The Aftermath of Anti-dumping: Are Temporary Trade Barriers Really Temporary?

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Abstract

This paper analyses the long-term impact of anti-dumping (AD) measures. In line with previous studies, we document a trade-depressing effect of AD measures on the exports of targeted countries while such measures are in force. However, in addition and new to this literature, we find strong evidence of a lasting negative effect which survives well beyond the revocation of the AD measures. In particular, our results indicate that while there is evidence of a short-lived bounce back of exports following immediately from the revocation of a previously installed AD measure, bilateral trade does not fully recover to its pre-intervention level.

Keywords: Antidumping, temporary trade barriers, trade depression, gravity model of trade, panel data, hysteresis

JEL classification: F13, F14

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1 Introduction

Despite the recent backlash against international trade, the past 25 years have brought about ongoing changes in the landscape of global trade policy. While tariffs continue to be the most powerful trade barrier in force, their average has fallen within this period both multilaterally in the course of the World Trade Organization's (WTO) Most Favoured Nation (MFN) practice, and more regionally owing to the contemporary growth of RTA. During this time, there has been a considerable increase in the use of non-tariff barriers with anti-dumping (AD) activity being the most prominent one (Prusa, 2005; Bown, 2011; Kee et al., 2013).

AD policy has long been a trade policy instrument of only a handful of mainly developed countries led by the United States, the European Union (EU), and Canada. Part of the extensive increase in global AD activity beginning from the 1990s is attributable to so-called "new heavy users", a group of emerging market economies (Bown, 2008). To this date, however, the reasons for this AD proliferation remains controversial. While AD policy finds WTO-legitimation if applied in order to prevent or offset "unfair" price setting in international trade relations, empirical literature has found evidence for various alternative – rather protectionist-inspired – explanations ranging from "trade policy substitution-" (Feinberg and Reynolds, 2007; Bown and Tovar, 2011; Moore and Zanardi, 2011; Ketterer, 2016; Silberberger and Stender, 2018) to "retaliation-" (Blonigen and Bown, 2003; Feinberg and Reynolds, 2006) to "safety valve" (Niels and Ten Kate, 2006; Moore and Zanardi, 2009) motives.

The increased proliferation of AD has led to a large body of empirical literature regarding the (immediate) impact of AD measures on affected bilateral trade with results consistently being found to be negative.[1] While the majority of papers has analyzed affected trade relations at sectoral levels (Staiger and Wolak, 1994; Prusa, 1997; Brenton, 2001; Konings et al., 2001; Prusa, 2001; Durling and Prusa, 2006; Ganguli, 2008; Park, 2009), there is also evidence that AD activity hampers aggregate bilateral trade (Vandenbussche and Zanardi, 2010; Egger and Nelson, 2011).

Albeit of equally high relevance from a trade policy perspective, a topic that has received only marginal academic attention concerns the long term impact of AD, in particular the effect upon the pattern of trade after the removal of such measures. This paper, therefore,

[1] Blonigen and Prusa (2016) give a comprehensive literature review on the trade effects associated with AD policy.

aims to fill this gap in the literature by assessing whether AD measures – which by nature are temporary trade barriers – affect trade values negatively exclusively while being in force, i.e. in merely a *temporary* manner, or instead induce *lasting* negative implications for affected bilateral trade even after their revocation. Insights from our research may be considered important for targeted implementation of trade policy that is of relevance not only with respect to AD policy, not just for AD policy but equally for the implementation of other forms of protection such as tariffs.

The idea that external shocks may have lasting effects upon trade, i.e. hysteresis, is not a new topic: the term was introduced in an early paper by Kemp and Wan (1974), and an influential literature developed in the 1980s and early 1990s motivated by the counter-intuitive behaviour of trade and exchange rates which prevailed at the time. We use the theoretical literature that was developed on exchange rate hysteresis in trade as the framework for our theoretical model in which we show that the trade-reducing effect of AD can be a permanent one. Similar to Baldwin (1990) we construct a Cournot model of oligopoly in which we consider persistence of exit of the foreign firm depending on barriers of (re-) entry by exporters. In our theoretical model, lasting effects upon trade may arise for a variety of reasons. First, in our benchmark model we demonstrate how the AD measure, while in force, induces entry by domestic rivals in the targeting country. Following revocation of the AD duty, re-entry may not occur if entry costs are high enough. This scenario may occur even if the productivity (as measured by unit costs) of domestic firms is lower than that of foreign firms. In an extension of the model we show how an AD measure may also have persistent effects on the intensive margin if exporting firms are considering investing in productivity-enhancing infrastructure or technology. In particular, we show that exporting firms may be put off by the AD duty and therefore produce less in subsequent periods, even after the trade measure is revoked. Without explicitly modelling it, we further suggest that AD measures might create a signal, on the part of the imposing country, to potential exporters, and this uncertainty may deter trade and investment (Pauwels et al., 2001). As Egger and Nelson (2011) argue, there is considerable anecdotal but not systematic evidence that previously targeted countries adjust their pricing in order to avoid the risk of AD. We also suggest that trade may be diverted to other destinations in the face of AD measures and if re-entry costs are high this may lead to hysteresis.

We then follow large parts of previous literature on the immediate trade impact of AD activity and employ a gravity-inspired dynamic panel data model that allows to control for forms of unobserved heterogeneity. Our period of investigation ranges from 1991 to 2014, covering 31 countries, including both developed and developing. In line with Bown (2013), which to the best of our knowledge is the only attempt to empirically address the impact of the removal of temporary trade barriers on bilateral trade, we find that exports of targeted countries experience an immediate increase once being relieved from the trade barrier. This effect, however, is only short-term, indicating that there is a hysteresis effect, because targeted countries generally could not manage to re-establish pre-AD export levels.[2]

Finally, considering that the potential existence of lasting trade depression may well depend on the intensity and dimension of the initial trade policy shock we explicitly analyze the aftermath of AD on bilateral trade with respect to variation in case durations. Our findings indicate that AD may have a more concerning trade-depressing effect than previous studies have suggested, especially for lower income countries.

The remainder of this paper is structured as follows: The theoretical model is outlined in section 2. Along with a detailed introduction of the data, our methodology is described in section 3. Section 4 presents the main results whereas section 5 discusses various extensions of our basic model. Section 6 concludes with policy implications.

2 The Theoretical Model

We demonstrate how AD measures might lead to persistent effects upon trade (hysteresis) in a theoretical model of Cournot oligopoly. With the choice of model, simplicity has been our guide. The intention is to provide a simple and clean framework to guide our expectations of the outcome of AD measures on bilateral trade.[3] We assume there are four firms in the model who compete in the familiar Cournot model of quantity competition. There are three periods, where period 0 serves as an initial condition. We trace the effects of anti-dumping in

[2]Bown (2013) analyzes a total of 746 cases that have been imposed and removed across fourteen G20 member countries between 1992 and 2008. His focus is on China, whose exports react differently from the rest of the sample. He finds that China's export performance adjusts comparatively quick and aggressively to improving market conditions, while there is only a moderate short-term effect in other targeted countries.

