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Anti-dumping Activities against China: Patterns and Effects[☆]

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Abstract

This paper provides a thorough description of anti-dumping activities in the period 1980–2015, with a focus on measures imposed by the European Union and the United States. We document a series of stylized facts, such as the emergence of China as a major target of administered protection, the concentration of duties in few sectors, and the increasing share of intermediate goods subject to anti-dumping measures. Product-level information on Chinese exporting firms shows that anti-dumping does indeed reduce exports and it has an impact on both the extensive and the intensive margin of trade. Moreover, the (FOB) price of targeted product tend to rise marginally, so that the fall in export quantities is particularly strong.

JEL codes: F13; F14

Keywords: anti-dumping duties; trade protection; China; discriminatory tariffs

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1. Introduction

Trade protection has been on the rise, especially since the 2008 financial crisis. Even if countries have not resorted to a 1930s-style, generalized increase in tariffs, several discriminatory measures have been introduced aimed at favoring domestic firms (Evenett, 2019), with anti-dumping (AD) duties playing an important role in this strategy.[1] The last 45 years have witnessed a global surge in the adoption of AD both for traditional users, such as the European Union (EU) and the United States (US), and emerging economies, such as India and Brazil. An important new fact that has been documented is the emergence of China as the single most important target of both European and American AD actions.

Starting from this evidence, the paper contributes to the existing trade literature by providing an in-depth analysis of the evolution of AD activities since the 1980s, with a particular focus on the emergence of China as a major target of administered trade protection by the EU and the US.[2] By combining detailed data on bilateral trade flows, on AD measures adopted across the world, and on firm-product exports for all Chinese exporting firms, we are able to present a complete picture of AD protection in the EU and the US, and its effects on China's exports, moving from an aggregate level down to sectors and firms. While much of the existing literature looks at the effect of AD policies at the macro-level, the use of detailed information on Chinese firms allows us to provide new evidence at the micro-level, shedding light on the impact of such trade policies on targeted exporters.

We start our empirical investigation from a macro perspective through the identification of the major trends in the usage of AD measures from the beginning of 1980s until 2015, thus extending the analysis to a longer period with respect to previous studies (Blonigen and Prusa, 2016; Vandenbussche and Viegelahn, 2011; Bown, 2018). In line with the existing evidence, we document an increase in the use of AD measures, for both traditional users and emerging countries. The two largest economies, the US and the EU, have intensified their usage of AD duties in terms both of the number of products and the amount of imports covered, and this trend has gained pace in the aftermath of the global financial crisis. When it comes to target countries, we document a shift away from G7 exporters toward emerging economies, as these become more tightly integrated into world trade and gain market shares. In this respect, we confirm the emergence of China as the single most important target of European and American AD actions, which has occurred in the last ten years or so. The analysis by industry and product characteristics attests a certain degree of concentration in the use of AD duties across industries, as documented by Blonigen and Prusa (2016). Although the degree of trade protection granted to different sectors does not vary much over time, we do observe a shift in the type of goods that are covered by AD measures over our sample period. In fact, both the EU and the US have been increasingly targeting intermediate and industrial goods, while somewhat lowering their coverage of consumption goods. Once again, this pattern

[1] The term "dumping" denotes a situation whereby a firm either charges a lower price in a foreign market than it does domestically, or it exports the good at a price below its production costs. For details on AD duties in the context of WTO rules, please refer to Article VI of the GATT 1994 AD Agreement.

[2] Throughout the paper we define the EU as being made up of 28 member countries: Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

is more pronounced after the Great Recession.

The paper then takes the perspective of target countries and provides evidence on the effects that AD policies have on Chinese exports and Chinese exporters. We find a significant decrease in trade flows for goods that are subject to AD measures, compared to similar products that are immune from this kind of protection. This fall in trade is sizable, ranging from -28% in the case of exports to the EU to -50% when we consider the US. The use of transaction-level Chinese data allows us to decompose the fall in exports into the extensive margin (i.e., the number of exporters) and the intensive one (i.e., the average export value of surviving exporters). To identify the effects of AD duties, we implement a rigorous empirical examination by applying a difference-in-differences-in-differences estimation strategy. To deal with endogeneity concerns, we use different control groups including one defined by propensity-score-matching (PSM). We show that the impact of AD works through both trade margins, reducing the number of exporting firms as well as average exports per firm. We also disentangle the aggregate effect into a quantity and a price margin. Consistently with the literature, we find evidence of a limited positive effect on export prices, so that the fall in the values of trade flows is largely driven by a sharp reduction in quantities. As such, AD measures appear to reach their target: Chinese exporters increase their prices and imports go down significantly, although the bulk of the effect tends to fade away after 5 years or so.

This paper contributes to the existing literature on AD in several ways. The first contribution stems from the extension of the analysis to the period after the global financial crisis, which has seen a substantial increase in the use of temporary trade barriers. Our work complements existing papers by confirming previous evidence and highlighting new stylized facts, such as the increasing focus on China and on intermediate goods, that do not seem just temporary reaction to the global crisis, but rather new trends that are here to stay. The paper directly speaks to the literature that investigates how an escalation of trade tensions, in particular the recent trade war between the US and China, may affect global value chains (e.g. Bown, 2018). Our results confirm that in the last decade AD measures have been progressively moving away from final products toward intermediate goods. While this may part of a strategy by governments in industrial countries to reshore chunks of the supply chain serving domestic production, the rising cost of intermediate inputs may negatively affect the competitiveness of domestic firms and their growth prospects.

The second contribution stems from the microeconomic analysis that adds to our understanding to the various channels through which firms respond to trade shocks. In particular, the paper complements a small but growing literature that studies the impact of AD measures on targeted exporters (Lu et al., 2013; Felbermayr and Sandkamp, 2020; Lee et al., 2017). Lu et al. (2013) focus on the effect of US AD measures on Chinese exports for the period 2000-2006, showing that the observed fall in trade is primary due to a drop in the number of exporters. This result is confirmed in Felbermayr and Sandkamp (2020), who extend the analysis to 2009. Lee et al. (2017) find that US AD actions against China do cause an increase in the price of those goods in the US market between 1998 and 2006, although the effect is short-lived. Our paper improves upon existing studies by using a much broader sample of countries and a longer period; rather than focusing on one specific export destination, we investigate all the 28 countries that have imposed AD measures against China between 2000 and 2015. As such, we provide a more comprehensive picture of the implications of AD measures for Chinese firms. This is crucial in understanding the relationship between the increasingly integrated Chinese economy and the proliferation

of AD measures imposed against it.[3]

The remainder of the paper is organized as follows. Section 2 presents a series of stylized facts regarding AD activity in the EU and the US. Section 3 illustrates the impact of AD duties on Chinese exports and decomposes the aggregate effect along different adjustment margins. Finally, Section 4 concludes.

2. Patterns in the EU and the US Anti-Dumping Policy

The purpose of this Section is to identify major trends in the usage of AD measures since the 1980s, with a specific focus on the EU and the US as users, and China as a target of trade barriers. We draw on data from the World Bank Global Antidumping Database (GAD) that provides information on all AD proceedings across countries. Section 2.1 describes the GAD dataset and presents some preliminary results, while Section 2.2 extends the analysis by exploiting detailed information on the specific products involved in each dispute, and thus going beyond the traditional *case metric*.[4]

2.1. Case metric analysis

Information on AD activities are taken from the GAD, a World Bank sponsored initiative that provides details about worldwide AD proceedings from the early 1980s until 2015 (Bown, 2015). While countries have a certain leeway in the actual implementation of AD laws, as long as their practices are consistent with a basic set of principles under the WTO Agreement on AD, there is substantial cross-country homogeneity in how the procedures work.[5] An AD proceeding typically involves an investigation of the evolution of import quantities and import prices from the countries that are accused of dumping by an import-competing domestic industry. The investigation procedure usually contains two main stages and lasts for about 12–15 months. In the first, preliminary, stage countries take provisional measures either by imposing temporary duties or by terminating the investigation. The second, final, decision occurs when the preliminary determination is affirmative and the country can either impose definitive measures, or dismiss the case without imposing any sanction. AD measures can be implemented in the form of an *ad valorem* duty (an import tax based on the value of transactions), a specific duty (a tax per quantity unit), or as price undertakings (whereby the targeted exporter agrees to sell its products at a minimum price). AD measures are meant to be in place as long as injurious dumping continues and they are generally imposed for a period of 5 years, after

[3]Rather than focusing on the intensive margin effect of AD measures, Chandra and Long (2013) provide empirical evidence that US-imposed AD duties lead to a significant drop in both labor productivity and total factor productivity of Chinese firms. Similar issue are studied by Jabbour et al. (2019) in relation to measures imposed by the EU. They find that the productivity of surviving Chinese exporters improves after the imposition of AD measures. Other empirical studies, such as Lu et al. (2018) and Chandra (2019), have shown that the imposition of tariffs leads targeted exporters to adjust their product scope not only vis-à-vis the policy-imposing country and but also relative to third markets. Equally important is the firms' decision to enter into and exit from export markets in response to AD shocks. This dimension has been investigated by Crowley et al. (2018), who find that Chinese firms are less likely to enter new foreign markets and more likely to exit from established foreign markets when their products are subject to AD measures.

