms

The paper begin by matching the AD duties targeting Brazilian product-firms from the GAD Database with the Brazilian firms listed on the SECEX (export database). This matches each AD duty to the 6-digit Harmonized System (HS) product from the named firm that its targeted by the specific country. As previously discussed, AD duties are set on a particular product line (HS line) from a particular firm that exports to a particular country. Therefore, it is not correct to assume that every product of that firm gets targeted with an AD duty.[8]

Table 1 provides a description of the Brazilian firms, comparing the principal characteristics of firms that received AD duties, firms that didn't receives AD duties and the entire universe of firms (including non-exporting firms). In general, firms that received AD duties

[7]For a detailed description of the Brazilian economy during the 1990s see Baumann (2002).
[8]Besedes and Prusa (2017) discussed this problem in detail.

tend to be larger in size, record higher revenues, export to more countries and produce more products (DeSouza and Li, 2022). Table A.1 shows the number of Brazilian firms by sector during the period. Table A.2 shows the number of Brazilian firms by sector as a percentage of the total in a five year gap.

Finally, this paper studies the effects of AD duties on the relation between employment of high skilled and low skilled workers in the targeted firms. These categories are defined by the RAIS. The paper uses the same definition and categorization as in Labanca et al. (2013) to classify both groups of workers. Table 2 presents the distribution of occupations according to RAIS. For the analysis, I group these five categories into two: high skilled and low skilled. High skilled are "Professional or Managerial", "Technical or Supervisory" and "Other high skilled"; low skilled worker are "Skilled Blue Collar" and "Unskilled Blue Collar". In their paper, Labanca et al. (2013) show that low skilled workers represent 70.9% of the total formal workforce in exporting manufacturing firms[9]. This information is relevant for this paper, given that most of the AD duties are imposed on manufacturing products, but this analysis includes all the exporting firms in the economy, including trading firms (See Valdebenito (2024b) for details).

3.3.2 Brazilian informal labor markets and labor unions

When examining the findings of this study, it is important to consider the role of labor unions in Brazil during the 1990s and early 2000s. Labor unions have significant influence in the manufacturing sector, shaping labor relations, economic policies, and social movements (Keck, 1992). Amid persistent high inflation and a shift toward economic liberalization, unions played a crucial role in advocating for collective bargaining to secure better wages, stabilize employment conditions, and shield workers from macroeconomic shocks (Cardoso & Helwege, 1995). The strength of these labor unions makes the process of firing workers less flexible and more expensive for the firm, delaying their response to negative macroeconomic

[9]Tables A.3 and A.4 of the Appendix present a detailed description of the distribution of workers by sector.

shocks, such as an increase in the tariffs levels of sudden shifts in demand.

In the 1990s and early 2000s, despite strict labor laws under the Consolidation of Labor Laws (CLT), Brazil's labor market, including exporting firms, exhibited notable informality (ILO, 2019). Informal employment was particularly prevalent in sectors crucial to Brazil's export economy, such as agriculture and small-scale manufacturing. While larger, capital-intensive exporting firms generally adhered to formal employment regulations, smaller firms and those in labor-intensive sectors often relied on informal labor (Carneiro, 2004). Economic instability and structural adjustments during this period exacerbated informality as firms sought to stay competitive, enhancing flexibility and cutting costs albeit operating in a gray area of compliance (Egger et al., 2020).

Exporting firms in Brazil likely employed informal workers as part of their operations, supported by evidence of a wage premium within these firms (Helpman et al., 2016). This premium could be attributed to the selection of high-productivity firms into exporting and the screening of workers to ensure higher average ability (González et al., 2022). Trade policies also played a role in shaping labor market dynamics, impacting the employment practices of exporting firms and affecting both formal and informal workers (Goldberg & Pavcnik, 2003).

Therefore, while the economic impact of anti-dumping duties on the Brazilian labor market may be influenced by the strength of unions within each industry, further research is needed to fully understand these effects across firms with varying union influences.

3.4 Empirical Model and Estimation Strategy

I study the effects of AD duties on three main measures of a firm's performance in the labor market: average wages, total wage bill and employment level. Furthermore, based on these results, I also investigate the effects of AD duties on the relative employment levels of high and low skilled workers.

Before going into the analysis, there are several data limitations that are necessary to mention. First, there is no available information on product prices and most of the AD duties against Brazil are value specific, instead of ad-valorem. Therefore, I cannot determine if the level of the AD duty is high or low compared to the original price of the product. Second, it is common in the AD investigation phase to impose preliminary AD duties. These duties are set during the first 3 to 6 months of the investigation and they act as a signal for whether the firms will receive final duties and how large they will be (Besedes and Prusa, 2016). The SECEX dataset only records end-of-year level data, so I cannot differentiate the period before or after the preliminary duties are imposed. Finally, the dataset does not have information on export volumes; it only has information on the export revenue that the firm receives from the destination country and the list of products that were exported to that country in a particular year. A detailed analysis of the effects of AD duties on the export revenue can be found in Valdebenito (2024b).

3.4.1 Stages of the AD process

The analysis of this paper is based on how the different stages of the AD process affect the firm's performance in the labor market. I construct a categorical variable that separates the AD stages in 4 different categories: Before anti dumping, Investigation stage, Approve stage and After anti dumping. Firms in the "Before anti dumping" category have not yet been targeted with an AD duty; "Investigation stage" are firms that are under an investigation process; "Approve stage" are firms that have active and final AD duties in force; and "After anti dumping" are firms that had the investigation dropped or the duties expired and were not renewed. Firms that are never named in an AD investigation are in the "No AD" group; most of the firms are in this group. Table 3 displays the number of observations in each stage of the AD process. Each observation represents an exporting firm in a particular year.

If the firm has at least one product that is targeted by at least one country, then it will be placed in one of these categories. It is not possible to separate which workers are responsible

for the products that are shipped to one specific country, therefore an AD duty is treated as affecting each member of the firm the same. Another implication is that this analysis does not separate the actions that were dropped versus the ones that are revoked and not renewed in a sunset review. The reason is that there are too few observations in each group.

3.4.2 Propensity Score Matching

This section presents the propensity score matching analysis used to control for selection and endogeneity for the effects of AD duties of the targeted firms. There are two main reasons to use this methodology: First, the literature agrees that the study of AD duties is plagued by selection. AD duties are in their essence not a random event. They are imposed on a specific product from a specific firm exported to a specific country, which econometrically speaking, generate bias in the estimation. To account for this econometric problem, the analysis begins by estimating a propensity score methodology to compare firms that have similar characteristics, that export similar products to the same countries.

A second reason that justifies the use of this methodology is the disproportionate sizes of the treatment and control groups. There is a small number of countries that use AD duties (particularly during this time period) and there is a smaller number of firms that are targeted with these duties, and so using a methodology that includes the entire sample, such a two stages least squares (2SLS) method (for example), generates biased estimates given that the number of observations in the treatment group are less than 0.1% of the ones in the control.

I present four different methods to perform the matching process: Mahalanobis matching, 1:1 nearest neighbor matching, 1:10 nearest neighbor matching; and Kernel matching. The Mahalanobis method balances all covariates simultaneously by considering the multivariate distance between treated and control units, which can lead to better balance across multiple covariates. The Kernel method considers each covariate individually, but it provides weights to each of the observations, resulting in a disproportionately large number of controls versus

the small number of observations in the treatment group. The 1:1 matching method finds the nearest neighbor of the matched sample and matches it with the most similar observations. The 1:10 method is similar but matches the observed sample with its ten closest neighbors (Imbes and Rubin, 2015; Abadie et al. (2004)).

The calibration procedure includes firm-level characteristics, the years the firm has been exporting and the share of the firm's revenue in the sector. The other variables are the number of products at the 4 digit HS that the firm exports and the countries that the firm is also exporting to. Both these variables are included to control for the diversification possibilities of the exporting firms. I include only firms that export similar products to the ones that are targeted, based on their 4 digit HS. The intuition behind this method is to construct a control sample of similar products and similar countries.

The first step in constructing this methodology is to identify an appropriate selection variable. This variable must satisfy two conditions: relevance to the treatment and independence from the outcome. Relevance to the treatment means that the variable must be correlated with the treatment assignment; it should predict whether or not the firm receives the treatment (in this case, being named in an AD process). Independence from the outcome means that the variable should not be correlated with the outcome variables (such as employment and wages).

In this analysis, the selection variable ($AD\_Experience_{jt}$) represents the cumulative experience of each destination country in imposing AD duties. This variable is adapted from Lourenco et al. (2021). As discussed by the authors, a country's past experience in imposing AD duties is positively correlated with its likelihood of imposing AD duties in the current period. Therefore, this variable is relevant because one can assume that if a country has consistently imposed AD duties in the past, it would be easier to impose AD duties in the present. However, this experience is not correlated with individual firms' decisions regarding hiring and firing workers or their average wage levels, making it independent from the outcomes variables and a good slection variable for the analysis.

Equation 1 shows the logistic model that estimates the probability that firm j is named in an AD procedure in stage 1 of the AD process. The intuition for matching in Stage 1 is that it represents the pre-treatment period, where firms are comparable to each other, and there is no clear indication of which firms will be named in the AD investigation and which will not. By matching firms in this initial stage, the model ensure that the firms are similar before any AD duties are imposed. This allows us to accurately compare the effects of subsequent stages (investigation, approval of duties, and revocation/dropping of duties) on the initially matched firms over the years.

$$(\text{AD Stage=1})_{jt} = \beta_1 + \beta_2 \text{Firm}_{jt} + \beta_3 \sum_{t=1}^{T=t-1} \text{AD\_Experience}_{ct} + \varepsilon \tag{3.1}$$

where $AD\ Stage = 1_{jt}$ is a binary variable that takes the value of 1 if firm j is named in an AD process in the following years. $Firm_{jt}$ is a vector of firm j's characteristics at time t. $AD\_Experience_{ct}$ represents the cumulative experience in each period the destination country is at imposing AD duties compare to the rest of the world. I perform the matching without replacement to utilize the large number of potential control firms in the sample. Matching with replacement could introduce bias into the estimation by overrepresenting certain control units, creating dependencies among matched pairs that violate the independence assumption, and increasing the variance of the estimator (Imbens and Rubin, 2015).

The propensity score used for all outcome variables (average wages, employment, wage bill and distribution of high and low skilled workers) is the same because it matches similar firms at the same AD stage. The only difference lies in the matching procedure, with the preferred method using this propensity score to pair the treatment and control firms. The tables and graphs for each outcome variable are similar, so I present those for the employment variable here. The rest of the graphs are available in the Appendix 7.2.