[3]Our framework has been adapted from Baldwin (1990) which analyses persistence in the entry decisions of firms. In particular, they show how firms, following their entry into a market, do not exit in the face of adverse economic conditions to avoid losing market share. Similar models are found in Baldwin (1988) and Baldwin and Krugman (1989). Our model, however, demonstrates how firms may be deterred from re-entry or how their investment decisions are hampered by a temporary trade impediment

periods 1 and 2. Of the four firms, two are located in country Rest of World (RoW) and the other two are located in country A. The two firms in RoW both produce output at marginal cost c_L and we label these firms $R1$ and $R2$. Similarly, we label the two firms in country A as $A1$ and $A2$, respectively. In our benchmark model, $A1$ and $A2$ differ in productivity, with $A1$ producing at marginal cost c_L, and $A2$ producing at c_H, where $c_H > c_L$. We assume a simple linear inverse demand function $p = a - Q$, where Q is the sum of the outputs of all active firms. The profits of firm j in location i with marginal cost c_k in period t are equal to:

$$\pi_{ijkt} = (p_t - c_k)q_{ijt}, \quad k = L, H \quad i = A, R \quad j = 1, 2, \quad t = 0, 1, 2 \tag{1}$$

Firms incur fixed entry costs which must be paid in the period of entry as well as a fixed operating cost which must be paid in all subsequent periods in order to remain active. The entry cost is denoted E_i, $i = A, R$, where it is assumed $E_R \geq E_A$. That is, typical entry costs which may include marketing, distribution and reputation are larger when operating overseas. If the firm has already entered the market we may assume that it will need to incur fixed per-period costs denoted F_i, $i = A, R$, where $F_R \geq F_A$. We further assume $E_i > F_i \; \forall \; i$. In order to focus the analysis on trade, we rule out the possibility for firms in RoW to serve the market in A through Foreign Direct Investment (FDI). The assets acquired through investment in entry and operating costs (E_i and F_i) are assumed to be entirely firm-specific and have no resale value (sunk costs). Firms discount the future by δ. As such, assuming a firm enters in period 0 and remains active in periods 1 and 2, the present discounted value of profits of firm j in i with marginal cost c_k are:

$$\pi_{ijk}^{PDV} = \sum_{t=0}^{2} \delta^t \pi_{ijkt} - E_i - \delta(1+\delta)F_i = \sum_{t=0}^{2} \delta^t (p_t - c_k)q_{ijt} - E_i - \delta(1+\delta)F_i. \tag{2}$$

2.1 Free trade

We first solve for equilibrium values under the assumption of free trade before moving onto the possibility of AD. In the free trade benchmark, we assume that taste and cost parameters are such that there is only room for three firms. We use backward induction to find the equilibrium under free trade. We provisionally assume that entry of all firms occurs, then solve for equilibrium outputs and ask which firms would find it profitable to enter. The profit-maximising solution obtained by optimisation of (1) yields the following equilibrium output for firm j in RoW in period t:

$$q_{Rjt}^{*} = \frac{a - 2c_L + c_H}{5}, \quad j = 1, 2. \tag{3}$$

Likewise, the profit-maximising solutions for equilibrium outputs of firms located in A, noting the difference in marginal costs, are:

$$q_{A1t}^{*} = \frac{a - 2c_L + c_H}{5}; \tag{4}$$

$$q_{A2t}^{*} = \frac{a + 3c_L - 4c_H}{5}. \tag{5}$$

The assumption of linear demand implies that operating profits of firms in equilibrium is the square of output, $\pi_{ijkt}^{*} = \left(q_{ijt}^{*}\right)^2$. The condition which guarantees that both firms located in RoW are active therefore satisfies $\left(q_{Rj0}^{*}\right)^2 + \delta\left(q_{Rj1}^{*}\right)^2 + \delta^2\left(q_{Rj2}^{*}\right)^2 - E_R - \delta(1+\delta)F_R \geq 0$. The condition that the high-cost $A2$ is active satisfies $\left(q_{A2,0}^{*}\right)^2 + \delta\left(q_{A2,1}^{*}\right)^2 + \delta^2\left(q_{A2,2}^{*}\right)^2 - E_A - \delta(1+\delta)F_A \geq 0$. Algebraically, both foreign firms are active if and only if:

$$c_L \leq \bar{c}_L \equiv \left(\frac{a + c_H - \Omega_R}{2}\right), \tag{6}$$

where $\Omega_R \equiv 5\sqrt{\left(\frac{E_R+\delta(1+\delta)F_R}{1+\delta+\delta^2}\right)}$. Likewise, algebraically, the high-cost firm in A does not enter under free trade if and only if:

$$c_h > \bar{c}_H \equiv \left(\frac{a + 3c_L - \Omega_A}{4}\right), \tag{7}$$

where $\Omega_A \equiv 5\sqrt{\left(\frac{E_A+\delta(1+\delta)F_A}{1+\delta+\delta^2}\right)}$.

2.2 Anti-dumping

We model anti-dumping as a standard trade policy instrument – an import tariff denoted τ – which is levied in period 1 and removed in period 2 on imports from firms located in RoW. The import tariff will reduce output of firms from RoW and may also prohibit imports from one or both firms. In this subsection, we would like to examine the case where the imposition of the anti-dumping duty τ induces at least one firm in RoW to exit the market entirely. Since the two foreign firms are identical, the threshold level of trade protection which induces exit is identical for both. We assume that when the tariff exceeds this threshold, a simple coin toss will determine which of the two firms exit and which remains active. To calculate this threshold level of the import tariff – denoted $\overline{\tau}$ – we compute equilibrium outputs assuming all three firms are active ($R1$, $R2$ and $A1$), then solve for the level of τ which leaves R_j, $j = 1, 2$ with negative profits. Optimisation of (1), assuming $A2$ is inactive, yields the following equilibrium solutions for output in period 1:

$$q_{R1}^{AD} = q_{R2}^{AD} = \frac{a - c_L - 2\tau}{4}; \tag{8}$$

$$q_{A1}^{AD} = \frac{a - c_L + 2\tau}{4}, \tag{9}$$

where the superscripts stand for "anti-dumping". The present discount value of profits of foreign firm j is now $\left(q_{Rj1}^{AD}\right)^2 + \delta \left(q_{Rj2}\right)^2 - (1+\delta)F_R$. Hence, at least one foreign firm (chosen randomly by toss of a fair coin) exits if and only if:

$$\tau > \overline{\tau} \equiv \frac{a - c_L + \overline{X}_R}{2}, \tag{10}$$

where $\overline{X}_R = \sqrt{16(E_R + \delta F_R) - (a - c_L)^2}$. The high-cost domestic firm will be able to enter if the present discounted value of its profits for periods 1 and 2 are non-negative. We can solve for the specific threshold of marginal costs which guarantees this by first solving for equilibrium outputs of active firms (one foreign firm, and two domestic firms), then solving for the threshold of marginal cost which delivers non-negative profits for the high-cost firm. We find that the high-cost domestic firm enters in the last two periods if and only if:

$$c_h < \overline{c}_H^{AD} \equiv \frac{a(2+\delta) + 2(c_H + \tau) + \overline{X}_A}{4 + \delta}, \tag{11}$$

where $\overline{X}_A = \sqrt{16F_A\delta(4+\delta) - \delta(a - c_H)^2 + 2\delta\tau(a - c_H) - \delta\tau^2}$. If conditions (10) and (11) hold, then the economy will not return to the free trade equilibrium in period 2. Instead of two foreign firms and one domestic firm serving the market in country A, there will be two domestic firms and one foreign firm. Hence, the effect of the anti-dumping duty is to increase the number of domestic relative to foreign firms, thereby increasing the size of the domestic sector.

