Antidumping and the Death of Trade*

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Abstract

We investigate the extent to which antidumping actions eliminate trade altogether. Using quarterly export data for products involved in U.S. antidumping cases we find that antidumping actions increase the hazard rate by more than fifty percent. We find strong evidence of investigation effects with the impact during the initiation and preliminary duty phases considerably larger than during the final duty phase. There are also important differences with respect to the size of duties. Cases with higher duties face a much higher hazard in the preliminary phase but there is little additional effect when the final duty is actually levied. By contrast, cases with lower duties have a smaller but more persistent effect on the hazard, which proves to be highly detrimental in the long run as many trade relationship cease during the duration of the order. Given the literature on heterogeneous firms and trade, our results imply antidumping protection imposes greater costs than previously recognized.

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1 Introduction

For almost four decades antidumping (AD) has been the most important form of discretionary protection,[1] outpacing all other forms of administered protection *combined* (Bhagwati, 1989; Zanardi, 2006; Bown, 2011). AD duties have been shown to significantly reduce exports from subject countries, 50–60% on average (Prusa, 2001). This paper examines the impact of AD on the ability of a subject supplier to maintain any market presence. We find that AD investigations often drive export suppliers entirely out of the market. Using U.S. AD case information along with highly disaggregated product-level quarterly export data we estimate the hazard of exports to the U.S. ceasing and find that AD increases the likelihood of exit by more than fifty percent. Considering that over the past two decades more than one-quarter of AD duties have exceeded 100% ad valorem it may not be entirely surprising that many subject suppliers are unable to continue to export to the United States.[2] Yet, this aspect of AD protection has been heretofore overlooked.

When exit occurs the literature on heterogeneous firms and sunk costs of trade implies costs associated with AD are larger than those captured by standard price and volume effects (Melitz, 2003). Our findings raise the possibility that an exporter may not recover the sunk costs required to service the destination market. If a firm could anticipate this (i.e., because certain destination markets or industries were known to be aggressive users of AD or because of the firm's prior experience with AD in other destination markets) then it might be unwilling to commit the sunk costs in the first place. Consequently, AD may have far greater welfare effects than generally recognized.[3] From an importing country point of view, if AD eliminates

[1]Antidumping has been estimated to be the most costly form of protection for both the U.S. and EU (Gallaway, Blonigen, and Flynn, 1999; Messerlin, 2001).

[2]Blonigen (2006) analyzes why AD duties are so large.

[3]Vandenbussche and Zanardi's (2010) results are consistent with this concern. They focus on trade flows (i.e., the intensive margin) and find AD reduces trade in products where no duty is imposed but which are similar to those where duties are imposed. Egger and Nelson (2011) also study AD spillover effects.

efficient foreign suppliers, less efficient domestic firms will continue to service the market which imposes additional costs on the economy (Pierce, 2011).

A related question is when AD affects trade. Is it when the case is initiated? Is it when the preliminary duty is levied? Or, is it when the final duty is levied? We find the most significant effects occur early in the investigation. Interestingly, the investigation effects are larger than those when the final AD duty is levied, implying that by the time the final duty is levied most of the effect on the extensive margin has already happened. Exporters often cease serving the market *during* the investigation. We also find important differences with respect to the size of duties. Cases with higher duties are much more likely to result in exit in the preliminary phase, but there is little effect on the exit likelihood in the final phase. By contrast, cases with lower duties experience a smaller but more persistent effect on the likelihood of exit.

2 Related Literature

There is a substantial literature on the intensive margin effects of AD protection; however, no previous study has analyzed AD's impact on the extensive margin. Prusa (2001), Bown and Crowley (2007), and Carter and Gunning-Trant (2010) use annual line-item trade data and estimate a 50–60% reduction in subject imports due to U.S. AD duties. Konings, Vandenbussche, and Springael (2001) and Ganguli (2008) find quantitatively similar effects on EU and India imports, respectively.

Several other studies have examined AD's impact on trade during the investigation. Staiger and Wolak (1994) use annual industry-level trade data for U.S. AD cases from the early 1980s and conclude that about half of the trade volume effect of an AD order occurs during the period of investigation. This is an important finding as it means that even if subject suppliers are ultimately exonerated the domestic industry gains substantial protection during the 12-month investigation. However, the use of annual industry-level data significantly complicates, and to some extent weakens, their analysis. Each industry is comprised of hundreds (or even thousands) of tariff-line codes, most of which are not protected. An industry is deemed to be protected if even a few of the tariff lines are protected. Further, results from Prusa (2001) and Bown and Crowley (2007) indicate the industry metric is a very noisy measure of actual product-level protection due to trade diversion. Moreover, preliminary duties are almost never in effect for a calendar year but rather are in effect for just two or sometimes three quarters. This complicates the derivation of within-year effects using annual data.[4] Krupp and Pollard (1996) and Baylis and Perloff (2010) also examine investigation effects and avoid some of these complications by using monthly data. Both studies document substantial trade effects during the period of investigation. Hillberry and McCalman (2011) use the same data we use to investigate trade patterns prior to an AD investigation.

This paper differs from prior studies in two key dimensions. First, we use quarterly line-item product level data. This allows us to precisely measure the timing of trade effects without the extraneous noise that characterizes monthly data. Second, we are the first to consider the effect of AD actions on duration of trade, a natural way to examine exit potentially caused by a specific event occurring while a spell of trade is active. Besedeš and Prusa (2006a) offered the first analysis of duration of trade, showing that the duration of U.S. imports is very short with a median of four years in length. A large number of papers have confirmed that short duration is a common characteristic of international trade at both the product-level[5] and firm-level.[6]

[4]Staiger and Wolak resolve this issue by making assumptions about what outcomes affect trade (and when those effects occur) and then adjust the annual data for the time within a calendar year with no protection, with preliminary protection, and with final protection. If the preliminary duty were imposed on August 1, then Staiger and Wolak assume trade was unaffected for seven months (213 days) and therefore occurred as it did prior to the investigation. They assume trade was affected only during the last five months of the year (152 days). Trade flow pre- and post-duty is derived from this identifying restriction.

[5]See Besedeš and Prusa (2006b, 2011), Besedeš (2008, 2011, 2013), Nitsch (2009), Jaud, Kukenova, and Strieborny (2009), and Carrère and Strauss-Khan (2012).

[6]See Görg, Kneller, and Muraközy (2012) and Cadot et al. (2011).

3 A Primer on U.S. AD Procedures

A short discussion of the United States' AD procedures will lay the groundwork for our empirical strategy.[7] In the U.S. an AD investigation begins when the domestic industry simultaneously files a petition with the U.S. Department of Commerce (USDOC) and the U.S. International Trade Commission (USITC). The petition includes two important pieces of information for our study. First, the petition specifies the exact product that is alleged to have been dumped. The product is identified by one (or more) 8- or 10-digit tariff line (HS) codes. If the investigation involved ball bearings, for example, the HS code will identify product size (e.g., 4mm versus 10mm ball bearings), material (metal versus plastic), and chemistry (carbon or alloy steel). Second, the petition indicates which country (or countries) is allegedly dumping. Only countries named in the petition are subject to the investigation and, if they are ultimately levied, to AD duties. We note that for a given subject country the AD duty does not vary by HS code, but the duty can vary by subject country.[8]

Once the petition is filed the investigation proceeds on a precisely specified statutory timeline (USITC, 2008) which is reflected in our analysis.[9] The investigation proceeds on a dual track, with the USDOC determining whether the product in question was sold at less than fair value and the USITC determining whether domestic firms suffered a material injury. The first major decision is the USITC's preliminary determination which decides whether the domestic industry is suffering (or is threatened by) material injury. This decision is made within a quarter of the petition initiation; a negative decision ends the case.

[7] While the WTO Antidumping Agreement provides broad guidelines, the AD process varies substantially from country to country (Blonigen and Prusa, 2003).

[8] Different AD duties can be levied on specific companies from the same source country; however, our trade data does not identify individual exporting companies so we use the weighted average AD margin for the supplying country ("all others" rate).

[9] Since our trade data is quarterly we discuss the timeline in terms of quarters. For example, the USDOC must normally make its preliminary duty determination no later than 160 days (two quarters) from the filing date, or 210 days (three quarters) if the case is deemed "complicated."

The next major decision occurs about one quarter later when the USDOC makes its preliminary duty determination. The USDOC must determine whether the foreign supplier(s) named in the petition sold their product at less than fair value. If the preliminary duty is more than *de minimis*, the AD duty goes into effect at that time.[10] About 95% of the USDOC's preliminary duties exceed the *de minimis* margin. If the preliminary duty is *de minimis* the investigation continues but the preliminary duty is not imposed.