Table 4 shows the number of firm-year observations in the treated and control groups for each matching method. The sample sizes represent the entire period during which the firms

in both the treatment and control groups are recorded. Figure 2 presents the propensity score (using the k-density) for the treated and control samples, comparing the matching samples for each method. Both lines represent the propensity score for the the treatment (blue) and control (red) groups. The Mahalanobis graphs shows that for each value of the propensity score in the treatment group, there is the same value in the control group, providing common support to the sample. The x-axis refers to the propensity score after matching.

The validity of the matching methodology is assessed by examining the balance of covariates, which reflects the mean difference between the treatment and control groups. A balanced sample confirms that the treatment and control groups exhibit similarities, thus ensuring that any observed causal effects can be attributed to the treatment rather than pre-existing differences. This study evaluates the balance of covariates both graphically (Figure 3) and statistically (Table 5).

Graphically, balance in the matched sample is indicated by the proximity of matched observations to the dashed line at 0 on the horizontal axis (Figure 3). The graph illustrates that the differences between matched samples are nearly zero compared to the unmatched sample (i.e., the entire dataset).

Table 5 assesses the balance of the Mahalanobis method by presenting results from the Hosmer-Lemeshow chi-squared test, which performs a two-sample t-test. This test compares the means of each variable between treatment and control groups for both the entire (unmatched) and matched samples. The table also shows that before matching, all of the covariates showed significant differences between treated and control, this differences are not significant after matching, suggesting that Mahalanobis matching effectively balanced the covariates between the treated and control groups. This significance is represented in column p>$||t||$, which shows the p-value for the t-test, indicating whether the difference in means is statistically significant. Large values (close to 1) indicate that this difference is not statistically significant and the means of the covariates are similar and the sample is balanced.

Consequently, the Mahalanobis method is the preferred specification as it achieves the best balance of covariates among the four alternatives while maintaining similar sample sizes. Additional test results for other methods are available in the Appendix 7.2

3.4.3 Econometric strategy: Mixed versus Fixed panels

Finally, the empirical strategy compares different models using both balanced and unbalanced panel techniques. Unbalanced panels arise due to missing data, which can introduce bias into the estimation. Valdebenito (2024a) discusses the literature on this issue and utilizes mixed model techniques with firm and firm-country level random effects. This paper proposes the use of mixed models with firm random effect parameters as a basis for comparison between the mixed and fixed models.

Mixed models are often better suited for handling missing data, making them particularly useful when estimating the effects of antidumping duties on the export revenue of firms (Valdebenito, 2024a). For example, a firm may have zero exports for several years and then resume exporting, which the mixed model can accommodate effectively. However, when estimating labor market outcomes such as employment and wages, missing data is more likely to indicate that a firm has exited the market, making a return unlikely. In such cases, it is more appropriate to use a fixed effects model.

The literature suggests that if firm-specific characteristics are correlated with the independent variables, a fixed effects model is preferred as it better handles unobserved characteristics. For example, employment and wages within firms can be significantly influenced by factors such as management quality, firm culture, and historical labor relations. These unobserved firm-specific characteristics are likely correlated with key independent variables like policy measures (e.g., antidumping duties), the number of countries a firm exports to, and the revenue from countries imposing duties. The fixed effects model controls for these unobserved characteristics by differencing them out, leading to more reliable estimates of how changes in policy and firm behavior affect employment and wages within the same firm

over time.

In summary, while mixed models are advantageous in certain contexts, such as handling intermittent exporting behavior, the fixed effects model is more appropriate for analyzing labor market outcomes where the presence of missing data is more indicative of permanent changes in the firm's operations. The fixed effects model's ability to account for unobserved firm-specific characteristics ensures that the estimated impacts of policies on employment and wages are not biased by these underlying factors.

3.4.4 Empirical Model

As previously mentioned, this paper estimate the effects of AD duties on four labor market outcomes for Brazilian firms: average wages, total wage bill, employment and the distribution of high versus low skilled workers of the targeted firms. The results are presented by calculating a lower bound for the effects of the duties on these measures. This lower bound is constructed as a dummy variable, indicating whether the firm has AD duties either in the investigation or in the approved phase of the process. Economically, if a firm is named in an AD procedure, then all the products of the firm are considered to be under AD process.

The analysis assumes that AD duties affect the entire firm, rather than just specific products or from one country, as it is challenging to determine the proportion of workers involved in the production of each product or responsible for exporting to a particular country. Consequently, the analysis provides insights solely on the sign, significance, and overall magnitude of the treatment variables.

Additionally, I impose the condition that the number of years a treated observation is in the market matches the number of years a control observation is in the market for each stage of the AD process. This approach controls for the timing of the AD process and ensures that the difference-in-difference analysis compares firms with similar market tenures. The rationale is to avoid comparing firms with significantly different market experiences, such as a firm that has been in the market for two years versus one that has been in the market for

eight years.

To account for the zeros in the dependant variable, I use a hyperbolic inverse transformation which has the benefit of having the value zero in its domain, unlike the logarithmic transformation. This allows me to include firms that exit a particular market or go out of business while the AD duties are active. I want to account for zero export revenue or zero employees in the firm, especially when AD duties could be influencing these numbers. AD duties are effective at restricting trade, terminating trade relations, and causing firms to stop exporting or even exit their domestic markets (Besedes and Prusa, 2017). Not considering the zeros, which include zero employment and zero wage bill, is underestimating the results by only controlling for firms that survive the duties, which is not always the case.

The problem with the hyperbolic inverse transformation is that the interpretation of the coefficients is not as straight forward as in the logarithm function, but for the positive numbers it follows a similar trajectory. A comparison against the logarithms transformation is presented in the Appendix 7.3, which provides a simpler interpretation of the coefficients for each table.

The following sections present the empirical model of the effects of AD duties on average wage, total wage bill, employment level, and the number of high and low skilled workers. The economic intuition behind the analysis suggests that AD duties will impact average wages by either altering the employment level or changing the total cost of workers. If average wages increase due to AD duties, this could be a reaction to either a decrease in the cost of workers or a decrease in the level of employment, with the other variable remaining unaffected. Conversely, if there is a decrease in average wages, it could be due to an increase in the cost of workers or an increase in the level of employment. Therefore, if any of these variables change, the critical question that arises is: which type of workers are more affected? Specifically, which type of worker feels the negative shock of the tariffs the most?

Average wages

I study the effects of AD duties on the firm's average wages. I start by linking the firm that was targeted with an AD duty with the worker level database from the RAIS. As discussed in the previous section, it is not possible to link an AD duty on a product to the specific worker that is responsible for that product; therefore, I can only link the AD duty to the firm targeted by the duty, affecting the firm's total number of workers. The level of analysis is the average wage of the exporting firm j at year t. The average wage is constructed as the total wage bill of the firm divided by the number of formal workers in year t. The explanatory variables are ($Stage = g_{jt}$) which are a series of dummy variables that represent each stage of the AD process of firm j at time t, where g takes the values 0,1,2,3,4. The estimating equation for the effects of AD duties on the workers' average wages is:

$$\begin{aligned} \text{wages}_{jt} = \beta_1 + \beta_2(\text{Stage=2})_{jt} + \beta_3(\text{Stage=3})_{jt} + \beta_4(\text{Stage=4})_{jt} \\ \beta_5 \text{Firm}_{jt} + \theta_t + \theta_j + \theta_{\text{years exporting}} + \varepsilon \end{aligned} \tag{3.2}$$

where $wages_{jt}$ is the average wage (hyperbolic inverse transformation) of firm j at time t; $Firm_{jt}$ are firm level characteristics; θ_t are calendar year fixed effects, θ_j are firm fixed effects and $\theta_{\text{years exporting}}$ are years exporting fixed effects. The coefficients of interest are β_2, β_3 and β_4, which represent the marginal effect of moving between the different stages of the AD process compare to the control group.

The intuition behind this equation is that the AD duty should decrease the average wages of the firm, as a response to a decrease in the employment level and the adjustment in the production process. The other effect is in the wage bill of the firm, if the employment level remains constant, the firm could be adjusting yearly wage level of the workers.

Wage Bill

I next study the effects of AD duties on the firm's wage bill. The wage bill is defined as the sum of the yearly wages for each worker in the year and it represents the total cost of the formal labor force for the firm. The estimating equation is the same as in section 4.4.1 where $wage\_bill_{jt}$ is the wage bill (hyperbolic inverse transformation) of firm j at time t; the rest of the variables, and their interpretation are the same as explained in the previous section.

A positive coefficient suggests that AD duties increase the wage bill of the targeted firms, which can be interpreted as an increase in the cost of workers. This effect alone could indicate that firms are either hiring more workers or paying higher wages. Conversely, a negative coefficient would suggest the opposite effect, indicating a decrease in the wage bill, which suggest that firms are lowering their employment level and/or reducing the total payment per worker (through cutting hours or reducing the per-hour payment).

Employment

Next, I turn to the effects of AD duties on the employment of the targeted firms. The level of observation is the employment level of a firm that received an AD duties during the period of analysis. The independent variable is the level of employment, where $Employment_{jt}$ is the total employment level (hyperbolic inverse transformation) of firm j at time t; the rest of the variables, and their interpretation are the same as explained in section 4.4.1.

The intuition behind this equation is that the AD may duty decrease the employment level of the firm as a response to the negative shock of the tariffs, which will decrease imports and raise prices of the export products. A positive coefficient, on the other hand, would indicates that the firm is increasing their employment despite the negative effect of the AD duties. This situation could occur if the firm is receiving support by the government to retain their employment level.

High versus low skilled workers

Finally, I test the effects of AD duties on both the high and low skilled workers of the targeted firms. This section follows the results obtained from the employment level analysis to provide further understanding of the important effects of these duties on the labor market. As mentioned in Section 3.1, low skilled workers represent, on average, 70.9% of the workforce in manufacturing exporting firms (Labanca et al., 2013). This analysis studies whether AD duties targeting these firms affects the distribution of high versus low skilled workers. The estimating equations are the same as in the previous sections and present the results for both the effects of AD duties on the number of high and low skilled workers.

3.5 Results

This section presents and discusses the empirical analysis of the effects of antidumping duties on targeted Brazilian firms between 1989 and 2001. The analysis estimates a mixed model to account for the imbalance in the panel, as discussed in Section 4.3. The mixed model includes calendar year, years exporting fixed effects and a Firm ID random effect parameter that controls for the heterogeneity of the firms. The tables also include the results for a calendar year, firm ID and years exporting fixed effects models. The preferred specification is the fixed effects models due to the handling of unobserved characteristics in the data (See section 4.3 for a discussion).