In this scenario, the expansion of the inefficient domestic firm delivers hysteresis. The assumption that firm $A2$ is less productive than the other three is not necessary for hysteresis to occur, however. In fact, an alternative scenario is based on multiple equilibria [citation needed]. Suppose there are four identical firms with two located in RoW and two located in country A. Suppose initially, that is in period 0, two foreign firms and one domestic firm are active, and that taste and cost parameters ensure that only three firms can be active at the same time (if they are to make non-negative profits). Similar to the case analysed formally above, it is possible that the protection the AD duty offers allows firm $A2$ to enter the market, and when this duty is revoked, the foreign firm which exited in response to the protective measure cannot re-enter. In this case, the sector moves from one equilibrium to another.

In the cases studied thus far, hysteresis comes about due to exit of at least one foreign firm. Hysteresis of an anti-dumping duty may also occur without affecting the number of foreign firms. We now assume an alternative model with one firm located in RoW labeled firm R and one firm located in country A labeled firm A. We assume all firms are active in 3 periods such that there is no entry or exit decisions. Suppose in period 1 the foreign firm has the opportunity to invest an additional fixed cost G_R in addition to the fixed cost required to remain active F_R. Such investment can be seen as R&D, for example. The investment is assumed to be durable for two periods. Incurring the additional investment allows the firm to produce at half marginal cost in the current period, $\frac{1}{2}c_R$ and at zero marginal cost in the following period. Under free trade the foreign firm will make this investment if and only if:

$$\pi_{it}\left(\frac{1}{2}c_R\right) + \delta\pi_{it}(0) - (1+\delta)F_R - G_R > \pi_{it}(c_R) + \delta\pi_{it}(c_R) - (1+\delta)F_R, \quad i = A, R \quad t = 1, 2. \tag{12}$$

We continue to assume the linear demand function $p = a - Q$ where Q is total output which is now the sum of the outputs of the foreign and domestic firms $Q = q_A + q_R$. We can use a two-firm version of (1), optimise with respect to outputs and then plug the resulting equilibrium outputs into (12), noting that equilibrium profit is output squared. Under free trade, the firm located in RoW will make the additional investment if and only if:

$$G_R < \overline{G}_R^{FT} \equiv \frac{c_R}{9}\left(4\delta(a - c_A - c_R) + 2(a - c_A) - 3c_R.\right. \tag{13}$$

Under anti-dumping, using similar steps, we can solve for the threshold level of G_R for which the foreign firm will make additional investment. The foreign invests if and only if:

$$G_R < \overline{G}_R^{AD} \equiv \overline{G}_R^{FT} - \frac{4\tau}{9}\left(2a - 3c_R - 2c_A\right). \tag{14}$$

It is easy to see that $\overline{G}_R^{AD} < \overline{G}_R^{FT}$, implying that under free trade, the foreign firm can afford to incur a higher cost of the efficiency-enhancing technology. Notice that the AD measure may have lasting effects, since after the revocation of said measure, output may be affected (period 2).

Hysteresis can be exacerbated if there is some uncertainty regarding whether the AD duty will be renewed or re-established once production increases. This reduces the expected profits of foreign firms and in the cases considered above, it may increase the likelihood of exit or further deter investment. As we mentioned in the introduction of this paper there is, however, only anecdotal but no systematic evidence on this Egger and Nelson, 2011.

There may also be the possibility of hysteresis following revocation of anti-dumping if such measure induces firms to incur sunk investments to other destinations. The reorientation towards other markets may persist if such investment is sunk.

3 Data and Methodology

Data

We extract annual bilateral import flows at the Harmonized System (HS) four-digit commodity level from the UN Comtrade database and combine those with aggregated AD information from the World Bank's Global Anti-dumping Database (GAD) collected by Bown (2015). This leaves us with a bilateral panel of 31 countries (see Appendix, Table 2.A.1 for the list of countries in our sample). The time period under consideration ranges from 1991 to 2014. For several imposing countries, however, AD data is not available from as early as 1991. Our data source also contains information regarding pre-1991 AD activity for individual countries, allowing to partly retrace four-digit AD cases that have come into force prior to 1991. With this, we are able to record the precise total duration of four-digit AD cases in our sample whenever available.

We take into account only those country-pair-commodity combinations that have experienced bilateral AD activity in the years between 1991 and 2014 with a minimum duration of at least twelve months, i.e. a full calendar year. As we consider annual instead of monthly data for our empirical analysis this translates into a minimum duration of at least three consecutive dataset-years since an AD case may begin/end at any point in time throughout the calendar year.

Additionally, we collect AD cases independently of being declared as a preliminary or a final measure. This *in*distinction brings both disadvantages and advantages. On the one hand, the generalization does not allow to analyze separately the effects of preliminary and final AD measures on bilateral trade relations. On the other hand, exclusive concentration on final AD measures would distort precise identification of resulting trade effects due to the omission of preceding trade barriers in force. In this respect, Staiger and Wolak (1994) give evidence on a nearly identical impact of preliminary and final AD measures on trade flows.

Table 1: Frequency of bilateral four-digit anti-dumping cases by duration (terminated cases), 1991-2014.

Duration (years)	AD cases
3	80
4	107
5	82
6	485
7	278
8	98
9	42
10	55
11	106
12	92
13	60
14	31
15	38
16	216
17	20
18	4
19	14
20	9
21	11
22	8
24	8
Total	1,844

Note: Duration in years refers to dataset-years. AD data based on countries considered for empirical analysis (see section 4 for details). Own calculation based on data from Bown (2015).

At a more detailed inspection, our sample originally covers a total of 3,058 bilateral four-digit AD cases between 1991 and 2014, i.e. (i) those that were initiated prior to 1991 and were still in force beyond 2014, (ii) those that were initiated prior to 1991 and have been revoked by 2014, (iii) those that were initiated in or after 1991 and were still in force beyond 2014, and lastly (iv) those that were initiated in or after 1991 and were revoked by 2014. As we attempt to shed light on what happens to bilateral trade relations once relieved from previously imposed AD protection, out of the total of 3,058 cases, we consider only those for empirical analysis that were not in force beyond 2014 – in other words, only those that were terminated between 1991 and 2014 – so that our sample reduces to 1,844 bilateral four-digit AD cases. The mean duration is 9.01 years. Table 1 gives an indication of the frequency of AD cases by their duration in years.

