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Size matters! Who is bashing whom in trade war?

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ABSTRACT

In this paper we present a dynamic model of trade wars in contingent protection. We find that "market size" matters in trade wars in the sense that countries are more likely to initiate anti-dumping cases against countries having sufficiently smaller home markets relative to their own, but less likely against countries with larger markets. We test this "selective-targeting hypothesis" using World Bank data of worldwide anti-dumping filings during the years 1995–2014, and find strong support for it. Thus, our study indicates the importance of relative market size in understanding recent patterns of anti-dumping filings and contingent protection in world trade.

1. Introduction

Since the early 1990s the use of contingent protection has spread from a handful of traditional users such as the U.S. and the E.U. to a large number of developing and semi-industrial countries, including Mexico, China, India, Turkey, Egypt, and Brazil (Bown, 2009; Vandenbussche & Zanardi, 2010)[1,2] This phenomenon has prompted the World Bank to create the worldwide dataset of global filing patterns of antidumping (hereafter AD), the most frequent form of contingent protection, allowing economists to study the spread and observed patterns of AD actions.[3]

A line of research has looked into what led to the worldwide spread of use of AD during the 1990s. Since that occurred while GATT/WTO-led tariff-cutting agreements were being concluded, it would be tempting to attribute the spread of AD use to signatory countries' attempt to substitute contingent protection for the tariffs they had agreed to eliminate. However, recent empirical work downplays this substitution hypothesis in favor of the alternative called the retaliation hypothesis, according to which

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[1] Contingent protection refers to antidumping, countervailing duties, and emergency safeguard protection.

[2] The recent rise in AD activity was not unexpected. Ethier (1982) warned us that antidumping would be "the principal battleground for the 'new protectionism'.

[3] Contingent protection is GATT/WTO legal, allowing a member to temporarily impose higher protection against importation of one or more goods from one or more countries (World Bank, http://go.worldbank.org/C8SJJ4GW50). Dong (2013) argues that AD is popular mainly because world trade rules allow it.

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developing and semi-developed countries, having long been targeted by industrial countries' AD laws, have finally codified their own laws so as to retaliate against those industrial countries (Dong, 2013).[4] Despite the spread of AD use, however, the fact remains that a considerable number of AD filings still occur in large industrial countries. For example, the G8 countries have filed (since 205) 21% of all new AD petitions worldwide (Evenett, 2013).

In this paper we extend the literature by providing a novel explanation for the observed patterns of contingent protection, where retaliation will be "selective" and only against trade partners of a particular size. This conclusion arises from an analysis of the dynamic model, where countries differ in domestic market size. Each country is fully aware that contingent protection against imports from a particular country may invoke retaliation and lead to a trade war with that country. The model predicts that a country will initiate contingent protection against imports from a country only if it has a substantially larger market than the latter. We dub this result the "selective targeting hypothesis."

This paper also contributes to a strand of literature on trade wars. The modern analysis of trade wars begins with the classical work of Johnson (1953–54), who considers a one-shot tariff game between two countries in a competitive-general equilibrium model. Extending the Johnson model, Kennen and Riezman (1988) find that "large countries" are more likely to win tariff wars. Elaborating further, Syropoulos (2002) shows that a large country will win a bilateral trade war if its country size exceeds the threshold level relative to the size of the trade partner. However, Kreinin, Dinopoulos, and Syropoulos (1996) find that in a three-country model even a smallest country may win a tariff war against a larger trading partner. These analyses highlight the welfare effect of tariffs through changes in the terms of trade in perfectly competitive environments.

The present paper contributes to the above literature by shifting focus from tariffs to contingent protection and also from perfect competition to imperfect competition. The difference between tariffs and contingent protection is well known; while tariffs must be applied uniformly to imports from all WTO members under the WTO's most-favored nation clause, contingent protection can be used to target specific countries, specific industries and even specific firms without violating the WTO's non-discrimination and reciprocity principles. As a result, contingent protection, unlike tariffs, is likely to generate little terms-of-trade effects. This fact justifies our departure from the general competitive equilibrium model in favor of an oligopolisitc competition model, which has the property that a country can affect its own import price (by AD) but cannot influence the import prices of the other country.[5] In such a setting, when countries play a static tariff game, each country has the incentive to levy an AD duty, regardless of country size. When countries interact repeatedly over time, however, two countries prefer to maintain free trade as long as their home markets are nearly equal in size. If the home market sizes differ substantially, however, the larger country has the incentive to take AD action against the smaller country, fully aware that the latter will retaliate. In contrast, the smaller country values free access to the larger export market and hence will not abandon free trade, unless in retaliation to the large country's unilateral AD action. This result leads to the following empirically testable hypothesis: a country is more likely to initiate AD actions against a country with a relatively smaller home market, but is less likely to do so against a country with a relatively larger home market than its own. We refer to this filing pattern of contingent protection as "selective targeting."

In the second part of this paper, we test the selective targeting hypothesis, using the entire World Bank data of countries involved in AD activities from 1995 to 2014.[6] Using several time-varying measures to capture the absolute and relative market size differences between trade partners, we find strong and robust evidence in support of our selective-targeting hypothesis; namely, the probability and the frequency with which a country initiates AD actions against its trading partner is positively related to its market size relative to the latter's.

At the heart of our analysis is a country's ability to retaliate against a trading partner's unilateral AD action. A number of recent studies have already examined the relationship between a country's capacity to retaliate and its probability of being targeted in AD initiations. In such studies, however, a country's retaliatory capacity is proxied either by the trade volumes with the trading partner in question (Blonigen & Bown, 2003) or by the presence of an active AD law, or lack thereof, in the country (Prusa & Skeath, 2004). In this paper, we find that a country's capacity to retaliate is best captured by its market size relative to that of a potential AD initiator.[7] This is a novel explanation for observed filing patterns. We verify our results using several estimation methods such as a probit model estimated with linear probability regressions as well as a Poison count data model regressions and negative binomial models.[8]

The rest of this paper is organized as follows. The next section lays out the theoretical model. Section 3 utilizes the World Bank global antidumping database during 1995–2014 to test the selective-targeting hypotheses derived from the theoretical model. The final section concludes.