[4]The term *case* refers to a specific country and industry involved in an AD proceeding (e.g. solar glass investigation from the EU against China, or silico-manganese against India). AD cases vary substantially in their coverage, with some of them affecting several products and billions of dollars in trade value, while others target a single tariff line.

[5]See Bown (2005) and Blonigen and Prusa (2016) for a detailed description of AD practices.

which they are subject to a mandatory review process and can be extended for decades.[6] The GAD dataset collects official documentation from national governments to organize information on the investigative procedures and outcomes of AD activity across importing countries (so-called *users*).

Of the circa 7,200 cases that have been initiated by almost 50 countries in the period 1980–2015 and are contained in the GAD dataset, more than 50% refer to just 5 users and the share grows as large as 75% if we enlarge the focus to cover the top 10 users (see Table A2 in the Appendix for the details, and Blonigen and Prusa, 2016 for analogous evidence).

During this period, the US have initiated 1,343 cases, followed by the EU, with 778. Despite the high concentration, however, temporary trade restrictions have spread beyond the four "historical users", namely the US, the EU, Canada and Australia that in the 1980s used to file almost all AD cases: in recent years several emerging economies have showed remarkable enthusiasm at AD measures, and countries like India, Brazil, Argentina, Mexico, South Africa and Turkey now feature among the top users.

China, the world's largest exporter, represents the main target of AD investigations, contributing to more than 20% of EU cases and to 14% of American ones. Indeed, China has become the single most common target of European AD investigations at least since 2005, attracting almost half of all filings: more that 70% of cases have resulted on some kind of protective measures being taken (Tables A3 and A4 in the Appendix) Something similar happens in the US, where China represents 36% of all cases initiated between 2004 and 2015. Here as well, 76% of investigations have resulted in the imposition of a final AD duty whose average level (158%) is almost 4 times as high as the average tariff facing all other exporters subject to AD measures.

Information on cases initiated and measures taken each year does not provide a clear picture of the accumulation of trade barriers over time, since it does not account for the possible removal or the renewal of measures. To better grasp the phenomenon we therefore calculate a "stock" indicator by taking the number of AD measures in force minus the number of measures revoked in that specific year, plus new measures imposed. Results for the EU (left panel) and the US (right panel) are presented in Figure 1. The number of AD measures in force has grown significantly over the period between the end of the 1980s and the beginning of the 2000s, while the last two decades have seen a more stable pattern, or a decline in the case of the EU. However, the number of measures in force against China has kept growing and shows no sign of abating. Between 2006 and 2015, China accounted for 50% of all measures in force in the EU and 35% of those active in the US. As of 2015, there were 87 and 262 active AD measures in effect in the EU and the US, respectively, and among them, 50 and 100 measures were targeting China explicitly.

The prominent role played by China is remarkable, but it is consistent with a more general shift in the use of AD measures, that are more and more directed toward emerging economies as they become progressively more integrated in the world trading system and they conquer market shares (Prusa, 2011).

2.2. Product metric analysis

An AD case may involve just a single tariff line, defined according to the 8/10-digit Harmonized System (HS) classification, or include dozens of them. Hence, while the case metric analysis gives a *prima face* evidence of the increasing role of AD measures

[6] Figure A1 in the Appendix reports the flowchart of a typical AD investigation in the EU.

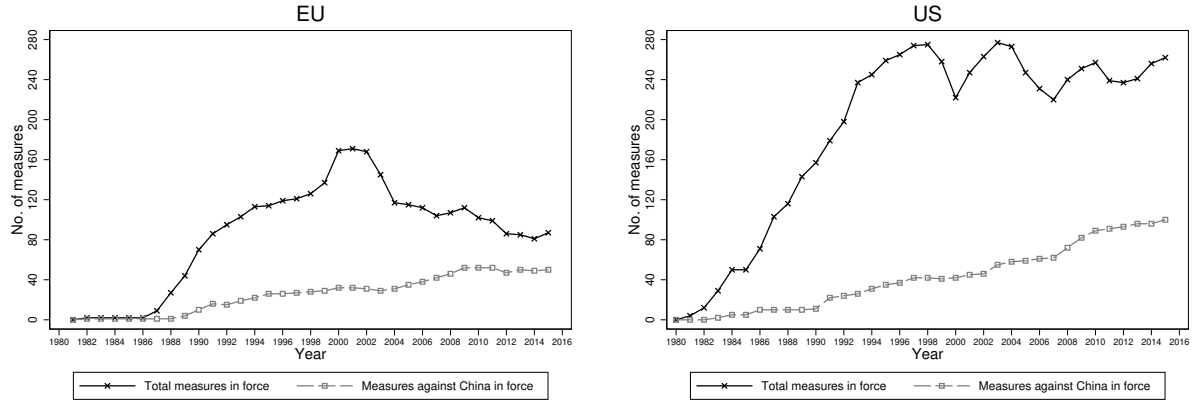

Figure 1: Stock of AD measures in force by the EU (left panel) and the US (right panel). Source: Authors' calculations using Global Antidumping Database (Bown, 2015).

against China, it has the limit of neglecting the number of product lines involved in each dispute and, more importantly, the value of trade affected by different cases. To better capture the scope and the size of each case, we adopt several 'product metrics' used in the literature to evaluate trends and patterns of AD activity (see Bown, 2011a,b; Prusa, 2011; Vandenbussche and Viegelahn, 2011, among others). For this purpose we exploit the product-level information contained in the GAD database, that details the various 8/10-digit HS code involved in each AD case, and match it to bilateral trade data taken from the CEPII-BACI dataset (Gaulier and Zignago, 2010).[7]

Two caveats are in order. The first problem stems from the product aggregation of the Harmonized System. In the GAD data products are identified at the 8/10-digit HS level, while BACI provides information at 6-digit HS level of aggregation, which is the finest level of classification that is common across countries. Trade data are therefore combined with the AD measures at 6-digit HS product level: this is likely to overestimate the impact of AD activity because AD cases often do not cover all product-lines within a 6-digit HS category. Yet, the fact that those 6-digit HS categories are consistently defined across all trading partners implies that any measurement error is common to all AD users and targets and will not bias our results. The second problem concerns the changes in the number of product codes over time. Because these changes occur more frequently at more disaggregated levels (Prusa, 2011), performing the analysis at the 6-digit level reduces possible errors. To harmonize the classification over time, we use concordance tables provided by the UN Statistics Division and reconcile the data to the 1996 version of the HS classification.

In what follows we provide a broad picture of the trends in AD activity over the last decades, looking at both the number of products and the share of a country's imports that are affected by AD duties. The first indicator proposed by Bown (2011a) is a *product count* metric of the annual stock of 6-digit HS products subject to AD measures. This product share (PS) counts the number of products under AD protection that are imported from a target country, divided by the total number of products imported:

[7]AD cases that have missing HS codes are excluded from the analysis.