As can be seen, case durations are far from being normally distributed where a cumulated frequency of 50 percent is found for those with a maximum in-force duration of seven years. When examining the noticeable peak of AD cases with a duration of 16 years, Mexico alone accounts for 192 out of the 216. Remarkably, all respective Mexican AD measures were installed from 1993 onwards.[4] There are eight outliers with a duration of 24 years each, all of them with the United States as imposing country. Targeting Japan and the European Union, seven cases span from 1988 to 2011 whereas one has been initiated in 1987 and revoked in 2010.

Moreover, Table 2 lists the ten most frequent AD users within our sample that account for 86.1 percent of respective total AD cases. The group is composed of so-called "traditional" (United States, European Union, Canada, and Australia) and a number of "new heavy" (Mexico, India, Argentina, South Africa, Brazil, and Peru) AD users. Among them, Mexico stands out not only with respect to the number of cases but also with an average imposition of case-specific AD measures of 13.9 years.

Our dataset includes annual effectively applied trade-weighted bilateral tariff rates at the HS four-digit commodity level taken from the World Integrated Trade Solutions (WITS) database whenever readily available.

Lastly, we contribute to the existing literature by incorporating the real exchange rate we calculated using UNCTAD data on annual nominal exchange rate (NER) and Consumer Price

[4]This coincides with previous evidence on rocketing Mexican AD activity in 1993 such as in Francois and Niels (2003) and Niels and Ten Kate (2004) where the former gives Mexico's appreciations of its real exchange rate as a possible explanation.

Table 2: Most frequent four-digit anti-dumping users (terminated cases only), 1991-2014.

Imposing country	Anti-dumping cases	Average duration (years)
Mexico	272	13.9
United States	259	11.3
European Union	229	8.0
India	198	6.7
Canada	172	9.6
Argentina	141	6.0
Australia	115	7.1
South Africa	86	7.9
Brazil	71	7.6
Peru	44	8.5
Total	1,587	9.32

Note: Duration in years refers to dataset-years. AD data based on countries considered for empirical analysis (see section 4 for details). Own calculation based on data from Bown (2015).

Index (CPI) data obtained from UNCTAD statistics (primary source) and the World Bank.[5] Taking into account the European integration process, we compute a representative exchange rate for the European Union with respect to its trading partners. The computational steps are provided in Appendix B.

[5]Nominal Exchange Rates towards the US-Dollar are used to derive bilateral exchange rates for each country with regard to the rest of the world. CPI data are not available for China for the years 1991 and 1992. For this reason, the trend in the GDP deflator (annual percent changes) was used to fill the data series.

Estimation issues

For econometric implementation, we employ a simple gravity-inspired dynamic panel data model as our baseline specification that reads as follows:

$$\begin{aligned}\ln \mathrm{M}_{ijkt} = \beta_0 + \beta_1 \ln \mathrm{M}_{ijkt-1} + \beta_2 \ln \mathrm{M}_{ijkt-2} + \beta_3 \ln \mathrm{Appliedtariff}_{ijkt} + \beta_4 \ln \mathrm{RER}_{ijt} \\ + \sum_{n=T-3}^{T-1} \gamma_n \mathrm{Before}_{ijk,n} + \sum_{m=T+1}^{T+3} \delta_m \mathrm{After}_{ijk,m} \\ + \pi_{ijk} + \eta_{it} + \mu_{jt} + \varphi_{kt} + \varepsilon_{ijkt}, \qquad (15)\end{aligned}$$

where ε_{ijkt} denotes an i.i.d error term, $\varepsilon_{ijkt} \sim (0, \sigma^2_\varepsilon)$, and ln denotes the natural logarithm; M_{ijkt} denotes country i's imports from j in HS four-digit sector k in period t, and β_0 is a constant. In order to capture bilateral import dynamics, we include the first as well as the second lag of the dependent variable. Moreover, $\mathrm{Appliedtariff}_{ijkt}$ is defined as $\left(1 + \frac{\mathrm{Tariff}_{ijkt}}{100}\right)$ where Tariff_{ijkt} is the effective applied tariff of i towards j in commodity k in period t. RER_{ijt} is the real exchange rate between i and j in period t and a rise corresponds to a depreciation of the importer's currency which translates into a loss of purchasing power abroad, presumably resulting in a reduction of imports.

In line with our theoretical model, which suggests that hysteresis is dependent upon a number of industry-specific and country-specific characteristics, we incorporate country-pair-industry effects (π_{ijk}). These effects control for unobserved heterogeneity among triads, and importer-year- and exporter-year effects (η_{it} and μ_{it}, respectively) to account for time-varying omitted variables such as multilateral trade resistance following Baier and Bergstrand (2007). The inclusion of country-pair-commodity effects only allows an interpretation of the within-group effects. As there may be annual commodity-specific global trends in bilateral trade, we also control for time-varying commodity effects through φ_{kt}.

While the inclusion of π_{ijk} resolves a potential bias stemming from the correlation of regressors and unobserved commodity-country-pair specific heterogeneity, there remains a correlation between the lagged dependent variables and the error term because the former are a function of the latter (Nickell 1981). However, Roodman (2009) argues that the bias in question will become insignificant the larger the T-dimension in panels. With this, covering a time span of 25 years, *classical* Ordinary Least Squares (OLS) fixed effects appears to be comparatively more efficient for the dataset at hand than the System Generalized Method of Moments (GMM) estimator suggested by Arellano and Bover (1995) and Blundell and

Bond (1998).[6]

We are interested in the trade-impact of an AD measure's transition from its status of being "in force" and "revoked". Two sets of policy dummy variables therefore form the heart of equation 15 where we define period T as the revocation year of an AD measure imposed by country i on j in sector k. Then, the dummy variable set $\text{before}_{ijk,n}$ creates three different policy dummy variables that equal unity for the last in-force year of an AD measure ($n = T-1$), and for its previous two years ($n = T-2$, and $n = T-3$, respectively), all zero otherwise.[7] Importantly, depending on the actual duration of individual AD cases, $\text{Before}_{ijk,n}$ may not only refer to the *last* years of an AD measure in force but could likewise capture its *initial* years. In a similar vein, $\text{Before}_{ijk,n}$ reduces to a two-period specification for those AD cases with a maximum duration of three years. Recapitulating empirical findings regarding the trade-depressing impact of AD activity on affected bilateral trade, nonetheless, we suspect coefficient estimates of all three to be negatively signed.

By comparison, the dummy variable set $\text{After}_{ijk,m}$ creates three different policy dummy variables that equal unity for the first full year after the revocation of a previously imposed AD measure ($m = T+1$), and for the following two years ($m = T+2$, and $m = T+3$, respectively), all zero otherwise. On the one hand, its coefficient estimates may be negatively signed, signaling lasting trade depression even after an AD measureâĂŹs revocation. On the other hand, its coefficient estimated could likewise be positively signed, indicating a boost in bilateral trade once the trade barrier has been removed.