The estimation tables follow the same structure though the entire section. Each table present the results of the model for the full sample (Columns (1) and (2)) and the matched sample (Columns (3) and (4)) using the Mahalanobis method to control for sample size and selection into AD. The results for the logarithmic transformation is presented in the Appendix 7.3 for each section.

The main control variables used for each model are: $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as

the number of countries a firm exports; $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio; and $Firm\_Share_{jt}$ as the share of export revenue of firm j over the same industrial sector.

3.5.1 Average wages

This section presents the results of the effects of AD duties on the average wage of the targeted firms. Average wage is measured as the wage bill of the firm divided by the number of employees in a particular year. The estimation results are displayed in Table 6, which includes a random effect parameter for the firm's ID that is significant and relevant for the model, as shown in columns (2) and (4). The preferred specification is column (3), which presents the matched sample using a fixed effects model. Column (4) present similar results, but larger values of AIC and BIC than column (3), suggesting that column (3) has a better goodness of fit (lower values are preferred).

Column (3) shows that average wages are only affected by AD duties once the targeted firms have received final AD duties; and they are not significantly affected during the investigation phase. A similar effect is recorded in column (4), which includes a firm effect random parameter, where AD duties have a weakly significant (at the 10% level) and negative effect both during the investigation and once the duties are approved. The economic interpretation of these results indicate that once the targeted firms have received final AD duties, they experience a decrease in their average wages in the medium term. There is no significant short term effect of AD duties on the average wages. This delayed effects could be a consequence of strong labor market restrictions and influence of labor unions that restrict flexibility on the labor market protecting workers.

Legally, firms in Brazil cannot unilaterally decrease the wage level of workers and therefore the changes of this ratio must be related to the hiring and firing of current workers, or to movements from formal to informal work (or informal to formal). New workers can be added to the firms at different wage levels or there could be adjustment on the working hours for

current and new workers (this data is not available). As discussed before, several authors agreed that both formal and informal workers coexist in formal Brazilian firms. To properly interpret these results, the following sections separately analyze the effects of AD duties on the wage bill (total cost of workers) and the employment level of the targeted firms.

Interestingly, there are no significant effects on the average wages after the AD process is finalized (After_AD), with the exception of column (2) that shows a negative and weakly significant coefficient. Columns (1), (2) display the estimation results for the full sample, not controlling for selection into AD. Both models present similar results with coefficients slightly higher that the matched models, particularly for the mixed specification (column (2) and (4)).

For every model, the coefficients of the control variables are significant and similar in sign and magnitude. The interpretation of the coefficients is presented using the logarithmic transformation from Table A.10 in the Appendix 7.3 which provides a more intuitive interpretation. The analysis also include, in parenthesis, the coefficients from Table 6 as reference. As mentioned, the preferred specification is column (3) where an increase of 1.0% in the share of revenue from the country imposing AD duties increases the average wages by 1.2% (.0129); exporting to one more extra country increases the average wages by 4.92% (.0527); adding one more product to the export mix increases the average wages by 17.1% (.1849); and an increase of 1.0% in the importance of the firm to the entire exporting sector (Firm Share) has no significant effects on the average wages of the targeted firms.

3.5.2 Wage Bill

This section estimates the effects of AD duties on the wage bill of the firm. The wage bill is defined as the sum of the yearly wages of all the formal workers the firm employs. The structure of Table 7 is the same as in the previous section. As before, the firm's ID random effect parameter is significant and clearly different that zero for columns (2) and (4), therefore it is appropriate to include it in the model allowing for firm heterogeneity. As

before, the preferred specification is column (3).

As in the previous section, the negative and significant effects of AD duties on the total cost of the worker (wage bill) are felt after firms have received AD final AD duties. There are no significant effects during the investigation and after the duties are revoked or dropped (After_AD). Column (4), the mixed model, present similar results in terms of magnitude and sign of the coefficients, but they are not significant. The economic interpretation of this negative effect after the firms have received final AD duties is consistent with the results of the previous section, in which average wages decreased in the medium term. A decrease in the average wages and in the total cost of workers could be related to a decrease in the number of workers these firms are employing. The next section analyzes this possibility.

Columns (1) and (2) display the estimation results for the full sample, not controlling for selection into AD. Both the mixed and fixed effects models show similar results to the matched sample in terms of sign and magnitude (higher), but they both present significant coefficients during the Investigation and after the duties are approved, but this change in significance could be related to selection bias and the difference in the sample sizes, generating bias in the estimation.

For every model, the coefficients of the control variables are significant and similar in sign and magnitude. The interpretation of the coefficients is presented using the logarithmic transformation from Table A.11 in the Appendix 7.3 and in parenthesis the coefficients from Table 7. As mentioned, the preferred specification is column (3) where an increase of 1.0% in the share of revenue from the country imposing AD duties increases the wage bill by 1.8% (.0189); exporting to one more extra country increases the wage bill by 13.1% (.1352); adding one more product to the export mix increases the wage bill by 29.4% (.3093); and an increase of 1.0% in the importance of the firm to the entire exporting sector (Firm Share) has no significant effects on the wage bill of the targeted firms. Overall, as in the model for average wages, firms that have more years of consecutive trade, that export to more countries and export a larger variety of products see positive effects on their average wages.

3.5.3 Employment

This section estimates the effects of AD duties on the employment level of the targeted firms. The structure of Table 8 is the same as in the previous section. Again, the preferred specification is column (3). For both column (3) and (4) the effects of AD duties on the targeted firm's employment level shows similar sign and magnitude to each other, but the coefficients are not significant.

To interpret this null result, it is important to remember that the RAIS only reports information on formal employment, which is subject to stricter labor laws, making the firing process harder and the adjustments in employment more costly. Another explanation is that some of the effects of AD duties on employment could be related to a movement from formal to informal work or informal to formal, masking the significance of the effects. The study of the informal market is outside the scope of this paper.

The results from the effects of AD duties on the average wages and the total wage bill suggest that there should be a decrease in the employment level in the medium term (once the AD duties are approved), but despite the negative coefficient in both columns (3) and (4) this effect is not significant. The question then arises, what is causing the average wages and the total cost of the workers to decrease if there is no movement on the average level of employment?. The next section proposes an explanation by focusing on the distribution of workers in these firms in order to determine if AD duties affect differently workers with high and low skilled level.

Columns (1) and (2) display the estimation results from the full sample showing similar results in terms of the sign and magnitude of the coefficients. But these results could be driven by the bias generated for not controlling for selection into AD or the highly disproportional size of the treatment and control groups.

For the all the specifications, the coefficients of the control variables are significant and similar in sign and magnitude. The interpretation of the coefficients is presented using the logarithmic transformation from Table A.12 in the Appendix 7.3 and in parenthesis the co-

efficients from Table 8. As mentioned, the preferred specification is column (3) where an increase of 1.0% in the share of revenue from the country imposing AD duties increases employment level by 0.78% (.0085); exporting to one more extra country increases the employment level by 7.6% (.0804); adding one more product to the export mix increases the employment level by 10.6% (.1215); and an increase of 1.0% in the importance of the firm to the entire exporting sector (Firm Share) has no significant effects on the employment level of the targeted firms.

3.5.4 High versus low skilled workers

This section estimates the effects of anti-dumping (AD) duties on high- versus low-skilled workers in targeted firms. The structure of Table 9 and Table 10 mirrors that of the previous section. The preferred specification is found in column (3).

In Table 9, the effects of AD duties on the employment of high-skilled workers during the investigation phase are both negative and significant (at the 10% level). These results indicate that when a firm is under an AD investigation, the number of high-skilled workers decreases compared to the control group. However, this effect is not significant for low-skilled workers, as shown in Table 10.

Once a firm has received final AD duties, they show a significant (at the 5% level) decrease on the number of high skilled workers (Table 9) as an average over the time period these duties are in force. Interestingly, this negative effect is not significant for low skilled workers (Table 10). The economic intuition of these results suggest that AD duties re decreasing the number of high skilled workers in the targeted firms once final AD duties are imposed.

These findings align with the results in previous sections, where approved AD duties lead to negative and significant effects on average wages, the total wage bill, and the number of high-skilled workers in these firms. The lack of impact on low-skilled workers could be attributed to the presence of informal labor markets that coexist with larger Brazilian firms.

As before, columns (1) and (2) of Table 9 and Table 10 display the estimation results for

the full sample, without controlling for selection into AD, and show similar coefficients to the matched samples. However, as discussed earlier, this could be related to selection bias and differences in sample sizes.

For the rest of the specifications, the coefficients of the control variables are, in most part, significant and similar in sign and magnitude. The interpretation of the coefficients is presented using the logarithmic transformation from Table A.13 and Table A.14 in the Appendix 7.3 and in parenthesis the coefficients from Table 9 and Table 10, respectively. As mentioned, the preferred specification is column (3) where an increase of 1.0% in the share of revenue from the country imposing AD duties increases the number of high skilled workers by 0.77% (.0088) and the number of low skilled workers by 0.69% (.0080); adding one more product to the export mix increases the number of high skilled workers by 6.11% (.0651) and the number of low skilled workers by 7.88% (.0824); adding one more product to the export mix increases the number of high skilled workers by 9.48% (.1103) and the number of low skilled workers by 6.38% (.0807); and an increase of 1.0% in the importance of the firm to the entire exporting sector (Firm Share) has no significant effects on the employment level of the targeted firms.

3.6 Conclusion

This paper examines the impact of anti-dumping (AD) duties imposed on Brazilian firms, focusing on the effects of these duties on labor market outcomes such as average wages, wage bill, employment, and the distribution of high- versus low-skilled workers from 1989 to 2001. To account for selection bias into AD, the study employs a propensity score methodology to match similar firms during the period before AD investigations are initiated. Additionally, the paper analyzes the effects of these duties at different stages of the AD process: the investigation phase, final duties, and the period when duties are dropped or revoked.

