PIIE PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS

WORKING PAPER

20-3 Global Value Chains and the Removal of Trade Protection

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February 2020

ABSTRACT

This paper examines how trade protection is affected by changes in the value-added content of production arising through global value chains (GVCs). Exploiting a new set of World Trade Organization (WTO) rules adopted in 1995 that impose an exogenously timed requirement for countries to reevaluate their previously imposed trade protection, we adopt an instrumental variables strategy and identify the causal effect of GVC integration on the likelihood that a trade barrier is removed. Using a newly constructed dataset of protection removal decisions involving 10 countries, 41 trading partners, and 18 industries over 1995–2013, we find that bilateral industry-specific domestic value-added growth in foreign production significantly raises the probability of removing a duty. The results are not limited to imports from China but are only found for the protection decisions of high-income countries. Back-of-the-envelope calculations indicate that rapid GVC growth in the 2000s freed almost a third of the trade flows subject to the most common temporary restrictions (i.e., antidumping) applied by high-income countries in 2006.

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JEL codes: F13, F14, F68
Keywords: global value chains, trade protection, antidumping

Authors' Note: We thank Alessandro Borin, Paola Conconi, Egor Gornostay, Sacha Kapoor, Marcus Noland, Roman Stöllinger, Patricia Tovar, Lorenzo Trimarchi, Eva Zhang, participants at the European Trade Study Group, the Ljubljana Empirical Trade Conference, the "Economics of Global Interactions" conference at the University of Bari Aldo Moro, and the Midwest International Trade Conference for comments. We also thank John Romalis for sharing his tariff data and Marcel Timmer for help with the intercountry input-output tables. Milla Cieszkowsky and Alisa Yusupova provided excellent research assistance.

1 Introduction

The landscape of international trade has evolved considerably in recent decades with the emergence of global value chains (GVCs), which have been well documented by economists (e.g. see, for example, Baldwin and Lopez-Gonzalez (2015) for a descriptive analysis). Yi (2003) was one of the first to demonstrate that it is the combination of vertical specialization and tariff reductions, but not tariff reductions alone, that explains the significant growth in the trade share of output. More recently, Johnson and Noguera (2017) showed that the value-added share of gross manufacturing exports (as a measure of the extent of processing done in a given country) fell by 20 percentage points between 1970 and 2009, due partly to the signing of regional trade agreements. Both contributions reveal the close relationship between trade liberalization and GVC development.

There is a growing literature that examines the interrelationship of GVCs and trade policy. Blanchard (2007, 2010), Ornelas and Turner (2008, 2012), and Antràs and Staiger (2012) make theoretical contributions by examining the effect of offshoring and foreign direct investment (FDI) on optimal trade policy. The empirical literature that links GVCs to trade policy is less abundant due to previous data availability. Blanchard, Bown, and Johnson (2017) and Ludema, Mayda, Yu, and Yu (2018) are two papers that reveal how GVC development reduces the incentives to apply trade protection. Similarly, Blanchard and Matschke (2015) and Jensen, Quinn, and Weymouth (2015) empirically show how trade policy has become endogenous to FDI and cross-border intra-firm trade. More recently, the trade war that began in 2018 gave rise to papers by Amiti, Redding, and Weinstein (2019), Bellora and Fontagné (2019), Flaaen and Pierce (2019), and Fajgelbaum, Goldberg, Kennedy, and Khandelwal (2020) who focus on the welfare implications of trade protection that take vertical linkages into account.

In this paper, we focus on the pre-Trump era and directly examine the effect of GVCs on trade policy. To do so, we exploit new rules introduced with the creation of the World Trade Organization (WTO) in 1995. Taking advantage of this exogenously-timed requirement for countries to re-evaluate their previously imposed trade protection, our setup resembles a quasi-natural experiment as it makes sure that the timing of the removal (or non-removal) decision is exogenous to the strategic decisions of firms and policymakers. Given this setup, we investigate whether growth in the importing country's domestic value-added (DVA) content in foreign production influences its trade policy. Considering that this DVA growth in production might be related to the fact that there is a trade barrier in place, we further strengthen the identification of the causal effect by using an instrumental variables strategy.

Our analysis combines newly constructed trade barrier review data with the OECD's Trade in Value Added (TiVA) estimates. It comprises 10 countries, 41 trading partners, and 18 industries over 1995-2013. The 10 policy-imposing countries we consider are four high-income (Australia, Canada, the EU, and the US) and six emerging (Argentina, Brazil, China, Mexico, India, and Turkey) economies that together accounted for 71% of world GDP and 65% of world imports in

2013. Our benchmark empirical result indicates that DVA growth in foreign production significantly raised the probability of removing antidumping duties by high-income economies, explaining about a third of these countries' reduction in trade protection in the mid-2000s.

With the availability of more direct measurements of GVCs, there are two papers that are closely related to ours. Blanchard, Bown, and Johnson (2017; BBJ in the following) develop a framework within a terms-of-trade model with political economy considerations to derive empirical predictions on the relevance of home and foreign value-added in foreign and domestic production respectively. Their empirical analysis (based on 14 countries and 16 sectors over 1995-2009) confirms that tariffs and temporary trade restrictions are applied less when GVC linkages are strongest, especially vis-à-vis China.[1] Following the predictions of this model and emphasizing political economy considerations, Ludema, Mayda, Yu, and Yu (2018; LMYY in the following) focus on the trade policies implemented by 28 countries towards China. Exploiting Chinese transaction-level data over 2002-2007, they find that countries curb their trade protection (i.e. both in terms of applied tariffs and antidumping) against China when their imports contain higher shares of DVA. Importantly, they show that this result is further contingent upon the industries' political power as well as the customization of inputs.

In common with BBJ and LMYY, we also use antidumping (AD) as our trade policy instrument. In fact, tariffs are applied to all trade partners (except for preferential tariffs) and change little over time. Instead, AD, which is used to eliminate the injurious effects of unfair pricing, is bilateral, it targets specific products (i.e. often defined at the 8- or 10-digit level of the Harmonized Schedule (HS) classification), and is frequently used by the world's largest economies. Differently from these two papers, we rely on the exogenous timing of the possible removal of trade protection to identify the causal effect of GVCs on trade policy. In fact, since 1995, the large majority of AD duties are applied for an initial period of five years due to the WTO-mandated rules. As a result, AD can only be extended for another five years through an official expiry review. This makes sure that the timing of the removal decision of a trade barrier is exogenous, and creates a suitable setting to analyze the effect of GVC development on the removal of trade protection.

There is anecdotal evidence that many countries have removed certain AD duties from their important GVC-partners. Table 1 panel (a) provides examples where an importer removed duties from export partners that had relatively higher DVA growth but extended them on others for the same product (e.g. in 2000, the US extended AD duties on Japanese *brass sheet and strip* but removed them from the Netherlands; between 1995 and 1999, US value-added in Japanese and Dutch basic metals production grew by -64% and 3% respectively). Table 1 panel (b) shows examples where an importer extended duties on goods that had relatively lower DVA growth but removed them from others imported from the same country (e.g. in 2005, the EU had three duties on India up for expiry; it removed the ones on *non-alloy steel hot rolled flat products* and *cathode-*

[1] Temporary trade barriers include antidumping, which is the most commonly used, countervailing duties, and safeguards. Antidumping can be used in the presence of unfair pricing; countervailing measures are meant to rectify the effects of illegal subsidies; and safeguards can be introduced when countries face substantial import surges.

ray colour TV picture tubes but extended the one on *steel wire rope*; the EU's DVA growth for the 'extended' sector was 32% while it reached 71% and 64% for the two 'removed' sectors respectively).

Our benchmark two-stage least squares result indicates that a one standard deviation increase in predicted DVA growth in foreign production increases the probability of removal for high-income countries by 16.5 percentage points, which explains about a third of the mean removal probability of 48%. This effect does not exist for the emerging country sample. The result for the high-income countries is robust to a battery of sensitivity checks, and is not driven by the most targeted country—i.e. China. In particular, taking the 5-year time exogeneity to the extreme, we uncover the same qualitative result when focusing only on the 134 duties that had to be reviewed by the US in 2000 as a result of the WTO's Anti-Dumping Agreement in 1995. As for the economic effects of our estimates, our back-of-the-envelope calculations indicate that the DVA growth in foreign production has resulted in about 0.48% of high-income country imports to be freed from trade protection in 2006, equivalent to about 30% of these countries' AD stock.

This paper is related to three strands of the international trade literature. As mentioned above, BBJ and LMYY specifically address the issue of how GVCs affect trade policy decisions. Our paper is largely complementary to theirs but differs in substantial ways. First, we exploit the setup of the AD system by focusing on the removal of trade protection, whose timing is exogenously determined. Second, even though political economy considerations play a role in the introduction of AD duties, we close that channel as much as possible by focusing on protection that is already in place. Third, in comparison to LMYY, we can take into account regional GVC developments in Factory North America and Factory Europe instead of only focusing on China (at the cost of using more aggregated industry-level data). Relatedly, whereas LMYY proxy for DVA using gross manufacturing trade data, we are also able to account for value-added arising through *indirect* exports. Finally, our analysis applies to the whole range of products subject to AD measures, and not only final goods as analyzed by BBJ, which is crucial since Bown (2018) finds that countries increasingly use temporary trade barriers (TTBs; i.e. antidumping measures, countervailing duties, and safeguards) on intermediates instead of final goods.

Second is the literature that examines trade protection along a country's supply chain. As already mentioned, Bown (2018) finds evidence of increased use of AD on intermediate goods, threatening GVC linkages. He highlights that many of these TTBs do not expire "on time," ending up being quasi-permanent. Indeed, protecting key inputs can have negative externalities. Vandenbussche and Viegelahn (2018) find that Indian firms that have to pay AD duties to import key inputs severely cut back in production. Similarly, Hoekman and Leidy (1992) provide a simple model to explain how protection on upstream goods can cause downstream users to ask for protection as well. Erbahar and Zi (2017) develop this idea, and find evidence for cascading protection in the US by linking its TTBs through input-output tables. Papers that focus on the political economy channels of trade protection and domestic supply chains include Ludema, Mayda, and Mishra (2018) who find that verbal opposition by firms influence the outcome of US tariff suspensions proposed by downstream firms, and Gawande, Krishna, and Olarreaga (2012) who build on the protection-for-sale model of Grossman and Helpman (1994) and find that trade policy outcomes can be determined by downstream and upstream industries' "lobbying competition."