An alternative empirical strategy to analyze the temporal effects of AD on bilateral trade compared to employing dummy variables would be to consider AD activity more *explicitly*, i.e. taking into account its actual degree of duty. However, there are several caveats speaking against it: (i) firstly, the type of AD measure installed may vary widely across cases encompassing ad-valorem duties, specific duties, suspension agreements, price undertaking from exporters, or duties becoming due only if export prices fall under a certain threshold, which makes consistent incorporation difficult, (ii) secondly, albeit while we use the most comprehensive database currently available for obtaining bilateral AD information, there are nonetheless numerous missing or inconsistent data entries in duty amounts, (iii) thirdly, as

[6]However, the GMM coefficient estimates of the before and after dummy variables confirm the results obtained from the FE regression model. Results are available on request.

[7]Since our main interest is to investigate what happens when an AD measure is revoked and not when it is put in place, we refrain from using an implementation dummy as done in Bown (2013).

our main interest lies in the transition period of bilateral AD measures from being in force to being revoked, one would find strictly zero duties once a measure had been revoked which yields no further informativonal value when incorporated continuously instead of binary, (iv) lastly, as discussed in Prusa (2001), targeted countries may respond to imposed AD duties by adjusting their export prices so that a continuous variable capturing AD activity would presumably underestimate its actual impact on affected bilateral trade.

4 Main Results

Table 3 presents the results of our baseline specification. Columns (1) and (2) report coefficient estimates for model specifications that separately include the sets of the Before- and After policy dummy variables, respectively, and column (3) displays those for their joint incorporation. Across model specifications, both the first and the second lag of the dependent variable are statistically significant at the 0.1 percent level. Their coefficient estimates are positively signed as is expected and close to those obtained in previous works (compare Ganguli, 2008 and Park, 2009). While sign and magnitude of the effectively applied bilateral tariff and the real exchange rate are in line with expectations and the gravity literature, however, the estimates are statistically insignificant possibly due to the incorporation of importer-year-, exporter-year- and commodity-year effects that already absorb a lot of temporal variation across countries and sectors.

Turning towards AD activity, we focus on the results obtained from the joint estimation reported in column (3) and compare coefficient estimates to those of the restricted model versions reported in columns (1) and (2). As expected, the policy dummy variables capturing the last three in-force years of an AD measure prior to its revocation are negatively signed and statistically significant (at least at the five percent level). We observe the largest effect in the last year before the trade barrier is removed ($T-1$) where in economic terms, based on its coefficient estimate, affected bilateral imports are reduced by some eleven percent in the last in-force year of an AD measure compared to a hypothetical counterfactual.Although smaller in economic terms and with a lower level of statistical significance, affected bilateral imports also appear to be lower in $T-2$ and $T-3$ as a result of the trade barrier. Note that in our dataset $\text{Before}_{ijk,T-3}$ may also capture the initial year of the trade barrier which may result in a higher coefficient estimate in $T-3$ than in $T-2$.

The comparatively stronger negative effect in terms of magnitude in the last in-force year of AD could be explained by a possible anticipation effect of market participants in imposing countries. Although there is no general rule for public notification when it comes to the revocation of an AD measure, market participants in imposing countries may well have information on an imminent revocation, for example owing to a reopening of the AD investigation in question or even official announcements in this respect. In expectation of a reduction of import prices as a result of being relieved from the burden of AD in the future, domestic consumers could as a consequence be motivated to postpone their consumption of foreign goods and show an even lower import demand.

When inspecting coefficient estimates of the After dummy variables, we find that affected bilateral imports increase in the very first year after the removal of the AD measure ($T+1$).

The effect is estimated to be statistically significant at the five percent level. The coefficient estimate indicates that imports are 6.5 percent higher compared to the counterfactual of an ongoing AD case. However, in $T+2$ and $T+3$ previously affected bilateral imports do not show any significant positive reaction to the trade barrier's removal anymore. Likewise, we neither find a respective significant effect for the (unreported) fourth year after revocation. Moreover, we also included a policy dummy variable that equals unity in the year of revocation, i.e. in period T, but did not obtain any significant effect in doing so. The findings for the after dummy variables point at a relatively weak trade-resuming effect in contrast to a strongly negative effect of a previously installed measure.

We obtain only slightly different results when the before- and after policy dummy variables are separately included (columns (1) and (2)). All coefficient estimates are slightly larger than those reported in column (3) and the after dummy variable in $T+2$ is significant at the ten percent level. The before dummy in $T-2$, however, is found to be highly significant consistently throughout our estimation, confirming our baseline results

Altogether, we find statistically significant negatively signed coefficient estimates for *all* before dummy variables but only *one* positively signed and statistically significant coefficient estimates for the after dummy variables. With this, we cautiously conclude that the reduction of affected imports due to the imposition of an AD measure cannot be compensated entirely and that lasting trade-depressing effects arising from the trade barrier are very likely.

5 Extension and Robustness Checks

Table 3: Baseline Model Specification

Dependent variable: ln Nominal imports			
	(1)	(2)	(3)
ln Nominal imports$_{ijkt-1}$	0.561***	0.561***	0.561***
	(0.016)	(0.016)	(0.016)
ln Nominal imports$_{ijkt-2}$	0.065***	0.065***	0.065***
	(0.013)	(0.013)	(0.013)
ln Appliedtariff	-0.162	-0.194	-0.172
	(0.266)	(0.269)	(0.267)
ln RER	-0.050	-0.046	-0.052
	(0.091)	(0.091)	(0.092)
Before$_{ijk,T-1}$	-0.124***		-0.116***
	(0.027)		(0.027)
Before$_{ijk,T-2}$	-0.075***		-0.067**
	(0.027)		(0.027)
Before$_{ijk,T-3}$	-0.090***		-0.082***
	(0.029)		(0.029)
After$_{ijk,T+1}$		0.082***	0.063**
		(0.027)	(0.028)
After$_{ijk,T+2}$		0.045*	0.026
		(0.025)	(0.026)
After$_{ijk,T+3}$		0.024	0.007**
		(0.026)	(0.026)
Observations	36,880	36,880	36,880
RMSE	0.724	0.725	0.724
Overall R^2	0.925	0.925	0.925
Within R^2	0.384	0.384	0.384

Note: ***significant at the 1%, **5%, *10% level. Robust, clustered (at country-pair-commodity level) standard errors in parentheses. Country-pair-commodity- π_{ijk}, importer -year- and exporter- year effects, and commodity-year effects (η_{it}, μ_{jt} and φ_{kt}) are always included in the estimation but not reported.

Differentiation by case durations

According to WTO law (Article VI:11) and reflecting the literal meaning of a temporary trade barrier, *de jure* AD measures should be terminated no later than five years after their imposition. *De facto*, this may nevertheless not necessarily be the case as is apparent from the variation in case durations in Table 1. Related to this, one might assume that the effect on trade flows differs with respect to the duration of the AD measure. Trade relations affected throughout a comparatively longer time span will presumably only be revived after a certain time – if at all. Targeted countries may have shifted their export activities to other destinations and fostered those new trade relations in the meanwhile, and hence it takes more time (in this case three years) for previously affected bilateral imports to pick up again after the revocation of the AD measure.