[4] Other studies supporting the retaliation hypothesis include Prusa (2001), Prusa and Skeath (2002, 2004); Martin and Vergote (2008); Feinberg and Reynolds (2006) and Moore and Zanardi (2009). The substitution hypothesis also enjoys some empirical support, notably by Feinberg and Reynolds (2007) and for India by Bown and Tovar (2011), who show that Indian liberalization efforts have resulted in a higher probability of antidumping filings.

[5] The classical work is the Brander and Krugman (1983) reciprocal market model.

[6] Following Bown (2008), we use the AD data after 1995, the year in which the use of AD for all WTO members became guided by a common set of rules for policy applications and international enforcement.

[7] In the current study, the unit of analysis is country-level which bypasses the fact that the likelihood of AD-action is not uniform across industries but more likely to be initiated by some industries than others. Therefore we cannot ascertain that our model would also explain incentives at more disaggregate levels of observations e.g. sector and/or product-level for which other models can be more appropriate (Blonigen & Bown, 2003).

[8] We use the zero inflated variants of those models to account for zeroes observed in the data

2. Theoretical framework

2.1. Basic model

We present a fairly stylized model of international trade in a partial equilibrium setting. The model employs some simplifying assumptions to derive our main result compactly. After it is demonstrated, we will show that the main result holds under more general conditions. We begin by considering the model that has two countries (home and foreign) and two goods (X and Y). Good X has demand only in the home country, and good Y is consumed only in the foreign country. The demand for good X is linear and is given by $P_x = \alpha - Q_x$, where α is the home country demand intercept and Q_x is total quantity demanded in the home country. The demand for good Y which is given by $P_y = a^* - Q_y$ (an asterisk (*) denotes the variables pertaining to the foreign country).

Each industry consists of two firms, one in each country. We normalize marginal cost to zero. In each sector firms play a *Cournot* game. Take good X. The home country protects its firm with a specific tariff t. Then, it is straightforward to show that the home firm and the foreign firm (exporter) produce the quantities

$$\mathrm{x} = (\alpha + \mathrm{t})/3 \text{ and } x^* = (a - 2t)/3. \tag{1}$$

Interchanging labels, we can obtain the equilibrium quantities for good Y, where t* is the foreign tariff:

$$\mathrm{y} = (a^* - 2t^*)/3 \text{ and } y^* = (a^* + t^*)/3. \tag{2}$$

The sum of the profit accruing to the home firms equals

$$(a + t)^2/9 + (a^* - 2t^*)^2/9 \tag{3}$$

while that to the foreign firms equals

$$(a - 2t)^2/9 + (a^* + t^*)^2/9. \tag{4}$$

A country's national welfare consists of the consumer surplus accruing to its consumers, the sum of profits earned by the domestic firms and the tariff revenue its government collects. Home country welfare is computed to equal

$$\mathrm{w}(\mathrm{t}, \mathrm{t}^*) = \left\{(2\alpha - \mathrm{t})^2/2 + 3\mathrm{t}(\alpha - 2\mathrm{t}) + (\alpha + \mathrm{t})^2 + (\alpha^* - 2\mathrm{t}^*)^2\right\}/9. \tag{5}$$

The first term on the right is the consumer surplus, the second is the tariff revenue, and the last is the industry profit. Similarly, foreign country welfare is given by

$$\mathrm{w}^*(\mathrm{t}, \mathrm{t}^*) = \left\{(2\alpha^* - \mathrm{t}^*)^2/2 + 3\mathrm{t}^*(\alpha^* - 2\mathrm{t}^*) + (\alpha^* + \mathrm{t}^*)^2 + (\alpha - 2\mathrm{t})^2\right\}/9. \tag{6}$$

These welfare formulas can be used to compute specific welfare values. First, when there is free trade, the equilibrium welfare levels for the two countries are

$$\mathrm{w}(0,0) = \alpha^2/3 + (\alpha^*)^2/9, \mathrm{w}^*(0,0) = (\alpha^*)^2/3 + \alpha^2/9. \tag{7}$$

Next, in a trade war both countries are assumed to choose the duty levels simultaneously to maximize own national welfare.[9] Substituting the optimal tariff for the home and the foreign country, $t_0 = a/3$ and $t_0^* = a^*/3$, into the above welfare expressions yields:

$$\mathrm{w}(\mathrm{t}_0, \mathrm{t}_0^*) = \left(\frac{7}{18}\right)\alpha^2 + \left(\frac{1}{8}\right)(\alpha^*)^2,\ \mathrm{w}^*(\mathrm{t}_0, \mathrm{t}_0^*) = \left(\frac{7}{18}\right)(\alpha^*)^2 + \left(\frac{1}{8}\right)\alpha^2. \tag{8}$$

Finally, when only the home country imposes the optimal tariff, home country and foreign country welfare are, respectively;

$$\mathrm{w}(\mathrm{t}_0, 0) = \left(\frac{7}{18}\right)\alpha^2 + \left(\frac{1}{9}\right)(\alpha^*)^2,\ \mathrm{w}^*(\mathrm{t}_0, 0) = \left(\frac{1}{81}\right)\alpha^2 + \left(\frac{1}{3}\right)(\alpha^*)^2. \tag{9}$$

[9] See Wu, Chang, and Chen (2013) for welfare implication of AD duties in an importing competing market and the optimal AD duty in a similar setting.

Similarly, when only the foreign country imposes the tariff, home country and foreign country welfare are

$$w(0,t_0^*)=\left(\frac{1}{3}\right)\alpha^2+\left(\frac{1}{81}\right)(\alpha^*)^2,\ w^*(0,t_0^*)=\left(\frac{7}{18}\right)(\alpha^*)^2+\left(\frac{1}{9}\right)\alpha^2. \tag{10}$$

If the countries play a one-shot tariff game, it is easy to show that levying the optimal tariff is the dominant strategy for each country. However, the equilibrium results in the prisoners' dilemma situation, as each country's welfare is lower than when they both practice free trade.