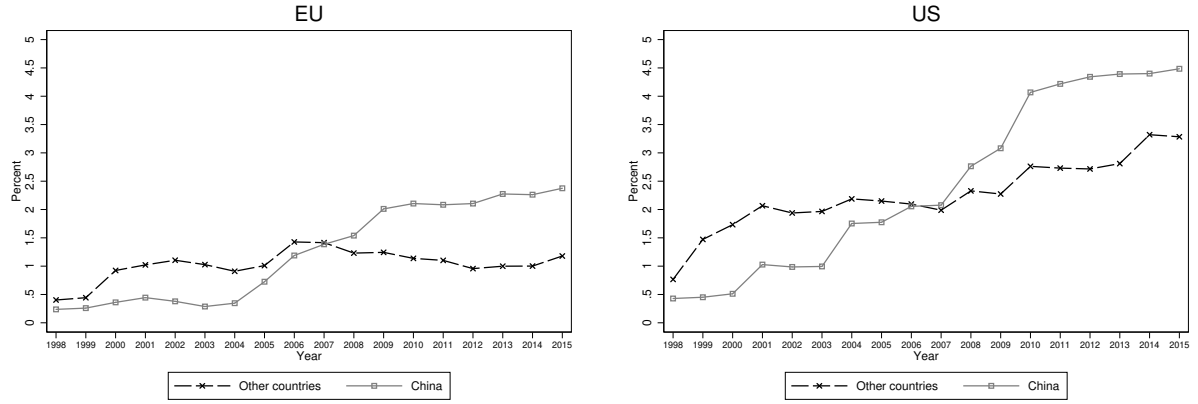

Figure 2: Product count metric: share of 6-digit HS products imported from China and other countries subject to AD measures (PS^{stock}_{kt}) by the EU (left panel) and the US (right panel). Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

$$PS^{stock}_{kt} = \frac{\#P^{AD}_{k,t}}{\#P_{k,t}} \quad , \tag{1}$$

where $\#P^{AD}_{k,t}$ stands for the number of 6-digit HS products subject to AD measures in the importing country k at time t and the denominator represents the total number of products imported by k at time t. We focus on the two most active users of AD measures, i.e., the EU and the US, so that in equation (1) $k \in \{EU, US\}$. As far as the target country is concerned, our attention is on China. Note that we only refer to products for which there has been an actual application of AD duties, and not just an investigation. However, for those products we also count preliminary measures since the investigation led to the imposition of a measure later on. This measure therefore captures the stock of products subject to AD at any point in time.

Figure 2 reports the evolution of PS^{stock} over time for both the EU (left panel) and the US (right panel), distinguishing between China and other target countries. Overall, around 1.5% of the products imported in the EU are subject to AD duties, while the share is around 1 percentage point larger (2.4%) for the US. However, Figure 2 shows once again that Chinese imports have a peculiar behavior: the share of Chinese products imported in the EU that are subject to AD measures has grown nearly eight-fold over the period from 2004 to 2015. While in 2004, only 0.3% of Chinese products were subject to duties, by 2015 the share had risen to nearly 2.4%. A similar trend applies to the US as well, although here the surge in AD protection has started already in the late 1990s, before China's WTO accession, and has moved from 0.5% of imported products in 1998 to over 4.5% in 2015. These results confirm those found in the case-metric analysis discussed in Section 2.1, as well as existing evidence covering earlier periods (Prusa, 2011; Vandenbussche and Viegelahn, 2011): they all show that Chinese products are increasingly targeted by AD actions both in the EU and in America.

While for the US the increased coverage of products subject to AD measures seems a general trend (see right panel of Figure 2), this is not the case for the EU, where PS^{stock} has been declining at least since 2006. As such, the sharp increase in the coverage of Chinese products affected by AD duties stands out as a deliberate attempt to fend off competition from Chinese producers. In fact, this is part of a broader trend that the EU trade policy

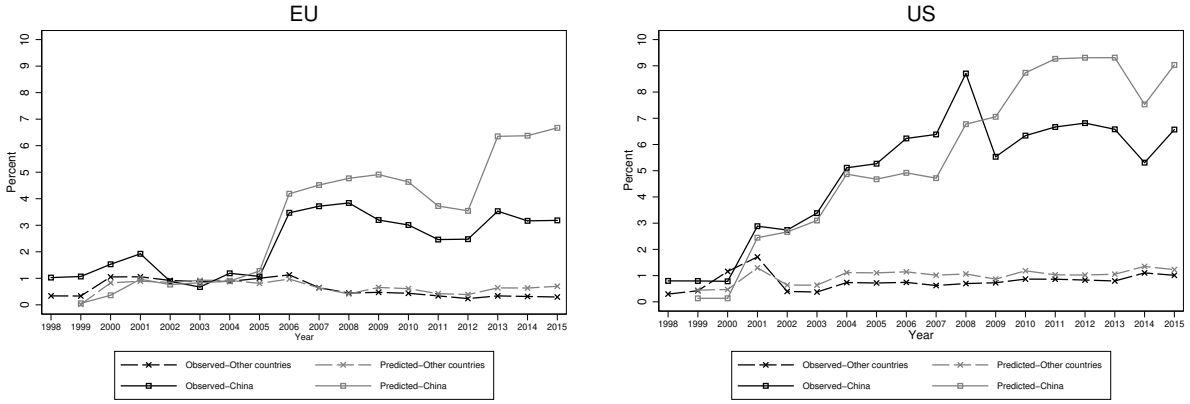

Figure 3: Trade weighted product metric: share of observed and predicted import values from China and other countries of 6-digit HS products subject to AD measures by the EU (left panel) and the US (right panel). Source: Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

seems more concerned with (possibly unfair) competition from emerging countries, while PS^{stock} relative to high-income exporters is going down (see also Vandenbussche and Viegelahn, 2011).

To capture more precisely the breadth of trade affected by AD measures, we turn to other two *trade-weighted* metrics. Our next indicator consists of the ratio between the value of imports subject to AD duties ($M^{AD}_{k,t}$) over a country's total imports ($M_{k,t}$):

$$IS^{observed}_{kt} = \frac{M^{AD}_{k,t}}{M_{k,t}} \quad . \tag{2}$$

As discussed by Bown (2011a) and Vandenbussche and Viegelahn (2011), one limitation of this indicator is that it does not take into account the negative effect that AD measures have on imports and it is therefore likely to underestimate the importance of trade restriction. After all, trade barriers are meant to limit imports into country k, so that actual trade flows are likely to be smaller than those we would observe in an hypothetical free-trade scenario. To overcome this issue, we modify the measure using a counterfactual "virtual" import flow. More precisely, we compute a predicted value for imports of products subject to AD duties ($\hat{M}^{AD}_{k,t}$) by taking the dollar value of imports the year *before* AD duties are first applied, and applying the average annual growth rate across all products that are never subject to any AD measure in our sample and that belong to the same industry (identified as a 2-digit HS category):

$$IS^{predicted}_{kt} = \frac{\hat{M}^{AD}_{k,t}}{\hat{M}^{AD}_{k,t} + M^{nonAD}_{k,t}} \quad . \tag{3}$$

Taken together, these two measures provide us with an assessment of the amount of trade that is covered by AD trade barriers. Figure 3 presents these two "weighted" indicators for the EU (left panel) and the US (right panel), from 1998 to 2015. The two measures follow a very similar pattern and confirm results from previous studies (Vandenbussche and Viegelahn, 2011): China is the most important target country and in 2005 there is a jump in the share of imports from China that are subject to AD measures; the share decreased in the aftermath of the financial crisis and the ensuing collapse of

global trade, but rebounded quickly in 2012. The share of imports from other countries that is subject to AD duties remains relative stable and low, below 1%, irrespective of the method applied.

For both the US and the EU, the difference between China and other target countries is much more pronounced under the trade-weighted metric than in the case of the product count measure.

2.3. Product metric analysis: by industry and product characteristics

We further investigate the characteristics of products subject to AD measures to look whether certain sectors are more prone to file AD complaints and certain types of goods are more likely to be hit by AD duties. The purpose of this exercise is twofold: on the one hand we aim at documenting the possible "capture" of AD policies by specific sectors, on the other hand we ask whether the emergence of global value chains (GVCs) have altered trade policy.

For what concerns the first issue, Morck et al. (2001) and Blonigen (2006) find that prior experience in filing AD cases is a major determinant of the probability that a firm or a sector will apply for AD protection in the future. Given that most of the existing evidence concerns the US, we provide some novel evidence on European sectors. Table 1 shows that for the US only three sectors (metals, wood and food) display a product coverage above 5%, with the first two significantly more protected than the others.[8] Even when considering a trade-weighted measure, only four sectors have a coverage larger than 5%, thus confirming that some industries are indeed more likely to ask for, and to receive AD protection. A similar degree of concentration is also found in the EU, although this is smaller once we weight the number of products for their import values. Metals, stone and glass, and electrical machinery are the industries with the largest PS^{stock} vis-à-vis all target countries in the EU, but only in case of metals is the share of imports subject to AD duties close to 5%. The ranking does not change if one distinguishes between China and other countries as target, nor if we consider previous years (results not reported). In fact, the data indicate that industries seeking AD protection have not changed much over the last two decades.