The USDOC's and USITC's final determinations both typically occur two quarters after the preliminary duty determination.[11] If both final determinations are affirmative, the final AD duty is imposed.[12] The preliminary and final duties are very similar with a correlation exceeding 0.9,[13] which means there is little uncertainty about the size of the final duty once the preliminary duty is announced. Therefore, for all intents and purposes once the preliminary AD duty has been determined the only remaining uncertainty involves the USITC's final injury determination.[14] Once imposed, the AD duty can be in place for an indefinite period of time.[15] In our data the average length of an AD order is 36 quarters.

The statutory framework leads us to divide a case into three stages: the initiation phase, the preliminary duty phase, and the final duty phase. The *initiation* phase is the period of time during the investigation before any additional duty is levied. It typically encompasses the time from when the case is initiated until either the USITC's negative preliminary determination or the date when the USDOC makes its

[10]A dumping margin less than two percent is *de minimis*.

[11]If the case is deemed complicated or if there are court challenges, the final determination can be delayed for a quarter or two (or in a few rare cases, even longer).

[12]Unlike some other forms of administrative protection and unlike AD policy in other countries, under U.S. law the AD duty is imposed without any input or approval from the President.

[13]Since 1990 the average (median) preliminary AD duty is 49.16% (30.94%) and the average (median) final AD duty is 53.2% (36.41%).

[14]Since 1990 about 75% of the USITC final injury determinations have been affirmative.

[15]Even though the Uruguay Round of the WTO included a mandatory sunset review, this provision has not resulted in shorter duration of AD duties (Prusa, 2011). The sunset provision simply requires every AD order be reviewed after it has been in place for five years (Moore, 2006).

preliminary duty determination. If the USDOC's preliminary duty is *de minimis* the initiation phase lasts until the final determination is made. Because no additional duties are levied during this phase it is often presumed that AD has no impact. However, this may not be the case. Trade could be affected if the specter of the investigation intimidates U.S. buyers from purchasing from the subject suppliers, the so-called *in terrorem* effect.

The *preliminary duty* phase encompasses the period when U.S. buyers pay the preliminary AD duty.[16] Once the USDOC and USITC final determinations are made the case is either terminated or an AD duty is imposed. The *final duty* phase begins the date the final AD duty is imposed and continues until the date the AD order is revoked.

Finally, we note that some AD cases are "settled." Settlements are usually the result of an agreement between the subject suppliers and the USDOC and limit export volume and/or establish minimum sales prices. While many U.S. AD cases were settled in the 1980s (Prusa, 1992) relatively few cases have been settled in the past 20 years.[17] We examine the impact of settled cases on the hazard rate by incorporating information on the duration of settlement agreements. We note, however, that we are unaware of any settlement agreement that mandated the cessation of exports.

4 Data

4.1 HS Trade Data

Quarterly trade data are from the U.S. Census' *U.S. Imports of Merchandize Trade* starting with Q2–1990 through Q4–2006. U.S. imports are recorded at the 10-digit HS level. The data include information on trade value, quantity shipped, duties

[16] The duty is held in an account and is returned to the buyer if the case is ultimately rejected.

[17] Settlements continue to be quite common in other countries, most notably in the EU.

collected, and import charges (insurance and freight).

In order to perform duration analysis we translate quarterly trade data into trade relationships and spells of service. A trade relationship is defined as a HS-country pair, while a spell of service consists of consecutive quarters during which a trade relationship is active. There are 10,423,157 quarterly HS-country observations which map into 2,660,147 spells of service reflecting 748,430 trade relationships. The vast majority of observed spells of service are essentially one-off events, with over 58% observed for just one quarter. The average observed spell length is 3.91 quarters. Roughly 60% of relationships have multiple spells of service accounting for 89% of all spells. The predominance of multiple-spell relationships is consistent with patterns documented in previous studies of trade duration. They are somewhat more prevalent in this study due to our use of quarterly data.

Two data issues, missing values and left censoring, cause almost half the quarterly trade observations to be dropped in our estimation. With respect to the former, Census trade data has a plethora of missing values. For instance, approximately 17% of the observations are dropped due to missing quantity information. Additional observations are dropped due to missing values for other control variables.[18] With respect to the latter issue, left censoring is an issue for all studies of trade duration and affects about 30% of all observations. Left censored spells are all spells active in the first observed quarter. By the term "first observed quarter" we mean either the very first quarter of our sample (Q2–1990) or the first quarter of a newly introduced product code.[19] Right censoring is also present (spells observed in the last observed quarter). However, unlike left censoring, hazard estimation techniques can account for right censoring. After taking into account these two data issues we have 5,417,711 quarterly HS-country trade observations.

[18]As a robustness check we eliminated certain control variables in order to mitigate the extent of missing data. Results (available on request) are similar to those presented.

[19]Pierce and Schott (2012) discuss the tendency for HS codes to be created.

4.2 AD Case Data

The *Global Antidumping Database* (Bown, 2012) contains information on the precise timing of each case, the HS product codes, the subject (or "named") countries, and the size of the preliminary and final duties. Restricting our sample to AD cases during the period covered by our trade data yields 833 AD cases involving 2,179 distinct HS codes and 8,127 HS-country observations.[20] We will say an AD case is "active" if it is in the midst of one of the three phases (initiation, preliminary duty, final duty). Bown's database allows us to create a precise quarterly history for every HS-country pair involved in a case. This history yields 181,804 quarterly observations for active AD cases at the HS-country-product level.[21]

4.3 Other Data

We follow the trade duration literature and include additional control variables. Initial size is controlled by the (log of) the volume of trade when a spell starts. We use GDP measured in constant dollars to capture country effects.[22] Other controls include standard gravity variables such as weighted distance, common language, and contiguity.[23] Finally, Census trade data allow us to calculate the paid tariff, transportation costs, and unit values. We do not use unit values themselves, but the coefficient of variation of unit values within an HS code in a given quarter, following Besedeš and Prusa (2006b). The variation in unit values captures the extent to which the product is differentiated, with more differentiated products exhibiting a larger variation in unit values.[24]

[20] About half the HS codes are involved in multiple cases, cases where either multiple codes are listed in the petition and/or the petition names multiple subject countries.

[21] Additional discussion of the data merging are contained in appendix A.

[22] Obtained from the World Bank's *World Development Indicators*.

[23] Obtained from CEPII's gravity dataset at `http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8`.

[24] Schott (2004) was one of the first to point out the extent of variation of unit values in U.S. product level trade data and the extent to which it reflected within-product specialization and vertical product differentiation.

5 Results

5.1 Methodology

We estimate the hazard of exports to the U.S. ceasing by using random effects probit. This approach does not impose the constraint that the hazard of two subjects be proportional to each other as is the case with proportional hazard estimators and allows for a more computationally feasible accounting of unobserved heterogeneity. We use the log of the number of quarters a spell has been active to specify how the hazard depends on time/duration.

While the use of probit has its advantages, its disadvantage is that the interpretation of coefficients is not straightforward. The effect of every covariate depends on its own estimated coefficient as well as that of time. Since the hazard of two subjects is no longer proportional, the effect of every covariate is not independent of duration. In addition, even if a coefficient is estimated to be statistically significant, its effect on hazard may not be significant as the significance depends not only on its own standard error, but also on that of every other variable.

We determine whether the effect of a covariate is significant by plotting two estimated hazard functions along with corresponding confidence intervals. All variables are evaluated at the same value, usually their sample mean, except for the specific variable of interest which will take on different values in turn. We then compare the 99^{th} percentile confidence intervals of the two hazard functions. If they do not overlap, the effect of the variable of interest is statistically significant.[25]

Countries which export products subject to AD investigations are organized into three groups: named, non-named, and "named, case dropped." An example will clarify our groupings. Suppose there are five countries that export the subject product to the U.S. (countries i, j, k, m, and n). Suppose further that three countries (i, j,

[25] Sueyoshi (1995) provides a detailed explanation, while Hess and Persson (2011) and Besedeš (2013) use this technique in the context of duration of trade.

k) are named in the petition but at some point country k is dropped. Countries i and j are classified as "named" countries and m and n are classified as "non-named." As long as the case is active against country k it is considered "named." However, as soon as the case against k is dropped k is classified as "named, case dropped."

We estimate three different specifications. In our basic specification we investigate whether the sheer existence of a case has an effect on the hazard of exports. We then examine whether the effect varies by phase of a case. Finally, we investigate whether the size of the preliminary and final duties have a nonlinear effect.