2.2. Repeated interactions

In this section we now enrich the model and consider the conditions for free trade in a repeated game setting.[10] We adopt the grim trigger strategy, which instructs each country to (A) set the tariff to zero in period 1, (B) to maintain zero tariffs in each subsequent period unless either country levied a non-zero tariff in the past, and (C) if a non-zero tariff is observed in any country in the past, to impose the optimal tariff. If both countries play this strategy, the home country has no incentive to deviate from free trade as long as

$$w(0,0)\geq(1-\delta)w(t_0,0)+\delta w\left(t_0,t_0^*\right) \tag{11}$$

or if the discount factor δ satisfies

$$\delta\geq\delta_H=\frac{w(t_0,0)-w(0,0)}{w(t_0,0)-w\left(t_0,t_0^*\right)}. \tag{12}$$

Substituting, we find

$$\delta_H=\left(\frac{9}{16}\right)\left(\frac{a}{a^*}\right). \tag{13}$$

Similarly, the foreign country has no incentive to deviate from free trade if

$$\delta\geq\delta_F=(9/16)\left(a^*/a\right). \tag{14}$$

Assume now that $\alpha>a^*$, i.e., the home country is larger.[11] Then, $\delta_H>\delta_F$ and hence we have the following results:

(i) If $\delta>\delta_H$, there is free trade;
(ii) If $\delta_H>\delta\geq\delta_F$, the small country wants free trade but the large country does not.
(iii) If $\delta_F>\delta$, neither country wants free trade.

If both markets are equal in size, free trade exists if and only if $\delta\geq\delta_H=\delta_F=9/16$. As the market size difference widens, δ_H increases, making the large country less interested in maintaining free trade, whereas δ_F decreases, making the small country more interested in staying with free trade. These facts yield the following testable hypotheses.

Proposition:

(A) *Antidumping actions are more likely to be initiated by larger countries*;
(B) *Antidumping actions are more frequent between dissimilar countries than between similar countries as regards domestic market size.*

The first conclusion of the proposition follows from results (i)–(iii) above. The larger country initiates an AD action unilaterally if result (ii) holds, but there is no circumstance in which the small country initiates an AD action unilaterally. The second conclusion is an immediate consequence of the first. If the discount factor is high enough to rule out result (iii) above, then an AD occurs only if result (ii) holds, i.e., there is a substantial market size difference between the two countries.

2.3. Extensions and variations

The above proposition was derived from the standard Cournot duopoly model. However, the conclusions of the proposition are fairly robust under alternative assumptions, as we demonstrate below. To begin with, price competition does not affect our results, since the effect of protection is similar in price and quantity competition (Helpman & Krugman, 1989).[12] Likewise, our results also hold under the general demand and cost functions used in the standard oligopoly models.[13]

[10] As Dong (2013) argued, dumping and AD are essentially a repeated behavior and should be modeled in a repeated game setting.
[11] Given that markets are segmented, the home market with a high intercept in the demand function will have the higher price and larger total sales in the free trade equilibrium. It can therefore be referred to as the larger market (Gupta, 1999).
[12] In price competition, we must assume products differentiation to avoid the Bertrand paradox.
[13] This is shown in the Appendix.

More controversial is our assumption that antidumping authorities maximize national welfare. While welfare maximization is still widely accepted as the government objective in theory, nowadays many trade economists are likely to agree with Siglitz (1997), who observes that antidumping has nothing to do with welfare maximization; rather it is simply a convenient way for the government to improve the competitiveness of domestic firms against imports. To reflect this view, we may assume that AD duties are set to maximize the domestic firms' profits.[14] Alternatively, we can turn to the literature on political economy to modify the governments' behaviors; for example, Hillman (1982) and Grossman and Helpman (1994) emphasize a tradeoff between the support the government receives from special interests and that from consumers, recommending the government's objective function that gives more weight on the firms' profits. Following this literature, if we let b>1 denote the weight the home government attaches to its domestic firms' total profits, then the home country's objective function is modified to

$$w(t,t^*)=\left\{\frac{(2\alpha-t)^2}{2}+3t(\alpha-2t)+b(\alpha+t)^2+b(\alpha^*-2t^*)\right\}/9. \tag{15}$$

Maximizing this alternative objective function yields the optimal duty $t=(1+2b)\alpha/(11-2b)$, which is higher than the optimal rate $t=\alpha/3$ obtained in our baseline model.[15] However, if the foreign country government behaves similarly, the home country's exporter faces a higher duty rate than in our baseline model and hence its profit (which corresponds to the last term in braces in the above welfare expression) declines more. Further, with more weight placed on the profit, the resulting prisoners' dilemma harms both countries' welfare (as perceived by the governments) even more. Thus, each government has a greater incentive to maintain free trade and avoid AD war than in the baseline model. Despite this qualitative changes, the political economy approach leaves the general conclusions of our proposition unaffected.

Thirdly, suppose that each country has multiple firms in each sector. If the home country has $n_x\geq 1$ firms and the foreign country has $n_x^*\geq 1$ firms in sector X, the equilibrium output by a typical home firm is $x=(\alpha+n_x^*t)/(N_x+1)$ and that by a typical foreign exporter is $x^*=[a-(n_x+t)]/(N_x+1)$, where $N_x=n_x+n_x^*$.[16] As in the baseline model, the home country maximizes the sum of the home country consumer surplus, its firms' profits from domestic sales and the tariff revenues. A straightforward calculation yields the optimal duty:

$$t_x=\frac{[N_x(n_x^*-1)+n_x^*(2n_x+1)]a}{2n_x^*[N_x(n_x+1)-n_x]}>0. \tag{16}$$

The home country's national welfare also includes the domestic firm's proceeds from exports to the foreign country in the Y sector, which equals

$$n_y\pi_y=n_y\frac{\left[a^*-\left(n_y^*+1\right)t_y^*\right]^2}{\left(N_y+1\right)^2}. \tag{17}$$

In this expression, t_y^* is the foreign country's AD duty, and n_y and n_y^* are the numbers of home and foreign firms in Y sector, which add up to N_y. While space prevents us from providing the full analysis, it is not difficult to show that if the two countries are similar, free trade yields a higher welfare to each country than an AD war. To understand this intuitively, assume complete symmetry; then the foreign firms' proceeds from the domestic market equal the home firms' proceeds from the foreign market. Then, home country welfare equals the total surplus generated in X sector, and equals the area under the demand curve; that is, $(\alpha-Q_x/2)Q_x$, where $Q_x=n_xx+n_x^*x^*$. Since $dQ_x/dt<0$, this welfare measure increases if both countries simultaneously eliminate the AD duties. If the foreign market is considerably smaller, however, the domestic firms' proceeds from foreign sales are less important relative to those from the domestic sales, and so the home country is willing to chance an AD war, as stated in the proposition. Thus, as in the baseline model, whether the home country keeps free trade or levies an antidumping duty depends on the size of the foreign market.