The presence of GVCs implies that countries are linked by trade in intermediates, so that foreign products are no longer (or no necessarily) only competing with domestic production, but often constitute essential inputs for local firms. In this context, we would expect that, at least in recent years, policymakers treat differently imports of consumption goods from imports of capital and intermediate products.

As shown in Figure 4, the shares of industrial and consumer goods imported from China and subject to AD measures increased significantly after 2004. Contrary to our expectations, after the 2008 crisis AD measures have been focusing increasingly on industrial goods, with consumer products playing a lesser role. For example, more than 6% of the value of imported intermediate inputs from China were subject to the EU AD duties in 2015. While the number of products classified as capital goods that are subject to AD protection has increased sharply since 2007, in trade-weighted terms, this category remains largely unaffected.

Figure 5 reports the same analysis by product categories for the US, and unveils a similar pattern: at least since the mid-2000s, American AD measures against China disproportionately affect intermediate inputs, and this difference across product-types seems

[8]The association between HS chapters and industries is reported in Table A1 in the Appendix.

Table 1: Product and Import coverage of anti-dumping measures, by industry and target country: EU and US, 2015

	EU						**US**					
	PS_{kt}^{Stock}			$IS_{kt}^{Observed}$			PS_{kt}^{Stock}			$IS_{kt}^{Observed}$		
	All countries	China	Others	All countries	China	Others	All countries	China	Others	All countries	China	Others
Anim	0.0	0.0	0.0	0.0	0.0	0.0	2.6	4.8	1.0	7.8	1.9	8.3
Chem	3.2	2.3	1.7	1.3	7.9	0.7	3.5	3.5	1.6	0.8	6.0	0.4
Elec	5.5	4.9	1.6	1.9	4.1	0.0	3.9	3.0	3.1	0.7	1.0	0.5
Food	3.9	1.3	2.8	0.5	7.6	0.2	5.5	3.5	5.0	3.5	12.0	3.0
Foot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hide	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mach	0.4	0.4	0.0	0.1	0.3	0.0	2.0	1.5	0.8	1.3	1.9	1.1
Metal	9.7	8.9	5.7	4.9	14.1	2.3	21.0	14.8	17.3	8.5	23.2	4.6
Mine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mis	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.3	0.6	3.4	11.6	0.0
Plas	1.0	1.0	0.5	0.9	3.8	0.0	4.1	4.2	1.5	5.3	18.7	0.8
Ston	8.0	8.2	0.0	1.9	18.6	0.0	2.1	2.3	1.6	0.9	4.9	0.1
Text	0.3	0.3	0.0	0.2	0.5	0.0	1.7	1.8	1.4	3.1	7.5	0.5
Toys	0.0	0.0	0.0	0.0	0.0	0.0	2.4	3.5	0.0	4.4	6.2	0.0
Tran	0.8	0.9	0.0	0.2	2.3	0.0	2.3	2.8	0.0	1.0	21.2	0.0
Vege	0.7	0.0	0.7	0.2	0.0	0.3	0.7	0.5	0.7	3.7	0.1	0.0
Wood	2.9	3.1	0.5	2.2	10.1	0.1	14.3	15.9	3.5	6.7	30.2	0.2

Notes: Percentage of 6-digit HS products imported by the EU and the US subject to AD measures in 2015 (PS_{kt}^{Stock}) and observed import values ($IS_{kt}^{Observed}$), by industry and target country. Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

to have widened after the financial crisis. This is somehow puzzling because imports of intermediate goods may contribute to the competitiveness of domestic firms: in fact, most countries generally impose lower import duties on intermediate inputs than on consumption goods. It is true, however, that China has been rapidly conquering market shares in intermediate and capital goods: between 2009 and 2015 its share of global exports of consumption goods has remained stable at around 27%, while it has climbed from 10% to 14% in intermediates (and from 27% to 31% in capital goods). Given that trade in parts and components has been growing faster than trade in other type of goods in the last decades, a rapid increase in China's market share is likely to have triggered alarm bells in many countries, that have reacted by using AD measures to protect domestic producers of intermediate goods.

To summarize, since the Great Recession both the EU and the US are increasingly applying AD duties on intermediates, and this shift of focus away from consumption goods is especially pronounced for the US where, for instance, around 13% of industrial goods imported from China were covered by AD measures in 2015, versus only 4% of final goods.

3. How do Chinese exporters respond to anti-dumping?

The results presented in Section 2 suggest an escalation in the use of AD measures against China, especially since its entry into the WTO in the early 2000s. Moreover, the analysis reveals a similar pattern across both the EU and the US, which are the two most important users of AD measures, with the EU becoming somehow more similar to the US in its use of this kind of administered trade protection.

How do exporting firms hit by AD duties react? In this Section we address this question by taking the perspective of target countries and providing evidence on the effects that AD measures have on Chinese exporters. In fact, while the existing literature offers important insights on the impact of AD protection on domestic industries that benefit from it, much less is known about the impacts that those measures have on target

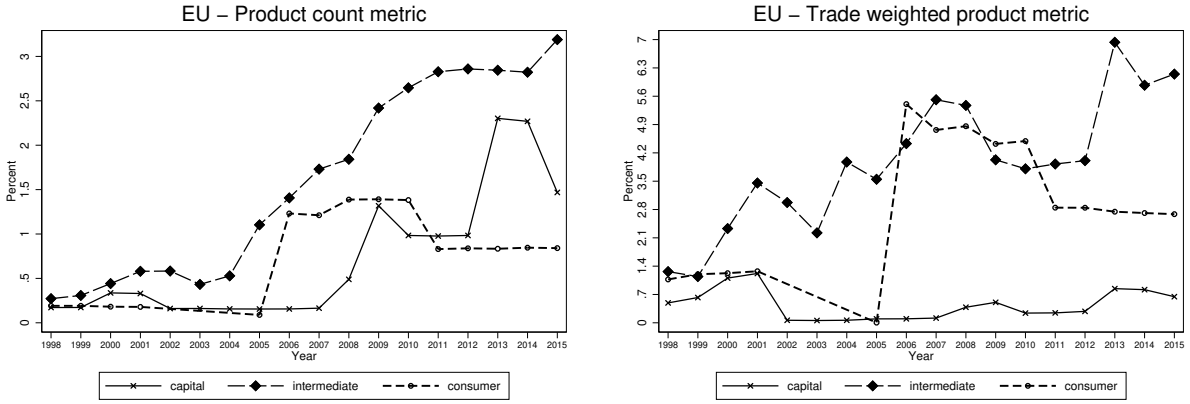

Figure 4: Product count and trade weighted metric: share of 6-digit HS products imported (left panel) and share of observed import values (right panel) from China subject to AD measures for consumer, industrial and capital goods by the EU. Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

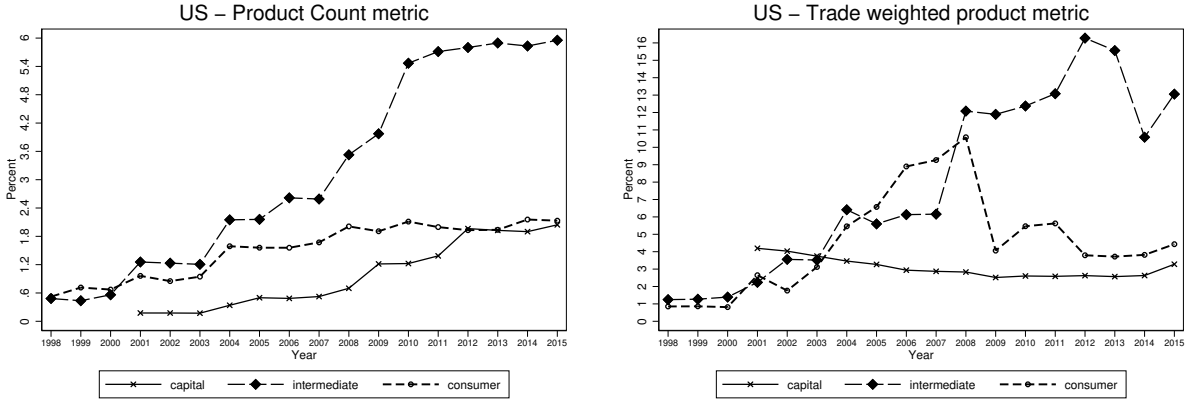

Figure 5: Product count and trade weighted metric: share of 6-digit HS products imported (left panel) and share of observed import values (right panel) from China subject to AD measures for consumer, industrial and capital goods by the US. Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

countries. To address the issue, we look both at aggregate trade flows (Section 3.1), and at microdata that allow us to decompose the overall negative effect in a number of different components, such as the number of exporters (extensive margin), the average exports per firm (intensive margin), average price and quantity (Section 3.2).