Third is the literature on the duration of AD duties and their extensions. The long literature on AD seems to have mostly neglected these aspects, which are nonetheless important.[2] Moore (2006) studies the US' AD expiry (or "sunset") reviews, and finds that the US generally followed the WTO's 5-year expiry rule, albeit with some (negative) biases against Chinese exporters. Cadot, de Melo, and Tumurchudur (2007) consider 17 countries for 1979-2005 and using a survival analysis find that the WTO's 5-year expiry rule effectively shortened the duration of AD duties, thanks largely to the new users of AD. Gourlay and Reynolds (2011) analyze the US' administrative reviews and find that foreign exporters rarely request such reviews to lower the duties they face, potentially due to the high costs of the review process. Nita and Zanardi (2013) provide a comprehensive analysis of the EU's AD reviews, and note that AD duties are reviewed frequently in the EU, not just through expiry reviews but also through interim reviews, where duty *levels* are reviewed. When it comes to the analysis of AD extensions, the paucity of data may explain the few contributions in the literature.

In this paper, we construct a unique AD expiry-review database for four high-income (Australia, Canada, the EU, the US) and six emerging (Argentina, Brazil, China, India, Mexico, Turkey) economies for 1988-2013. We document that (i) once up for review, AD duties are removed half the time on average, (ii) duties on Chinese goods are less likely to be removed relative to duties on other countries' products, and (iii) the average duration of a TTB is larger than five years (except for Argentina). In this way, we contribute to the AD literature by establishing that part of protectionism might lie under the disguise of prolonging existing duties, which are not counted as "new" trade barriers in the existing literature. Furthermore, the newly collected dataset will help researchers better understand the review process, which turns out to be important as shown by the results in this paper.

In the next section we provide a brief overview of the AD process, with a focus on its review procedures. Section 3 describes the data and provides stylized facts. In Section 4 we explain the mechanism that ties GVCs and trade protection and how that determines our empirical methodology. In Section 5, we provide our results with robustness checks, and present a quantification exercise. Finally, Section 6 concludes.

2 Antidumping process

Although countries have some flexibility in their AD administration, the process must follow the general framework set out by the WTO's Anti-Dumping Agreement of 1995. In short, a case is initiated by an industry lodging a petition that presents evidence of alleged sales of a given product

[2] See Blonigen and Prusa (2016) for an extensive literature review on antidumping.

from a given country at a price lower than its 'normal value' (i.e. dumping) that cause injury to the domestic industry.[3] Once a case is filed, the relevant authority (or authorities in some countries) pursues an investigation to verify the existence of dumping and injury. If there is evidence that dumping has caused (or threatens to cause) injury to the domestic industry, the administering authority imposes AD duties to rectify the effects of dumping. These duties are applied only to the countries specified in the original petition, with some firms facing substantially higher duties than others due to differences in dumping margins.

Until the introduction of the WTO's Anti-Dumping Agreement, there was no general rule about the length of an AD duty, which could have remained in place without any specific limit (except if the AD legislation of a country already included a time limit). Instead, Article 11.3 of the WTO's Anti-Dumping Agreement specifies that "any definitive anti-dumping duty shall be terminated on a date not later than five years from its imposition ..., unless the authorities determine, in a review ..., that the expiry of the duty would be likely to lead to continuation or recurrence of dumping and injury."[4] Thus, duties are generally introduced for a 5-year period and can be extended beyond this initial time only upon completion of an expiry review. We exploit this WTO rule to make sure that the timing of the possible renewal of a duty is not strategically chosen by the domestic industry or policymakers. Thus, observations in our econometric analysis are duties that are supposed to expire in a given year during 1995-2013 (irrespective of whether or not an expiry review is conducted, as further discussed below). Therefore, a duty against a given country for a specified product may appear more than once in our analysis if that duty is extended at least once.

As an example, let us follow the case of the US duties on *brass sheet and strip* (part of the basic metals sector) imported from Japan and the Netherlands, as reported in Table 1 panel (a). The original petitions were filed by the US domestic industry in July 1987 and the investigation was concluded with the introduction of AD duties in December 1988. As a result of the newly introduced WTO rules, expiry reviews (separately for each country) were initiated in early 1999. Although continued evidence of dumping was found for both countries, material injury caused by imports from the Netherlands was not found. As a result, the AD duties against the Netherlands expired in April 2000, while those on Japan were extended for an additional five years. Absent the new regulations, it is likely that the AD duties against the Netherlands would not have been removed in 2000. The duties against Japan were further reviewed in 2005 and 2011 and extended in both cases.[5] In terms of our econometric analysis, this case provides us with four observations: one review for the Netherlands and three reviews for Japan. Notice that all observations pertain to the period after the WTO's Anti-Dumping Agreement, as we use this regulation to eliminate the endogeneity of a review's timing, not to define a difference-in-differences setup.

While countries have slightly different review procedures (as detailed in Appendix Section B),

[3]See Blonigen and Prusa (2016) for a thorough description of the history and implementation of AD laws.

[4]See `https://www.wto.org/english/docs_e/legal_e/19-adp_01_e.htm` for the description of Article 11.

[5]The effective date of extension of the second review was April 2006 leading to an extension until 2011. Although outside of our sample period, these duties were extended also in 2017 and are still in force.

duties are generally subject to an expiry review if an interested party, or the authority in charge of AD policy, requests that such a review takes place. Thus, not all duties are reviewed. On average, our data (described in the next section) reveals that 69% of duties were subject to an expiry review (with significant heterogeneity across countries). Note that when an expiry review is not initiated, we still have an observation in our dataset for the year in which the duty does expire.

Interestingly, the new WTO requirement applied to all AD duties in place in 1995, and not only to the ones implemented since the introduction of the agreement. As a result, a large number of duties, mostly imposed by high-income countries, were suddenly up for expiry in 2000 (see Figure B.1 in Appendix Section B). In a robustness check, we exploit this characteristic to push our identification strategy to the limit (of available data) by focusing solely on US AD duties up for removal in the early 2000s.

3 Data

In order to exploit the institutional setting of AD removals, we collected expiry-review data for all major AD users via official government sources.[6] These consist of four high-income (Australia, Canada, the EU, and the US) and six emerging countries (Argentina, Brazil, China, India, Mexico, and Turkey). Together, these countries' AD petitions made up 72% of the world AD caseload in 1995-2013, and they accounted for about 71% of world GDP in 2013. This unique dataset enables us to see the initiation, preliminary, and final decision dates, as well as whether the administering authority has decided to remove the duty. Note that not all AD duties are reviewed unless an interested party asks for a review to be carried out. The likelihood of an expiry review investigation and its cost depend on that country's institutional setting. As explained in Appendix Section B, there is heterogeneity of institutional context for the review of AD duties.

We combine our database on AD expiry reviews with the original Global Antidumping Database (GAD) (Bown, 2015) to be able to add duties that expired without an expiry review. This allows us to track each duty from its original imposition date to its expiry/removal regardless of whether the duties were officially reviewed before expiry (we also have investigations that were still in force as of end-2013, the end of our sample period). We create our dependent variable, which is whether the duties are removed or not, by proxying the year that the duties are "supposed to expire." This is simple for cases without an expiry review—for those we take the expiry year as the supposed-to-expire year. For measures with an expiry review, we take the final-decision year of the expiry review investigation as the year when measures are supposed to expire. Thus, for each investigation, we have a supposed-to-expire year variable and a dummy that indicates whether the duties are removed.

In the end, the dataset we use in our econometric analysis includes each AD duty that was up for removal sometime in 1995-2013. Some duties appear only once, as they were not extended when

[6] See Appendix Table A.1 for each country's official online government source.

up for renewal the first time, but some others reappear in different years if they were extended at least once during our sample period. For example, the US duties on Japanese *brass sheet and strip* described in Section 2 were subject to three expiry reviews in 1995-2013. In fact, the same duty appears, on average, 1.2 times in our benchmark regression sample.

Note that an investigation is at the country-pair-HS6 level (most duties are applied at an even more disaggregate level than HS6, but we aggregate up to the internationally standardized HS6 level for cross-country comparison). However, our main independent variable, the growth in DVA in production, is at a more aggregate industry level. Thus, we assign each investigation to one of the 18 tradable IO industries of the OECD's Trade in Value Added (TiVA) database using the HS6-ISIC Rev.3 and ISIC Rev.3-IO industry concordance tables provided by the UN COMTRADE and OECD, respectively. These industries are listed in Appendix Table A.2.

Our main independent variable, bilateral-industry-level growth in DVA, as well as our instruments are from TiVA. For the 1995-2011 period, TiVA computes country-industry-specific value-added content (in millions of $) for each country's exports of a particular industry by multiplying those exports with the global Leontief inverse matrix derived from the the OECD's Inter-Country Input-Output tables.[7] We use these value-added figures to first compute the total share of a country's value-added in another country's exports of a certain industry. Then, using the proportionality assumption, we multiply this share with the exporter's total production of a industry, whose level is also provided by TiVA, to attain value-added figures for each country in another country's production of an industry.

Considering the link between DVA and the removal of trade protection, Figure 1 plots DVA in foreign manufacturing in billions of $ (on the left axis) and removal shares (on the right axis), separately for high-income and emerging countries in our sample. Notice that the removal share is the number of removed country-product duties divided by the total number of country-product duties that are due to expire in a given year. Focusing first on panel (a), both graphs show that the DVA in foreign production has consistently increased since the early-2000s, except during the Great Trade Collapse in 2009, when the DVA in foreign production dropped sharply. Note, however, that the DVA levels of high-income countries are substantially larger than that of emerging countries—at its peak in 2011, the DVA of emerging countries stood at around $1.6 trillion, less than half of the $4 trillion of value-added provided by high-income countries for foreign production. Both graphs seem to indicate that there is a slight downward trend in removal shares alongside a growth of DVA levels in foreign production.

The graphs in panel (b) zoom in on the chemicals and metals sectors, the two industries with the most number of AD duties up for expiry. For high-income countries, there seems to be a positive relationship between removal shares and DVA in metals, but not so much for chemicals. The reverse seems to be true for the emerging country sample: a slightly positive relationship between removal

[7] TiVA uses the methodology of Wang, Wei, and Zhu (2013) who extend the framework of Koopman, Wang, and Wei (2014) to compute bilateral sector-specific value added figures. See `http://www.oecd.org/sti/ind/tiva/TIVA_2016_Definitions.pdf` for a detailed explanation.

shares and DVA for the chemicals sector, but not for the metals sector.

For our regression analysis, there are some data limitations. TiVA provides data for 63 countries only, and lumps the remaining countries into the "rest of the world" category. The list of 63 countries includes all our policy-imposing economies but not all the exporting countries in our sample. Thus, out of the 82 exporters in our data, we are able to include only 41 countries. Nevertheless, this set of countries includes the most frequently targeted countries: China, South Korea, Japan, the US, and the EU (including its individual countries).[8] The same database provides us with gross exports by exporter at the industry level which we use to compute our instrument (construction details are in Section 4). Note that the TiVA database ends in 2011 and since we use lags of DVA growth, our analysis stops in 2012 (and in a robustness check we include 2013 by imputing 2011 DVA figures for 2012).[9]

We obtain industry output growth variables from UNIDO at the ISIC Rev.3 level (we have 74 unique 4-digit ISIC industries). Note that we only control for industry growth rates for the importer—controlling it for the exporter would restrict our sample size even further. Instead, we use GDP growth rates for the exporter, obtained from the World Bank's World Development Indicators.[10] We compute bilateral exchange rate growth using data from the US Department of Agriculture (USDA). For import growth at the HS6 level, we use import data from UN COMTRADE,[11] and to control for regional trade agreements (RTAs) we use data from de Sousa (2012).