Fourthly, suppose there is free entry of firms. Since exporting firms always make smaller profits than home-based rivals under AD protection, with identical market size exporters cease to be competitive and trade is eliminated at any duty rate.[17] To avoid this stark result let us make the following modifications to the baseline model. Suppose that entry requires a sector-specific input. If we assume without loss of generality that every firm requires one unit of such an input to enter, then the equilibrium number of firms in each sector equals the country's total supply of the specific input and hence is given; see Dixit and Grossman (1986) and Thisse (2010) for similar treatments. All free entry does is to transfer the entire firm profits to the owners of the specific inputs. Then, the modified model is exactly the same as the one described in the preceding paragraph and so free entry of firms does not affect our conclusions.

[14] See Miyagiwa, Song, and Vandenbussche (2016) for this approach to AD duty incidence.
[15] We suppose that $b<9/4$ to prevent the duty from being prohibitive.
[16] We assume that all firms are identical within each country.
[17] This result is due to our assumption that exporting firms do not serve their home market consumers. If they serve both home and foreign markets, reciprocal AD duties need not eliminate trade; see Brander and Krugman (1983).

Lastly, it is well known (and our data will confirm below) that only a fraction of AD cases result in actual impositions of protection measures, i.e., AD duties (or price undertaking in many E.U. cases). In actual fact, many AD petitions are withdrawn voluntarily in favor of negotiated settlements between the petitioning firms and the exporters. To understand this phenomenon, a brief description of the AD investigation process seems in order. In the U.S., for example, American firms seeking relief from "dumped or subsidized" imports may file a petition simultaneously with the U.S. Department of Commerce (Commerce) and the U.S. International Trade Commission (ITC). Then, the ITC conducts a preliminary material injury investigation while Commerce sets about determining whether the dumping or subsidization exists and, if so, the margin of dumping or amount of the subsidy. Under the law the ITC is required to complete its preliminary investigation within 45 days of the receipt of the petition. If the ITC determination is negative, the investigation is terminated. Otherwise, both agencies continue their investigations, and the ITC completes its final phase injury investigation within 120 days or 45 days after an affirmative final determination by Commerce, whichever is later. If both the ITC and Commerce determinations are affirmative, Commerce issues an order to assess the AD duty at the rate equal to the dumping margin.[18] The E.U. process is similar, except that the EU Commission is responsible for determination of both dumping and material injuries and that the price undertaking, not an AD duty, is the preferred AD measure.[19]

Our dataset summary in Table 1 below shows good proportions of AD investigations are dropped before AD measures are imposed. Of courses, some cases are terminated because of the lack of evidence of dumping or material injury attributable to dumped imports. However, many more cases are dropped in favor of negotiated settlements with the exporters. Searching an explanation for why voluntary termination of many AD investigations, Prusa (1992) finds that petition withdrawals can be more advantageous to the petitioning firms and industries than the actual levying of AD duties. More pertinent to our paper, however, is his finding that "on average, withdrawing a petition has nearly the same effect as having duties levied." For example, "for the 1981–1982 period, dumping duties lowered the value of trade to 84 percent of its previous value while petition withdrawals were associated with a value of trade that was 80% of its previous value" (Prusa, 1992, page 8). This finding implies that our model is still pertinent in the presence of frequent AD petition withdrawals. The only concern is that, in cases of negotiated settlements, who will appropriate the tariff revenue that would be collected by the government, should the duty be imposed. The strategic trade literature shows that it is the foreign firm that internalizes this revenue as it alters its behavior (e.g., by restricting exports voluntarily or by agreeing to raise export prices to avoid the duty assessments). This loss of the tariff revenue requires some modification in our welfare calculus but the general conclusions of our proposition still remains unaffected.[20]

3. Empirical analysis

3.1. Data

In this section we empirically test the hypotheses (i) and (ii) of the proposition obtained in section 2. To this end, we utilize the country-level information on anti-dumping actions from the *Global Antidumping Database* at the World Bank.[21] The GDP data (real GDP) and economic growth rates come from the IMF's *The World Economic Outlook* (WEO) database, and the population size from *IMF DataMapper*.

Table 1 lists 31 countries in the World Bank dataset as initiators and/or targets of AD actions (including AD investigations and final AD measures).[22] These countries combined generate close to 90% of the world's total GDP and account for 80% of the world's total exports. The first column of Table 1 shows the number of times that each country has acted as an initiator in an antidumping investigation. The third column lists the number of times each country has been targeted by other countries' antidumping investigations. Since AD investigations are often withdrawn or terminated without completion, we also report, in columns (2) and (4), the number of AD measures — the AD investigations that resulted in actual assessments of AD duties (or price undertakings in most European cases). Columns (5) and (6) show each country's average GDP and population during the sample period.