5.2 Control Variables

Before turning our attention to case relevant variables, we summarize the effect of the other control variables. Given that the estimates are virtually identical across all specifications and all effects are consistent with results in the literature we expedite our discussion by only presenting them once (Table 1).[26] Time/duration is estimated to have a large negative coefficient, indicating that the hazard decreases with duration. The larger the initial volume exported, the lower the hazard, indicating that initial size matters. Distance is estimated to have a statistically significant but small negative effect on hazard — the larger the distance, the lower the hazard. Larger exporter's GDP reduces hazard, while Canada and Mexico, the two countries sharing a border with the U.S. have a significantly lower hazard.

Common language increases the hazard somewhat, while tariffs and transportation costs weakly reduce the hazard. Products with a higher variation in unit values across suppliers have a lower hazard, reflecting that differentiated products face a lower hazard. The estimated parameter ρ captures the extent of data variation attributable to unobserved heterogeneity. It is estimate to be around 0.2 in most of our specifications, which is in line with the value obtained by Besedeš (2013) using

[26]Full results are available upon request.

Time (ln)	−0.421***
	(0.001)
Initial volume (ln)	−0.121***
	(0.000)
Weighted distance (ln)	−0.007**
	(0.003)
COV unit values (ln)	−0.023***
	(0.001)
GDP (ln)	−0.051***
	(0.001)
Contiguity	−0.257***
	(0.007)
Common Language	0.036***
	(0.003)
Tariff (ln)	−0.008***
	(0.000)
Transportation costs (ln)	−0.013***
	(0.000)
Product with a case	−0.061***
	(0.005)
Non-named country	0.059***
	(0.007)
Named, case dropped	−0.085***
	(0.022)
Named country	0.175***
	(0.015)
Constant	3.169***
	(0.033)
Observations	5,417,711
Log-Likelihood	−2,641,464
ρ	0.208***

Standard errors in parentheses with *, **, *** denoting significance at 10%, 5%, and 1%.

Table 1: **Basic Specification**

annual 10-digit product level U.S. data.

5.3 Basic Specification

We now turn to the estimated AD effects in our basic specification. We begin by noting that products that were a part of an AD petition have a lower hazard (−0.061) than those which did not have a petition filed. Interestingly, the parameter estimate for the "non-named country" (0.059) essentially offsets the product effect which means exports from these countries face the same hazard as products which never were a part of a petition.

We find that named countries face a higher hazard (0.175). By contrast, the hazard falls when a named country is dropped from the investigation. We show these estimated effects in Figure 1. When plotting the fitted hazard we assume that an AD case has the following time profile: the petition is initiated in the ninth quarter of an active spell, the initiation phase lasts two quarters, the preliminary dumping duty phase lasts two quarters, and the final duty phase lasts 20 quarters.[27] All but the petition initiation and the length of the final duty phase are determined by the statute. With respect to the initiation timing, we opt for the ninth quarter because that is the median duration prior to a filing. With respect to the duration of the final duty phase our assumption reflects the statute's sunset provision, although in practice final duties are often imposed for a longer period. Finally, for those countries initially a part of a petition but dropped at some point, we assume they were dropped during the preliminary phase.[28]

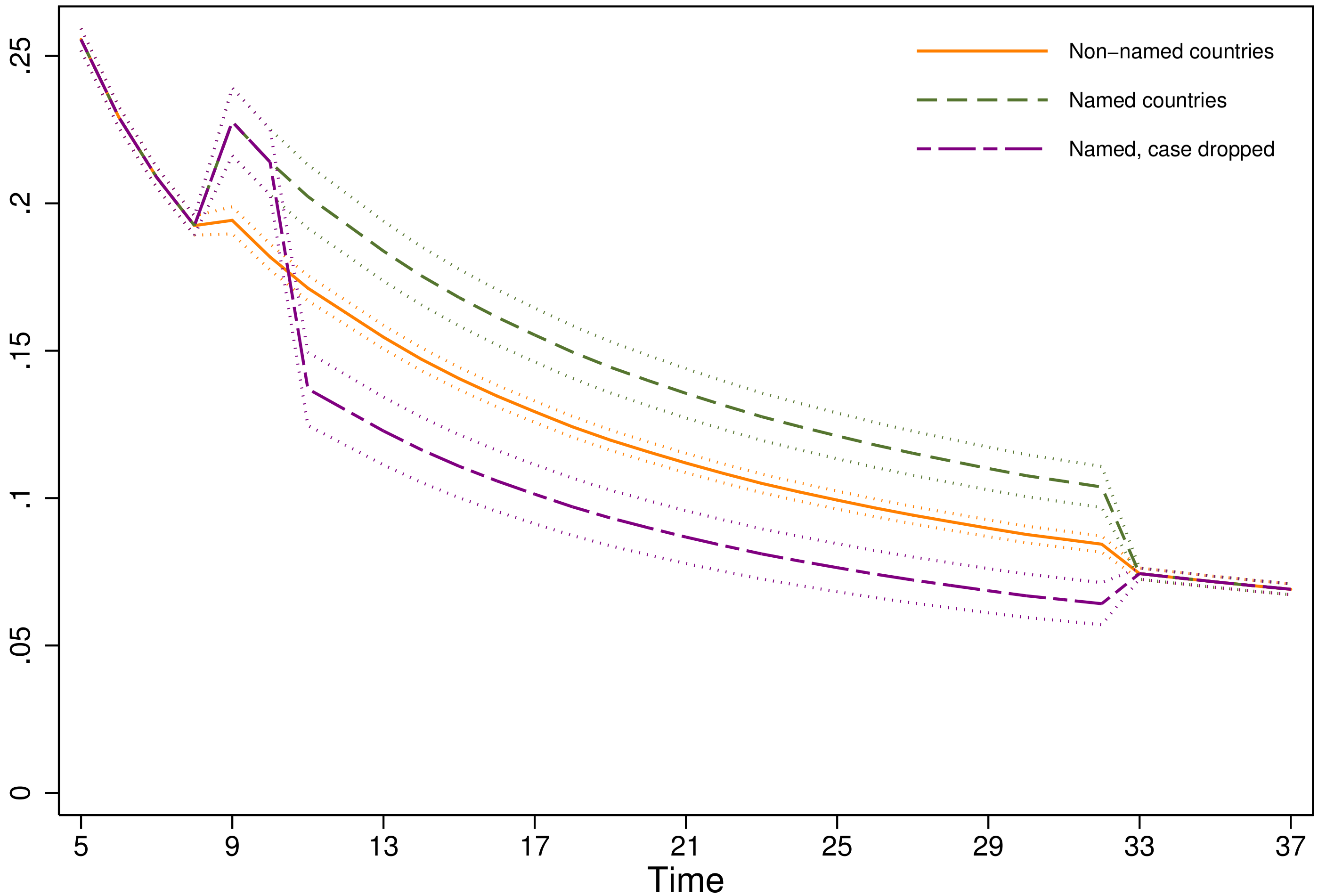
The hazard for the named country is 3.6 percentage points higher during the duration of a typical case (24 quarters). Relative to the hazard if there were no case this estimate implies a 32.7% increase in a named country's hazard (see Table 3).

5.4 Phases Specification

The basic specification constrains the effect of the AD case to be same for each phase of the case. We now introduce separate dummies for each phase and find that the effect varies substantially by phase. The results in Table 2 indicate that the likelihood that exports will cease is higher in the initiation and preliminary phases than in the

[27] The timing assumptions only affect the simulations based on the estimated parameters. The estimation uses the actual timing for each case.

[28] Countries are most frequently dropped early in the investigation.



Filing occurs in quarter 9, initiation lasts 2 quarters, preliminary duty in place for 2 quarters final duty in place for 20 quarters

Figure 1: **Effects of an AD Case (basic specification)**

final phase.[29] The estimates confirm Staiger and Wolak's (1994) conclusion that AD generates substantial protection during the 12-month investigation.