Table 2 provides summary statistics on trade barrier removals for the entire sample in panel (a) and the sample used for our benchmark regression in panel (b).[12] Note that data availability for our independent variables forces us to use only 50% of the data.[13] There are three main reasons why we lose observations in our regressions. First, we lose observations where the exporter is not one of the 63 countries that are in the TiVA dataset. Second, our analysis starts from the year 2000, which corresponds to five years after the WTO's Anti-Dumping Agreement in 1995 that mandated expiry reviews, and thus we exclude reviews that occurred pre-2000. Third, some importer-industry-year or exporter-year combinations lack the required macro controls and/or industry output growth

[8]To make sure that the composition of the European Union does not change within our sample period, we use the EU15 definition (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the UK).

[9]In 2018, the OECD released a newer version of TiVA for 2005-2016, but we prefer to use the 1995-2011 version to be able to include the rapid GVC expansion that occurred in 1995-2007. Unfortunately, the two versions cannot be easily aggregated due to methodological differences in calculating value-added. See `https://www.oecd.org/industry/ind/tiva-2018-differences-tiva-2016.pdf` for details. Also, our choice of TiVA as opposed to using the World Input Output Database (WIOD) is due to TiVA's broader coverage of countries (63 versus 40) for the required 1995-2011 period. Similarly, even though another frequently used dataset, the Eora Global Value Chain Database, includes a large set of countries, it features only eight manufacturing sectors—too aggregated for our purpose of analyzing trade barriers at the product level.

[10]For Taiwan, the data is taken from the National Statistics, Republic of China (Taiwan), Statistical Bureau.

[11]Note that an investigation might include multiple HS6; in those cases we aggregate imports to the investigation level by summing up import values for all targeted HS6.

[12]We refer to the set of all observations that are in 1996-2013 as the "entire sample," even though we have collected data dating back to 1988. The reason why we exclude them is that AD duties did not have to abide by the maximum 5-year expiry-review rule before the WTO's Anti-Dumping Agreement in 1995.

[13]Replacing our industry-level variable with GDP, or changing the DVA growth variable to be over a shorter time span adds more observations. See Section 5 for these robustness checks.

variable at the 4-digit ISIC level. Still, the variables in the two samples are highly correlated (0.74-0.98) and the shares are very similar. Thus, we now describe our dataset using the figures in panel (a), bearing in mind that the regression sample we use is in panel (b). Before delving into statistics, it is important to mention that the US has the largest share (27%) of observations, followed by the EU and India (13% each).

The first fact to notice from the table is the 50% removal rate on column 3: on average, a duty is removed half the time. Nevertheless, this share varies from a low of 33% in the US, to a high of 72% in Australia. AD duties on China, which are less likely to be taken off (33%), are removed less than 20% of the time by the US, Turkey, and Brazil.[14] In the following columns we examine the metals and the chemicals sectors, the two most frequently targeted industries making up 35% and 32% of all observations.[15] The removal rate for the metals sector is lower than the average at 44% (column 9), while for the chemicals sector it is about the same as the average at 52% (column 12). Appendix Section B.1 provides more details on the data, with a focus on the duration and extension of duties. Among other statistics, the data reveals that AD duties, on average, last more than five years for all our countries except Argentina (who often imposes AD for two years instead of the usual five), and the ones imposed by the US last longest (12 years on average).

4 Methodology

The anecdotal evidence as well as the examples in Table 1 suggest that there is a relationship between DVA growth and trade protection, which we formally test in this paper. But why would we expect such a relationship to exist?

BBJ build a multi-sector multi-country model of trade policy with GVCs and show that final-good tariffs decrease in the DVA in those goods because of terms-of-trade (ToT) motives. In this setup, higher tariffs would lower the world price of the good in question, which in turn would hurt (i.e. reduce profits) domestic upstream producers. This is the case regardless of political economy considerations. They show that the optimal bilateral tariff imposed by country i on product x from country j in year t is given by:

$$tariff_{ijxt} = \beta_{ijxt} \times DVA_{ijxt} + \frac{1}{\varepsilon_{ixj}} + R_{ijxt}. \tag{1}$$

Here $DVA_{ijxt} = \boldsymbol{r'_{ijxt}} \boldsymbol{\nu_{ijxt}}$, where $\boldsymbol{\nu_{ijxt}}$ is the vector of value-added inputs supplied directly and indirectly by i for j's production of x, and $\boldsymbol{r_{ijxt}}$ is the vector of their prices. $\beta_{ijxt} < 0$ captures non-time-varying importer-industry political economy weights, bilateral import-demand and export-supply elasticities, as well as time-varying bilateral product-specific imports. $\frac{1}{\varepsilon_{ixj}}$ is the bilateral export-supply elasticity, and R_{ijxt} is a collection of terms that captures non-time-varying

[14] Running a simple regression of a removal dummy on a Chinese-exporter dummy (with a year trend, and importer and industry fixed effects) gives a coefficient of -0.19, significant at the 1% level.

[15] We include both basic and fabricated metals in the metals sector for our descriptive statistics.

political economy weights for upstream and downstream industries, bilateral import-demand and export-supply elasticities, time-varying bilateral product-specific imports, and foreign value-added (i.e. $FVA_{ixt} = \sum_{j \neq i} \boldsymbol{r}^{\boldsymbol{f}\prime}_{\boldsymbol{ijxt}} \boldsymbol{\nu}^{\boldsymbol{f}}_{\boldsymbol{ijxt}}$, where $\boldsymbol{\nu}^{\boldsymbol{f}}_{\boldsymbol{ijxt}}$ is the vector of value-added inputs supplied directly and indirectly for i's production of x by all countries j except i, and $\boldsymbol{r_{ijxt}}$ is the vector of their prices).[16]

Based on estimating a reduced-form of equation (1), BBJ find that TTBs, especially against China, are applied less when GVC linkages are strong. Our analysis is also based on (1) and thus complementary to BBJ's, but it differs in four significant ways. First, instead of examining the stock of imposed AD measures, we are looking at AD removals. Second, instead of analyzing the relationship between DVA levels and trade policy in levels, we examine the effect of DVA *growth* on trade protection removals—since we have *changes* on the right-hand side, this enables us to control for non-time-varying factors such as political economy weights and bilateral import-demand and export-supply elasticities.[17] Third, we include all types of goods in our analysis while they only look at final goods. Finally, whereas BBJ analyze TTB coverage ratios at the importer-exporter-industry-year level, our observations are at the more disaggregate importer-exporter-investigation-year level, where an investigation refers to a set of 6-digit Harmonized Schedule (HS6) products.

Based on equation (1), our estimating specification is given by:

$$removal_{mijnt} = \beta \times \Delta \ln DVA_{ijnt-1} + \gamma \mathbf{X}_{mijht} + \delta year_t + \theta_{in} + \mu_j + \epsilon_{mijnt}, \tag{2}$$

where our dependent variable is a binary indicator equal to 1 if the AD duty is removed. Notice that our analysis is framed at the investigation (m) and year (t) level, with a bilateral importer-exporter (ij), TiVA industry (n), and UNIDO sector (h) dimension. As explained in the data section, we assign investigations to industries using the targeted HS code information.[18]

Our main independent variable $\Delta \ln DVA_{ijnt-1}$ is the log growth of DVA of an importer i in the exporter j's production of targeted industry n in the last 4-years before the duty is supposed to expire (lagged 4-years generally corresponds to growth since last renewal/imposition).[19] Differently from BBJ, we use the growth rates instead of DVA in levels because our dependent variable captures a *change* in trade protection instead of its level. As for the timing, we use a lagged 4-year DVA growth rate to be able to identify the DVA growth over a reference period, whose robustness to alternative definitions is verified. Notice that these growth rates vary at the importer-exporter-industry-year level.

[16] See BBJ (2017) page 19 for equation (1) written in more detail as well as its derivation on page 12.

[17] Equation (1) still has time-varying factors such as imports and FVA. We control for import growth in all our regressions, and control for FVA as a robustness check. The reason we do not include FVA growth in all our regressions is because it does not have a bilateral dimension and thus can be highly collinear with our importer-industry fixed effects.

[18] Note that each investigation m, based on the targeted HS6, is matched to a unique UNIDO industry h (one of the 89), and a unique TiVA IO industry n (one of the 18).

[19] The correlation between the 4-years DVA growth rate and the DVA growth rate since last renewal/imposition is 0.91. We use the 4-years DVA growth rate since it enables us to retain the 148 observations where last renewal/imposition is before 1995.

Following papers by Knetter and Prusa (2003) and Bown and Crowley (2013, 2014) who show the importance of macro variables in influencing trade policy, we include bilateral exchange rate growth and exporter GDP growth rates in $\mathbf{X}$. We further control for industry h-specific output growth rate based on UNIDO classification, and investigation m-specific bilateral 4-year import growth rate to be in line with the theory.[20] We also control for RTAs since Johnson and Noguera (2017) have pointed out their significant influence in the development of GVCs. We include a linear year trend $year_t$ to control for the overall growth in DVA, importer-industry fixed effects θ_{in} to control for institutional differences across countries and other country-industry determinants such as the lobbying power of the US steel industry, and exporter fixed effects μ_j to control for the differential treatment of certain exporting countries like China.[21] We prefer to use the linear probability model instead of a probit specification as we have many fixed effects and thus can run into the incidental parameters problem. Still, we report the probit results in the robustness section.

We hypothesize that β is positive: the DVA growth rate raises the probability that a trade barrier is removed. However, there are two challenges associated with interpreting the estimated β in equation (2) as a causal effect. First, ideally, we would want the possibility of removal to be randomly drawn for any duty in place. This is not the case, but the rule imposed by the WTO to review any existing AD duty every five years provides an exogenous timing for our observations, known in advance to firms but not adjustable. Second, our main independent variable is potentially endogenous to the fact that AD duties are in place—firms would be less likely to expand their GVCs if they face higher duties back home. Since all our observations consist of importer-exporter-product combinations that are already sitting under trade protection, simple OLS regressions would suffer from a selection bias. The fact that our independent variable is at a more aggregate level than the investigation level partially addresses this issue, but adds measurement error. Thus, in order to identify the strictly exogenous portion of DVA growth in production, we use an instrumental variables strategy.