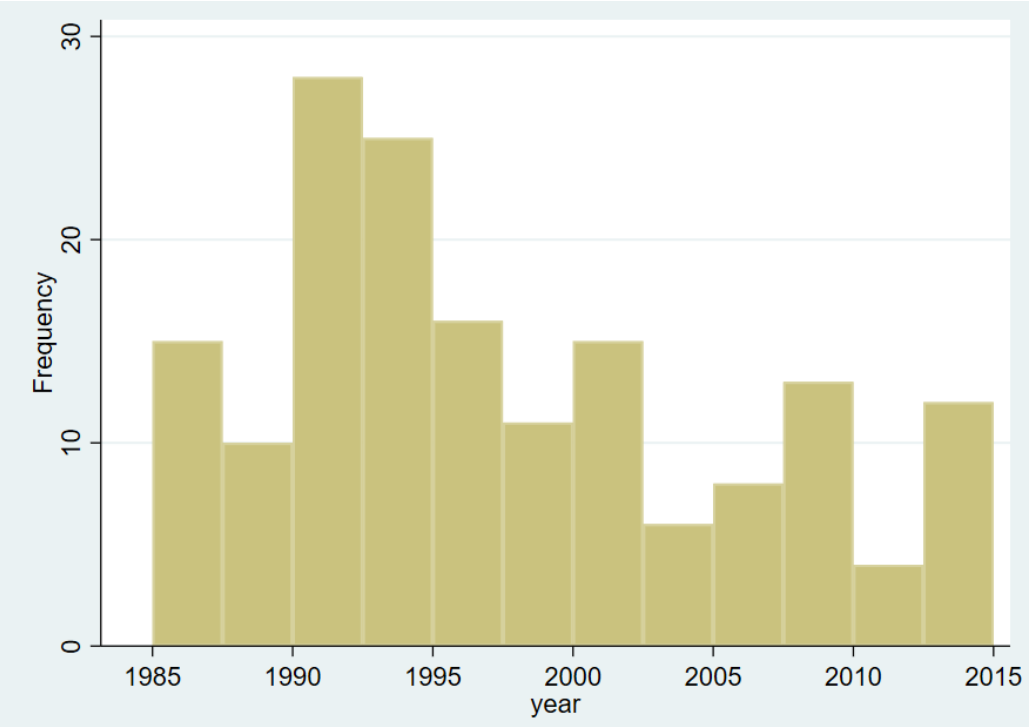
The findings indicate that firms subject to final AD duties experience a decrease in

average wage levels, total wage bills, and the number of high-skilled workers. These effects are significant only when the duties are approved. There are no significant effects during the investigation phase, which may be due to the shorter duration of AD investigations and the stringent labor laws governing large exporting firms in Brazil. The study also finds no significant impact of AD duties on total employment levels or the number of low-skilled workers in the targeted firms, suggesting possible substitution between formal and informal workers that the data does not capture.

The magnitude of AD duties, often exceeding 100% of the product's price, severely undermines the competitiveness of the targeted firms in the destination countries that impose these duties. The results suggest that AD duties have long-term effects on the labor market outcomes of targeted firms. Valdebenito (2024a) finds that AD duties significantly reduce the targeted firms' export revenue in both the short and long term, forcing them to adjust their workforce and export strategies accordingly.

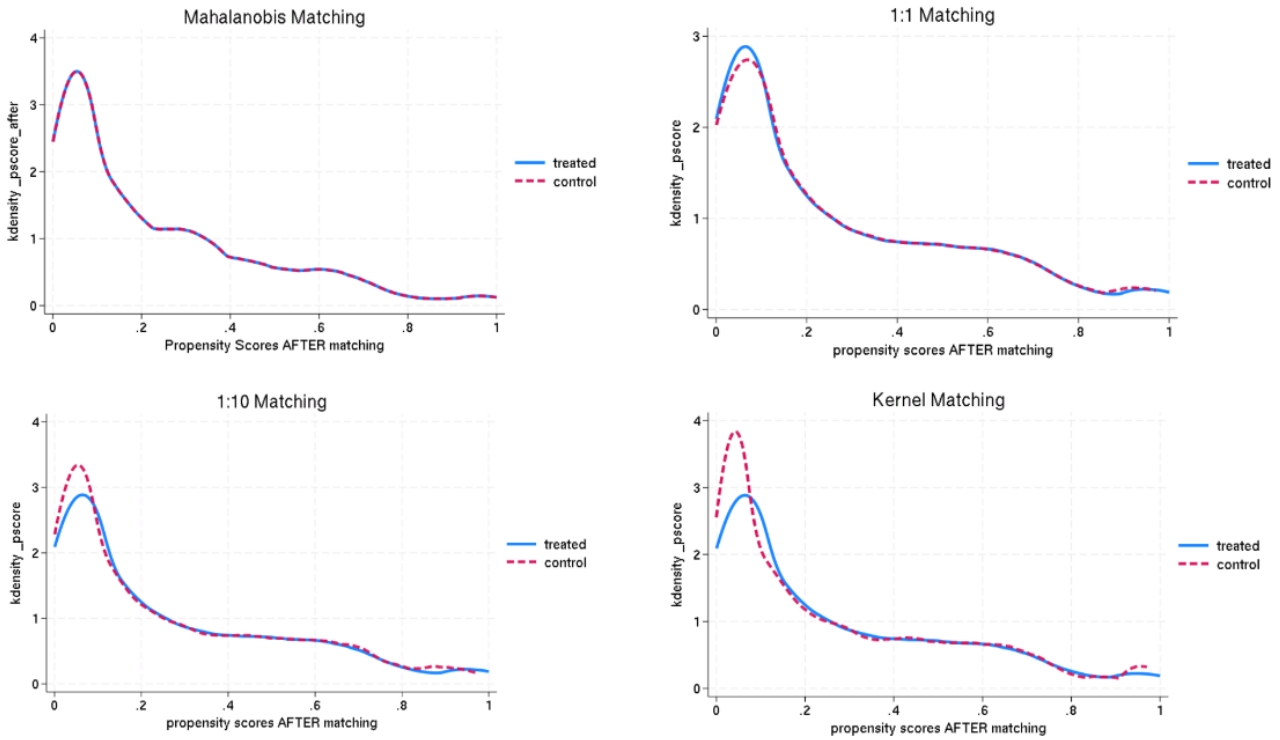
3.7 Figures

Figure 3.1: AD actions against Brazil from 1985 to 2015



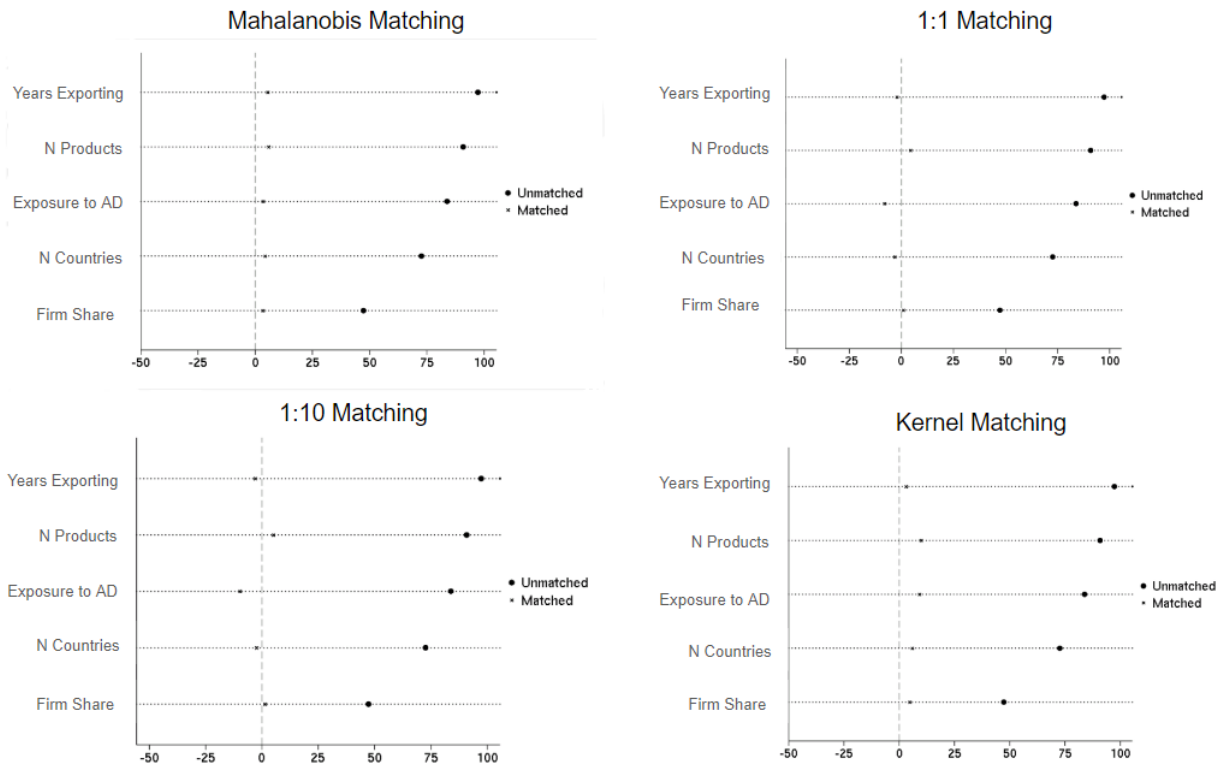
Notes: This graph shows the products that were targeted by AD actions, aggregated by industry using 2 digit HS-code. The most targeted product are the 2-digit HS line 72 of "Iron and Steel" with 1,637 products targeted, representing 52.3% of the total. Second is "footwear", 2-digit HS line 64, with 645 products (20.1% of the total). Third is "cotton" (2-digit HS line 52) with 153 products targeted (4.9% of the total).
Source: Global Anti-dumping Database (GAD).

Figure 3.2: Propensity score matching



Notes: This figure presents the propensity score distribution (using the k-density) for the treated and control samples for each matching method. Common support occurred when the treatment (blue) and control (red) lines overlap.
Source: Author's own work.

Figure 3.3: Balance comparison four matching methods



Notes: This figure presents the difference in means for each covariate for the matched (small dots) and unmatched (large dots) samples in each of the matching methodologies. Values close to zero indicates that the difference in means of the treated and control samples are similar
Source: Author's own work.

3.8 Tables

Table 3.1: Description of Brazilian firms (on average)

	AD Firms	Exporting Firms (Non AD)	All Firms
Size (# Workers)	1,654.7	401.5	13.9
Export Revenue (US$ Millions)	51.4	5.3	-
Number of Destination Countries	7.8	4.01	-
Number of Exported Products	49.0	14.9	-
Number of Firms	117	10,444	2,535,979

Notes: This table provides a description of Brazilian firms. "AD Firms" are those that are named in an AD process. "Exporting firms" are those that export but are not target in AD investigations. "All Firms" includes all firms in the dataset, including non-exporting firms. The size is measured by the number of workers, export revenue is in US dollars, the number of destination countries indicates the average number of countries firms export to, and the number of exported products indicates the average number of products firms export.
Source: Valdebenito (2024a).