Product with a case	-0.061^{***}
	(0.005)
Non-named country	0.059^{***}
	(0.007)
Named, case dropped	-0.081^{***}
	(0.022)
Initiation phase	0.361^{***}
	(0.031)
Preliminary duty phase	0.448^{***}
	(0.041)
Final duty phase	0.111^{***}
	(0.017)
Observations	5,417,711
Log-Likelihood	−2,641,405
ρ	0.208^{***}

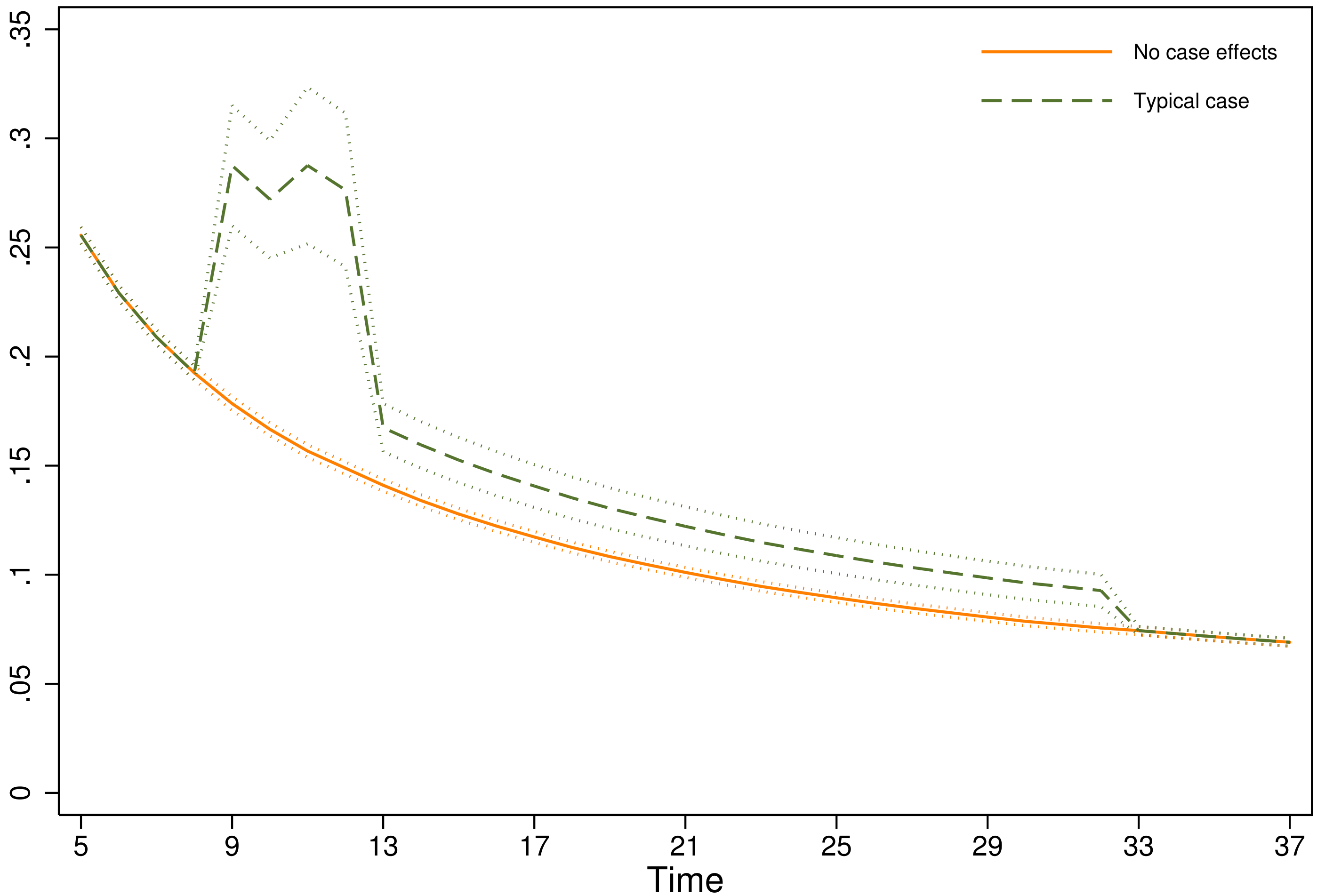
Standard errors in parentheses with *, **, *** denoting significance at 10%, 5%, and 1%.

Table 2: **Phases Specification**

The variation by phase is clearly seen in Figure 2 where we plot the hazard profile of a typical case. For comparison purposes, we also include the hazard profile with all phase dummies set to zero which allows us to isolate the pure effect of a case. As seen, the hazard increases when the case is initiated and increases further when preliminary duties are levied. Interestingly, while final duties still increase the hazard relative to what it would be in the absence of a case, the effect during the final duty phase is considerably smaller than during either of the two early phases.

Table 3 provides perspective on the increase in the hazard during the various phases. The increase in the hazard in the first two phases is remarkable. The hazard during the two-quarter initiation phase increases 10.7 percentage points, which is a 62.2% increase relative to the "no case" benchmark. The impact during the two-quarter preliminary duty phase is even larger — an 84.6% relative increase in the

[29] In Table 2 we only report estimates for the phases and the product and country dummies. Complete results are available on request.



Filing occurs in quarter 9, initiation lasts 2 quarters, preliminary duty in place for 2 quarters, final duty in place for 20 quarters

Figure 2: **Phase-Specific Effects**

hazard. The hazard during the final phase is 20.8% higher than it would be if no case had been filed. Over the entire duration of the case, we find a case increases the hazard by an average of 3.7 percentage points. Given that in the absence of a case, the hazard averages 11.04% between quarters 9 and 32, our estimates imply an AD case increases the hazard by 33.5%.

	Average increase in hazard – Phase Specific						Entire Duration of Case	
	Initiation		Preliminary		Final			
Specification	Nominal	Relative	Nominal	Relative	Nominal	Relative	Nominal	Relative
Basic	—	—	—	—	—	—	3.6%	32.7%
Phases	10.7%	62.2%	12.9%	84.6%	2.1%	20.8%	3.7%	33.5%
AD duties								
≤ median	11.3%	59.8%	6.2%	36.9%	4.3%	38.9%	5.1%	41.4%
> median	11.3%	59.8%	24.5%	145.7%	-0.1%	-0.6%	2.9%	23.9%

Table 3: **Impact of AD – Average increase in hazard**

Additional context for understanding the impact of AD can be found by comparing AD with the impact of three other factors that influence export survival: common border, GDP, and the initial volume of trade. The results are shown in Figure 3 and each comparison confirms that AD has a substantial impact on the hazard. In the top panel we plot the fitted hazard for a typical case and for a country sharing the border with the U.S. We then eliminate both the AD case and also the common border. As seen, the lack of a common border increases the hazard, but its effect is only about half that of an AD case during the critical initiation and preliminary phases.

In the middle panel we contrast the impact of an AD action with that of GDP. We find that GDP would need to be reduced by three orders of magnitude to have a comparable effect as an AD case (during the initiation and preliminary phases). Said differently, our results imply that exports subject to an AD investigation have the same hazard profile as if a German exporter were suddenly relocated and forced to operate as an exporter from Benin, Armenia, or Barbados, or an exporter from Sweden were suddenly relocated to Comoros or Guinea-Bissau.

In the bottom panel we compare the impact of an AD action with that related to the initial volume of trade. We find that the initial volume of exports would need to be reduced by one order of magnitude to generate a comparable hazard effect in the initiation and preliminary phases.

We offer an additional approach to quantifying the effect of an AD case: relative survival experience. Consider two identical products — one with and one without an AD case. We then consider how many spells would survive with and without a case during the 24 quarters of a typical case. The results in Table 4 demonstrate the excessive failure due to the AD action. Our basic specification (Table 1) implies only about one-third as many spells will survive the entirety of the AD case as would if there were no case. In the phases specification, we find about 25% more spells fail during the initiation phase and about 46% more spells fail through the end of the preliminary duty phase. Similar to the prediction from our basic specification, under the phases specification only about one-third as many spells will survive the entire AD case as would if there were no case (i.e., about 66% more spells fail).