Our instrument, $\Delta \ln exports_{jnt,-i,-m}$, is the exporter j's industry n-specific 4-year log growth rate in exports to the rest of the world that does not include the HS6 product(s) targeted in investigation m. The intuition behind this instrument is that an exogenous export supply shock would require more DVA from any country participating in that good's production. Note that the instrument does not include exports to the importing country i with the trade barrier in place so that it satisfies the exclusion restriction. Moreover, it excludes the HS6 product(s) that are sitting under AD to make sure that the export growth is not due to trade deflection.[22] We use this instrument and estimate specification (2) using two-stage least squares (2SLS), clustering the standard errors at the country-pair level to account for correlated shocks (our results are robust to

[20] This variable, which is bound between -2 and 2, is calculated using the formula proposed by Davis, Haltiwanger, and Schuh (1996) so that we retain periods with zero imports.

[21] Note that since our specification is in quasi-differences, the importer-industry and exporter fixed effects control for their time-varying trends.

[22] In unreported results, we exclude the broader HS4 category that the targeted HS6 product belongs to as a robustness check, and find very similar coefficients.

clustering at the importer-industry level).

An alternative and intuitive way to think about the relationship between GVCs and trade protection is based on an FDI/offshoring argument, whereby a country would not want to restrict imports that contain substantial DVA. This is one mechanism proposed by Jensen, Quinn, and Weymouth (2015), who show that increased vertical FDI and intrafirm trade has led to lower demands for AD protection by US companies.[23] Similarly, Blanchard and Matschke (2015) find that the US has given preferential market access through its Generalized System of Preferences scheme to countries that host US multinational affiliates that export back to the US. Applied to our framework of duty reviews, this would mean that increased GVC participation would increase the likelihood of removing trade barriers thanks to FDI and offshoring.

It is simple to change the main regressor in specification (2) to measure DVA in imports to reflect this alternative channel, as we do in one of our robustness checks (and the results are qualititatively the same). However, it is not possible to test one channel against the other since DVA in imports and DVA in foreign production are, by construction, very similar to each other since bilateral imports is included in foreign production. Since we use DVA growth as our regressor, these two variables might differ not because of GVC linkages, but if bilateral imports grow at a substantially different rate than foreign production.

5 Results

Table 3 reports our main results. We start with the full sample before splitting it between high-income and emerging economies.[24] The first three columns report our benchmark results while the last three columns make use of the importer's GDP growth in order to retain observations that are otherwise lost due to data availability.

Column 1 shows that the DVA growth coefficient is positive and significant at the 5% level when we use the entire sample. When we split the set of countries into two, results are qualitatively different. The DVA growth coefficient is positive and highly significant for high-income countries (in column 2), which indicates that a one standard deviation (0.297) increase in the *predicted* 4-year DVA growth in foreign production increases the probability of removing an AD duty by 16.5 percentage points ($0.556 \times 0.297 = 0.165$), which is about a third of the mean removal rate of 48%. However, this result does not hold for emerging economies in column 3. The first-stage results in Appendix Table A.3 indicate that the instrument is positive and significant at the 1% level in all specifications of Table 3, with Kleibergen-Paap (KP) Wald-F statistics above the critical value for 10% maximal IV size (16.4) in all but one specification (column 6).

[23] Note that certain downstream firms within an industry might support AD protection if it can lead to hurting their direct competitors. Since our study is at the industry-level, and not at the firm-level, we are not able to address this concern regarding within-industry competition for protection.

[24] The qualitative results would be unchanged if we used an interaction term for our main regresor to allow different effects for high-income and emerging countries but we prefer to split samples to allow flexible responses for all regressors.

The last three columns of Table 3 replace the importer's industry-level output growth with the importer's GDP growth. This adds an extra 473 observations to our sample, mostly for emerging countries. The results are qualitatively the same, with column 5 showing that a one standard deviation (0.271) increase in *predicted* DVA growth increasing the probability of removal for high-income countries by 9.9 percentage points ($0.364 \times 0.271 = 0.099$). Column 6 for emerging economies shows a negative and significant effect of DVA growth on the probability of removal, possibly revealing the importance of controlling for industry growth. However, it is worth noting that this result is not robust, as it is only present in two of the robustness checks that are reported below. Furthermore, the KP statistic is below the critical value, suggesting that the instrument in this specification is not particularly strong.

An interesting result that comes out from Table 3 is the non-significant coefficients of the macro variables that were found to be important determinants of AD petitions by high-income countries in the existing literature. For emerging economies, exporter GDP growth positively affects the probability of AD removals. This is in line with the findings of Bown and Crowley (2014) who show that the number of AD initiations by emerging economies decrease with foreign GDP growth.[25] This reveals that emerging country AD authorities anticipate "continued likelihood of dumping" by exporters who face negative demand shocks in their own countries.[26] The limited explanatory power of our macro controls reinforces the idea that the decision to remove these duties is not as linked to political-economy considerations as it is the case for the introduction of new measures, and gives support to our approach of using the *growth* of DVA as the independent variable to investigate the effect of GVCs on trade protection. On the other hand, columns 1 and 4 indicate that import growth at the HS6 level (covering the products that are investigated) negatively affects the probability of removal: countries are probably reluctant to encourage further import growth that threaten to weaken their import-competing industries. Moreover, the benchmark result in column 2 shows that high-income countries are more likely to remove duties on their RTA partners, and that countries are becoming less likely to remove protection over time as indicated by the negative and significant coefficient of $year_t$.

Comparing the results in Table 3 with the analogous OLS results reported in Appendix Table A.4 reveals that OLS coefficients have the expected positive sign for high-income countries but are imprecisely estimated and display lower magnitudes. This negative bias of the OLS coefficient is possibly due to the measurement error in the DVA growth variable, reverse causality, or an omitted variable that is related to removals and DVA growth in opposite ways. In either case, the bias suggests that having AD protection in place affects DVA growth, and that an instrument is needed to identify the exogenous variation in DVA growth.

Before engaging in a long list of robustness checks, Table 4 reports the results of two exercises related to the IV approach. In the first three columns, the instrument is calculated using exports

[25] Bown and Crowley (2013) find this result also for high-income countries for the pre-crisis (pre-2009) period.

[26] This "venting-out" via exports with "dumped" prices is formalized by Crowley (2010) who builds on the reciprocal dumping model of Brander and Krugman (1983).

at the 2-digit HS level, which allows for a more disaggregate definition of industry (i.e. 73 HS2 industries instead of 18 TiVA sectors). This causes us to lose 44 observations due to removing the exports of the investigated HS6 from the HS2 flows and thus having zero HS2 exports for cases that cover entire HS2 sectors. The magnitude of the effect is slightly larger than the benchmark effect of 16.5 percentage points found in Table 3: a one standard deviation (0.285) increase in predicted DVA growth in foreign production raises the probability of removal by 22 percentage points for high-income countries ($0.773 \times 0.285 = 0.220$). In the last three columns, taking into consideration that import growth might also be endogenous to AD in place, we instrument import growth with the importer's import growth of the same HS6 from the rest of the world ($\Delta imports_{imt-1,-j}$), which proxies for demand. The positive effect of DVA growth on AD removals by high-income countries is preserved, although with a lower significance level. Notice, though, that the two instruments are not jointly strong as indicated by the KP statistics.[27]

Overall, the results in Tables 3 and 4 point to a clear conclusion: the decisions of high-income countries to remove trade barriers are (statistically and economically) affected by the extent of value chain integration. The result that emerging economies' AD removals do not depend on DVA growth may be explained by their relatively low levels of DVA. In fact, comparing the samples in columns 2 and 3 on Table 3, we observe that even though the mean DVA growth rate for emerging countries was almost double that of high-income countries (69% versus 35%), the mean level of DVA in foreign production was less than half of the one for high-income economies ($2.1 versus $5.3 billion). It may be that the emerging economies' DVA in foreign production has not yet reached a level to matter for AD removal decisions.[28]

5.1 Robustness checks

Table 5 panels (a) and (b) provide robustness checks for our high-income and emerging economy benchmark results respectively (columns 2 and 3 in Table 3). We report only the main coefficient and omit the control variables for clarity. In column 1, we add exporter-industry fixed effects to control for export-supply elasticities while column 2 goes further by including importer-exporter-industry fixed effects to control for overall bilateral-industrial relationships that might affect GVC linkages and duty removals simultaneously. The results are robust to these more demanding specifications. In column 3, we find that adding year fixed effects instead of a linear trend to control for global macro shocks eliminates the significance of the result (p-value 0.18). However, the instrument loses its strength as indicated by the low KP statistic, since the year dummies absorb a lot of

[27] Results would be qualitatively unchanged if we were to exclude import growth as a control. Alternatively, if we use the instrument for import growth as a second instrument for our main regressor, keeping import growth as an exogenous regressor, we obtain a DVA growth coefficient of 0.589 for the high-income sample, significant at the 1% level. This enables us to test for overidentifying restrictions and we get a Hansen p-value of 0.44, indicating that the exogeneity of the instruments cannot be rejected.

[28] In unreported results, we split the sample into two based on the median of lagged (by 4-years) log DVA levels, and find that the DVA growth coefficient is significant only for the above-median sample, lending some support to this conjecture.

the variation in the first stage, even though none of them are statistically significant in the second stage.[29] Still, to allow more flexibility than a linear trend, in column 4, we include importer-specific trends and the coefficient of interest remains positive and significant at the 5% level.

In Table 5 column 5, we employ a probit estimator since we have a dummy variable as a dependent variable, while in column 6 we use a 3-year (instead of 4) DVA growth rate, and find qualitatively similar results. In column 7, we change our regressor to be DVA growth in imports instead of foreign production to test for the alternative FDI/offshoring channel. Not surprisingly, the results are qualitatively similar to our benchmark case, consistent with the fact that DVA in imports is constructed similarly to DVA in foreign production.

In the last five columns of Table 5 we add extra regressors. A crisis dummy in column 8 (taking the value of 1 in years 2008-2010) shows that removal of protection was less likely during the Great Recession but it did not affect the role of DVA growth. In column 9, we control for lagged 4-year FVA growth to be more closely in line with the theory but it turns out not to be statistically significant. In column 10, we add the log level of ad-valorem duties imposed in the original investigation as policymakers might be reluctant to remove large duties. This turns out to be the case, as shown by the negative and significant coefficients we find for $\ln duty_m$ for both groups of countries.[30] Note that this specification results in a smaller sample size due to some observations missing duty levels and dumping margins.