Table 3.2: Occupation categories in RAIS

ISCO-88 occupation category	Occupation Level
Legislators, senior officials, and managers	Professional or Managerial
Professionals	Professional or Managerial
Technicians and associate professionals	Technical or Supervisory
Clerks	Other high skilled
Service workers and sales workers	Other high skilled
Skilled agricultural and fishery workers	Skilled Blue Collar
Craft and related workers	Skilled Blue Collar
Plant and machine operators and assemblers	Skilled Blue Collar
Elementary occupations	Unskilled Blue Collar

Notes: This table provides a description of the distribution of workers' occupation recorded in the RAIS. The table shows five different categories grouping each occupation: "Professional or Managerial", "Technical or Supervisory","Other high skilled", "Skilled Blue Collar" and "Unskilled Blue Collar".
Source: Labanca et al. (2013).

Table 3.3: Number of observations in each stage of the AD process

AD stage	Frequency	Percent
No AD	43,025	96.22
Before AD	513	1.15
Investigation AD	283	0.63
Approve AD	421	0.94
After AD	471	1.05
Total	44,713	100

Notes: This table shows the number of observations (firm-year) in each stage of the AD process. Firms in the "Before anti dumping" category have not yet been targeted with an AD duty; "Investigation stage" are firms that are under an investigation process; "Approve stage" are firms that have active and final AD duties in force; and "After anti dumping" are firms that had the investigation dropped or the duties expired and not renewed. Firms that are never named in an AD investigation are in the "No AD" group.

Table 3.4: Treatment and control groups with different specifications for firm level analysis

Matching Method	Treatment	Control	Total
Mahalanobis	1,688	3,625	5,313
1:1	1,688	3,354	5,042
1:k (10)	1,688	18,123	19,811
Kernel	1,688	43,025	44,713

Notes: This table shows the sample sizes for treatment and control groups for each of the four different matching methods. The level of observation is at the firm-year level. For example: Firm A exporting in 1990 and in 1991 is recorded as two different observations.

Table 3.5: Two-sample t-test for Mahalanobis matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
Exposure to AD (%)	Unmatched	5.797	4.519	10.8		2.71	0.007
	Matched	5.797	5.748	0.4	96.1	0.06	0.951
Years Exporting	Unmatched	2.629	2.412	8.6		1.60	0.109
	Matched	2.629	2.745	-4.6	67.2	-0.99	0.322
N Countries Category	Unmatched	8.039	2.502	76.4		23.71	0.000
	Matched	8.039	7.059	1.1	98.6	0.15	0.884
N Products Category	Unmatched	3.173	1.011	84.3		29.65	0.000
	Matched	3.173	3.152	0.5	99.5	.06	0.954
Firm Share	Unmatched	18.732	5.226	54.0		16.50	0.000
	Matched	18.732	18.328	1.6	97.0	0.21	0.830

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 3.6: Effects of AD duties on Average Wages

	Average Wage by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Average\_Wage(arc)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.3871**	-.6763***	-.2434	-.3115*
	(.1566)	(.1776)	(.1599)	(.1875)
$Approve\_AD_{jt}$	-.3825***	-.6766***	-.3625**	-.4699*
	(.1435)	(.2479)	(.1530)	(.2636)
$After\_AD_{jt}$	-.1255	-.5157*	-.0935	-.3162
	(.1423)	(.2774)	(.1593)	(.3078)
$AD\_Revenue_{jt}$	.0113***	.0107***	.0110***	.0129***
	(.0028)	(.0036)	(.0028)	(.0036)
$N\_Countries\_Cat_{jt}$	.0915***	.0740***	.0591***	.0527***
	(.0061)	(.0081)	(.0095)	(.0114)
$N\_Products\_Cat_{jt}$	.2783***	.3253***	.2033***	.1849***
	(.0154)	(.0234)	(.0278)	(.0350)
$Firm\_Share_{jt}$	-.0018*	-.0003	-.0031	-.0011
	(.0010)	(.0010)	(.0026)	(.0029)
Firm RE	-	2.033***	-	1.869***
	-	(.0268)	-	(.0875)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.032	-	0.043	-
AIC	185,980	208,522	21,684	23,603
BIC	186,049	208,801	21,737	23,813

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio: and $Firm\_Share_{jt}$ as the share of export revenue of firm j over the same industrial sector. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.7: Effects of AD duties on the Wage Bill of the firm

	Wage bill by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Wage\_bill(arc)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.5684**	-.7912***	-.3588	-.3869
	(.2245)	(.2587)	(.2273)	(.2701)
$Approve\_AD_{jt}$	-.4655**	-.6994*	-.4353**	-.5095
	(.2062)	(.3569)	.(2172)	(.3740)
$After\_AD_{jt}$	-.1354	-.4814	-.0296	-.2458
	(.2042)	(.3821)	(.2278)	(.4239)
$AD\_Revenue_{jt}$	.0199***	.0196***	.0189***	.0211***
	(.0040)	(.0052)	(.0040)	(.0053)
$N\_Countries\_Cat_{jt}$	.1954***	.1823***	.1352***	.1355***
	(.0095)	(.0149)	(.0148)	(.0203)
$N\_Products\_Cat_{jt}$	.4138***	.4608***	.3093***	.2977***
	(.0218)	(.0362)	(.0389)	(.0533)
$Firm\_Share_{jt}$	-.0010	.0030*	-.0009	.0027
	(.0015)	(.0018)	(.0040)	(.0052)
Firm RE	-	3.368***	-	3.302***
	-	(.0379)	-	(.1386)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.053	-	0.070	-
AIC	215,828	240,170	25,563	27,844
BIC	215,897	240,448	25,616	27,634

Notes: This table reports the effects of anti-dumping (AD) duties on the firm wage bill. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio; and $Firm\_Share_{jt}$ as the share of export revenue of firm j over the same industrial sector. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.8: Effects of AD duties on Employment

	Employment by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Employment(arc)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.2123**	-.2177**	-.1378	-.1261
	(.0936)	(.1061)	(.0935)	(.1089)
$Approve\_AD_{jt}$	-.1060	-.1165	-.1021	-.1021
	(.0877)	(.1424)	(.0907)	(.1474)
$After\_AD_{jt}$	-.0093	-.0469	.0619	.0227
	(.0891)	(.1551)	(.0984)	(.1726)
$AD\_Revenue_{jt}$	.0092***	.0093***	.0085***	.0091***
	(.0017)	(.0024)	(.0017)	(.0024)
$N\_Countries\_Cat_{jt}$	.1101***	.1101***	.0804***	.0837***
	(.0045)	(.0083)	(.0070)	(.0105)
$N\_Products\_Cat_{jt}$	.1571***	.1634***	.1215***	.1218***
	(.0094)	(.0166)	(.0168)	(.0255)
$Firm\_Share_{jt}$	.0007	.0027***	.0019	.0034
	(.0007)	(.0009)	(.0018)	(.0027)
Firm RE	-	1.788***	-	1.863***
	-	(.0167)	-	(.0727)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.078	-	0.101	-
AIC	135,604	161,681	16,613.5	18,900.8
BIC	135,673	161,960	16,666.0	19,110.9

Notes: This table reports the effects of anti-dumping (AD) duties on the firm's employment level. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio; $Firm\_Share_{jt}$ as the share of export revenue of firm j over the same industrial sector. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.9: Effects of AD duties on High Skilled Workers

	Number of High skilled workers by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$High(arc)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.2099**	-.1235	-.1528*	-.0911
	(.0873)	(.0972)	(.0888)	(.1022)
$Approve\_AD_{jt}$	-.2116***	-.1276	-.1874**	-.1288
	(.0811)	(.1272)	(.0846)	(.1302)
$After\_AD_{jt}$	-.1622**	-.0979	-.0634	-.0320
	(.0822)	(.1407)	(.0898)	(.1504)
$AD\_Revenue_{jt}$	.0089***	.0097***	.0083***	.0088***
	(.0015)	(.0021)	(.0015)	(.0021)
$N\_Countries\_Cat_{jt}$	.0845***	.0848***	.0651***	.0687***
	(.0037)	(.0065)	(.0065)	(.0093)
$N\_Products\_Cat_{jt}$	.1305***	.1364***	.1103***	.1132***
	(.0081)	(.0134)	(.0159)	(.0236)
$Firm\_Share_{jt}$	.0021***	.0043***	.0026	.0041*
	(.0006)	(.0008)	(.0017)	(.0025)
Firm RE	-	1.598***	-	1.643***
	-	(.0140)	-	(.0545)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.075	-	0.101	-
AIC	117,818	144,609	15,010.5	17,300.4
BIC	117,887	144,888	15,063.0	17,510.5

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.10: Effects of AD duties on Low Skilled Workers

	Number of Low Skilled Workers			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Low(arc)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.1439	-.1526	-.0956	-.0930
	(.0959)	(.1005)	(.0976)	(.1058)
$Approve\_AD_{jt}$	-.0029	-.0197	-.0157	-.0263
	(.0893)	(.1325)	(.0953)	(.1398)
$After\_AD_{jt}$	.0450	.0045	.1198	.0759
	(.0932)	(.1535)	(.1030)	(.1723)
$AD\_Revenue_{jt}$	.0083***	.0083***	.0076***	.0080***
	(.0017)	(.0022)	(.0017)	(.0022)
$N\_Countries\_Cat_{jt}$	.1047***	.1056***	.0824***	.0840***
	(.0048)	(.0088)	(.0077)	(.0110)
$N\_Products\_Cat_{jt}$	.1217***	.1214***	.0807***	.0794***
	(.0100)	(.0177)	(.0194)	(.0303)
$Firm\_Share_{jt}$	.0008	.0025***	.0022	.0034
	(.0007)	(.0009)	(.0018)	(.0027)
Firm RE	-	1.842***	-	1.966***
	-	(.0169)	-	(.0799)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.063	-	0.083	-
AIC	136,552	162,803	16,945.2	19,242.4
BIC	136,622	163,082	16,997.7	19,452.5

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

3.9 Appendix Figures and Tables

Table 3.A.1: Number of Brazilian firms by sector in a 5 year gap

Sector	2-Digit CNAE	1986	1990	1995	2001
Agriculture, Mining, Food and Textile	1-14	10,134	14,445	21,219	23,470
Leather, Wood and Paper	15-18	20,362	30,980	58,611	70,259
Petrochemicals	19-21	8,676	12,385	20,482	25,101
Mineral and Metal Products	22-25	10,158	14,015	23,744	29,397
Electrical and Machinery Equipment	26-28	13,605	19,570	31,332	41,481
Automobiles and Transportation Equipment	29-33	7,390	10,151	15,409	18,670
Services	35-97	293,138	447,272	895,327	1,317,123
Total Number of Firms	-	363,463	548,818	1,066,124	1,525,501

Notes: This table presents the number of Brazilian firms by sector in 5 year periods.
Source: RAIS.