Table 1 displays substantial variations in filing pattern across countries. For example, during the period 1995–2014, China was subject to 997 (the largest number) AD investigations and 724 final AD measures, while it launched 196 AD investigations, of which 142 cases became final AD measures. During the same period, the U.S. faced 256 AD investigations and 150 final AD measures abroad while initiating 469 AD investigations, of which 239 became final AD measures.[23]

Columns (5) and (6) also show considerable differences in market size across countries, allowing us to empirically evaluate the relationship between AD filings and relative market size. For our empirical analysis to be presented below, we pool 20 years (1995–2014) of information for each of the bilateral country pairs.[24]

The summary statistics of our data are reported in Table 2. The *AD_IN_dummy* indicates a bilateral dummy that takes the value 1 whenever a country initiates AD investigations against another country, and takes the value 0 otherwise. The *AD_IN_freq*

[18] See, e.g., https://www.usitc.gov/press_room/usad.htm, or *Antidumping and countervailing duty handbook* (United States International Trade Commission (2015).
[19] See, e.g., http://trade.ec.europa.eu/doclib/html/151016.htm.
[20] If the governments sell protection in exchange for political contributions as in Grossman and Helpman (1994), the loss of the tariff revenue would be even less consequential.
[21] Available at http://econ.worldbank.org/ttbd/gad/
[22] For the selection of these countries we follow Bown (2015)'s "Global Antidumping Database," which discusses the selection criteria in detail. Note that the table includes both AD initiators and targets to avoid selection biases.
[23] Bao and Qiu (2011) find marked asymmetries in filing behaviors when a country is involved in AD cases as a plaintiff and when it is involved as a defendant.
[24] The World Bank's AD data series for the 31 countries in Table 1 start in different years. The data are only from 1995 to avoid the problem of missing values.

Table 1
Individual country as AD initiator and target (1995–2014).

Country	(1) Initiator (investigation)	(2) Initiator (measure)	(3) Target (investigation)	(4) Target (measure)	(5) GDP	(6) Population
Argentina	282	188	43	17	303.10	38.67
Australia	248	81	26	11	754.18	20.55
Brazil	295	141	117	84	1248.71	183.77
Canada	148	69	45	20	1113.07	32.20
Chile	22	3	31	20	135.56	16.18
China	196	142	997	724	3234.42	1287.85
Colombia	63	24	7	1	177.25	42.39
Costa Rica	7	1	1	0	23.86	4.21
Ecuador	2	1	2	2	41.94	13.51
European Union	324	205	554	267	13,098.95	469.42
India	551	395	185	107	987.98	1121.58
Indonesia	107	41	176	106	411.22	224.57
Israel	49	10	12	6	160.64	6.69
Jamaica	5	3	0	0	10.74	2.63
Japan	7	6	184	123	4745.94	126.62
Malaysia	63	36	120	66	161.42	25.63
Mexico	106	68	65	41	789.22	105.93
New Zealand	49	20	10	4	98.10	4.10
Pakistan	68	34	14	8	118.53	155.36
Paraguay	2	1	3	3	12.01	5.76
Peru	92	50	5	1	97.13	27.40
Philippines	18	8	16	6	132.04	84.51
South Africa	208	89	68	41	238.89	47.31
South Korea	120	65	328	189	785.57	47.51
Taiwan	59	15	253	160	359.99	22.58
Thailand	55	36	181	121	212.55	63.84
Trinidad and Tobago	9	7	4	1	14.32	1.30
Turkey	155	132	67	27	475.77	67.30
United States	469	239	256	150	12,047.08	296.06
Uruguay	6	2	5	3	26.99	3.33
Venezuela	11	7	21	10	221.16	26.82

Note: Source of data for anti-dumping cases: Global Anti-dumping Database (World Bank). GDP in billion dollars, population in million.

variable records the number of times the country initiates AD investigations against another country. Accordingly, the *AD_MS_dummy* indicates a bilateral dummy that takes the value 1 whenever a country imposes final AD measures against another country, and takes the value 0 otherwise. The *AD_MS_freq* variable records the number of times the country imposes final AD measures against another country. As for relative market size between target j and initiator i, we use two proxies: the GDP ratio GDP_j/GDP_i, and the population ratio Pop_j/Pop_i. Finally, $Growth_i$ is the GDP growth rate of an initiating country.

3.2. Methodology

To study the determinants of AD actions we adopt the following econometric specification. We assume that whether or not a country initiates an AD action against a specific trade partner in a particular year is related to its partner's market size. We treat the decision to take an AD action as a binary variable, and develop the probit model in which the dependent variable, Y_{ijt}, equals

Table 2
Summary statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
AD_IN_dummy	18,540	0.09	0.299	0	1
AD_IN_freq	18,540	0.20	0.911	0	29
AD_MS_dummy	18,540	0.06	0.244	0	1
AD_MS_freq	18,540	0.11	0.594	0	12
GDP_i	18,540	1366	3259	5.09	18,341
GDP_j/GDP_i	18,540	21.6	108	0.0004	2090
Pop_i	18,540	147.9	297	1.26	1364
Pop_j/Pop_i	18,540	13.8	59	0.000279	1018
$Growth_i$	18,540	3.7	3.6	−13.13	18.2

Table 3
Model on AD-investigation (marginal probability effect).

	(1)	(2)	(3)	(4)	(5)
GDP_j/GDP_i	−0.000935***	−0.000975**	−0.000877**		
	(−3.61)	(−2.44)	(−2.13)		
Pop_j/Pop_i				−0.00130***	−0.00117***
				(−3.28)	(−2.99)
$Retaliate_j$	1.377***	0.509***	0.504***	0.506***	0.503***
	(40.67)	(12.39)	(12.26)	(12.32)	(12.22)
$Growth_i$	0.00408	−0.00591	−0.00108	−0.00561	−0.00133*
	(1.05)	(−1.07)	(−0.19)	(−1.01)	(−0.23)
$GDP_j/GDP_i * Growth_i$			−0.000260***		−0.000201***
			(−2.87)		(−2.68)
Constant	−1.526***	−1.082***	−1.098***	−1.083***	−1.098***
	(−70.30)	(−9.10)	(−9.22)	(−9.11)	(−9.23)
Country FE	No	Yes	Yes	Yes	Yes
Observations	17,580	17,013	17,013	17,013	17,013
Pseudo R^2	0.145	0.374	0.375	0.374	0.375

Notes: t Statistics in parentheses. ***/**/* reflect respectively 1%, 5% and 10% significance level. Coefficients are marginal effects; the coefficients are the marginal probability effects, e.g., −0.000935 means that the probability of observing an AD initiation decreases by 0.0935%.

one if country i filed at least one AD petition against country j in year t. More specifically, we assume that the probability that country i initiates an AD action against country j in year t is defined by

$$\Pr\left(Y_{ijt}=1|X_{ijt},\varepsilon_{ijt}\right)=\Phi\left(X_{ijt}\beta+\varepsilon_{ijt}\right) \tag{18}$$

where X_{ijt} is a vector of regressors including various factors that explain AD filling decisions, ε_{ijt} is an error term capturing unobserved factors, with ε~N(0,1); βs are the parameters to be estimated, and Φ is the CDF of the standard normal distribution. The marginal effect of an individual variable can be interpreted as the effect of a unit change in the independent variables of interest on the probability that a particular country files AD against a trade partner.