In column 11 we control for whether the investigation targets an input rather than a final or a capital good. In fact, DVA might inherently be lower in the production of inputs, and thus excluding the input dummy might bias our main estimated coefficient. The results show that the type of good does matter (i.e. lower probability of removing AD on inputs) but our coefficient of interest barely changes. Finally, in column 12, we control for changes in other trade barriers since papers by Feinberg and Reynolds (2007) and Moore and Zanardi (2009) indicate that there might be substitution between the use of different trade barriers. We include lagged 4-year tariff growth since DVA growth might also be affected by tariffs (as BBJ's results suggest), and also a dummy indicating whether there was a new TTB (AD, CVD, or SG) petition during the "supposed-to-expire" year covering the same HS6-exporter combination.[31] Column 12 shows that tariff growth negatively affects the removal probability for high-income countries, suggesting complementarity between AD extensions and tariffs (without changing our main result), but it does not have an effect for emerging countries' removal decisions. TTB petitions, on the other hand, increases the

[29] To address the concern that inference might be incorrect with a weak instrument, we run a weak IV test for the specification with year fixed effects, and find an Anderson-Rubin statistic of 2.79, which rejects the hypothesis that $\beta = 0$ at the 10% level.

[30] We obtain these duties from GAD and use dumping margins when the duties are not in ad-valorem form (e.g. specific duties in terms of quantities).

[31] We thank John Romalis for sharing a sample of the tariff data used in Feenstra and Romalis (2014). This data is at the importer-exporter-SITC Rev.2-year level, and takes into account tariffs in trade agreements with their phase-in schedules, as well as other preference schemes provided to developing countries. We match this dataset with our investigations using the UN's HS combined-SITC Rev.2 concordance table, and take the simple average tariff for each investigation which might include multiple HS6 codes. We take the log growth rate by first adding 1 to tariffs to include zeros.

probability of removal by 27 percentage points for the emerging country sample, but does not have an effect on high-income countries' AD removals. In short, none of these methodological alternatives affect the previous qualitative result for either sample of countries.

The next set of robustness checks, in Table 6, employs different samples with panels (a) and (b) dedicated to high-income and emerging countries, respectively. We start in column 1 by excluding China as an exporter since it is the most frequently targeted country by AD duties.[32] In column 2, we exclude Mexico as an exporter due to its large share of processing trade. In column 3 of panel (a), we exclude the EU from the sample of high-income countries as the EU also alters the duration of certain measures through interim reviews, which are not included in our dataset. Indeed, excluding the EU results in a larger coefficient. In column 3 of panel (b), we drop Argentina from the sample since it has a distinct AD review procedure and often imposes AD duties for a shorter (2-year) duration. In column 4, we include 2013 by imputing the same value of DVA for 2012 (since the TiVA dataset stops in 2011). None of these modifications changes our qualitative result for high-income countries. For the emerging-country sample, notice that excluding China leads to a negative and significant coefficient for DVA growth—one of only three specifications with this result.

In columns 5 and 6 of Table 6, we exclude the two most frequently targeted sectors, metals and chemicals respectively, and find that the coefficient becomes much larger but imprecisely estimated (p-value: 0.13) when metal cases are excluded (and the KP statistic indicates that the instrument loses its strength),[33] while there is no change in the coefficient when we exclude the duties on chemicals. In column 7, we exclude trade barriers that were enacted after 2001 when China joined the WTO and the GVCs expanded at a faster rate. We engage in this check because DVA growth might have had an effect on the duties that were originally imposed after 2001. Even though our IV strategy should address this problem as our instrument is not related to the period when the duty was initially imposed, column 7 acts as a further robustness check on the selection issue. We find that even in this case, the coefficient remains significant with a similar magnitude. Finally, column 8 recovers some observations by imputing "rest of the world" DVA figures for exporters that are not in the TiVA dataset. Results are robust to these modifications. Importantly, in all columns except for panel (a) column 5 and panel (b) columns 6 and 7, the KP statistics are above the critical value.

Finally, as a further robustness check, we take the exogeneity of the timing of reviews to the extreme and consider AD duties imposed before 1995 and up for renewal in the US in the early 2000s.[34] Here, since our sample size is limited, we exclude industry fixed effects and use robust

[32] Note that Kee and Tang (2016) use transaction-level data and show that their Chinese value-added estimate is higher than what is reported by IO-based estimates due to aggregation biases. Even though the importer-industry and exporter fixed effects should address this concern, our exclusion of China in this column is a further check on this issue.

[33] As in footnote 29, we run a weak IV test on the high-income non-metal sample and find an Anderson-Rubin statistic of 3.21, which rejects the hypothesis that $\beta = 0$ at the 10% level.

[34] For this exercise, we only include the US since other countries already had some form of mandated review procedures for AD duties.

(instead of clustered) standard errors. The first two columns of Table 7 show the results if we focus on the 134 duties up for expiry in 2000, at the cost of being able to include (in column 2) only the import growth control because of the cross-section setup and the inclusion of exporter fixed effects. In the following two columns, we include duties up for renewal also in 2001 and 2002.[35] The estimated coefficient of interest is positive and highly significant in all four columns. The most conservative specification in column 2 indicates that a one standard deviation (0.135) increase in predicted DVA growth in foreign production increases the probability of removal by 12.5 percentage points ($0.924 \times 0.135 = 0.125$)—explaining about a third of the mean removal rate of 35% for this sample. Again, this magnitude is very similar to our benchmark result.

In conclusion, our results are robust to a battery of robustness checks, dealing with methodological and conceptual sensitivities. Thus, there is strong evidence of the role of GVCs in the removal of AD duties for high-income economies but not for emerging economies. In the next section we move from the statistical significance of our results to an interpretation of their economic effects.

5.2 Quantification exercise

How important are our findings in terms of their economic magnitude for high-income countries? One way to answer this question is to use our estimates to calculate the number of AD duties that would not have been removed without DVA growth. With this piece of information, we can also calculate the share of trade freed from trade protection because of DVA growth. In other words, how different would the trade policy of high-income countries look like in the absence of GVCs?

Based on the specification of Table 3 column 2, Table 8 provides different ways to look at the economic effects of DVA growth on trade protection in high-income countries. In each case, we show the results for the years 2001 and 2006, which are chosen to exclude the financial crisis and have as many duties up for renewal as possible in a given year. All these figures are based on a comparison between the actual 4-year DVA growth rates and a hypothetical scenario where these rates are zero (i.e. no change in GVC interrelationships). Column 3 shows that the average removal rate of AD duties for high-income countries would have been 2.1 and 27.9 percentage points lower in 2001 and 2006 respectively, without DVA growth. Notice, first, the significant jump between the two years, which is due to the much higher DVA growth rates that countries experienced over the more recent period, as shown in column 2.

We can translate the number of duties removed due to DVA growth into trade coverage ratios using figures from Bown (2011). We find that, on average, 0.02% and 0.48% of high-income manufacturing imports were freed from AD duties in 2001 and 2006, respectively, because of the increase in DVA. To put these figures in context, column 5 translates the effects in terms of reduced AD protection: around 1% and 30% of AD protection were removed due to DVA growth in 2001 and 2006 respectively. Considering that in 2006 the stock of AD duties covered 1.6% of these

[35] We do not include the extra controls because of limited time variation, but including the macro controls still gives a positive and significant coefficient for the key regressor of interest.

high-income countries' total imports, this quantification exercise highlights the role of GVCs in shaping trade policy, and how these effects can be hidden in the "details" of the AD system (i.e. never reaching headline news).

Table 8 also shows that the aggregate results hide significant country and sector heterogeneity. The US and the EU seem to experience relatively less freer trade in 2006 but note the smaller number of duties up for expiry in these two countries. At the sector level, the metals sector records the largest effect in 2006, which is consistent with the prime role of this sector in the use of AD and the substantial growth of its GVCs in the second part of the sample (while it experienced a GVC contraction in the years up to 2001).

While these results allow us to put the estimates in perspective and point out the significant role of GVCs in shaping trade policy, it is important to keep in mind the caveats that go with such an exercise. In particular, the calculations regarding trade ratios do not take into account how duties of different levels may have different coverage in terms of goods in differently sized markets. Here, we assume that the duties are identical (in a given market or sector), which is correct only "on average," but also note that the number of duties up for renewal in a given year is often not large (52 in 2001, and 99 in 2006).

6 Conclusion

The interaction of global value chains and trade policy has turned out to be an important avenue of research, especially with the current trade tensions that threaten to disrupt established cross-border linkages. To contribute to this research, we exploited the exogenously imposed timing of AD reviews and tested the effect of DVA growth on the removal of trade protection based on the motivation that domestic firms will favor the removal of trade barriers on goods that contain their own value-added, and Blanchard, Bown, and Johnson's (2017) theoretical prediction that countries have an incentive to remove trade barriers on products that have large domestic content due to terms-of-trade considerations. To this end, we assembled a unique AD expiry-review database for four high-income (Australia, Canada, the EU, the US) and six emerging (Argentina, Brazil, China, India, Mexico, Turkey) economies for 1988-2013.

By exploiting WTO rules introduced in 1995 and instrumenting DVA growth in foreign production with exogenous export supply shocks, our benchmark result for high-income countries showed that a one standard deviation increase in predicted DVA growth increases the likelihood of removing a trade barrier by 16.5 percentage points—about a third of the mean removal rate of 48%. We found that this result, which does not hold for the emerging country sample, is highly robust to alternative specifications and samples, including the set of US AD duties that suddenly came up for review in 2000.

Our back-of-the-envelope calculations showed that DVA growth in foreign production has resulted in freeing 0.48% of high-income country manufacturing imports from trade protection, equivalent to a reduction of almost one-third in AD trade coverage. Thus, our results reveal that trade policy is not only becoming endogenous to GVC linkages in the world but that the effects are economically large. Moreover, our results can potentially shed some light on the recent angst about globalization if too many trade barriers were removed during the rapid GVC expansion era, benefiting multinationals but leaving workers exposed to import competition.