Table 3.A.2: Number of Brazilian firms by Sector as Percentage of the Total (%)

Sector	2-Digit CNAE	1986	1990	1995	2001	Average by Sector
Agriculture, Mining, Food and Textile	1-14	2.8	2.6	2.0	1.5	2.2
Leather, Wood and Paper	15-18	5.6	5.6	5.5	4.6	5.3
Petrochemicals	19-21	2.4	2.3	1.9	1.6	2.1
Mineral and Metal Products	22-25	2.8	2.6	2.2	1.9	2.4
Electrical and Machinery Equipment	26-28	3.7	3.6	2.9	2.7	3.2
Automobiles and Transportation Equipment	29-33	2.0	1.8	1.4	1.2	1.6
Services	35-97	80.7	81.5	84.0	86.3	83.1
Total Workers	-	100.0	100.0	100.0	100.0	100.0

Notes: This table presents the number of Brazilian firms by sector in 5 year periods as percentages.
Source: RAIS.

Table 3.A.3: Brazilian Formal Workers by Sector

Sector	2-Digit CNAE	1986	1990	1995	2001
Agriculture, Mining, Food and Textile	1-14	986,590	1,191,161	1,810,006	2,051,956
Leather, Wood and Paper	15-18	1,762,878	2,101,996	2,415,350	2,182,675
Petrochemicals	19-21	662,264	759,407	841,102	859,899
Mineral and Metal Products	22-25	803, 685	966,565	1,090,199	956,664
Electrical and Machinery Equipment	26-28	955,356	1,014,034	993,910	954,952
Automobiles and Transportation Equipment	29-33	1,078,420	1,132,469	1,059,510	944,752
Services	35-97	14,160,613	16,668,732	21,090,946	25,217,881
Total Workers	-	20,409,806	23,834,364	29,301,023	33,168,779

Notes: This table shows the distribution of Brazilian workers by sector using the 2-Digit CNAE classification.
Source: RAIS.

Table 3.A.4: Brazilian Formal Workers by Sector as Percentage of the Total (%)

Sector	2-Digit CNAE	1986	1990	1995	2001	Average by Sector
Agriculture, Mining, Food and Textile	1-14	4.8	5.0	6.2	6.2	5.5
Leather, Wood and Paper	15-18	8.6	8.8	8.2	6.6	8.1
Petrochemicals	19-21	3.2	3.2	2.9	2.6	3.0
Mineral and Metal Products	22-25	3.9	4.1	3.7	2.9	3.6
Electrical and Machinery Equipment	26-28	4.7	4.3	3.4	2.9	3.8
Automobiles and Transportation Equipment	29-33	5.3	4.8	3.6	2.8	4.1
Services	35-97	69.4	69.9	72.0	76.0	71.8
Total Workers	-	100.0	100.0	100.0	100.0	100.0

Notes: This table shows the distribution of workers by sector in percentage of the total using the 2-Digit CNAE classification.
Source: RAIS.

Table 3.A.5: AD actions filed by every country during 1982 and 2015

Heavy Users

Country	N# AD	(%)
USA	1,138	16.8
EU	779	11.5
India	764	11.3
Australia	575	8.5
Brazil	451	6.7
Canada	412	6.1
ROW	2,638	38.9
Total	6,756	100

Most Targeted

Country	N# AD	(%)
China	1,281	18.9
Korea	466	6.9
USA	437	6.5
Taiwan	357	5.2
Japan	329	4.9
Brazil	246	3.7
ROW	3,638	53,8
Total	6,756	100

Source: Global anti dumping Database.

Notes: This table shows the number of AD actions initiated by every country from 1982 to 2015. In the panel to the left are the countries that have initiated the most AD actions. In the panel to the right are the countries that have been targeted the most.
Source: Global Anti-dumping Dataset.

Table 3.A.6: Brazilian Firms targeted by AD duties during 1986 to 2001 by country

Country	No. Number of firms	Percent
Argentina	250	74.8
Canada	39	11.7
USA	15	4.5
Mexico	12	3.6
EU	9	2.9
Australia	5	1.5
South Africa	3	0.9
Peru	1	0.3
Total	334	100

Notes: This table shows Brazilian Firms targeted by AD duties during 1986 to 2001 by country.
Source: Global Anti-dumping Dataset.

Table 3.A.7: Two-sample t-test for 1 to 1 matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
Exposure to AD (%)	Unmatched	5.797	4.519	10.8		2.71	0.007
	Matched	5.797	6.199	-3.4	68.5	-0.48	0.628
Years Exporting	Unmatched	2.694	3.989	-54.3		-10.14	0.109
	Matched	2.694	2.834	-5.9	89.2	-1.17	0.242
N Countries Category	Unmatched	8.039	2.502	76.4		23.71	0.000
	Matched	8.039	7.760	3.8	95.0	0.46	0.649
N Products Category	Unmatched	3.173	1.011	84.3		29.65	0.000
	Matched	3.173	3.327	-6.0	92.9	-0.75	0.455
Firm Share	Unmatched	18.732	5.226	54.0		16.50	0.000
	Matched	18.732	18.198	2.1	96.0	0.29	0.775

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 3.A.8: Two-sample t-test for 1 to 10 matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
Exposure to AD (%)	Unmatched	5.797	4.519	10.8		2.71	0.007
	Matched	5.797	5.676	1.0	90.5	0.15	0.880
Years Exporting	Unmatched	2.694	3.989	-54.3		-10.14	0.109
	Matched	2.694	3.055	-15.1	72.1	-2.81	0.005
N Countries Category	Unmatched	8.039	2.502	76.4		23.71	0.000
	Matched	8.039	8.745	-9.8	87.2	-1.06	0.290
N Products Category	Unmatched	3.173	1.011	84.3		29.65	0.000
	Matched	3.173	3.462	-11.2	86.7	-1.36	0.175
Firm Share	Unmatched	18.732	5.226	54.0		16.50	0.000
	Matched	18.732	20.295	-6.3	88.4	-0.82	0.414

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 3.A.9: Two-sample t-test for kernel matching

		Mean			**% reduct**	**t-test**	
Variable	Sample	Treated	Control	%bias	[bias]	t	p>||t||
Exposure to AD (%)	Unmatched	5.797	4.519	10.8		2.71	0.007
	Matched	5.797	4.661	9.6	11.2	1.48	0.139
Years Exporting	Unmatched	2.694	3.989	-54.3		-10.14	0.109
	Matched	2.694	3.234	-22.7	58.3	-3.99	0.000
N Countries Category	Unmatched	8.039	2.502	76.4		23.71	0.000
	Matched	8.039	7.630	5.6	92.6	0.62	0.534
N Products Category	Unmatched	3.173	1.011	84.3		29.65	0.000
	Matched	3.173	3.044	5.0	94.0	0.59	0.553
Firm Share	Unmatched	18.732	5.226	54.0		16.50	0.000
	Matched	18.732	16.914	7.3	86.5	0.98	0.327

Notes: This table shows the results of two-sample t-tests for various covariates before and after Mahalanobis matching. The objective is to evaluate the balance between treated and control groups. The %bias column shows the standardized mean difference between treated and control groups, and the % reduct [bias] column indicates the percentage reduction in bias after matching. The H0 is that there is no difference in the means of the covariates between the treated and control groups. The t-test and p-values indicate whether the differences between treated and control groups are statistically significant. After matching, the bias is significantly reduced, and none of the covariates show significant differences, indicating successful matching.

Table 3.A.10: Effects of AD duties on Average Wages

	Average Wage by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Average\_Wage(ln)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.3585**	-.6154***	-.2261	-.2832*
	(.1464)	(.1660)	(.1495)	(.1754)
$Approve\_AD_{jt}$	-.3601***	-.6213***	-.3429**	-.4361*
	(.1343)	(.2313)	(.1433)	(.2458)
$After\_AD_{jt}$	-.1260	-.4763*	-.0962	-.2961
	(.1331)	(.2591)	(.1489)	(.2871)
$AD\_Revenue_{jt}$	.0106***	.0101***	.0103***	.0121***
	(.0026)	(.0033)	(.0026)	(.0033)
$N\_Countries\_Cat_{jt}$	.0849***	.0688***	.0550***	.0492***
	(.0057)	(.0076)	(.0088)	(.0106)
$N\_Products\_Cat_{jt}$	.2568***	.3004***	.1879***	.1713***
	(.0144)	(.0218)	(.0262)	(.0330)
$Firm\_Share_{jt}$	-.0017*	-.0002	-.0029	-.0010
	(.0009)	(.0010)	(.0025)	(.0027)
Firm RE	-	1.895***	-	1.743***
	-	(.0248)	-	(.0826)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.032	-	0.043	-
AIC	179,441	201,906	20,945	22,859
BIC	179,510	202,184	20,998	23,069

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.A.11: Effects of AD duties on the Wage Bill of the firm

	Wage bill by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Wage\_bill(ln)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.5404**	-.7344***	-.3422	-.3615
	(.2144)	(.2472)	(.2171)	(.2582)
$Approve\_AD_{jt}$	-.4433**	-.6478*	-.4159**	-.4780
	(.1972)	(.3405)	(.2076)	(.3565)
$After\_AD_{jt}$	-.1345	-.4440	-.0310	-.2265
	(.1951)	(.3641)	(.2175)	(.4036)
$AD\_Revenue_{jt}$	.0191***	.0189***	.0181***	.0202***
	(.0038)	(.0050)	(.0038)	(.0050)
$N\_Countries\_Cat_{jt}$	.1887***	.1770***	.1310***	.1318***
	(.0091)	(.0144)	(.0142)	(.0195)
$N\_Products\_Cat_{jt}$	.3923***	.4359***	.2938***	.2837***
	(.0208)	(.0347)	(.0373)	(.0513)
$Firm\_Share_{jt}$	-.0008	.0031*	-.0007	.0028
	(.0014)	(.0017)	(.0038)	(.0050)
Firm RE	-	3.240***	-	3.185***
	-	(.0360)	-	(.1328)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.054	-	0.071	-
AIC	211,310	235,700	25,068	27,145
BIC	211,380	235,979	25,121	27,355

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.A.12: Effects of AD duties on Employment