Therefore, we speculate that longer case durations will lead to a higher likelihood of lasting trade depression in affected bilateral trade and separately analyze short-run (shorter than six years) and long-run (longer than twelve years) cases. Avoiding a sample split, we generate four separate sets for each of the before- and after policy dummy variables in the same manner as in the baseline regression yet involving a further differentiation with respect to those case durations (i) shorter than six years, (ii) longer or equal than six years, (iii) shorter than twelve years, and (iv) longer or equal than twelve years. Results are presented in Table 4.

For those AD cases that are in force up to five years (column 1) we do not find any effect on bilateral trade in the years before and after revocation. With this, the baseline regression results presented in Table 3 seem to be driven primarily by cases in force for six years or longer. Hence, AD measures that are literally in force only "temporarily" do not seem to affect bilateral imports significantly.[8] The results reported in columns (2) and (3) where regressions include cases that are in force six and twelve years are in line with the baseline results. We again find affected bilateral imports to be significantly reduced in the last in-force years of an AD measure. A similar picture emerges when we turn towards the trade effects associated with the removal of a previously installed AD measure. As is the case with the immediate impact of AD on affected bilateral trade, we find a continuous trade-depressing effect of AD on affected bilateral trade and a statistically significant stimulation only shortly $(T+1)$ after the revocation. Regarding those cases with a duration of twelve or more years, we only observe a small trade-depressing effect two years before the AD is finally revoked. In addition, trade does not seem to resume immediately after the revocation but instead slightly after three years.

[8] In this setting, $\text{before}_{ijk,T-3}$ definitely captures the initial year of the three-year cases in our sample but is also not statistically significant.

Table 4: Model specification by case duration (CD)

Dependent variable: ln Nominal imports				
	(1)	(2)	(3)	(4)
	cd<6 years	cd≥6 years	cd<12 years	cd≥12 years
ln Nominal imports$_{ijkt-1}$	0.561***	0.561***	0.561***	0.561***
	(0.016)	(0.016)	(0.016)	(0.016)
ln Nominal imports$_{ijkt-2}$	0.0647***	0.065***	0.065***	0.065***
	(0.013)	(0.013)	(0.013)	(0.013)
ln Appliedtariff	-0.185	-0.177	-0.192	-0.163
	(0.267)	(0.267)	(0.266)	(0.269)
ln RER	-0.041	-0.054	-0.047	-0.045
	(0.091)	(0.091)	(0.092)	(0.091)
Before$_{ijk,T-1}$	-0.020	-0.125***	-0.137***	-0.064
	(0.077)	(0.029)	(0.033)	(0.055)
Before$_{ijk,T-2}$	-0.050	-0.069**	-0.064**	-0.101*
	(0.108)	(0.028)	(0.031)	(0.052)
Before$_{ijk,T-3}$	-0.059	-0.084***	-0.080**	-0.041
	(0.120)	(0.030)	(0.036)	(0.050)
After$_{ijk,T+1}$	0.054	0.065**	0.073**	0.027
	(0.073)	(0.030)	(0.031)	(0.058)
After$_{ijk,T+2}$	0.006	0.030	0.021	0.050
	(0.055)	(0.029)	(0.029)	(0.056)
After$_{ijk,T+3}$	0.073	-0.004	-0.009	0.098*
	(0.063)	(0.028)	(0.028)	(0.059)
Observations	36,880	36,880	36,880	38,880
RMSE	0.725	0.724	0.724	0.725
Overall R^2	0.925	0.925	0.925	0.925
Within R^2	0.383	0.384	0.384	0.383

Note: ***significant at the 1%, **5%, *10% level. Robust, clustered (at the country-pair-commodity level) standard errors in parentheses. Country-pair-commodity- (π_{ijk}), importer -year- and exporter- year effects, and commodity-year effects (η_{it}, μ_{jt} and φ_{kt}) are always included in the estimation but not reported.

In summary, the baseline regression results seem to be driven by cases that are in force between six and twelve years.

Differentiation by Income Levels of Imposing Country

We speculate that the imposition of AD could be more trade depressing (in both its immediate and its lasting impact) for countries that provide only marginal economic attraction for exporting countries as is the case with most developing countries. Briefly explained, one may assume that targeted exporting countries could maintain a reorientation of their export activities even after the revocation of the AD measure in question due to reasons of little market potential of previous trading partners.

Therefore, we estimate the baseline model specification separately for high-income countries (Table 5, columns (1) through (3)) and middle and low-income countries (Table 5, columns (4) through (6)).[9] In the following discussion of the results, we again focus on our main specifications reported in columns (3) and (6) in Table 5. The results for high income countries (19,087 observations) are similar to the baseline regression results in terms of magnitudes of coefficient estimates and findings for the after dummy variables, but with the exception that we find the before variables to be significant only in $T-1$. In contrast, an AD measure imposed by lower income countries has a significantly negative effect on affected bilateral imports across all three years before the AD is revoked but no significant trade-resuming effect. We cautiously argue that trade barriers harm high-income countries' imports less than lower income countries' imports.

Share of Imports as Dependent Variable

Lastly, we re-estimate equation 15 with country j's share in total i's import in sector k in period t, $\ln \text{Import share}_{ijkt}$, as the dependent variable instead of the logarithm of bilateral imports. Shares are frequently used as a dependent variable in the literature to examine

[9] The classification of high, middle and low-income countries is based on the World Bank Atlas methodology. In 2003, the threshold was 765 US-Dollars for low income, 3,035 US-Dollars for lower middle income, 9,385 US-Dollars for upper middle income and above 9,385 US-Dollars high income countries.

Table 5: Results by Income Group

Dependent variable: ln Nominal imports						
	High-income countries			Low- and middle-income countries		
	(1)	(2)	(3)	(4)	(5)	(6)
ln Nominal imports$_{ijkt-1}$	0.561***	0.561***	0.561***	0.541***	0.542***	0.541***
	(0.027)	(0.027)	(0.027)	(0.022)	(0.022)	(0.022)
ln Nominal imports$_{ijkt-2}$	0.087***	0.089***	0.088***	0.063***	0.064***	0.064***
	(0.021)	(0.021)	(0.021)	(0.018)	(0.018)	(0.018)
ln Appliedtariff	-0.488	-0.513	-0.506	-0.302	-0.349	-0.308
	(0.558)	(0.556)	(0.556)	(0.438)	(0.440)	(0.438)
ln RER	-0.059	-0.070	-0.063	-0.059	-0.042	-0.061
	(0.148)	(0.149)	(0.148)	(0.144)	(0.143)	(0.144)
Before$_{ijk,T-1}$	-0.160***		-0.153***	-0.121***		-0.107**
	(0.042)		(0.043)	(0.043)		(0.045)
Before$_{ijk,T-2}$	-0.032		-0.028	-0.146***		-0.133***
	(0.038)		(0.039)	(0.047)		(0.048)
Before$_{ijk,T-3}$	-0.048		-0.043	-0.189***		-0.175***
	(0.038)		(0.038)	(0.04)		(0.054)
After$_{ijk,T+1}$		0.093**	0.077**		0.100*	0.065
		(0.035)	(0.035)		(0.051)	(0.053)
After$_{ijk,T+2}$		0.031	0.018		0.106**	0.070
		(0.038)	(0.038)		(0.045)	(0.045)
After$_{ijk,T+3}$		-0.010	-0.023		0.0693	0.0397
		(0.037)	(0.037)		(0.049)	(0.050)
Observations	19,087	19,087	19,087	15,456	15,456	15,456
RMSE	0.682	0.682	0.682	0.773	0.773	0.773
Overall R^2	0.929	0.929	0.929	0.904	0.903	0.904
Within R^2	0.404	0.404	0.404	0.350	0.349	0.350