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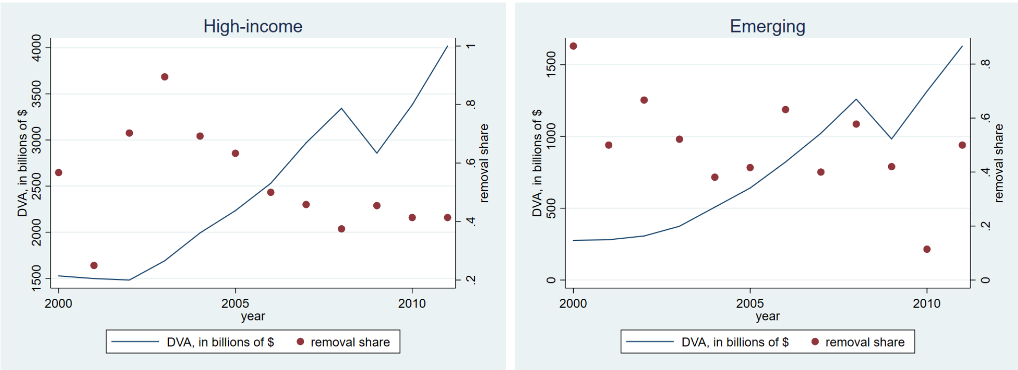
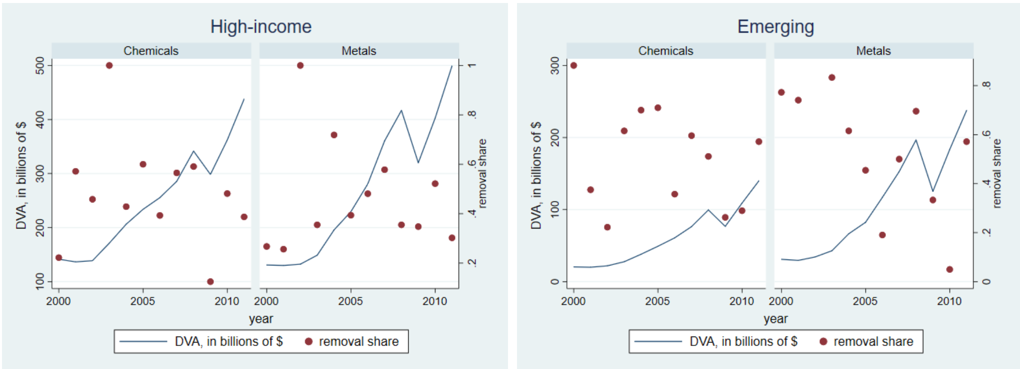
Figures and tables

Figure 1: DVA in foreign production and the share of removals

(a) High-income versus emerging countries



(b) By sector



Source: Authors' depictions using data from the GAD and TiVA.

Table 1: Examples of AD removals

(a) Same product-year, different exporters

Importing country	Product (sector)	Year	Original year	What happened?	DVA statistics
Australia	Linear low density polyethylene (chemicals)	2008	2003	Extend for Thailand, remove from Korea	90% growth for Thailand ($235M), 118% for Korea ($2.9B)
Turkey	Polyvinyl chloride (chemicals)	2008	2003	Extend for Germany, Italy, Romania, and the US, remove from Belgium, Finland, Greece, Hungary, Israel, and Netherlands	Average DVA growth for removed and extended countries are 95% and 59%, respectively
USA	Brass sheet and strip (basic metals)	2000	1988	Extend for Japan, remove from the Netherlands	-64% growth for Japan ($2.5B), 3% for the Netherlands ($216M)

(b) Same exporter-year, different products

Importing country	Exporter	Year	Original year	What happened?	DVA statistics
Canada	USA	2000	1986, 1995, 1995	Extend for potatoes (agriculture) and refined sugar (food products), remove from jars (non-metallic products)	Highest DVA growth for non-metallic products of 29% (others had marginal or negative growth)
EU	India	2005	1999, 2000, 2000	Extend for steel wire rope (fabricated metals), remove from non-alloy steel hot rolled flat products (basic metals) and cathode-ray colour television picture tubes (electronics)	DVA growth in order are basic metals (71%), electronics (64%), and fabricated metals (32%)
Mexico	USA	2010	2005, 1995, 2005, 2005, 2005, 2000	Extend for carbon steel tubing (basic metals) and four chemical products (chemicals), remove from beef (food products)	Highest DVA growth for food products of 10% (others had marginal or negative growth)

Source: Authors' calculations using data from the GAD and TiVA.

Table 2: Summary statistics on AD reviews

Importing country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(a) Entire sample (1996-2013)	Number of duties due to expire	Number of removals	Removal share	Number of duties due to expire on China	Number of removals on China	Removal share for China	Number of duties due to expire (metals)	Number of removals (metals)	Removal share (metals)	Number of duties due to expire (chem.)	Number of removals (chem.)	Removal share (chem.)
Argentina	192	128	67%	48	23	48%	73	45	62%	20	13	65%
Australia	164	118	72%	21	15	71%	16	14	88%	78	50	64%
Brazil	149	67	45%	37	7	19%	38	21	55%	50	26	52%
Canada	247	139	56%	33	12	36%	154	83	54%	2	2	100%
China	120	45	38%	.	.	.	10	8	80%	87	29	33%
EU	348	232	67%	97	46	47%	87	61	70%	137	82	60%
India	329	203	62%	87	37	43%	18	17	94%	237	138	58%
Mexico	171	71	42%	57	19	33%	71	29	41%	41	16	39%
Turkey	173	63	36%	61	10	16%	36	10	28%	53	32	60%
USA	686	224	33%	137	22	16%	391	106	27%	117	39	33%
Total	2,579	1,290	50%	578	191	33%	894	394	44%	822	427	52%
(b) Regression sample (1996-2012)												
Argentina	7	5	71%	3	2	67%	4	2	50%	0	0	.
Australia	74	51	69%	9	6	67%	15	14	93%	31	19	61%
Brazil	28	12	43%	7	1	14%	18	8	44%	3	3	100%
Canada	117	64	55%	18	7	39%	79	39	49%	2	2	100%
China	101	40	40%	.	.	.	7	5	71%	76	27	36%
EU	210	128	61%	67	28	42%	58	38	66%	79	40	51%
India	211	125	59%	57	25	44%	9	9	100%	164	92	56%
Mexico	106	46	43%	38	16	42%	41	19	46%	26	10	38%
Turkey	85	34	40%	36	8	22%	19	4	21%	23	19	83%
USA	357	125	35%	71	16	23%	218	65	30%	60	20	33%
Total	1,296	630	49%	306	109	36%	468	203	43%	464	232	50%

Notes: Correlation of variables between the two samples ranges from 0.74 to 0.98.

Table 3: Main results

	Benchmark			Macro controls		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: $removal_{mijnt}$	All	High-income	Emerging	All	High-income	Emerging
$\Delta \ln DVA_{injt-1}$	0.236**	0.556***	-0.185	0.099	0.364***	-0.402**
	(0.113)	(0.155)	(0.144)	(0.089)	(0.112)	(0.169)
$\Delta \ln exch.\ rate_{ijt-1}$	0.000	0.002	0.000	0.000	0.003	-0.000
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
$\Delta \ln ISIC\ output_{iht-1}$	-0.061	-0.025	-0.140			
	(0.105)	(0.101)	(0.134)			
$\Delta \ln GDP_{it-1}$				-0.787	-2.442*	0.480
				(0.540)	(1.255)	(0.812)
$\Delta \ln GDP_{jt-1}$	1.675*	-1.437	4.924***	1.621**	-0.366	4.110***
	(0.966)	(1.242)	(1.271)	(0.774)	(0.856)	(0.942)
$\Delta imports_{ijmt-1}$	-0.029**	-0.035	-0.007	-0.031***	-0.032	-0.019
	(0.014)	(0.022)	(0.020)	(0.012)	(0.019)	(0.017)
RTA_{ijt-1}	-0.015	0.140**	-0.060	-0.008	0.059	-0.044
	(0.054)	(0.070)	(0.074)	(0.039)	(0.068)	(0.074)
$year_t$	-0.014	-0.032**	-0.005	-0.005	-0.016**	-0.001
	(0.009)	(0.012)	(0.015)	(0.006)	(0.007)	(0.013)
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
KP	65.3	51.3	22.4	54.6	42.0	15.3
Observations	1,296	754	531	1,769	931	832

Notes: Standard errors clustered by country-pair are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table 4: IV sensitivity

	Alternative IV (HS2)			Instrument import growth		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: $removal_{mijnt}$	All	High-income	Emerging	All	High-income	Emerging
$\Delta \ln DVA_{injt-1}$	0.378***	0.773***	-0.338	0.177	0.455*	-0.207
	(0.145)	(0.189)	(0.227)	(0.138)	(0.264)	(0.135)
$\Delta \ln exch.\ rate_{ijt-1}$	0.001	0.002	0.000	0.000	0.002	-0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
$\Delta \ln ISIC\ output_{iht-1}$	-0.040	-0.017	-0.106	-0.108	-0.013	-0.263**
	(0.112)	(0.113)	(0.138)	(0.105)	(0.104)	(0.124)
$\Delta \ln GDP_{jt-1}$	1.148	-2.296	5.491***	1.389	-1.722	4.831***
	(1.086)	(1.466)	(1.334)	(1.129)	(1.234)	(1.465)
$\Delta imports_{ijmt-1}$	-0.028**	-0.040*	-0.009	0.171**	0.112	0.226**
	(0.014)	(0.023)	(0.021)	(0.079)	(0.195)	(0.099)
RTA_{ijt-1}	-0.012	0.147*	-0.044	0.004	0.117	-0.028
	(0.055)	(0.081)	(0.077)	(0.064)	(0.088)	(0.090)
$year_t$	-0.016	-0.043***	-0.001	-0.015	-0.026	-0.014
	(0.010)	(0.014)	(0.017)	(0.010)	(0.018)	(0.017)
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
KP	34.3	28.3	10.2	8.9	1.5	7.8
Observations	1,252	727	512	1,296	754	531

Notes: Standard errors clustered by country-pair are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table 5: Robustness checks on specification

(a) High-income	(1) Exporter-Industry FE	(2) Imp-Exp-Industry FE	(3) Year FE	(4) Importer-trends	(5) Probit	(6) 3-yr DVA growth	(7) DVA in imports	(8) Crisis dummy	(9) FVA growth	(10) Duty levels	(11) Inputs	(12) Other trade barriers
$\Delta \ln DVA_{injt-1}$	0.530***	0.446***	0.510	0.446**	1.687***	0.540***	0.286***	0.557***	1.197*	0.541***	0.532***	0.502***
	(0.174)	(0.156)	(0.376)	(0.174)	(0.357)	(0.168)	(0.089)	(0.151)	(0.662)	(0.153)	(0.153)	(0.155)
$Crisis_t$								-0.147**				
								(0.057)				
$\Delta \ln FVA_{int-1}$									-0.621			
									(0.465)			
$\ln duty_m$										-0.053***		
										(0.019)		
$input_m$											-0.192**	
											(0.079)	
$\Delta \ln tariffs_{imjt-1}$												-0.092*
												(0.053)
$TTB\ petition_{imjt}$												-0.075
												(0.131)
KP	50.8	56.9	11.0	32.1	46.1	39.7	82.6	51.1	5.8	53.2	51.7	49.9
Observations	701	645	754	754	721	780	750	754	754	701	754	748
(b) Emerging	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta \ln DVA_{injt-1}$	-0.177	-0.127	-0.131	-0.260	-0.622	-0.144	-0.090	-0.250	-0.215	-0.316*	-0.193	-0.176
	(0.154)	(0.214)	(0.374)	(0.171)	(0.426)	(0.142)	(0.091)	(0.184)	(0.163)	(0.175)	(0.138)	(0.141)
$Crisis_t$								0.095				
								(0.098)				
$\Delta \ln FVA_{int-1}$									0.050			
									(0.095)			
$\ln duty_m$										-0.072*		
										(0.036)		
$input_m$											-0.319***	
											(0.055)	
$\Delta \ln tariffs_{imjt-1}$												0.025
												(0.060)
$TTB\ petition_{imjt}$												0.273***
												(0.076)
KP	16.6	14.4	5.5	26.0	22.4	36.1	27.6	23.1	22.9	28.9	22.9	22.8
Observations	487	434	531	531	470	543	510	531	531	432	531	527
Importer-Industry FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	No	No	No	No	No	No	No	No	No	No	No
Imp-Exp-Industry FE	No	Yes	No	No	No	No	No	No	No	No	No	No