	Employment by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Employment(ln)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.1825**	-.1692*	-.1192	-.1017
	(.0857)	(.0967)	(.0855)	(.0993)
$Approve\_AD_{jt}$	-.0822	-.0737	-.0809	-.0727
	(.0810)	(.1294)	(.0835)	(.1340)
$After\_AD_{jt}$	-.0068	-.0201	.0618	.0373
	(.0826)	(.1429)	(.0910)	(.1587)
$AD\_Revenue_{jt}$	.0085***	.0087***	.0078***	.0083***
	(.0016)	(.0022)	(.0016)	(.0022)
$N\_Countries\_Cat_{jt}$	.1037***	.1045***	.0764***	.0797***
	(.0042)	(.0078)	(.0065)	(.0099)
$N\_Products\_Cat_{jt}$	.1354***	.1385***	.1060***	.1067***
	(.0087)	(.0154)	(.0158)	(.0241)
$Firm\_Share_{jt}$	.0009	.0027***	.0022	.0035
	(.0006)	(.0008)	(.0017)	(.0026)
Firm RE	-	1.709***	-	1.780***
	-	(.0156)	-	(.0676)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.080	-	0.103	-
AIC	127,055	153,594	15,722.0	18,040.1
BIC	127,124	153,873	15,774.5	18,250.1

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.A.13: Effects of AD duties on High Skilled Workers

	Number of High skilled workers by Firm			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$High(ln)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.1825**	-.0855	-.1368*	-.0724
	(.0807)	(.0886)	(.0823)	(.0935)
$Approve\_AD_{jt}$	-.1880**	-.0935	-.1656**	-.1024
	(.0752)	(.1153)	(.0785)	(.1177)
$After\_AD_{jt}$	-.1602**	-.0805	-.0619	-.0195
	(.0765)	(.1291)	(.0836)	(.1374)
$AD\_Revenue_{jt}$	.0082***	.0090***	.0077***	.0081***
	(.0015)	(.0020)	(.0014)	(.0019)
$N\_Countries\_Cat_{jt}$	.0782***	.0792***	.0611***	.0647***
	(.0034)	(.0061)	(.0060)	(.0086)
$N\_Products\_Cat_{jt}$	.1091***	.1115***	.0948***	.0979***
	(.0075)	(.0123)	(.0150)	(.0223)
$Firm\_Share_{jt}$	.0023***	.0043***	.0028*	.0042*
	(.0006)	(.0008)	(.0015)	(.0023)
Firm RE	-	1.560***	-	1.591***
	-	(.0136)	-	(.0507)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.073	-	0.100	-
AIC	110,550	137,965	14,195.1	16,526.4
BIC	110,620	138,244	14,247.6	16,736.4

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Table 3.A.14: Effects of AD duties on Low Skilled Workers

	Number of Low Skilled Workers			
	Full Sample		**Mahalanobis**	
	F. E.	**Mixed**	**F. E.**	**Mixed**
$Low(ln)_{jt}$	(1)	(2)	(3)	(4)
$Investigation\_AD_{jt}$	-.1159	-.1040	-.0795	-.0694
	(.0902)	(.0927)	(.0920)	(.0981)
$Approve\_AD_{jt}$	.0235	.0278	.0066	.0060
	(.0842)	(.1209)	(.0901)	(.1280)
$After\_AD_{jt}$	.0472	.0327	.1190	.0913
	(.0885)	(.1439)	(.0978)	(.1616)
$AD\_Revenue_{jt}$	.0076***	.0077***	.0069***	.0072***
	(.0016)	(.0020)	(.0016)	(.0020)
$N\_Countries\_Cat_{jt}$	.0986***	.1003***	.0788***	.0806***
	(.0045)	(.0085)	(.0073)	(.0104)
$N\_Products\_Cat_{jt}$	.0986***	.0951***	.0638***	.0630**
	(.0096)	(.0169)	(.0189)	(.0295)
$Firm\_Share_{jt}$	.0010	.0026***	.0024	.0035
	(.0006)	(.0009)	(.0017)	(.0026)
Firm RE	-	1.798***	-	1.912***
	-	(.0161)	-	(.0768)
Observations	44,069	44,669	5,236	5,243
Calendar Year FE	YES	YES	YES	YES
Exporting Year FE	YES	YES	YES	YES
Firm FE	YES	NO	YES	NO
R-square (within)	0.061	-	0.081	-
AIC	130,277	156,986	16,316.7	18,638.7
BIC	130,347	157,264	16,369.2	18,848.8

Notes: This table reports the effects of anti-dumping (AD) duties on the firm average wages. Columns (1), (2), (3), and (4) show results for different model specifications. The variables include $Investigation\_AD_{jt}$ which indicates the investigation phase of AD, $Approve\_AD_{jt}$ indicating the approval phase, $After\_AD_{jt}$ for post-AD implementation effects; $AD\_Revenue_{jt}$ is the share of total revenue received from country initiating AD process against the firm; $N\_Countries\_Cat_{jt}$ as the number of countries a firm exports; and $N\_Products\_Cat_{jt}$ as the number of products in a firm's export portfolio. Firm random-effects parameters are shown where applicable. Standard errors are in parentheses. Significance levels are denoted by * (10%), ** (5%), and *** (1%).

Bibliography

Abadie, A., Drukker, D., Herr, J. L., & Imbens, G. W. (2004). "Implementing matching estimators for average treatment effects in Stata", Stata journal 4, 290-311.

Aguayo-Tellez, E., Muendler, M. A., & Poole, J. P. (2010). Globalization and formal sector migration in Brazil. World development, 38(6), 840-856.

Arkolakis, C., Ganapati, S., & Muendler, M. A. (2021). The extensive margin of exporting products: A firm-level analysis. American Economic Journal: Macroeconomics, 13(4), 182-245.

Avsar, V. (2013). antidumping, retaliation threats, and export prices. the world bank economic review, 27(1), 133-148.

Avsar, V. & Sevinc, N. (2019) Does antidumping cause investment and R&D?: Evidence from Turkey, Applied Economics, 51:52, 5674-5682.

Bazzi, S., Muendler, M. A., Oliveira, R. F., & Rauch, J. E. (2023). Credit Supply Shocks and Firm Dynamics: Evidence from Brazil (No. w31721). National Bureau of Economic Research.

Baghdadi, L., Kheder, S. B., & Arouri, H. (2019). Assessing the performance of offshore firms in Tunisia. Journal of Economic Integration, 34(2), 280-307.

Baltagi, B. H., Song, S. H., & Jung, B. C. (2001). The unbalanced nested error component regression model. Journal of econometrics, 101(2), 357-381.

Baltagi, B. H., & Song, S. H. (2006). Unbalanced panel data: A survey. Statistical Papers, 47(4), 493-523.

Baumann, R. (2002). Brazil in the 1990s: an economy in transition. En: Brazil in the 1990s: an economy in transition-London: Palgrave/St. Antony's College, 2002-p. 1-38.

Berman, E., Bound, J., & Griliches, Z. (1994). Changes in the demand for skilled labor within US manufacturing: evidence from the annual survey of manufactures. The quarterly journal of economics, 109(2), 367-397.

Besedeš and Prusa (2017), "The Hazardous effects of antidumping". Economic Inquiry (ISSN 0095-2583) Vol. 55, No. 1, January 2017, 9–30.

Blonigen, B., & Haynes, S. E. (1999). antidumping investigations and the pass-through of exchange rates and antidumping duties.

Blonigen, B. A., & Park, J. H. (2004). Dynamic pricing in the presence of antidumping policy: Theory and evidence. American Economic Review, 94(1), 134-154.

Blonigen and Prusa (2016), "Chapter 3: Dumping and antidumping Duties". Handbook of Commercial Policy. Volume 1, Part B, 2016, Pages 107-159.

Bown, C. P., & Crowley, M. A. (2007). Trade deflection and trade depression. Journal of International Economics, 72(1), 176-201.

Bown (2008): "The WTO and antidumping in developing countries". Economics & Politics, 20: 255-288.

Bown, Chad P. 2011. "Taking Stock of antidumping, Safeguards and Countervailing Duties, 1990-2009," The World Economy.

Bown, C. P., & Tovar, P. (2011). Trade liberalization, antidumping, and safeguards: evidence from India's tariff reform. Journal of Development Economics, 96(1), 115-125.

Bown, C. P. (2013). Emerging economies and the emergence of south-south protectionism. Journal of World Trade, 47(1).

Bown, C. P., & Crowley, M. A. (2014). Emerging economies, trade policy, and macroeconomic shocks. Journal of Development Economics, 111, 261-273.

Bown, C. P., & Reynolds, K. M. (2017). Trade agreements and enforcement: evidence from WTO dispute settlement. American Economic Journal: Economic Policy, 9(4), 64-100.

Cardoso, E. A., & Helwege, A. (1995). Latin America's economy: Diversity, trends, and conflicts. Mit Press.

Carneiro, F. G. (2004). Are minimum wages to blame for informality in the labour market?. Empirica, 31, 295-306.

Chandra, P., & Long, C. (2013). VAT rebates and export performance in China: Firm-level evidence. Journal of Public Economics, 102, 13-22.

De Souza, G., & Li, H. (2022). The employment consequences of anti-dumping tariffs: Lessons from Brazil.

Durling, J. P., & Prusa, T. J. (2006). The trade effects associated with an antidumping epidemic: The hot-rolled steel market, 1996–2001. European Journal of Political Economy, 22(3), 675-695.

Egger, P., & Nelson, D. (2011). How bad is antidumping? Evidence from panel data. Review of Economics and Statistics, 93(4), 1374-1390.

Egger, H., Egger, P., Kreickemeier, U., & Moser, C. (2020). The exporter wage premium when firms and workers are heterogeneous. European Economic Review, 130, 103599.

Engbom, N., Gonzaga, G., Moser, C., & Olivieri, R. (2022). Earnings inequality and dynamics in the presence of informality: The case of Brazil (No. w29696). National Bureau of Economic Research.

Ernst, C. (2008). Recent dynamics in Brazil's labour market. Internat. Labour Office.

Feenstra, R. C. (1995). Estimating the effects of trade policy. Handbook of international economics, 3, 1553-1595.

Feenstra, R. C., & Taylor, A. M. (2008). International trade. Macmillan.

Feenstra, R. C. (2015). Advanced international trade: theory and evidence. Princeton university press.

Felbermayr, G., & Sandkamp, A., 2020. "The trade effects of anti dumping duties: Firm-level evidence from China", European Economic Review, Volume 122, 2020, 103367, ISSN 0014-2921.

Ganguli, B. (2008). The trade effects of Indian antidumping actions. Review of International Economics, 16(5), 930-941.