3.1. Effects on aggregate exports

We examine the effect of AD duties on Chinese exports, by looking separately at export flows toward the EU, the US and all the 28 countries that have adopted measures against China in the period under consideration.[9]

[9]These are **Argentina**, **Australia**, **Brazil**, **Canada**, **Colombia**, the **EU**, **India**, Indonesia, Israel, Japan, Jamaica, Malaysia, **Mexico**, New Zealand, Pakistan, Peru, Philippines, Russia, South Africa, South Korea, Taiwan, Thailand, Trinidad and Tobago, **Turkey**, Ukraine, Uruguay, the **US** and Venezuela. Among these, the top 3 users are the US, the EU and India. The top 10 countries (identified in bold) account for almost 80% of all AD cases against China between 1998 and 2015.

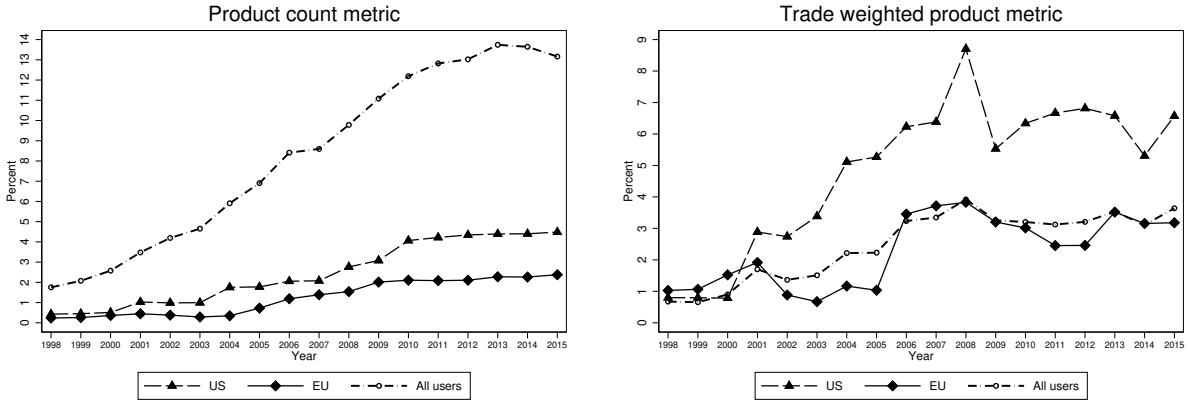

Figure 6: Product count and trade weighted metric: share of Chinese 6-digit HS products exported (left panel) and share of exports (right panel) subject to AD measures imposed by the EU, the US and all 28 countries. Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

Figure 6 considers the effect of AD measures on the patterns of Chinese exports in terms of number of products exported (left panel) and total exports involved (right panel). In line with the results provided by Bown (2015), the left panel of Figure 6 shows that following China's WTO accession in 2001, an increasing share of its exported products have been targeted by AD measures, either in the US or in Europe, although the rate of increase is much higher for its American exports. Before 2001, less than 1% of products were subject to AD barriers. That figure has more than tripled for the US over the period 2002–2015, moving from 1% to 4.5%; in the case of exports to the EU, the share of products affected has increased from 0.4% to 2.4%.

The evolution looks even more remarkable when one accounts for the value of exports hit by AD measures (see the right panel of Figure 6). In fact, while the share of 6-digit HS codes exported from China to the US is about 4.5%, these items account for almost 7% of Chinese exports, suggesting that American duties tent to target goods that features high export values. Moreover, if we take into consideration the negative effect of AD on observed exports, and compute an hypothetical "predicted" value, the share of Chinese exports affected by American duties would reach 10% (this last results is not shown in Figure 6).[10]

Another feature that emerged from the analysis was the progressive shift toward intermediate and capital goods as targets of AD measures imposed by the EU and the US. To investigate whether this is a general trend or rather a specific choice of the two most frequent users of AD protection, Figure 7 displays the usual breakdown by product category applied to Chinese exports by all the 28 countries that have imposed some AD restrictions over the period 1998–2015. We see a pattern very similar to the one discussed in Section 2.3: by the end of the sample period, intermediate goods have become the primary target of AD protection both in terms of the number of products covered and in terms of the share of Chinese exports affected by those measures. The difference across product categories, especially between intermediate and consumption goods, becomes more apparent

[10]In Section 2.3 we have observed that in the US and the EU usage of AD measures varies a great deal across different sectors. This concentration remains even when we take the perspective of Chinese exporters: although all products face some degree of AD protection by at least one country, trade-weighted measures show that only a few sectors experience a substantial amount of AD barriers.

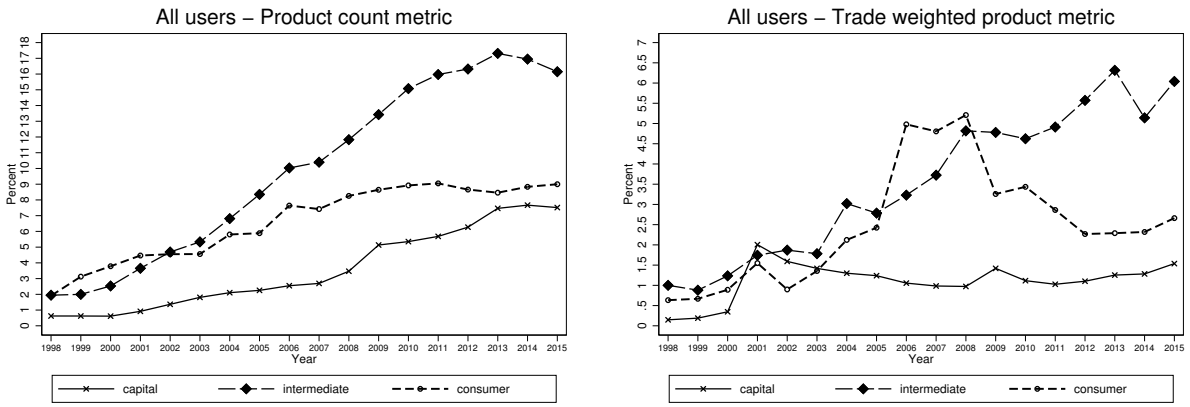

Figure 7: Product count and trade weighted metric: share of Chinese 6-digit HS products exported (left panel) and share of exports (right panel) subject to AD measures from all users for consumer, industrial and capital goods. Source: Authors' calculations using Global Antidumping Database (Bown, 2015) and BACI dataset.

in the aftermath of the financial crisis: by 2015 industrial goods have attained a product coverage ratio of 16% and a trade-weighted coverage of roughly 6%.

3.2. The effects on export margins

While the previous section has focused on the aggregate effects on Chinese exports, this section provides a micro-oriented perspective by looking at different trade margins. In particular, we are interested in determining whether the reduction in exports caused by AD measures is mainly due to a decrease in the number of exporters (extensive margin), or in the export values of surviving exporters (intensive margin). Moreover, we look at whether prices and quantities react differently to AD duties, and investigate the evolution of these effects over time. Understanding how firms in the target country respond is an essential component in describing the implications of trade policy for sectors, firms and industrial dynamic.

To address this question we combine the usual information from the GAD database with data collected by the Chinese Customs, which report annual export transactions at the firm-product-destination level over the period 2000–2015. For each export flow, we observe both values and quantities, together with information regarding the customs regime (e.g. processing trade or ordinary trade). Products are classified according to the Harmonized System classification at the 8-digit level and then aggregated at the 6-digit level. The customs data include around 5,000 products exported to 237 countries or territories.[11] By exploiting the information on the company name, we exclude intermediary firms from our sample.[12] We end up with an unbalanced panel of 491,785 firms (or 43 million firm-product-destination observations), that we use to break down total export flows in terms of the number of firms that sell a given product in a specific destination at time t (the extensive margin, NF_{pdt}) and their average exports per product-country-year (the intensive margin, $Avg.Exports_{pdt}$). Furthermore, we also decompose

[11]We drop all observations with no information on destinations, and those reporting export to the People's Republic of China.