Notes: All regressions include the controls used in Table 3; they are omitted in the table for clarity. Panel (a) and (b) have robustness checks for the results in Table 3 columns 2 and 3 respectively. p-value for the coefficient on panel (a) column 3 is 0.18. Column 5 reports slope estimates. Standard errors clustered by country-pair are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table 6: Robustness checks on sample

(a) High-income	(1) No CHN exporter	(2) No MEX exporter	(3) No EU/ARG importer	(4) Include 2013	(5) No metals	(6) No chemicals	(7) Imposed pre-2002	(8) Include ROW
$\Delta \ln DVA_{injt-1}$	0.689***	0.498***	0.648***	0.354**	0.933	0.571***	0.439**	0.559***
	(0.214)	(0.137)	(0.241)	(0.156)	(0.607)	(0.179)	(0.178)	(0.153)
KP	26.5	54.6	26.6	68.1	4.5	38.5	32.5	52.1
Observations	585	735	545	783	384	585	626	766
(b) Emerging	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta \ln DVA_{injt-1}$	-0.258**	-0.178	-0.193	-0.148	0.038	-0.084	-0.196	-0.166
	(0.106)	(0.143)	(0.143)	(0.130)	(0.178)	(0.418)	(0.382)	(0.146)
KP	55.6	22.6	22.0	25.1	26.3	3.8	12.3	22.2
Observations	385	527	524	569	432	242	263	538
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All regressions include the controls used in Table 3; they are omitted in the table for clarity. Panel (a) and (b) have robustness checks for the results in Table 3 columns 2 and 3 respectively. p-value for the coefficient on panel (a) column 5 is 0.13. Standard errors clustered by country-pair are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table 7: The US AD reviews in 2000-2002

	2000		2000-2002	
Dep. var.: $removal_{mijnt}$	(1)	(2)	(3)	(4)
$\Delta \ln DVA_{injt-1}$	0.904***	0.924***	0.855**	1.034***
	(0.337)	(0.288)	(0.366)	(0.376)
$\Delta imports_{ijmt-1}$		0.054		-0.001
		(0.064)		(0.058)
$year_t$				-0.030
				(0.187)
Exporter FE	Yes	Yes	Yes	Yes
KP	11.8	24.3	11.8	18.3
Observations	134	93	146	106

Notes: Robust standard errors are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table 8: Quantification exercise

(a) 2001	(1) Number of duties up for expiry	(2) Avg. 4-yr DVA growth	(3) Change in removal rate due to DVA growth	(4) % of imports freed	(5) % of AD protection freed
All high-income	52	3.8%	2.1%	0.02%	0.91%
EU	9	17.4%	9.7%	0.02%	0.74%
USA	34	8.2%	4.5%	0.03%	0.82%
Chemicals	13	25.5%	14.2%	0.20%	21.18%
Metals	32	-6.1%	-3.4%	-0.13%	-1.99%
(b) 2006	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
All high-income	99	50.3%	27.9%	0.48%	30.27%
EU	17	55.3%	30.7%	0.19%	5.94%
USA	59	40.3%	22.4%	0.20%	7.78%
Chemicals	22	46.6%	25.9%	0.23%	28.96%
Metals	59	58.3%	32.4%	2.27%	53.19%

Notes: All results are based on estimated coefficients from column 2 of Table 3. Figures in column 3 are the difference between the predicted probability of removal with (observed DVA growth rate) and without (DVA growth=0) DVA growth. Figures in columns 4 and 5 are computed using average import coverage shares of AD duties, which we obtained from Bown (2011).

A Appendix tables

Table A.1: Data sources

Policy-imposing country	Data source
Argentina	`https://www.argentina.gob.ar/cnce`
Australia	`https://www.adcommission.gov.au/Pages/default.aspx`
Brazil	`http://www.mdic.gov.br/sitio/`
Canada	`http://cbsa-asfc.gc.ca/sima-lmsi/menu-eng.html`
China	`http://english.mofcom.gov.cn/`
EU	`http://trade.ec.europa.eu/doclib/cfm/doclib_search.cfm`
India	`http://www.dgtr.gov.in/`
Mexico	`https://www.gob.mx/se/acciones-y-programas/industria-y-comercio-unidad-de-practicas-comerciales-internacionales-upci`
Turkey	`https://www.ticaret.gov.tr/ithalat/ticaret-politikasi-savunma-araclari`
USA	`https://www.usitc.gov/`

Table A.2: TiVA industries

TiVA industry	TiVA industry code	Share of observations
Chemicals and chemical products	C24	31.87%
Basic metals	C27	27.92%
Fabricated metal products except machinery and equipment	C28	6.75%
Textiles, textile products, leather and footwear	C17T19	4.85%
Food products, beverages and tobacco	C15T16	4.30%
Machinery and equipment n.e.c	C29	4.03%
Rubber and plastics products	C25	3.88%
Pulp, paper, paper products, printing and publishing	C21T22	2.99%
Other non-metallic mineral products	C26	2.79%
Manufacturing n.e.c; recycling	C36T37	2.48%
Computer, electronic and optical products	C30T33X	2.29%
Electrical machinery and apparatus n.e.c	C31	1.90%
Other transport equipment	C35	1.28%
Wood and products of wood and cork	C20	0.85%
Agriculture, hunting, forestry and fishing	C01T05	0.58%
Mining and quarrying	C10T14	0.50%
Coke, refined petroleum products and nuclear fuel	C23	0.47%
Motor vehicles, trailers and semi-trailers	C34	0.27%

Notes: Based on the 2,579 observations in our sample.

Table A.3: First-stage for Table 3

Dep. var.: $\Delta \ln DVA_{injt-1}$	Benchmark (1) All	 (2) High-income	 (3) Emerging	Macro controls (4) All	 (5) High-income	 (6) Emerging
$\Delta \ln exports_{jnt-1,-i}$	0.416***	0.325***	0.549***	0.386***	0.361***	0.407***
	(0.052)	(0.045)	(0.116)	(0.052)	(0.056)	(0.104)
$\Delta \ln exch.\ rate_{ijt-1}$	0.001	-0.001	0.003	0.001	-0.002	0.003***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
$\Delta \ln ISIC\ output_{iht-1}$	0.044	0.025	0.088			
	(0.076)	(0.075)	(0.139)			
$\Delta \ln GDP_{it-1}$				-0.208	-0.400	-0.016
				(0.707)	(1.071)	(0.906)
$\Delta \ln GDP_{jt-1}$	1.453*	1.382	1.160	1.816***	1.451	1.860*
	(0.826)	(1.298)	(1.173)	(0.629)	(0.945)	(0.975)
$\Delta imports_{ijmt-1}$	0.010	0.004	0.029	0.011	0.009	0.020
	(0.012)	(0.013)	(0.023)	(0.011)	(0.012)	(0.016)
RTA_{ijt-1}	0.038	-0.040	0.062	-0.022	-0.012	-0.058
	(0.056)	(0.094)	(0.086)	(0.055)	(0.092)	(0.066)
$year_t$	0.029***	0.043***	0.012	0.026***	0.029***	0.018
	(0.008)	(0.009)	(0.014)	(0.006)	(0.006)	(0.013)
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
KP	65.3	51.3	22.4	54.6	42.0	15.3
Observations	1,296	754	531	1,769	931	832

Notes: Standard errors clustered by country-pair are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table A.4: OLS results

	Benchmark			Macro controls		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: $removal_{mijnt}$	All	High-income	Emerging	All	High-income	Emerging
$\Delta \ln DVA_{injt-1}$	0.004	0.077	-0.107*	0.004	0.060	-0.062
	(0.042)	(0.049)	(0.064)	(0.034)	(0.040)	(0.051)
$\Delta \ln exch.\ rate_{ijt-1}$	0.001	0.001	0.000	0.000	0.002	-0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
$\Delta \ln ISIC\ output_{iht-1}$	-0.033	0.024	-0.150			
	(0.096)	(0.087)	(0.135)			
$\Delta \ln GDP_{it-1}$				-0.776	-2.556**	0.167
				(0.548)	(1.136)	(0.724)
$\Delta \ln GDP_{jt-1}$	2.270***	-0.415	4.722***	1.895***	0.440	3.257***
	(0.856)	(0.929)	(1.262)	(0.692)	(0.800)	(0.959)
$\Delta imports_{ijmt-1}$	-0.026*	-0.029	-0.010	-0.029**	-0.024	-0.026*
	(0.013)	(0.020)	(0.019)	(0.012)	(0.019)	(0.015)
RTA_{ijt-1}	-0.006	0.120*	-0.064	-0.010	0.060	-0.021
	(0.054)	(0.071)	(0.074)	(0.039)	(0.065)	(0.067)
$year_t$	-0.001	0.001	-0.008	-0.002	-0.003	-0.010
	(0.008)	(0.006)	(0.014)	(0.005)	(0.005)	(0.010)
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj-R^2	0.18	0.17	0.20	0.19	0.20	0.18
Observations	1,296	754	531	1,769	931	832

Notes: Standard errors clustered by country-pair are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table A.5: First-stage for Table 4

	Alternative IV (HS2)			Instrument import growth		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	High-income	Emerging	All	High-income	Emerging
	Dep. var.: $\Delta \ln DVA_{injt-1}$			Dep. var.: $\Delta \ln DVA_{injt-1}$		
$\Delta \ln exports_{jnt-1,-i}$	0.295***	0.242***	0.330***	0.400***	0.306***	0.536***
	(0.050)	(0.046)	(0.103)	(0.051)	(0.046)	(0.115)
$\Delta imports_{imt-1,-j}$				0.059***	0.072***	0.046
				(0.019)	(0.025)	(0.029)
				Dep. var.: $\Delta imports_{ijmt-1}$		
$\Delta \ln exports_{jnt-1,-i}$				0.025	0.161	-0.059
				(0.128)	(0.158)	(0.208)
$\Delta imports_{imt-1,-j}$				0.322***	0.224***	0.374***
				(0.064)	(0.082)	(0.092)
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
KP	34.3	28.3	10.2	8.94	1.49	7.83
Observations	1,252	727	512	1,296	754	531

Notes: Table reports the instruments only and omits the control variables for brevity. Standard errors clustered by country-pair are in parentheses. Significance levels: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

B Institutional setting

Countries differ in how they administer antidumping protection. Some countries such as the US and Canada have a dual-track system where dumping and injury determinations are made separately by two different bodies. The EU and most other countries have a single-track system, where the same government body examines dumping, injury, and their causality. Countries also differ in how they administer reviews for existing AD duties. These differences influence how frequently AD duties go through expiry reviews, and when they do, how likely they are to be extended. Since these differences might influence the probability of a trade barrier being removed, we briefly explain each country's AD review mechanism in this section. For readers interested in the details, Table B.1 shows the official online sources for each country's AD review mechanism.