	Ratio: Spells Surviving AD Case to Spells Surviving with No Case		
Specification	Initiation Phase	Preliminary Phase	Final Phase*
Basic	—	—	36.6%
Phases	75.8%	54.4%	33.9%
AD duties			
≤ median	74.0%	63.4%	23.3%
> median	74.0%	36.8%	37.4%

* Entire duration of case

Table 4: **Impact of AD – Spells surviving through end of each phase**

5.5 Nonlinear Impact of Duties

We now investigate how the size of preliminary and final AD duties affects the hazard. Rather than using a single variable to identify the duty effect for each phase, we use two dummies per phase. The dummies correspond to whether the duty is below or above the median.[30] As shown in Table 5 there are interesting differences in the effect

[30] Alternatively, we divided AD duties into quartiles finding qualitatively similar results. Duties in the bottom two quartiles cause a persistently higher hazard for the entire case, while duties in the

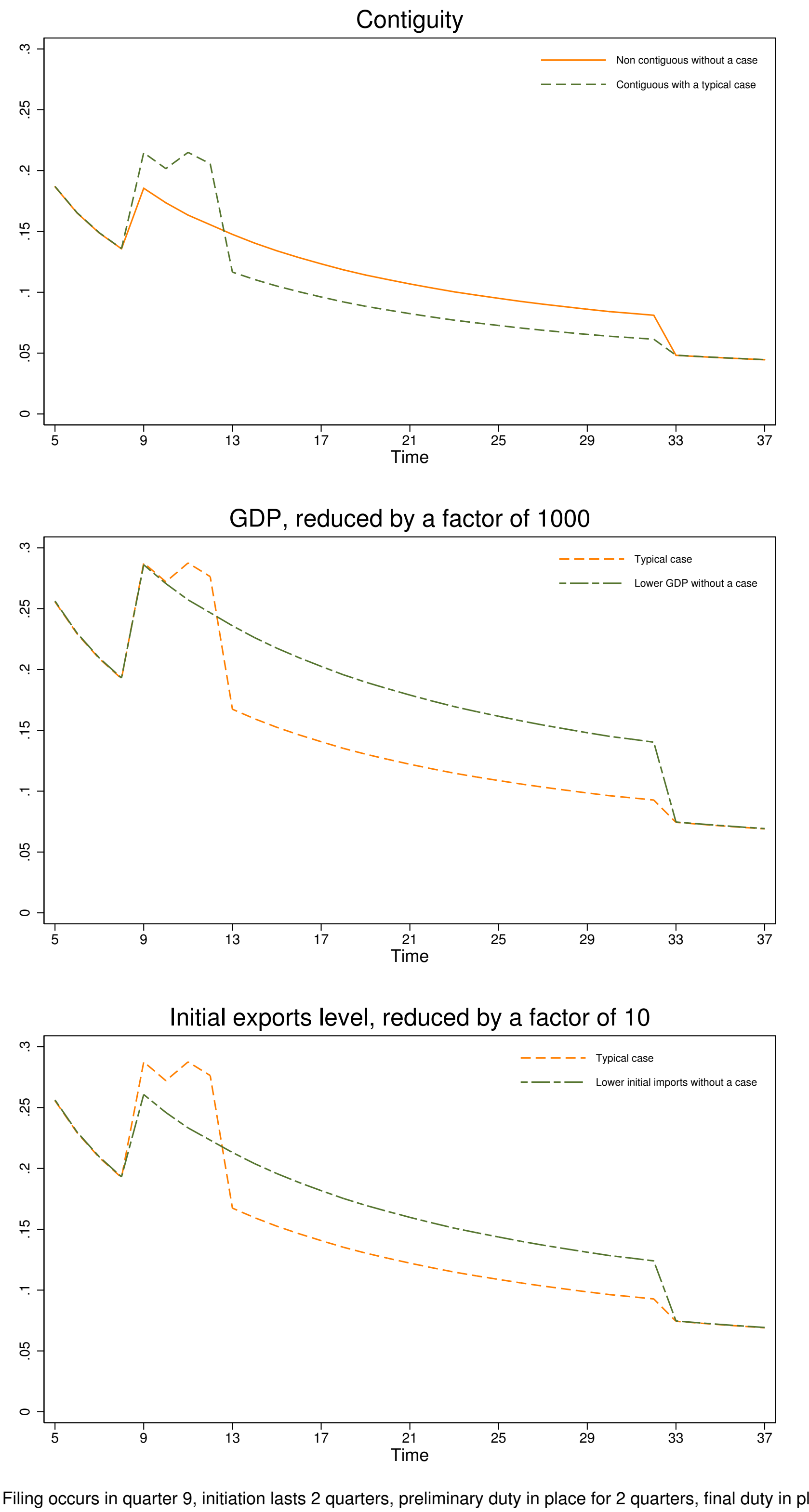


Figure 3: **Equivalent Hazard Effects**

of the level of duties, indicating significant nonlinearities.

Product with a case	-0.060^{***}
	(0.004)
Non-named country	0.058^{***}
	(0.007)
Named, case dropped	-0.082^{***}
	(0.022)
Initiation phase	0.363^{***}
	(0.031)
Preliminary duty $\leq$ median	0.223^{***}
	(0.057)
Preliminary duty $>$ median	0.742^{***}
	(0.061)
Final duty $\leq$ median	0.204^{***}
	(0.024)
Final duty $>$ median	-0.004
	(0.025)
Observations	5,417,711
Log-Likelihood	$-2,641,361$
ρ	0.208^{***}

Standard errors in parentheses with *, **, *** denoting significance at 10%, 5%, and 1%.

Table 5: **High and Low Duty Specification**

The effect of preliminary duties is consistent with our prior expectations: duties above the median have a greater effect on the hazard than duties below the median. This is clearly seen in Figure 4. A preliminary duty below the median increases the hazard by an average of 6.2 percentage points, an increase of 37% relative to the hazard in the absence of a case (Table 3). By contrast when the preliminary duty is above the median, the hazard increases by 24.5 percentage points, which corresponds to a remarkable 146% increase in the hazard relative to the absence of a case.

By contrast, the results involving the impact of the final AD duties are surprising. The key insight is that the impact of the final duty depends on what happened *during* the course of the investigation. The estimates imply that when a high duty is levied

upper two quartiles sharply increase the hazard during the preliminary phase only, while having little effect on the hazard during the final phase. We also used the size of the duty, separately estimated for high and low duties, and find similar results to those reported using the dummy specification.

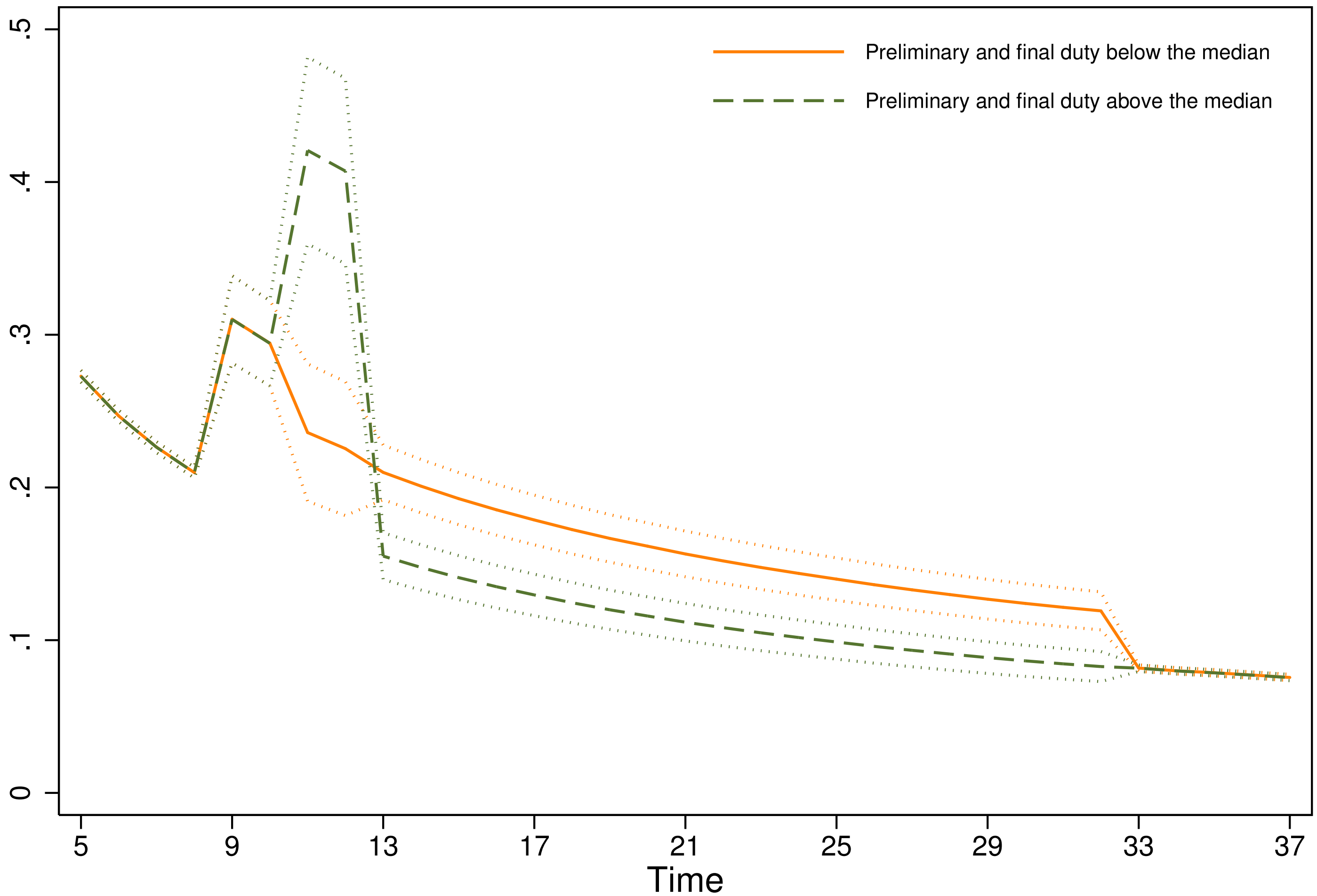


Figure 4: **Nonlinear Effects of Antidumping Duties**

in the preliminary stage, there is very little additional impact when the final duty is levied.[31] By the time the final duty is levied, most of the spells that will fail have already done so. There is very little additional attrition due to the AD case. On the other hand, when a low duty is levied in the preliminary stage, the final duty has a significant effect on the hazard. A final duty below the median increases the hazard by an average of 4.3 percentage points, an increase of almost 39% relative to the hazard in the absence of a case.