[12]More precisely, we follow Ahn et al. (2011) and Fan et al. (2015) and identify intermediaries by looking for the elements such as "trading", "exporting" and "importing" in company names.

total export values into a price margin ($Price_{pdt}$) that captures the average unit value at the product-destination-year level and a quantity margin ($Quantity_{pdt}$) that measures the overall quantity of product p exported to destination d at time t.

To identify the possible effects of antidumping measures, we employ a difference-in-differences-in-differences (DDD) estimation strategy. This approach exploits a triple difference, and it aims at addressing possible concerns associated with a more classical difference-in-differences (DD) specification, which would be prone to either selection bias or the presence of confounding factors.In particular, one could implement a DD strategy that compares products subject to AD duties in a given country with products exported to the same destination but immune from administered protection (before and after the policy measure, changes over time being the first source of variation that is exploited). In this case, there might be a selection problem if the goods that attract AD measures are different from the control group; in other words, the common trend assumption may not hold. To address such concerns, an alternative DD specification would compare exports to a country imposing AD duties with those directed toward destinations where the same product does not face any kind of restrictions. While this approach would dispel concerns about a possible selection bias, it opens the door to other unaccounted confounding factors due to country-specific drivers different from AD duties.

A triple difference, inherent in a DDD strategy, allows us to exploit all sources of variation. Exports of Chinese goods before/after the imposition of AD duties are compared with the performance of the same product shipped to destinations where tariffs are not imposed, and with different products (not subject to AD measures) exported to the same country that adopts administered protection.

The DDD equation we estimate takes the following form

$$y_{pdt} = \beta_0 + \beta_1 \mathrm{AD}_{pdt} + \delta_{pd} + \delta_{dt} + \delta_{pt} + \epsilon_{pdt} \quad , \tag{4}$$

where the subscripts p, d and t respectively denote 6-digit HS product categories, destinations and years. Our main variable of interest is the dummy AD_{pdt} that takes value 1 if product p exported to destination d is subject to AD measures at time t and 0 otherwise. The inclusion of product-destination, destination-year and product-year fixed effects allows us to estimate a DDD model by exploiting the variability over time before and after the AD measure is imposed, the within-country across-product variation between targeted and unaffected products, and the variation within HS-6 product category across destinations imposing and not-imposing AD duties. In particular, δ_{pd} captures the average export performance of each product in a given destination (so that AD_{pdt} captures variation over time), δ_{dt} refers to average destination-time effects (thus exploiting variation across products exported to the same destination), while δ_{pt} controls for product-time effects and thus lets us compare the same good exported to different destinations. This complete set of fixed effects is meant to saturate all possible sources of variation unrelated to trade policy, and capture possible supply effects (e.g. Chinese firms becoming more productive), demand-side factors, or product-destination specific tastes. We cluster standard errors at the product-destination level, but the results are robust to alternative treatments of the error terms such as clustering at the product level.

The dependent variable y_{pdt} in equation (4) is either the (log) of total exports ($Exports_{pdt}$) or one of its components; in fact, we decompose aggregate exports into an extensive and intensive margins, and then also into a price and a quantity effect.

We start our empirical analysis by estimating equation (4) over the complete sam-

Table 2: The effect of AD measures on Chinese exports

Panel A: AD duties imposed by 28 countries					
dep. var (logs):	Exports	NF	Avg. Exports	Quantity	Price
	(1)	(2)	(3)	(4)	(5)
AD_{pdt}	-0.372***	-0.169***	-0.203***	-0.438***	0.067***
	(0.025)	(0.009)	(0.021)	(0.027)	(0.010)
N	3,377,729	3,377,729	3,377,729	3,369,138	3,369,138
adj. R^2	0.667	0.839	0.536	0.772	0.882
Panel B: AD duties imposed by the US					
dep. var (logs):	Exports	NF	Avg. Exports	Quantity	Price
	(1)	(2)	(3)	(4)	(5)
AD_{pdt}	-0.717***	-0.276***	-0.441***	-0.840***	0.126***
	(0.106)	(0.040)	(0.086)	(0.117)	(0.027)
N	3,329,462	3,329,462	3,329,462	3,320,910	3,320,910
adj. R^2	0.666	0.838	0.535	0.771	0.882
Panel C: AD duties imposed by the EU					
dep. var (logs):	Exports	NF	Avg. Exports	Quantity	Price
	(1)	(2)	(3)	(4)	(5)
AD_{pdt}	-0.289***	-0.158***	-0.131***	-0.357***	0.070***
	(0.031)	(0.011)	(0.025)	(0.033)	(0.013)
N	3,361,719	3,361,719	3,361,719	3,353,132	3,353,132
adj. R^2	0.666	0.838	0.535	0.771	0.882

Note: The unit of observation is a product-destination-year triplet, with products defined at the 6-digit HS level. All regressions include product-destination, destination-year and product-year fixed effects. The robust standard errors in parentheses are clustered at the product-destination level. Asterisks denote significance level: ** < 0.05, *** < 0.01.

ple that includes all destinations and all products. In this case, treated products are those subject to AD duties in any of the 28 countries that have adopted such measures against China in the period 2000–2015, while the control group is made of all other 6-digit HS products. Panel A of Table 2 presents the results of this baseline specification. Consistently with the existing literature (see Prusa, 2001; Vandenbussche and Zanardi, 2010; Egger and Nelson, 2011; Lu et al., 2013, among others), AD measures are associated with a substantial fall in Chinese exports, which decline by approximately 30%.[13] Columns (2)–(3) provide results for the extensive and intensive margins of adjustment: since the two margins combine to make aggregate exports, by the properties of ordinary least squares the sum of the coefficients across Columns (2) and (3) yields the coefficient for aggregate exports. Although the point estimate for the intensive margin is somewhat larger, the two coefficients are not statistically different at standard confidence levels, and both the number of exporters and average exports per firm decline. On the other hand, Columns (4)–(5) shows that AD measures induce a small increase in the average price of

[13]Prusa (2001) shows that AD duties cause the value of imports to fall by an average of 30-50%. A similar effect is observed by Lu et al. (2013) for the period 2000–2006.

FOB prices, so that quantities fall even more than export values.[14]

In panels B and C of Table 2 we focus on AD measures imposed respectively by the US and the EU, to investigate whether they have a differential effect on Chinese exports. Panel B shows that American AD activity has a much larger effect on trade: Chinese export values fall by approximately 50% ($e^{-0.717} - 1 \approx 0.50$), although the qualitative picture remains broadly unchanged. The intensive and extensive margin adjustments are not statistically different one from another, prices edge up by 10% and export quantities fall more than proportionally. AD measures imposed by the EU, on the other hand, have an effect that is similar to the average impact across all destinations. These results, and in particular the finding that EU duties have a smaller effect on Chinese exports than measures imposed by the US, are consistent with those reported by Felbermayr and Sandkamp (2020), who however do not find any significant effects on prices.

The inclusion of all products not subject to AD duties in the regression may raise concerns due to the fact that AD tends to be concentrated in specific sectors (see Section 2.3) and goods targeted by administered protection may be different from the other products. In a first attempt to address such an issue, we repeat the estimation of equation (4) on a limited sample comprising only products that are subject to AD measures in at least one country, but not subject to tariffs in other destinations: *every* Chinese product in the sample is thus both affected by AD and not affected, depending upon the destination market.[15] This approach controls for possible common factors that characterize "treated" goods, and might therefore induce a selection bias.

Table A5 in the Appendix shows that results are virtually unchanged, both in terms of size and significance of the estimated coefficient for the AD_{pdt} dummy, suggesting that there is no large bias associated with the use of the complete sample. Note that it is not possible to replicate this strategy when focusing on AD measures adopted by a single country, such as the US or the EU, in the context of a DDD approach. The reason is that when the sample is restricted to those products subject to AD in a single destination (e.g., the US), we lose the possibility to compare them with other goods exported to the same destination but not facing any restrictions. Hence, we lose one dimension of the triple difference inherent in the DDD estimation.