Among the high-income economies in our sample, the US and Canada follow a similar approach. In the US, the International Trade Administration (ITA) of the Department of Commerce publishes in the Federal Register a notice of initiation of a review of AD duties (also called "sunset" reviews), and if no interested party responds, then the duties expire in their scheduled date. If interested parties do respond adequately to the notice of initiation, the ITA (for dumping) and the International Trade Commission (ITC; for injury) conduct full reviews jointly, as in original AD investigations. Note that the ITA also conducts annual administrative reviews that can result in changes of duty levels. In Canada, the Canadian International Trade Tribunal (CITT) determines whether there is a need for a review. If yes, then the Canada Border Services Agency (CBSA) conducts a review on the likelihood of "continued or resumed dumping" if duties were to be revoked. Finally, if the CBSA concludes affirmatively, the CITT examines the link between dumping and the likelihood of injury to decide whether to extend the duties. Note that akin to the US' administrative reviews, Canada undertakes interim reviews which can change the level of duties. The only major difference between the two countries is that in the US the review investigations officially start once there is adequate demand from the domestic industry, whereas in Canada, it is the administering authority that decides to conduct a review or not.

In the EU, the European Commission (the Commission) publishes a Notice of Impending Expiry. If the domestic industry responds adequately to the notice, the Commission begins an official expiry review to decide whether to extend the duties or not. These reviews can also be initiated by the Commission *ex-officio.* Note that the Commission also conducts interim reviews where the level of duties can change, and in some cases the duties can be prolonged (see Nita and Zanardi, 2013). The expiry reviews in Australia follow a similar procedure, except that the domestic industry must actively respond to the Anti-Dumping Commission's expiry notice. Like the EU, interested parties can also request periodic reviews that can result in the modification of duty levels. Note that this type of (non-expiry) reviews are not included in our database and are outside the scope of our research.

The emerging economies in our sample have more flexible approaches to conducting expiry reviews. In fact, the official government sources of some countries do not specify the exact requirements for a review to be valid. Nevertheless, all of the six countries' AD administering authorities publish a notice of expiry before a duty is supposed to expire. It seems that in all of them, the administering authority can initiate a review *ex-officio* like in the EU, or the domestic industry can respond to the notice of expiry to officially start an expiry review investigation. While all six countries' systems look similar to each other, Mexico's system (even though having a single-track investigation system) is very close to the US and Canada system, and Turkey's review procedures look very similar to the EU's. Like the high-income countries, the emerging economies have interim reviews, and some of these can result in the prolongation of duties. For all countries, once an expiry review is initiated, the administering authority must find that the removal of duties will lead to injury or threat of injury caused by continued dumping—an obscure task that requires coming up with a counterfactual.

B.1 Duration and extension of duties

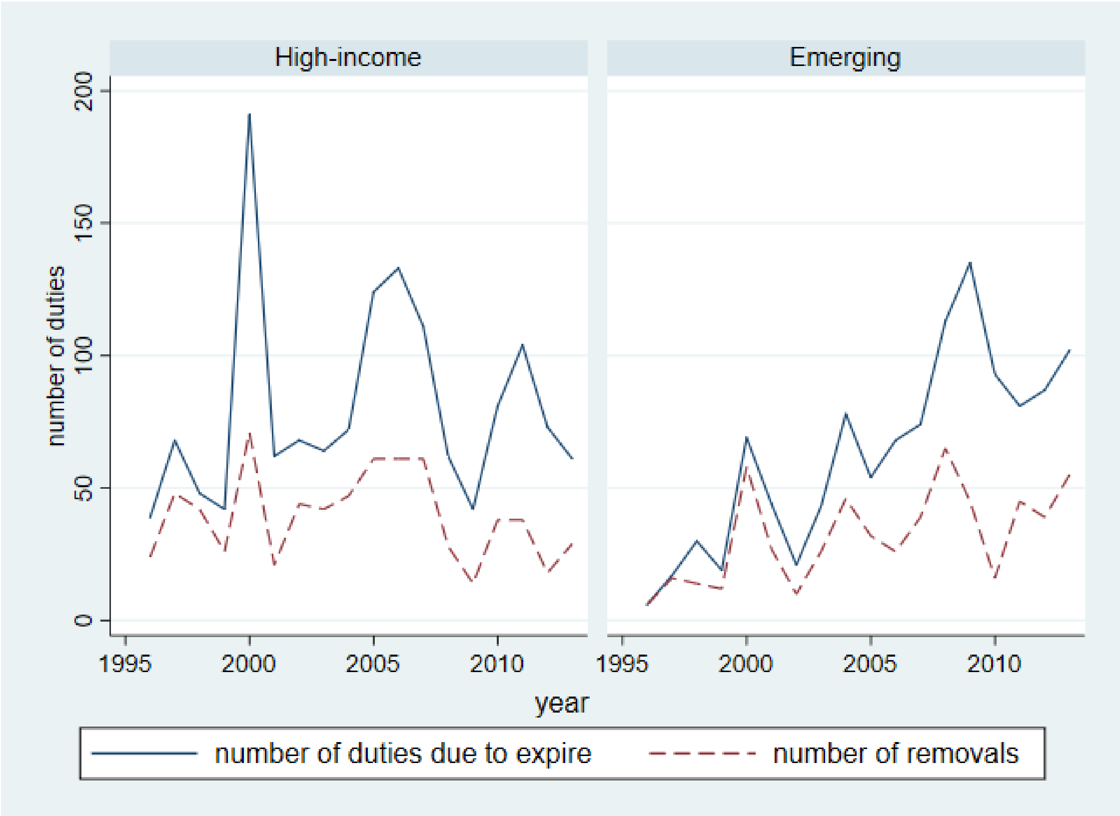
In Table B.2, we examine the duration and extension of duties. In column 1, we present the mean duration of an AD duty for each country, including duties that were still in effect as of end-2013 (censored). The AD duties imposed by the US last longest, with an average of 12 years. This is three years longer than the country with the second-highest duration of duties, Mexico. Note that Argentina, who often imposes duties for two years, is the country with the minimum average duration of 4.8 years. Restricting the sample to expired duties (uncensored) in column 2 gives similar conclusions.[36] Column 3 shows the average number of extensions by each country—again, the US stands out by extending a duty 1.1 times on average, followed by Mexico. Finally, columns 5 and 6 show the number of expiry reviews conducted by each importing country and the share of duties that went through expiry reviews. On average, a duty is reviewed 69% of the time. This high figure is largely driven by the US (89%), Canada (86%), and Mexico (78%), and it is lowest for Argentina, who reviews cases only 39% of the time. This heterogeneity in the share of duties that are reviewed is largely due to the different AD institutional settings of the countries.

Next, we analyze the evolution of removals over time. Figure B.1 shows the number of duties to expire and the number of removals for the high-income (Australia, Canada, the EU, the US) and emerging-country (Argentina, Brazil, China, India, Mexico, Turkey) samples separately. Note how, for high-income countries, the number of duties due to expire peaks in 2000, due to the new WTO mandate on reviewing existing duties by 2000 (when the US had a staggering 134 duties up for review). The removal share after 2000 had a mean of 46% with a standard deviation of 13%. For emerging countries, the number of duties due to expire has a rising trend as these countries became frequent users of temporary trade barriers. For them, the removal share after 2000 had a mean of 52% with a standard deviation of 16%. The low standard deviations for the removal

[36] About a third of the duties in our data were still in effect by the end of 2013, making the uncensored sample size two-thirds of the censored sample size.

shares reveal that these shares do not change much over the years. Moreover, a simple t-test that compares the two samples' removal shares shows that they are not significantly different from each other.

Figure B.1: Number of duties to expire and removals



Notes: Sample covers 1996-2013 with 2,579 observations. The high-income countries are Australia, Canada, the EU, and the US; the emerging countries are Argentina, Brazil, China, India, Mexico, and Turkey.

Table B.1: Government sources for AD review procedures

Policy-imposing country	AD review administering authority	Source
Argentina	The National Commission for Foreign Trade	http://www.sice.oas.org/antidumping/legislation/arg/766_e.asp
Australia	The Anti-Dumping Commission	https://www.adcommission.gov.au/accessadsystem/continuationinquiries/Pages/default.aspx
Brazil	The Department of Commercial Defense	http://www.mdic.gov.br/index.php/comercio-exterior/defesa-comercial/145-o-que-e-defesa-comercial
Canada	The Canadian International Trade Tribunal (CITT) & The Canada Border Services Agency (CBSA)	http://cbsa-asfc.gc.ca/sima-lmsi/expg-ldexp-eng.html
China	Ministry of Commerce (MOFCOM)	https://enforcement.trade.gov/trcs/downloads/documents/china/index.html
EU	The European Commission	http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_151019.pdf
India	Directorate General of Trade Remedies	http://www.dgtr.gov.in/sites/default/files/Compendium_of_Law%26Regulations_for-mail.pdf
Mexico	The Secretariat of the Economy	see Bowman, Covelli, Gantz, and Uhm (2010)
Turkey	The Ministry of Trade	http://www.tariff-tr.com/AntiDumping.aspx
USA	The International Trade Administration (ITA) & The International Trade Commission (ITC)	https://www.usitc.gov/trade_remedy/documents/handbook.pdf

Table B.2: Duration and extension of AD duties

Importing country	(1) Mean duration of duties (censored)	(2) Mean duration of duties (uncensored)	(3) Mean number of extensions (censored)	(4) Mean number of extensions (uncensored)	(5) Number of expiry reviews	(6) Share of duties with an initiated review
Argentina	4.82	4.37	0.44	0.25	71	39%
Australia	6.51	6.25	0.37	0.21	103	64%
Brazil	7.97	6.79	0.86	0.39	100	74%
Canada	7.78	7.71	0.64	0.39	209	86%
China	6.08	6.20	0.69	0.24	76	70%
EU	7.48	7.18	0.42	0.24	180	51%
India	5.96	5.67	0.44	0.13	211	64%
Mexico	9.05	9.02	1.00	0.59	141	78%
Turkey	6.51	6.68	0.71	0.11	120	68%
USA	11.99	11.54	1.14	0.49	604	89%
Total	7.91	7.38	0.69	0.30	1815	69%

Notes: Data is based on the entire sample (1996-2013). Duration is in number of years. Censored includes the duties that are still in effect as of end-2013 (total of 1,839 duties), whereas uncensored has the removed duties only (1,243 duties).

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