Our findings seemingly indicate lower final duties have a stronger effect than higher duties. This, however, is a bit misleading. Lower duties increase the hazard whenever they are applied, both during the preliminary and final phases. On the other hand, higher duties, have an extraordinarily large impact during the preliminary phase, but have little additional effect during the final stage. For all intents and purposes the entire might of the effect of a high duty case is loaded into the preliminary phase.

The simulation results presented in Table 4 further clarify the differential long-run effect of low and high duties. As seen, lower duties have a smaller, but more persistent impact, while higher duties have a large impact for a brief period of time. At the end of the preliminary phase, cases with high duties experience far more failure than those with low duties. However, by the end of the long-run (20 quarter) final duty phase cases with low duties have greater failure.

6 Robustness

We now examine the robustness of our results. We perform two types of robustness exercises. We begin by re-estimating the model after addressing possible measurement issues in our trade data. Due to space considerations we only report results for

[31] Cases with preliminary duties above (below) the median almost always also have final duties above (below) the median. In our data, over 90% of the cases where the duties are classified as low–low or high–high.

the phases specification.[32] We then perform additional simulation exercises (similar to those in Tables 3 and 4). In these alternative simulations we make different assumptions about the timing of the case and also evaluate the exogenous variables at values other than their means.

6.1 Alternative Specifications

Adjusting for Gaps between Spells

We first explore whether eliminating short gaps between spells affects our results. The significance of short gaps has been discussed in a number of papers in the duration of trade literature (Besedeš and Prusa, 2006a; Hess and Persson, 2011; Görg, Kneller, and Muraközy, 2012). Our concern is that spells separated by a short period of inactivity (no trade) might be more appropriately treated as one longer continuous spell. For example, suppose a trade relationship has two active spells, five and seven quarters in length, separated by one quarter with no observed trade. Should that one quarter of inactivity be interpreted as a failure? Or might it be more sensible to presume the short gap is not economically meaningful and therefore treat the relationship as having one 13-quarter long spell? If the latter, are our results changed?

We adjust the data to treat short gaps as benign, where we define "short" as a gap of 1-, 3-, or 6-quarters. For short gaps we act as if there were positive trade during the gap which leads us to merge two (or more) separate spells into one longer spell. In the 3-quarter gap adjustment, for instance, four consecutive quarters of no trade would be interpreted as a true break in service while a gap of three or fewer quarters will be viewed benignly and the spells on either side of the gap will be merged.[33]

The gap adjusted results are given in columns (2)–(4) of Table 6. For convenience

[32] We estimated our other specifications (basic, duties) after making the adjustments. Results for other specifications are consistent with those discussed in the text and are available on request.

[33] For example, a relationship with two spells, say five quarters and seven quarters, separated by a three quarter gap will be treated as a single 15 quarter spell.

		Gap Adjustment			Unchanged HS
	Benchmark	One-quarter	Three-quarter	Six-quarter	Codes Only
	(1)	(2)	(3)	(4)	(5)
Product with a case	−0.061***	−0.059***	−0.047***	−0.055***	−0.073***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)
Non-named country	0.059***	0.068***	0.089***	0.119***	0.036***
	(0.007)	(0.007)	(0.008)	(0.009)	(0.012)
Named, case dropped	−0.081***	−0.082***	−0.141***	−0.109***	−0.103***
	(0.022)	(0.024)	(0.029)	(0.035)	(0.039)
Initiation phase	0.361***	0.468***	0.526***	0.451***	0.232***
	(0.031)	(0.034)	(0.037)	(0.041)	(0.069)
Preliminary duty phase	0.448***	0.519***	0.495***	0.293***	0.551***
	(0.041)	(0.046)	(0.051)	(0.056)	(0.081)
Final duty phase	0.111***	0.176***	0.238***	0.288***	0.115***
	(0.017)	(0.019)	(0.022)	(0.025)	(0.033)
Constant	3.168***	2.868***	2.658***	2.811***	3.191***
	(0.033)	(0.032)	(0.034)	(0.038)	(0.045)
Observations	5,417,711	5,260,098	5,515,611	6,023,571	3,115,512
Log-Likelihood	−2,641,405	−2,213,098	−1,787,405	−1,493,467	−1,469,299
ρ	0.208***	0.197***	0.215***	0.278***	0.208***

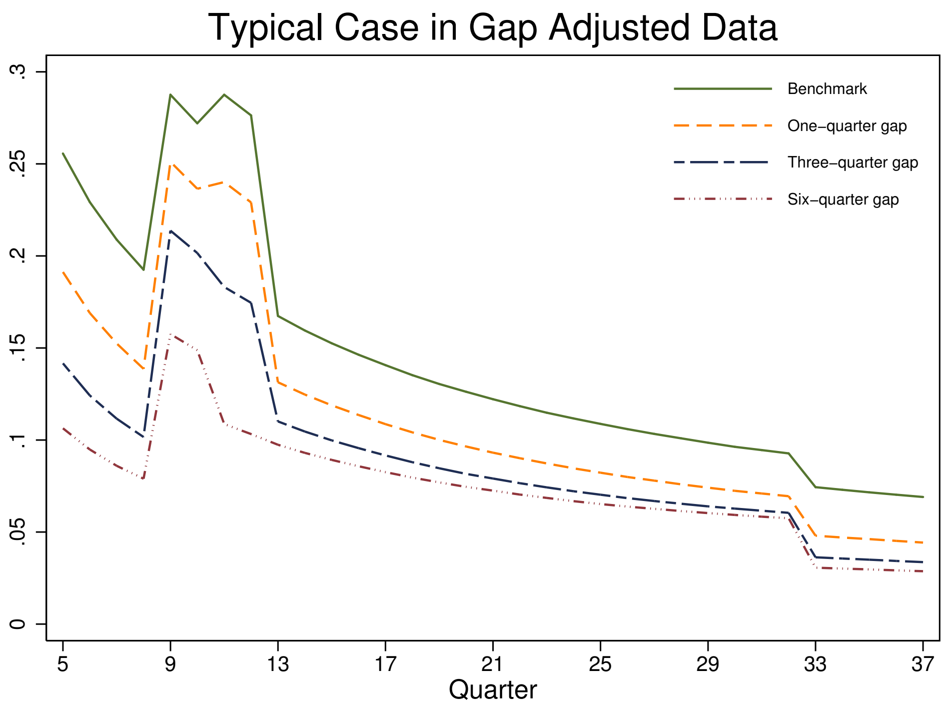
Standard errors in parentheses with *, **, *** denoting significance at 10%, 5%, and 1%.

Table 6: **Alternative Specifications**

we also present the relevant coefficients from our phases specification in column (1). If the high frequency of data is driving failures, rather than spells actually failing, we would expect that the gap adjusted data would reflect either smaller hazard effects or a complete lack thereof. Our results indicate the opposite. Controlling for the various case-related effects, all coefficients of interest remain significant and most increase in magnitude as the length of the gap adjustment increases.

The hazard profiles for each of the gap adjusted data as well as the benchmark data are plotted in the top panel of Figure 5. Merging spells separated by gaps reduces the hazard, as one should expect since it creates longer spells. More relevant for our research question is the finding of continued large hazard effects resulting from an AD case under every gap adjustment. The *relative* effects of an AD case with gap-adjusted data is remarkably consistent. With our benchmark data (i.e., no adjustments for gaps) we noted there would be 66% fewer active spells at the end of a typical case than if there was no case. With one-quarter gaps eliminated there would be 69% fewer active spells, while with 3- and 6-quarter gaps eliminated there would be 68% and 62% fewer active spells.[34]

[34]Full results reported in Appendix B.