To further test the robustness of our results, we establish a second alternative control group following drawing upon matching techniques. As detailed in Appendix D, we first use a logit model to estimate the probability of being subject to AD measures based on a set of observable characteristics (Chinese import penetration, unit price, GDP growth in the destination country, the real exchange rate, sector, destination and time effects). Then, each product-destination pair is matched with its five "nearest neighbors" within the same 2-digit HS chapter, that is, with the five products-destination pairs, not subject to AD measures, that are closest to the treated product in terms of the propensity score. Table A7 in the Appendix shows that after the matching procedure, the treated and control group are very similar, at least in terms of observable characteristics.

Results stemming from the estimation of equation (4) on the PSM sample are reported in Table 3. Once again, results are consistent with the those reported in Table 2 above.

[14] In a robustness check, not shown, we split the group of AD-imposing countries in two groups, high-income and emerging economies. Results are similar to those presented in Table 2, with no differential effect between the two groups.

[15] For instance, shipments of "warm-water shrimp" (HS 030613) from China were subject to AD measures in the US in 2004, but faced no restrictions in the EU.

Table 3: The effect of AD measures on Chinese exports: Propensity Score Matching

Panel A: AD duties imposed by 28 countries					
dep. var (logs):	Exports	NF	Avg. Exports	Quantity	Price
	(1)	(2)	(3)	(4)	(5)
AD_{pdt}	-0.384***	-0.154***	-0.231***	-0.453***	0.067***
	(0.043)	(0.016)	(0.034)	(0.047)	(0.013)
N	146,004	146,004	146,004	145,815	145,815
adj. R^2	0.702	0.882	0.556	0.737	0.846
Panel B: AD duties imposed by the US					
dep. var (logs):	Exports	NF	Avg. Exports	Quantity	Price
	(1)	(2)	(3)	(4)	(5)
AD_{pdt}	-0.583***	-0.270***	-0.313***	-0.665***	0.081**
	(0.122)	(0.045)	(0.100)	(0.134)	(0.034)
N	106,150	106,150	106,150	105,990	105,990
adj. R^2	0.696	0.877	0.545	0.715	0.826
Panel C: AD duties imposed by the EU					
dep. var (logs):	Exports	NF	Avg. Exports	Quantity	Price
	(1)	(2)	(3)	(4)	(5)
AD_{pdt}	-0.329***	-0.190***	-0.139**	-0.402***	0.072***
	(0.082)	(0.031)	(0.065)	(0.086)	(0.023)
N	133,072	133,072	133,072	132,891	132,891
adj. R^2	0.692	0.878	0.546	0.729	0.840

Note: The unit of observation is a product-destination-year triplet, with products defined at the 6-digit HS level. All regressions include product-destination, destination-year and product-year fixed effects. The robust standard errors in parentheses are clustered at the product-destination level. Asterisks denote significance level: ** < 0.05, *** < 0.01.

Point estimates are somehow larger for the average effect across all the 28 imposing countries and in the case of the EU (panels A and C, respectively), and smaller in the case of the US (panel B), although the economic effects on Chinese exports remain in the same range.

Overall, the empirical analysis suggests that AD measures against China lead to a significant decrease of exports, that occurs both through the extensive and the intensive margins of trade. Moreover, AD duties are associated with a slight increase in FOB prices and, consequently, a large quantity adjustment. Because the foundations of AD cases rest on the notion that exporters are selling their products at a price that is too low, from a political economy perspective it appears reasonable that Chinese firms choose not to internalize the AD duties and, on the contrary, increase their export prices even if this implies a relatively larger fall in export quantities and revenues. On the one hand, this strategy may result in final consumers (or producers sourcing intermediate inputs from China) to complain against AD measures; on the other hand, the attempt to mitigate the impact of duties by lowering export prices might attract further scrutiny and tighter measures by importing countries.

3.3. Dynamic analysis

This section presents a dynamic analysis of the effect of AD duties on Chinese exports, focusing on the impact on trade values, quantities and prices. In particular, we are interested in the effect of AD measures from the first year of their adoption ($t = 0$) to five years after ($t + 5$). Our empirical strategy is similar to the one used by Lee et al. (2017) and entails a slight modification of our baseline regression (equation (4)) that reads

$$y_{pdt} = \gamma + \sum_{s=0}^{5} \gamma_s AD_{pd,t+s} + \delta_{pd} + \delta_{dt} + \delta_{pt} + \epsilon_{pdt}. \tag{5}$$

In this case the coefficients of interest are $\gamma_0, \ldots, \gamma_5$, which represent the effect of AD measures on trade flows in a specific year ranging from t to $t + 5$.

Results obtained using the PSM sample are summarized in Figure 8, whereas those accruing from the complete sample containing all products, being very similar, are relegated to the Appendix (see Figure A2).

When we look at the whole group of countries imposing AD duties against China, we observe that the evolution of trade flows is mainly driven by changes in export quantities, which bear the brunt of the adjustment, while prices show a small increase that appear significant only 4 years after the adoption of the measures. Results for the US (middle panel) are much less precisely estimated: the confidence intervals are larger and we do not find a significant effect on prices in any of the five years following the introduction of AD measures. The effect is almost never significant and, in general, we find little evidence of a strong impact of AD duties on any of the dimensions under investigation. On the contrary, results for the EU show a U-shaped evolution that is similar to the one observed for the larger sample of all AD users; here as well the impact on prices is only marginally significant in year $t + 3$, and after 4–5 years after their inception, AD duties seem to lose a large fraction of their effect.

4. Conclusion

This paper has documented the patterns of AD protection during the period 1980–2015. On the one hand, this kind of administered protection is no longer confined to the four "historical users" (Australia, Canada, the EU, and the US), but is now common practice also among emerging economies. On the other hand, we continue to see a marked concentration in the use of AD duties across sectors, although the EU and the US are more frequently targeting intermediate goods, both in terms of the number of products covered by AD measures and as a share of imports that are affected. The political will to "reshore" some stages of the production process and the increasing relevance of trade in parts and components represent possible explanations for this pattern, that is more apparent since the global financial crisis.

China has emerged as a preferred target for trade barriers, and this is another trend that is more pronounced in recent years. The slow recovery experienced by several industrial countries (most notably in Europe) after the Great Recession, the negative correlation that traditionally exists between the adoption of temporary trade barriers and the macroeconomic environment (Bown, 2018), and the rapid increase in global market shares captured by China, all contribute to explain such an evolution.

Transaction-level data covering Chinese exporters show that AD duties exert a negative effect on trade flows, with both the intensive and extensive trade margin contributing to the fall in export values. Moreover, in line with the previous literature, we find a strong

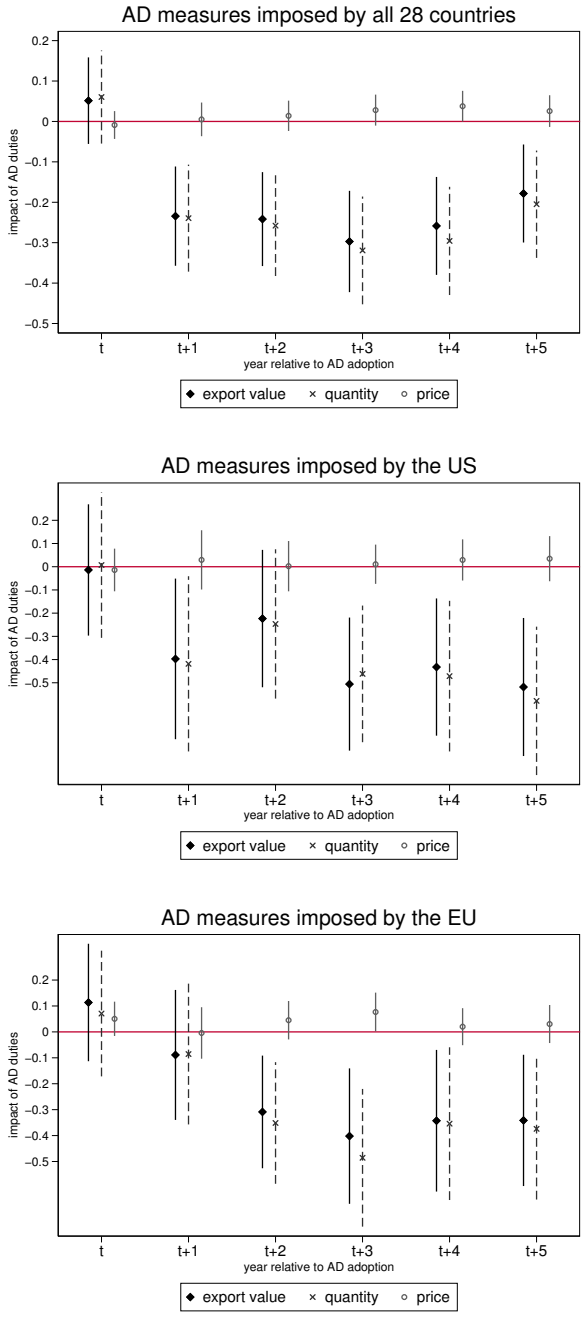

Figure 8: Dynamic effect of AD duties on export values, export quantities and export prices, from the first year of imposition $t = 0$ to five years afterwards $t + 5$. Top panel: average impact of AD duties across all 28 destinations imposing measures against China. Middle panel: impact of AD duties by the US. Bottom panel: impact of AD duties by the EU. The control group is defined using PSM.

reduction in export quantities and a small increase in the FOB price of products facing AD measures. In this respect, one could say that AD duties are achieving their goal.