3.3. Results

3.3.1. Antidumping investigations

We run regressions based on different sets of explanatory variables. Table 3 shows the results from the probit model, where the dependent variable takes on 1 whenever a country i initiates an AD investigation against a target country j. The dependent variable is regressed on different sets of explanatory variables. For a proxy for relative market size, we consider both the GDP ratio (GDP_j/GDP_i) and the population ratio (Pop_j/Pop_i), where j denotes a target and i denotes an initiator. The estimates are marginal probability effects of a change in the explanatory variable (or a discrete change for dichotomous regressors), i.e., the percentage changes in the average probability of filing an antidumping investigation resulting from a one standard deviation change in each regressor while keeping all other determinants at their mean values.

The results in columns (1)–(3) indicate a statistically significant negative relationship between AD investigations and trade partner's market size. This implies that the probability of AD investigation by a country is negatively related to its trade partner's market size, which confirms our theory. Alternative to relative GDP, we also experiment with relative populations of countries i and j to represent the relative size of their domestic markets. The results for these specifications are shown in columns (4) and (5), but are qualitatively similar.[25] These findings are consistent with our selective-targeting hypothesis.

The above model includes some control variables. A first is designed to capture the effect of business cycles. For example, Knetter and Prusa (2003), Niels and Francois (2006) and Feinberg (2005) found evidence that contingent protection is counter-cyclical. This has the intuitive explanation. During recessions, domestic firms are likely to perform poorly, making it easier to claim material injury for AD actions. Further, foreign firms may price lower for their export during recessions, thereby increasing the likelihood of pricing below fair value (Knetter & Prusa, 2003). Extending this line of research further, Moore and Zanardi (2011) studied the patterns of antidumping for countries at different development levels, and found the following result: declining national economic activities is associated with more AD petitions for developing countries, but evidence is weak for cyclical patterns in developed countries.[26] Continuing with this line of literature, we let variations in GDP growth rate ($Growth_i$) capture the influence of business cycles on AD initiations.

[25] We run regressions using both the univariate models and the multi-variate models but report only the results from the latter due to space. The results from the simple univariate models are available upon request.
[26] However, the significance of their coefficient is not robust across specifications.

A second control variable we use is the interaction term between the growth rate and the relative market size, ($GDPj/GDPi * Growth_i$). Our results show that this interaction term has a negative coefficient, implying that during economic downturn larger countries are even more likely to adopt AD compared with smaller ones. Finally, we include the control variable that reflects strategic interactions in antidumping. The variable $Retaliate_j$ takes the value of 1 if country j takes an AD action in year t − 1 against country i. This variable thus is designed to capture the "*tit-for-tat*" retaliation as proposed by Prusa and Skeath (2004). Our results show that a country is more likely to take an AD action against the previous year's AD initiator against its exports. More specifically we find that, controlling for unobserved country fixed effects, the probability of observing an AD investigation by country j against country i increases by about 50% while keeping all other determinants at their mean values, if the former has been targeted by the latter's AD action in the previous year.

The results in Table 3 confirm that relative market size is important in explaining the pattern of AD activity, and appears robust to the inclusion of additional control variables. The insertion of country-level fixed effects reinforces this result. This is a first confirmation that countries are less likely to initiate contingent protection against a trade partner having a sufficiently larger market size.

3.3.2. Antidumping measures

In Table 4, we run the same specification as in Table 3, but now instead of using AD-initiations, we use AD measures as the dependent variable. As noted earlier, AD measures represent only the AD investigations that were completed and resulted in actual impositions of AD duties or price undertakings. Our specifications in Table 4 show results for the probability model where we alternatively use the relative ratio of GDP (*GDPj/GDPi*) versus the relative ratio of population (*Popj/Popi*) as a measure of relative market size of bilateral trade partners. Whether relative market size is proxied by the GDP ratio or the population ratio, use of AD measures as the dependent variable yields the results very similar to the ones obtained with AD investigations as the dependent variable.

3.3.3. Developed versus developing countries

We next examine whether developed and developing countries behave differently in AD actions. Using World Bank criteria, we classify the countries in our dataset and run regressions separately for developed and developing countries. The results are reported in Table 5. While the negative relative market size effect remains evident, we do find some differences between developed and developing countries. When we use GDP as a proxy for market size, the effect is negative for both groups, but is statistically insignificant for developed countries. In contrast, when we use population as a proxy for market size, we also get statistically significant negative effects for both groups but now the effect is more significant for developed countries than for developing countries. Interestingly, the results in Table 5 also show that business cycles have opposite effects for developed and developing economies. This is consonant with the findings of Moore and Zanardi (2011) mentioned above.

3.4. Alternative models and robustness checks

3.4.1. Antidumping frequency and zero inflated Poisson model

The analysis so far is based on how *likely*, i.e., whether or not, a country initiates AD actions against another country. Such a measure however does not capture the *intensity* of AD activity, i.e., the number of AD initiations within a given time span, say one year. In this subsection, therefore, we examine how *often*, i.e., how many times, a country initiates AD cases against another. For this purpose, we utilize a count data model Poisson regression $E(Y|x) = e^{\theta x}$ where Y is the dependent variable counting how

Table 4
Model on AD-measures (marginal probability effect).