Note: ***significant at the 1%, **5%, *10% level. Robust, clustered standard errors in parentheses. Country-pair-commodity- (π_{ijk}), importer -year- and exporter- year effects, and commodity-year effects (η_{it}, μ_{jt} and φ_{kt}) are always included in the estimation, but not reported. High-income countries: Australia, Canada, EU, Israel, Korea, New Zealand, Taiwan, USA Upper middle-income countries: Argentina, Chile, Costa Rica, Mexico, Malaysia, Trinidad and Tobago, Turkey, Venezuela Lower middle-income countries: Brazil, China, Colombia, Indonesia, Peru, Philippines, Thailand, South Africa Low-income countries: India, Pakistan

Table 6: Model Variation - Import Share as Dependent Variable

Dependent variable: ln Import share			
	(1)	(2)	(3)
ln Import share$_{ijkt-1}$	0.547***	0.548***	0.547***
	(0.016)	(0.016)	(0.016)
ln Import share$_{ijkt-2}$	0.072***	0.073***	0.072***
	(0.013)	(0.013)	(0.013)
ln Appliedtariff	-0.101	-0.129	-0.110
	(0.241)	(0.242)	(0.241)
ln RER	-0.0419	-0.039	-0.044
	(0.087)	(0.087)	(0.087)
Before$_{ijk,T-1}$	-0.114***		-0.107***
	(0.026)		(0.026)
Before$_{ijk,T-2}$	-0.068***		-0.061**
	(0.026)		(0.026)
Before$_{ijk,T-3}$	-0.070**		-0.063**
	(0.028)		(0.028)
After$_{ijk,T+1}$		0.080***	0.063**
		(0.026)	(0.027)
After$_{ijk,T+2}$		0.038	0.022
		(0.025)	(0.025)
After$_{ijk,T+3}$		0.023	0.008
		(0.025)	(0.025)
Observations	36,880	36,880	36,880
RMSE	0.705	0.705	0.705
Overall R^2	0.872	0.872	0.872
Within R^2	0.373	0.372	0.373

Note: ***significant at the 1%, **5%, *10% level. Robust, clustered standard errors in parentheses. Country-pair-commodity- (π_{ijk}), importer -year- and exporter- year effects, and commodity-year effects (η_{it}, μ_{jt} and φ_{kt}) are always included in the estimation but not reported. Asterisks denote the level of statistical significance with *** p<0.001, ** p<0.01, * p<0.05, âĂă p<0.1.

trade diversion effects arising from AD activity (Park, 2009; Brenton, 2001). Within our sample, a lower country j's share in total i's import implies that, *ceteris paribus*, imports are diverted to other markets. Hence, we assess the effect of an AD measure on changes in the economic importance of one country with respect to total imports. We find that an AD measure in its last three years of implementation significantly reduces the importance of the targeted country. Although the coefficients are slightly smaller, the results indicate that a loss of imports by 10.1 percent (Table 6, column (3)) in the last year of in force cannot be compensated by an increase of 6.4 percent attributed to the revocation. Most importantly, we detect three significantly negatively signed before policy variables but only one positively signed after variable. In summary, the results are quantitatively confirmed that the burden of a temporary trade barrier may indeed prompt targeted countries to shift exports to other destinations in the meanwhile. We find lasting negative implications for trade relations between imposing and target countries of AD protection.

6 Concluding Remarks

Within the past 25 years, AD policy has evolved into a widely applied trade barrier of both developed and developing countries. While its original intention lies in the prevention or offset of price dumping in international trade, recent economic literature has given rise to the concern that AD may simply be another protectionist measure in the set of trade policies. In this paper, we have examined whether AD measures negatively affect bilateral trade as previously documented in the literature. However, in addition, we investigate whether such adverse effects may outlive their revocation. Building upon a theoretical model, our results reveal several insights. Firstly, we find a continuously strong trade-depressing effect of AD on affected bilateral trade even shortly before the revocation of the trade barrier. Secondly, affected bilateral trade increases significantly in the first full year after the revocation of a previously installed AD measure. However, we do not find evidence of a respective stimulus from the second year following the revocation. The estimated cross-country effects seem to be primarily driven by those AD cases that have a duration of more than six, but less than twelve years. Differentiating the sample into high-income and low- and middle-income countries indicates that the trade-depressing effect is much more pronounced in low- and middle-income countries whereas the increase of trade after the revocation of the AD measure can only be observed for high-income countries. The results also hold for the use of share of imports as dependent variable instead of the value of. Additionally, they are robust to the inclusion of panel fixed- and various individual effects.

Based on our findings, we argue that presumably the reduction of imports that a country experiences in the course of the imposition of an AD measure is not compensated by its revocation in most observed cases. Conversely, the negative effect of AD measures on affected bilateral trade is not restricted to their actual temporal duration but instead lasting negative implications arising from AD on affected bilateral trade are highly probable. One possible reason for these findings could be that in response to AD measures targeted countries permanently shift some of their export activities to other countries. The observation that the effect is most pronounced for case durations longer than five years seems plausible since a longer duration increases the incentive for countries to find alternative trade partners. Moreover, low- and middle-income countries seem to face stronger lasting trade-depressing effects. This could be due to their limited economic importance and limited market potential and/or to the higher elasticity of substitution and resulting higher competitive pressure. From a global trade policy perspective, AD measures may thus be considered even more concerning in terms of a trade-depressing effect than previous studies have suggested, especially for lower income countries. With this, it should be chosen as a policy option more cautiously than is currently the case.

Appendix

A Data

Table 2.A.1: Country Sample

Argentina, Australia, Brazil, Canada, Chile (1995), China (1997), Colombia, Costa Rica (1996), Ecuador (1998), European Union, India (1992), Indonesia (1996), Israel, Jamaica (2000), Japan, Republic of Korea, Malaysia (1995), Mexico, New Zealand (1995), Pakistan (2002), Paraguay (1999), Peru (1992), Philippines (1994), South Africa, Taiwan, Thailand (1996), Trinidad and Tobago (1997), Turkey, United States, Uruguay (1997), Venezuela (1992).

Note: The European Union is treated as a single country. Its evolutionary enlargement of member states is considered. Unless otherwise stated in parentheses, the initial year of the respective country in our sample is 1991.