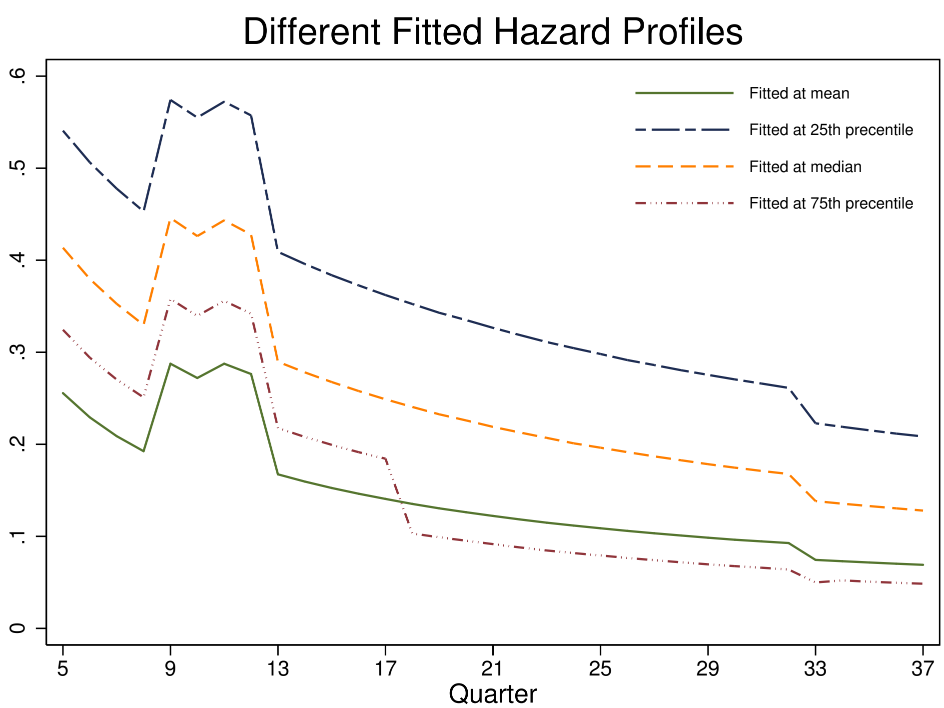


Figure 5: **Robustness Plots**

Product Code Changes

We were concerned by the potential role played by product code changes. Codes are often changed for a variety of reasons, with new codes introduced and old codes discontinued. These redefinitions are potentially problematic as they could possibly introduce artificial failure, where a spell ends not because the actual flow of trade ceased, but because the code is no longer used. In our benchmark analysis we controlled for implications of a code change with our left-censored and right-censored adjustments. We now examine whether this benchmark approach affects our results. We do so by limiting our sample to only those codes which were not changed between 1990 and 2007 using the Pierce and Schott (2012) concordance of U.S. 10-digit HS codes.[35] As seen in column (5) of Table 6, our results are qualitatively unchanged as compared to the benchmark results. In fact, arguably the major impact from restricting our analysis to unchanged codes is a 40% reduction in our sample size.[36]

6.2 Alternative Simulations

Starting Point of a Case

In all our simulations of the effect of an AD action we have assumed that the investigation started in quarter nine, the median starting point for an active spell in our sample. We now investigate how the effect of a case depends on when it commences. We compare that simulated profile with profiles where the case start in different times: in quarter 5, quarter 13, etc.

[35] We chose to investigate the constant set of codes, rather than reclassifying codes using the Pierce and Schott (2012) algorithm. Their approach involves synthetic HS codes which unify all codes that belong to the same code family. This approach is a problem for our study. In our application a single synthetic code contains a mix of HS codes, some that were subject to a case and others that were not. This makes it difficult to characterize whether the synthetic code was subject to an investigation.

[36] The HS codes that change in our sample account for 55% of all observed U.S. imports over this time period. These figures are comparable to those reported by Pierce and Schott (2012). They report that between 1989 and 2004 43% of all products accounting for 59% of all U.S. imports are in HS codes that changed.

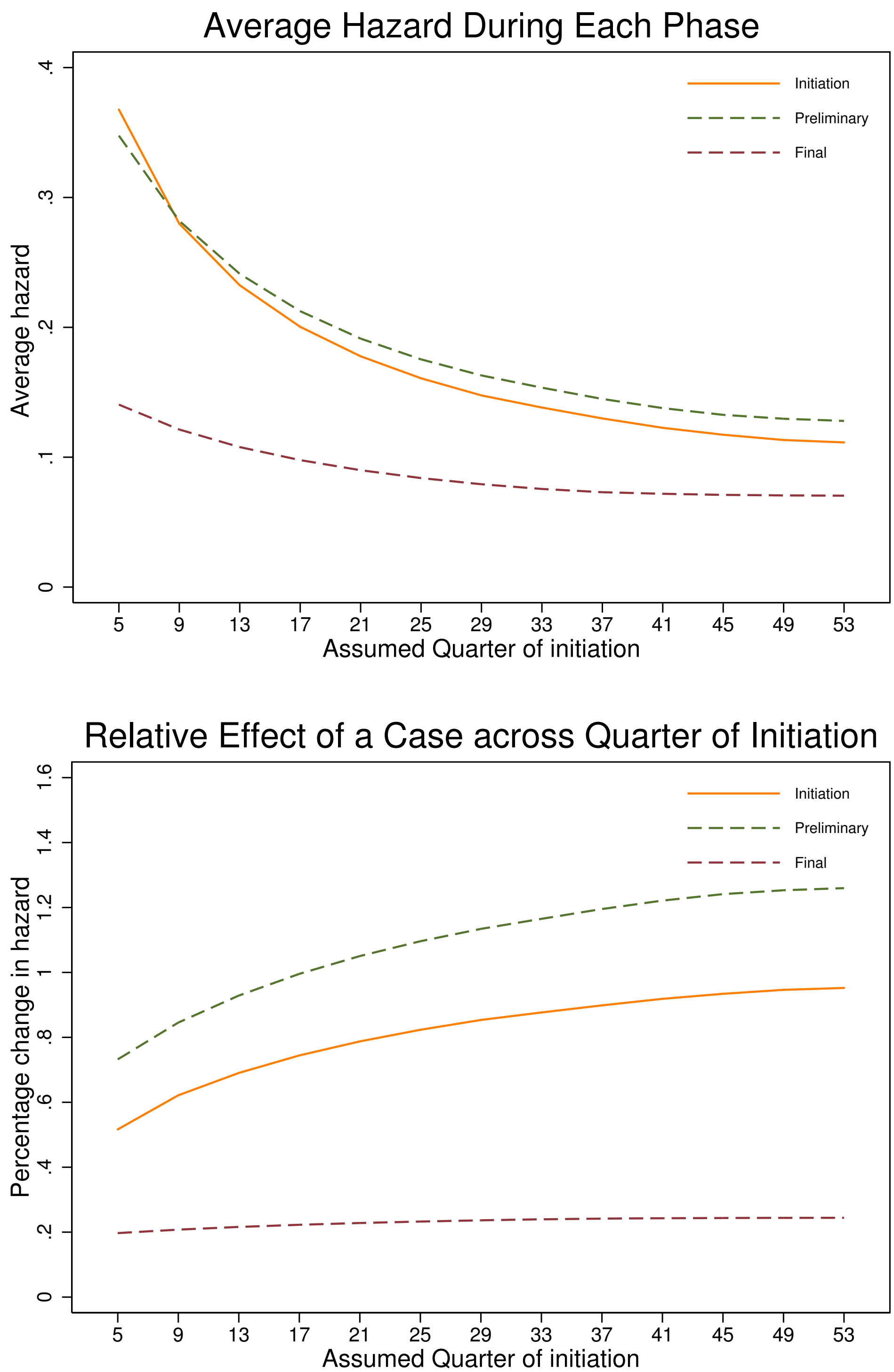


Figure 6: **Average Hazard Effects by Phase and Quarter of Filing**

The upper panel of Figure 6 shows the average hazard during each phase as it varies with the (assumed) quarter of initiation. Consider when a case is initiated in quarter five. The figure shows that average hazard is 36.8% during the initiation phase, 34.8% during the preliminary phase, and 14.1% during the final phase. This analysis confirms that the hazard rate during each phase differs from the average hazard for the entire case. In addition, the figure reveals that as the quarter of initiation of a case increases, the average hazard during each phase decreases. For instance, the average hazard during the preliminary phase is 34.8% if the case is initiated in quarter five, 28.2% if the case is initiated in quarter nine, 24.1% if the is case initiated in quarter thirteen, and progressively falls until quarter 53 when the average hazard during the preliminary phase is just 11%.