	(1)	(2)	(3)	(4)
GDP_j/GDP_i	−0.00779***	−0.00722***		
	(−5.26)	(−4.32)		
Pop_j/Pop_i			−0.00113***	−0.00102**
			(−2.76)	(−2.50)
$Retaliate_j$	0.106	0.106	0.0878	0.0897*
	(1.45)	(1.45)	(1.20)	(1.23)
$Growth_i$	−0.00583	−0.00399	−0.00495	−0.00101
	(−0.95)	(−0.59)	(−0.81)	(−0.16)
$GDP_j/GDP_i * Growth_i$		−0.000173		−0.000257**
		(−0.67)		(−2.32)
Constant	−1.329***	−1.336***	−1.345***	−1.358***
	(−8.92)	(−8.94)	(−9.02)	(−9.10)
Country FE	Yes	Yes	Yes	Yes
Observations	17,344	17,344	17,344	17,344
Pseudo R^2	0.363	0.364	0.360	0.360

Notes: t Statistics in parentheses. Coefficients are marginal effects. ***/**/* reflect respectively 1%, 5% and 10% significance level.
The coefficients are the marginal probability effects, e.g., −0.00779 means that the probability of observing an AD initiation decreases by 0.799%.

Table 5
Model on AD-measures for developed and developing (marginal probability effect).

	Developed		Developing	
	(1)	(2)	(3)	(4)
GDP_j/GDP_i	−0.00833		−0.00874***	
	(−0.93)		(−4.73)	
Pop_j/Pop_i		−0.00307**		−0.000739*
		(−2.30)		(−1.77)
$Retaliate_j$	0.0264	−0.0428	0.107	0.0915
	(0.14)	(−0.21)	(1.34)	(1.15)
$Growth_i$	0.0650**	0.0657**	−0.00906	−0.00527
	(2.49)	(2.56)	(−1.29)	(−0.80)
$GDP_j/GDP_i * Growth_i$	−0.00348	−0.00295	−0.000133	−0.000243**
	(−1.11)	(−1.34)	(−0.50)	(−2.27)
Constant	−3.406***	−3.432***	−1.268***	−1.283***
	(−10.95)	(−10.99)	(−7.50)	(−7.59)
Country FE	Yes	Yes	Yes	Yes
Observations	2680	2680	13,506	13,506
Pseudo R^2	0.320	0.322	0.360	0.354

Notes: t Statistics in parentheses. ***/**/* reflect respectively 1%, 5% and 10% significance level. The coefficients are the marginal probability effects, e.g., −0.00874 means that the probability of observing an AD measure decreases by 0.874%.

many times the event in question occurs, x is a vector of independent variables, and θ is the vector of the parameters to be estimated. We then use the method of maximum likelihood to estimate the parameter values.[27]

In actual fact, AD activity is a "rare" rather than a "routine" event in any country. Therefore, we normally have lots of "zeroes" in AD counts. An excess of zero counts in the underlying count data makes the Poisson model subject to potential estimation bias for such samples. To overcome this difficulty, we resort to the "zero inflated Poisson (ZIP)" model. The ZIP model consists of two components that correspond to two-zero generating processes. The first one is governed by a binary distribution that generates structural zeros. The second is governed by a Poisson distribution that generates counts, some of which may be zero. The two model components are described as follows: $P_r(y_j=0)=\pi+(1-\pi)e^{-\lambda}$ and $P_r(y_j=h_i)=(1-\pi)\frac{\lambda^{h_i}e^{-\lambda}}{h_i!}$, $h_i \geq 0$, where y_j is the outcome variable, λ is the expected Poisson count, and π is the probability of extra zeros.

We run the ZIP model with relative market size ($GDPj/GDPi$) and with retaliation ($Retaliate_j$) as predictors of the counts, and with the country (of original) as the predictor of the excess zeros. Table 6 reports the results, where the dependent variable is AD-frequency, i.e., the number of AD cases country i initiates against country j.[28] The results in the top row of Table 6 indicate that for each one-unit increase of the size ratio between trade partners (country j vis-a-vis country i), the expected log count of the number of AD cases taken by country i against country j will be reduced roughly by 0.015. Similarity of results between Table 6 and Table 4 indicates the robustness of our findings.

3.4.2. China

Another robustness check consists in verifying whether our empirical results are driven by the fact that we include China or not. We conduct such analysis to address the concern that China is heavily targeted by antidumping worldwide and that China is becoming a more active user of its own antidumping initiations, which makes us wonder if results would go through without China included.[29] This is what we pursue in Table 6 in the last two columns, where we show the results of the zero inflated Poisson model but now excluding (cases both towards and by) China. It can be noted that results are qualitatively the same as that from the sample including China, but the effect of relative size become slightly more significant. In this sense, it is safe to say that the inclusion of China is not driving the main result.

3.4.3. Negative binomial

Finally, we verify our results using negative binomial regressions with frequencies of AD measures as a dependent variable. The negative binomial model is intended to correct the possible misleading results derived from the Poisson models when the restrictive assumptions regarding over-dispersion are not met. Table 7 reports the results of the negative binomial regressions. They again support our hypothesis that countries are more likely to target smaller trade partners in AD.

To conclude this section, our empirical results obtained under different model specifications and with different estimation methods render strong support to our selective targeting hypothesis.

[27] Due to space limitation, the results are omitted but available upon request.
[28] To save space, we only report the results with AD measures; the results with AD investigations are qualitatively the same and available upon request.
[29] We are grateful to one referee for point out this.

Table 6
Zero inflated Poisson count data model on frequency of AD-measures with and without China.

	With China		Without China	
	(1)	(2)	(3)	(4)
GDPj/GDPi	−0.0147***	−0.0134***	−0.0163***	−0.0148***
	(−5.28)	(−4.40)	(−4.44)	(−3.96)
Growthi	0.0000182	0.00371	−0.0142	−0.00938
	(0.00)	(0.41)	(−1.37)	(−0.83)
$Retaliate_j$	0.160**	0.159**	0.239**	0.238**
	(2.05)	(2.04)	(2.00)	(1.99)
$GDPj/GDPi * Growth_i$		−0.000423		−0.000575*
		(−0.93)		(−1.13)
Observations	18,540	18,540	17,342	17,342

Note: t Statistics in parentheses. ***/**/* reflect respectively 1%, 5% and 10% significance level. The model includes a constant term and predictors for the excess zeros whose estimates are suppressed. The coefficients indicate that for each unit increase of the explanatory variables, the change in the expected log count of the response variable.