Gaston, N., & Trefler, D. (1994). Protection, trade, and wages: Evidence from US manufacturing. ILR Review, 47(4), 574-593.

Goldberg, P. K., & Pavcnik, N. (2003). The response of the informal sector to trade liberalization. Journal of development Economics, 72(2), 463-496.

Goldberg, P. K., & Pavcnik, N. (2005). Trade, wages, and the political economy of trade protection: evidence from the Colombian trade reforms. Journal of international Economics, 66(1), 75-105.

González, X., Loveira, R., & Pazó, C. (2022). Performance pay, firm size and export market participation: Evidence from matched employer–employee data. Labour, 36(3), 342-366.

Helpman, E., Itskhoki, O., Muendler, M. A., & Redding, S. J. (2016). Trade and inequality: From theory to estimation. The Review of Economic Studies, 84(1), 357-405.

International Labour Organization (ILO). (2018). "Labour market reforms in Brazil"

Imbens, G. W., & Rubin, D. B. (2015). Causal inference in statistics, social, and biomedical sciences. Cambridge University Press.

Margaret E. Keck. The Workers' Party and Democratization in Brazil. New Haven, CT: Yale University Press, 1992. Journal of Interamerican Studies and World Affairs, 35(4), 202-209.

Klein, M. W., Schuh, S., & Triest, R. K. (2003). Job creation, job destruction, and international competition. WE Upjohn Institute.

Konings, J., Vandenbussche, H., & Springael, L. (2001). Import diversion under European antidumping policy. Journal of Industry, Competition and Trade, 1, 283-299.

Konings, J., & Vandenbussche, H. (2008). Heterogeneous responses of firms to trade protection. Journal of International Economics, 76(2), 371-383.

Knetter, M. M., & Prusa, T. J. (2003). Macroeconomic factors and antidumping filings: evidence from four countries. Journal of International Economics, 61(1), 1-17.

Kwak DW. (2011). Three essays on unbalanced panel data models. [Order No. 3468529]. Michigan State University.

HALTIWANGER*, J. O. H. N., Kugler, A., Kugler, M., Micco, A., & Pages, C. (2004). Effects of tariffs and real exchange rates on job reallocation: evidence from Latin America. The Journal of Policy Reform, 7(4), 191-208.

Hirakawa, O., Muendler, M. A., & Rauch, J. E. (2010). Employee spinoffs and other entrants: stylized facts from Brazil (No. w15638). National Bureau of Economic Research.

Labanca, C., Molina, D., & Muendler, M. A. (2013). Preparing to export (No. w18962). National Bureau of Economic Research.

Liu, X., & Shi, H. (2019). Anti-dumping duty circumvention through trade rerouting: Evidence from Chinese exporters. The World Economy, 42(5), 1427-1466.

Lourenco, L., Silveira, D., Oliveira, G., & Vasconcelos, C. (2021). Do antidumping Measures Increase Market Power? Evidence From Latin American Countries. *The International Trade Journal*, 1-27.

Lu, Y., Tao, Z., & Zhang, Y. (2013). How do exporters respond to antidumping investigations?. Journal of International Economics, 91(2), 290-300.

Ma, X., Muendler, M. A., & Nakab, A. (2023). Exporting, Wage Profiles, and Human Capital: Evidence from Brazil. *Review of Economics and Statistics*, 1-46.

Menezes-Filho, N. A., Muendler, M. A., & Ramey, G. (2008). The structure of worker compensation in Brazil, with a comparison to France and the United States. *The Review of Economics and Statistics*, *90*(2), 324-346.

Muendler, M. A. (1986). Trade, technology and productivity: a study of Brazilian manufacturers 1986-1998. *Technology and Productivity: A Study of Brazilian Manufacturers, 1998*.

Muendler, M. A. (2007). Trade and workforce changeover in Brazil.

Muendler, M. A. (2010). Trade reform, employment allocation and worker flows. In *Trade Adjustment Costs in Developing Countries: Impacts, Determinants and Policy Responses*, World Bank, Washington, DC, *1*(858), 103-141.

Muendler, M. A., Rauch, J. E., & Tocoian, O. (2012). Employee spinoffs and other entrants: Stylized facts from Brazil. *International Journal of Industrial Organization*, *30*(5), 447-458.

Muendler, M. A., & Rauch, J. E. (2018). Do employee spinoffs learn markets from their parents? Evidence from international trade. *European Economic Review*, *105*, 159-173.

Niels, G., & Ten Kate, A. (2006). Antidumping policy in developing countries: Safety valve or obstacle to free trade?. European Journal of Political Economy, 22(3), 618-638.

Paz, L. S. (2014). The impacts of trade liberalization on informal labor markets: A theoretical and empirical evaluation of the Brazilian case. Journal of International Economics, 92(2), 330-348.

Pierce, J. R., & Schott, P. K. (2016). The surprisingly swift decline of US manufacturing employment. American Economic Review, 106(7), 1632-1662.

Prusa, T. J. (2001). On the spread and impact of anti-dumping. Canadian Journal of Economics/Revue canadienne d'économique, 34(3), 591-611.

Romalis, J. (2007). NAFTA's and CUSFTA's Impact on International Trade. The review of Economics and Statistics, 89(3), 416-435.

Sandkamp, A. N. (2019). The trade effects of antidumping duties, non-tariff barriers and maritime security. (Doctoral dissertation, LMU).

US International Trade Commission, June 1995. The Economic Effects of Antidumping and Countervailing Duty Orders and Suspension Agreements. US International Trade Commission, Washington, DC.

Valdebenito, J. (2024a). End of trade: Brazilian exports under Anti-Dumping policy. (Working Paper)

Valdebenito, J. (2024b). How strong is the Anti-dumping punch?. (Working Paper)

Vandenbussche, H., & Zanardi, M. (2010). The chilling trade effects of antidumping proliferation. *European Economic Review*, *54*(6), 760-777.

WTO (2019). AD initiations: by reporting member. Available at `http://www.wto.org/`.

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Professional Summary

Ph.D. in Economics specialized in International Trade, International Economics, and International Political Economy. Extensive experience in economic research using large datasets, applied microeconomics, and policy analysis. My research experience is complimented by a three-year tenure as an economist at the Latin American Steel Association. I bring a practical understanding of global economic trends, experience in a multinational environment, ability to develop meaningful relations and a proven analytical perspective.

Education

Ph.D. in Economics, Syracuse University, NY, USA. 2019 – June 2024.

- *Research Interests:* International Trade, Applied Econometrics and International Political Economy.
- *Dissertation title:* The Other Side of the Coin: Effects of Anti-Dumping Duties on Firms and Workers.

M.A. in International Relations and Foreign Affairs, Syracuse University, NY, USA. 2017 – 2019.

M.A. in Economics, Syracuse University, NY, USA. 2017 – 2019.

B.A. in Economics, University of Chile, Santiago, Chile. 2009 – 2014.

Employment

Visiting Scholar, U.C. San Diego, California, USA, 2022 – Present.

- Produced academic research using large matched worker-firm and export-level administrative and confidential databases, contributing to the understanding of labor market dynamics and the effects of trade barriers on exporting firms.
- Provided mentoring and technical assistance to new researchers, enhancing their research skills and improving project outcomes.

Research Assistant, Syracuse University, NY, USA, 2018-2024.

- Reviewed economic literature, assisted with empirical analysis and managed data procurement, cleaning, and analysis using Stata and R.

- Provided mentoring and technical assistance to new researchers, enhancing their research skills and improving project outcomes.

Economist, Latin American Steel Association (Alacero), Santiago, Chile. 2014 – 2017.

- Led the Economics and Statistics department, overseeing a significant expansion from 7 to 15 countries in the coverage of policy and economic reports.
- Produced technical monthly reports on global economic statistics and commercial trends, effectively communicating complex economic data to stakeholders.
- Provided insightful economic analysis of industrial, environmental, and trade policies, directly contributing to informed and data-driven decision-making.
- Participated in the negotiation procedures to modify the scope of products different countries include in their statistical reports to create a unified Latin American Index.

Technical Secretary, Latin American Steel Association (Alacero), Santiago, Chile. 2015 – 2017.

- Represented Alacero in several international forums, working groups, and committees, enhancing the organization's global presence.
- Coordinated and streamlined statistical reports from country representatives in the steel industry, improving project management efficiency.
- Consolidated and presented key industry insights, such as the Latin American Steel Consumption Outlook and economic perspectives, to industry directors, enhancing communication and presentation effectiveness.

Research Papers:

- ``***Distributional effects of Anti-dumping duties on the workforce of targeted firms***'': Analyzed the economic impact of Anti-Dumping policies on employment, average wages, total labor costs, and distribution of skilled versus unskilled workers of targeted firms.
- ``***End of trade: Exports after Anti-dumping duties***'': Find that Anti-Dumping duties increases the risk of a targeted product to exit the destination market, ending trade relations between firms and countries.
- ``***How strong is the Anti-dumping punch?***'': Estimate the economic impact of Anti-Dumping duties on the targeted firms' export revenue at both the firm and the country level.

Seminar, Conferences and Awards

Rutgers University, Seminar speaker. March 2024.

Southern Economic Association (SEA), Conference presenter. Fall 2023.

Western Economic Association International (WEIA) Conference presenter. Summer 2022.

Thompson-Burkhead Fund Research Grant $4,000. Summer 2021.

Goekjian and Perryman-Program on Latin America and the Caribbean Research Grant $3,000. Summer 2021 – 2022 – 2023.

Technical Skills

Software: STATA, R, GitHub, Meltwater, Microsoft Office and Latex.

Professional: Economic Analysis, Statistical Modeling, Data Interpretation, Quantitative Analysis, Data Visualization, Policy Evaluation, Econometric Techniques, Research Methodology, Economic Policy, Presentation Skills and Project Management.

Languages: Spanish (native), English (fluent), Portuguese (beginner).

Teaching Experience

Lab Instructor:

- Economic Statistics.
- Public Economics.

Teaching Assistant:

- Game Theory and Economic Strategy.
- Introduction to Macroeconomics.
- Introduction to Microeconomics

Relevant Coursework

Trade and Development: *Topics International Economics; Advanced International Trade; Stabilization and Growth in Emerging Markets; Development: Theory and Practice. Macroeconomics.*

Urban Economics: *Cities in Developing Economies; Regional and Spatial Economics; Urban Economics.*

Econometrics: *Panel Data and Spatial Econometrics; Discrete Choice and Duration Analysis; Time Series; Econometric Methods.*

Program Evaluation: *Program Evaluation.*