The declining effects do not necessarily imply that the impact of an AD action is less important. Rather, one needs to recognize the average hazard in the absence of a case also decreases as the starting time increases. Thus, we believe the case effect should be measured relative to the "no case" hazard. The bottom panel of Figure 6 plots the percentage change in the hazard associated with a phase relative to the hazard when there is no case. Even though the average hazard of an AD action decreases with the quarter of initiation, the relative effect *increases*. For example, look just at the effect of the preliminary phase. If the case is initiated in the fifth quarter the AD action increases the relative hazard by almost 73%, while if the case is initiated two years later, in quarter 13, the AD action increases the relative hazard by almost 92%. A similar pattern is seen for the AD's effect during the initiation phase. AD's effect during the final phase is constant as starting time varies. Thus, while the upper panel suggests that AD's impact on the hazard for longer lived spells decreases the later the case is initiated, the bottom panel shows that the relative effect actually increases the later the case is initiated.

Fitting the Hazard at Values other than Sample Mean

Throughout our analysis we have consistently used the fitted hazard evaluated at the mean value of each variable across all observed spells. We now simulate the fitted hazard at other points in the distribution of every variable. In the bottom panel of Figure 5 we plot the hazard fitted at mean, median, the 25^{th}, and the 75^{th} percentiles. The fitted hazard evaluated at the mean produces a more rapid reduction in the number of surviving spells than the alternatives. The hazard evaluated at the 25^{th} percentile displays the highest hazard, generally at least twice as large as the hazard evaluated at the mean. This suggests that our benchmark evaluation of the hazard (using the mean) may well understate the actual hazard faced by a typical exporter to the U.S. We further note that the sizeable impact of AD phases is seen regardless of how we evaluate the fitted hazard.

7 Conclusion

In this paper we set out to examine whether antidumping petitions and duties have an effect on the extensive margin of U.S. imports. Using quarterly trade flow data in combination with detailed case-specific data we find that AD actions have a large effect, causing subject suppliers to completely abandon the U.S. market. We find that not only is this effect large, but that there are large differences across different stages of a case. Across all products, an AD action increases the hazard in every stage, but interestingly we find that the smallest effect is during the final AD duty phase and larger effects during the initiation and preliminary phases.

We also find that the effect varies by the size of the AD duty. Cases with lower duties have a more persistent effect throughout the duration of the case, while cases with large duties have a much more dramatic effect during the initiation and preliminary phase but little effect in the final phase. Our results are robust to a number of concerns, including gaps between spells, changes in HS codes, and different assumptions about the timing of a case's initiation.

Given that the existing literature has focused on evaluating the effects of AD actions by focusing on the intensive margin, our discovery of significant effects on the extensive margin implies current estimates of welfare effects associated with AD are underestimated. If AD actions cause exporters to abandon the U.S. market, the consequences in the form of persistently lower competition and higher prices need to be recognized. Further, if a foreign supplier is forced to abandon the U.S. market due to AD, it may be reluctant to return at a future point. This reluctance would be due to the uncertainty associated with the ability of the exporter to recover prospective sunk costs when considering re-entry from the fear of facing another AD claim in the future. It may also be possible that in products or industries where AD activity is particularly intense, such as steel, fewer prospective exporters enter the market due to the risk of facing an AD petition which can make it impossible for the firms to recover the sunk costs needed to service the market. In such instances there may be significant welfare consequences (for specific markets) from potential, but never realized trade.

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A Adjustments to AD Case Data

A few adjustments to the AD case data were required, generally involving cases that were settled or were filed multiple times. AD duty orders are eventually revoked when it is determined that dumping or injury is no longer present. For some cases, the revocation date is missing; this is often true for settled cases. If no revocation information is available, we assume cases were revoked five years after the last decision date recorded in the *Global Antidumping Database* (Bown, 2012). A five year duration was chosen as that is the length of time of the sunset provision.

A separate issue occurs when the same HS-country pair is named in multiple cases. This most typically occurs when the initial petition was rejected very quickly (e.g., in the first quarter). In such cases the domestic industry generally corrects the deficiencies in its petition and re-files at some later date. In such circumstances it seems sensible to focus on the trade impact of the re-filed case. When this occurred we focused on the case which resulted in the imposition of a final duty (i.e., we dropped the quickly rejected petition).

A related issue occurs when the same HS-country pair is named in cases involving different products. For example, a HS code might be included in a case involving "steel plate" and also a case involving "steel sheet." As disaggregated as the HS classification is, it is well documented that the HS system nonetheless has codes that are broader than desired. In the handful of cases where the same HS-country pair was named in multiple cases and the cases involved different product names, we assigned the HS code to the case involving a larger volume of trade.

B Extended Summary Tables of Results

	Average increase in hazard – Phase Specific						Entire Duration of Case	
	Initiation		Preliminary		Final			
Specification	Nominal	Relative	Nominal	Relative	Nominal	Relative	Nominal	Relative
Basic	—	—	—	—	—	—	3.6%	32.7%
Phases	10.7%	62.2%	12.9%	84.6%	2.1%	20.8%	3.7%	33.5%
AD duties								
$\leq$ median	11.3%	59.8%	6.2%	36.9%	4.3%	38.9%	5.1%	41.4%
$>$ median	11.3%	59.8%	24.5%	145.7%	-0.1%	-0.6%	2.9%	23.9%
Gap adjustment								
1 qtr	12.1%	98.8%	12.8%	119.2%	2.6%	38.5%	4.2%	56.4%
3 qtr	11.8%	130.7%	10.0%	127.8%	2.9%	59.2%	4.3%	77.0%
6 qtr	8.3%	118.2%	4.4%	71.9%	3.2%	78.9%	3.7%	83.2%
Unchanged codes	6.3%	39.2%	15.9%	112.4%	2.0%	22.1%	3.5%	34.9%
Fitted at								
25^{th} pctile	14.3%	33.9%	17.7%	45.6%	3.9%	13.6%	5.9%	19.3%
median	13.5%	44.9%	16.5%	60.7%	3.1%	16.7%	5.1%	25.1%
75^{th} pctile	12.2%	53.8%	14.7%	73.0%	1.9%	20.6%	3.8%	34.1%
Initiation qtr								
5	12.5%	51.7%	14.7%	73.2%	2.3%	19.7%	4.2%	31.1%
9	10.7%	62.2%	12.9%	84.6%	2.1%	20.8%	3.7%	33.5%
13	9.5%	69.0%	11.6%	92.9%	1.9%	21.6%	3.4%	35.0%
17	8.6%	74.4%	10.6%	99.6%	1.8%	22.3%	3.1%	36.2%
21	7.8%	78.8%	9.8%	105.0%	1.7%	22.8%	2.9%	37.1%
25	7.3%	82.3%	9.2%	109.6%	1.6%	23.3%	2.7%	37.9%
29	6.8%	85.4%	8.7%	113.4%	1.5%	23.7%	2.6%	38.4%
33	6.5%	87.7%	8.3%	116.5%	1.5%	24.0%	2.4%	38.9%
37	6.1%	89.9%	7.9%	119.5%	1.4%	24.2%	2.4%	39.1%
41	5.9%	91.9%	7.6%	122.1%	1.4%	24.2%	2.3%	38.9%

Table 7: **Impact of AD – Average increase in hazard (Complete Results)**

	Ratio: Spells Surviving AD Case to Spells Surviving with No Case		
Specification	Initiation Phase	Preliminary Phase	Final Phase*
Basic	—	—	36.6%
Phases	75.8%	54.4%	33.9%
AD duties			
≤ median	74.0%	63.4%	23.3%
> median	74.0%	36.8%	37.4%
Gap adjustment			
1 qtr	74.3%	54.6%	31.1%
3 qtr	75.8%	60.2%	32.1%
6 qtr	82.9%	75.3%	38.3%
Unchanged codes	85.5%	56.8%	36.1%
Fitted at			
25^{th} pctile	56.6%	28.6%	6.7%
median	65.1%	39.0%	17.8%
75^{th} pctile	70.9%	47.2%	30.6%
Initiation qtr			
5	69.6%	46.4%	27.2%
9	75.8%	54.4%	34.0%
13	79.2%	75.2%	65.3%
17	81.6%	63.4%	42.9%
21	83.4%	66.3%	46.1%
25	84.7%	68.6%	48.7%
29	85.8%	70.4%	50.8%
33	86.5%	71.8%	52.5%
37	87.2%	73.1%	53.9%
41	87.8%	74.2%	54.8%

* Entire duration of case

Table 8: **Impact of AD – Spells surviving through end of each phase (Complete Results)**