4. Concluding remarks

In this paper we develop a dynamic "market-size-matters" model of contingent protection to explain the observed patterns of contingent protection uses in recent years. Since contingent protection policy is country- and firm-specific, we focus on bilateral trade policy between two governments involving two goods. Our model yields the following testable hypothesis: a country initiates contingent protection policy against a trading partner only if the latter has a considerably smaller domestic market than its own, while avoiding confrontation with a country having a substantially larger domestic market than its own. We then test this selective-targeting hypothesis using the World Bank dataset on worldwide antidumping filings and find strong and robust support for it. Our empirical analysis also indicates that during economic recessions large countries are more likely to use AD than small countries. It also uncovers evidence of retaliation as a motive for AD actions, in consonance with the literature investigating similar issues.

Given substantial differences in market size between developed and developing countries, our analysis highlights the difficulty in averting trade wars between the North and the South. In longer runs, as some countries in the South will surely grow economically, the North's incentives to target them in contingent protection will diminish. However, our analysis implies that such "newly industrialized" countries may in turn start trade wars with smaller countries in the South.

In our empirical study we use countries as the unit of analysis, taking no account of the possible inter-industry differences in likelihood of AD actions within each country. A possible future extension therefore is to explore the complementarity of our approach with the one that focuses on AD incentives at more disaggregate (i.e., sector and product) levels (e.g., Blonigen & Bown, 2003).

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Table 7
Negative binomial model on frequency of AD-measures.

	(1)	(2)	(3)	(4)
GDP_j/GDP_i	−0.0157***	−0.0144***		
	(−5.20)	(−4.40)		
Pop_j/Pop_i			−0.00136	−0.00118
			(−1.55)	(−1.35)
$Retaliate_j$	0.187*	0.186*	0.167	0.169**
	(1.80)	(1.80)	(1.61)	(1.63)
$Growth_i$	−0.00298	0.000778	−0.00131	0.00665
	(−0.31)	(0.07)	(−0.14)	(0.66)
$GDP_j/GDP_i * Growthi$		−0.000398		−0.000607***
		(−0.83)		(−2.89)
Country FE	Yes	Yes	Yes	Yes
Observations	18,540	18,540	18,540	18,540
Pseudo R^2	0.315	0.315	0.312	0.312

Note: t Statistics in parentheses. ***/**/* reflect respectively 1%, 5% and 10% significance level. Model includes a constant term whose estimate is suppressed.

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Appendix A. The model under general demand and cost functions

Consider the good X market. Given the home country duty level t the home firm maximizes $\pi_x = p(x + x^*; \alpha)x - c(x)$ while the foreign firm maximizes $\pi_x^* = p(x + x^*; \alpha)x^* - c(x^*) - tx^*$, where α is a demand shift parameter with $\partial p/\partial\alpha > 0$. Assume that the profit functions satisfy the standard properties including strict concavity and differentiability so that the Nash equilibrium $(x(t, \alpha), x^*(t, \alpha))$ is unique and the "Hahn" stability condition is satisfied. Define the total equilibrium output by $X(t, \alpha) = x(t, \alpha) + x^*(t, \alpha)$. Let $\pi_x(t, \alpha)$ and $\pi_x^*(t, \alpha)$ denote the Nash equilibrium profits. It is straightforward to show the effect of a change in t; $dx/dt > 0$, $dx^*/dt < 0$, $dX/dt < 0$, $d\pi_x/dt > 0$, $d\pi_x^*/dt < 0$ at a given α. It can also be shown that an increase in α raises the equilibrium output levels and profits. The good Y market is similar except that the home country is the exporter there. Let $(y(t^*, \alpha^*), y^*(t^*, \alpha^*))$ be the Nash equilibrium output vector and let $\pi_y(t^*, \alpha^*)$ and $\pi_y^*(t^*, \alpha^*)$ denote the Nash equilibrium profits under the foreign country duty t^*. Define home country welfare by

$$w(t, t^*) = \int_0^{X(t,a)} p(z, a)dz - p(X(t, a))X(t, a) + \pi_y(t^*, a^*) + tx(t, a).$$

The first two terms represent the consumer surplus while the last term is the tariff revenue. Foreign country welfare $w^*(t, t^*)$ is similarly defined.

In the one-shot game, the two governments choose their tariff levels simultaneously to maximize respective national welfare, full aware of the consequences of their actions on the profits. The home country optimal duty level t_o satisfies the first order condition:

$$p'(xdx/dt + x * dX/dt) + x + tdx * /dt = 0.$$

Since the first two terms are positive, it is evident that $t_o > 0$. The foreign country's optimal duty t_o^* is similarly calculated to be positive, implying that the two countries are caught in an AD war. Importantly, note that t_o and t_o^* are determined independently of each other, that is, $\partial t_o/\partial t_o^* = \partial t_o^*/\partial t_o = 0$. This is due to the fact that t and t^* affects welfare separately. That is, an increase in t, for example, raises π_x and lowers the home country consumer surplus (net of the tariff revenue), while an increase in t^* lowers π_y but has no other effects. Therefore, if the effect of the foreign AD duty t^* on π_y is similar to that of the home duty t on π_x, the home country benefits from simultaneous reductions in t and t^* by the same rates, implying that free trade dominates the trade war; i. e., $w(0, 0) > w(t_o, t_o^*)$. However, given α, if α^* is arbitrarily small, the effect of the foreign AD duty on π_y is also negligible, so $w^*(t_o, t_o^*) > w(0, 0)$; the home country does not face a prisoners' dilemma situation. By continuity, if α is sufficiently large relative to α^*, we still have that $w^*(t_o, t_o^*) > w(0, 0)$. An extension to a repeated game setting is straightforward.

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