Table 2.A.2: Descriptive Statistics

VARIABLE	Obs	Mean	Std. Dev.	Min	Max
Ln Nominal imports	54,133	15.810	2.918	0.000	24.263
ln Applied tariff	55,649	0.080	0.087	0.000	0.961
ln RER	59,416	-0.953	2.716	-9.698	9.698
ln Import share	54,133	1.807	2.144	-13.154	4.605
$\text{before}_{ijk,T-1}$	59,920	0.031	0.173	0	1
$\text{before}_{ijk,T-2}$	59,920	0.030	0.172	0	1
$\text{before}_{ijk,T-3}$	59,920	0.029	0.168	0	1
$\text{after}_{ijk,T+1}$	59,920	0.028	0.164	0	1
$\text{after}_{ijk,T+2}$	59,920	0.026	0.159	0	1
$\text{after}_{ijk,T+3}$	59,920	0.024	0.154	0	1

Table 2.A.3: Variable Description, Data Transformation and Source

Variable	Description and Transformation	Data Source and Availability
Nominal imports	Volume of annual imports of country i from j at the Harmonised System (HS) four-digit commodity level k in period t in thousands of US-Dollar	UNCTAD (citation needed)
Applied tariff	$\left(1 + \frac{\text{Tariff}_{ijkt}}{100}\right)$ where Tariff_{ijkt} is the ad-valorem effectively applied tariff of i towards j at the HS four-digit commodity level k in period t.	TheWorldBank2013b (citation needed), Trains database
Real exchange rate	Annual bilateral real exchange rate of country i relative to its trading partner j in period t, $\text{RER}_{ijt} = \frac{\text{CPI}_{jt}}{\text{CPI}_{it}} \frac{\text{NER}_{it}}{\text{NER}_{jt}}$, where NER is annual nominal exchange rate and CPI is Consumer Price Index (see Appendix B). To fill in missing CPI data for China for the years 1991 and 1992 the GDP deflator (annual %) was used as benchmark.	UNCTADSTAT (citation needed), World Bank (citation needed)
Import share	Share of j in i's annual total imports at the HS four-digit commodity level k in period t.	Own computation based on data from UNCOMTRADE (citation needed)

$\sum_{n=T-3}^{T-1} \text{Before}_{ijk,n}$	Dummy variable set consisting of three dummy variables that equal unity for the last in-force year of an AD measure that i imposes on j at the HS four-digit commodity level k $n = T - 1$, and for its previous two years $n = T - 2$, and $n = T - 3$, respectively), all zero otherwise.	Own computation based on data from Bown (2015).
$\sum_{m=T+1}^{T+3} \text{After}_{ijk,m}$	Dummy variable set consisting of three dummy variables that equal unity for the first full year after the revocation of a previously imposed AD measure that i imposes on j at the HS four-digit commodity level k $m = T + 1$, and for the following two years $m = T + 2$, and $m = T + 3$, respectively), all zero otherwise.	Own computation based on data from Bown (2015)

B Technical Note: Real Exchange Rate

The annual real exchange rate between importer i and exporter j in period t is defined as $\text{RER}_{ijt} = \frac{\text{CPI}_{jt}}{\text{CPI}_{it}} \frac{\text{NER}_{it}}{\text{NER}_{jt}}$ using UNCTAD data on annual nominal exchange rates NER and CPI data, taken from UNCTADSTAT (citation needed) and TheWorldBank2016 (citation needed). We employ this definition for all sample importers except for the European Union (EU).

In case of the EU we instead rely on the Real Effective Exchange Rate (REER) as we need to consider both the regional integration process of the EU and the relative importance of individual European countries.[10] We follow the methodology introduced in Schmitz et al. (2012) and Turner and Van't dack (1993) and use a double-weighted index. While we rely on the simple RER for all other economies in our sample, we cannot use the simplified measure for the European Union. The REER of country i against the European Union, EU, is calculated as:

$$\text{REER}_{i,EU} = \prod_{e=1}^{N} \left(\frac{\text{CPI}_e}{\text{CPI}_i} * \frac{\text{NER}_i}{\text{NER}_e} \right)^{w_e}, e = 1, 2, ..., N \tag{16}$$

where N stands for the number of countries in the reference group European Union and e are the EU member countries.[11] The NERs for the Eurozone are converted from fixed historical exchange rates of national currencies towards the Euro.[12]

The trade weight w_e of each country in the reference group EU is defined as:

$$w_e = \left(\frac{m^a}{x^a + m^a} \right) w_e^m + \left(\frac{x^a}{x^a + m^a} \right) w_e^x \tag{17}$$

[10] European integration process:

1991-1994: Belgium, France, Germany, Italy, Luxembourg, Netherlands, Denmark, Ireland, United Kingdom, Greece, Portugal and Spain.

1995: Austria, Finland and Sweden joined.

2004: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia joined.

2007: Bulgaria and Romania joined.

2013: Croatia joined.

[11] N varies according to the European integration process.

[12] Naturally, we have to deal with some missing values for Slovenia, Slovakia, Lithuania, Latvia, Estonia, Czech Republic and Croatia for the years 1991, 1992 and 1993. In order to keep the observations, the earliest reported values were taken for previous years. Since individual CPI data only enter as a weight into the REER this is not a problem.

where w_e^m and w_e^x are the import and export weights of each European country in country i's imports and exports from the European Union.[13] m^a refers to country i's total imports from the European countries and x^a are total global exports. Following common practice of central banks, imports and exports refer to trade in manufactured goods. We again use UNCOMTRADE (citation needed) data but on the International Standard Industrial Classification (ISIC) Revision 3 division 15-37 level.[14]

The import weight w_e^m is the simple share of each European country in total imports from the European Union:

$$w_e^m = \frac{m_{i,e}^a}{\sum_{e=1}^{N} m_{i,e}^a} \tag{18}$$

where $m_{i,e}^a$ denotes gross import flows from the European country e into country i.

Double export weights are used to capture the effect of competition faced by country i with respect to global producers of manufactured goods. The export weights also take into account the export flows of country i to all trading partners h. The export weight is defined as follows:

$$w_e^x = \sum_{h=1}^{H} (S_{e,h} x_h), e = 1, 2, \ldots, N; h = 1, 2, \ldots, H \tag{19}$$

where $S_{e,h}$ is the share of e's supply of manufactured goods in country h's market and x_h is the share of each market h in total exports of country i.

$$x_h = \frac{x_{i,h}^a}{\sum_{h=1}^{H} x_{i,h}^a} \tag{20}$$

where $x_{i,h}^a$ is defined as gross exports from country i to country h and $S_{e,h}^a$ is gross export flows from the European country e to all markets h for $e \neq h$ and for domestic supply for $e = h$. Data on domestically produced manufactured goods (ISIC Revision 3, divisions 15-37) is obtained from UNCTADSTAT (citation needed).

[13] The trade weights for the effective exchange rate are averaged over the EU integration period (1991-1994; 1995-2003; 2004-2006; 2007-2012).

[14] Data on domestically produced manufactured goods are available on this classification level.

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