The generalized increase in the usage of AD duties, both in terms of the number of countries imposing them and the amount of trade covered by such measures, is in line with the evidence by Evenett (2019), who documents a widespread adoption of discriminatory practices in the aftermath of the Great Recession. Given the recent trade war between the US and China, and the ongoing (as of early 2020) crisis of the WTO appellate body

following the expiration of the terms of two judges, which may leave the dispute-settlement institution unable to function, the trends highlighted in the paper do not bode well for international trade in the years to come.

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Appendix A. Ancillary Information

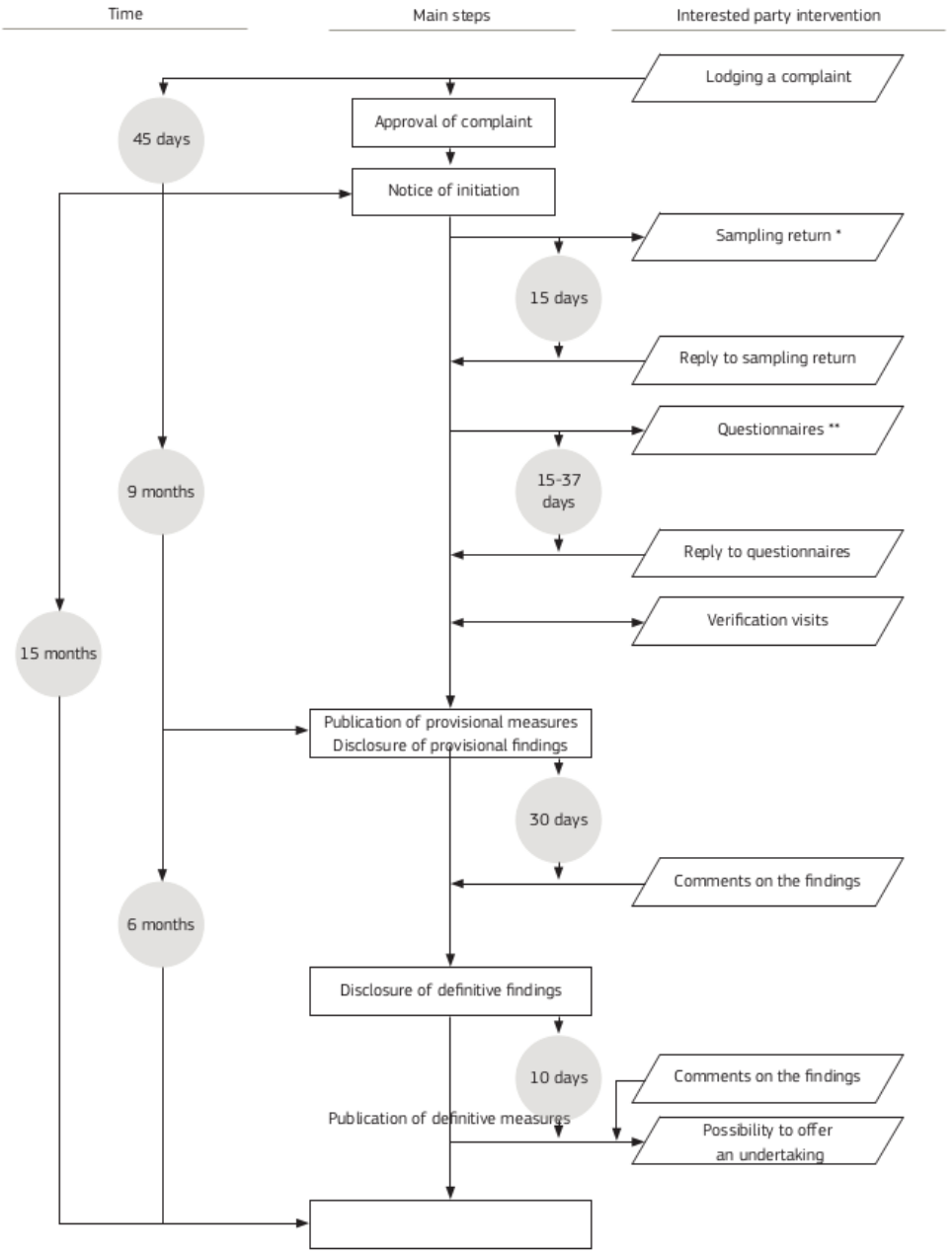

Figure A1: Flowchart of a typical AD investigation in the EU.

Table A1: Industry definitions and classifications

Industry	Product	HS chapters
Anim	Live animals and animal products	01-05
Chem	Chemicals	28-38
Elec	Electronics and electrical machinery	85
Food	Animal or vegetable oils and fats, prepared foodstuffs, beverages, tobacco	16-24
Foot	Footwear	64-67
Fuel	Fuel	27
Hide	Hides, skins	41-43
Mach	Machinery	84
Metal	Metals	72-83
Mine	Mineral products	25-26
Mis	Miscellaneous	90-94, 96-99
Plas	Plastic, rubber	39-40
Ston	Stone, glass	68-71
Text	Textiles, clothing	50-63
Toys	Toys and sports equipment	95
Tran	Transportation equipment	86-89
Vege	Vegetable products	06-15
Wood	Wood	44-49

Appendix B. Detailed evidence from case metric analysis

Table A2 testifies for the degree of concentration in AD activity across countries. Based on information about 7,200 cases included in the GAD dataset, we see that the top 5 (10) countries account for more than 50% (75%) of all AD case initiations. Other authors (e.g. Blonigen and Prusa, 2016) have reported similar findings. However, in recent years several emerging economies have scaled up the imposition of AD duties and countries like India, Brazil, Argentina, Mexico, China, South Africa and Turkey now feature among the top users, alongside the four historical users (US, EU, Canada and Australia).

Table A2: The top 10 users of anti-dumping measures, 1980–2015

Country	AD cases initiated	Percent	Cumulative sum
US	1,343	18.9	18.9
EU	778	10.8	29.7
India	764	10.6	40.3
Australia	575	8.0	48.3
Brazil	450	6.3	54.6
Canada	412	5.7	60.3
Argentina	380	5.3	65.6
South Africa	306	4.2	69.8
Mexico	285	3.9	73.7
Turkey	262	3.7	77.4

Notes: Number of AD cases initiated between 1980–2015 by country. Authors' calculations using Global Antidumping Database (Bown, 2015).

Table A3 displays evidence concerning the main targets of AD activities. It shows that China, the world's largest exporter, represents the main target of investigations, contributing to more than 20% of EU cases and to 14% of American ones. Other Asian countries, such as India, South Korea and Japan also feature prominently on Table A3. In fact, between 1980 and 2015, the EU has initiated 778 cases, of which 161 involve China (almost 21% of the total), 54 South Korea (7%) and 45 India (6%): these three countries alone thus represent 1/3 of all cases initiated by the EU. An analogous concentration emerges in the case of US investigations: out of the 1,343 cases initiated, China has been targeted 190 times (14%), followed by Japan (9%) and South Korea (6%).

Table A4 documents the number of AD cases initiated against China since 1980 by both the EU and the US, together with the number of cases that have resulted in AD duties being levied. The rapid growth in the share of world's exports captured by China has stoked fears across many industrial countries and has been the subject of much debate on both sides of the Atlantic. This is well documented by China becoming the single most common target of European AD at least since 2005, with almost half of all investigations targeting Chinese producers. Of these, more than 70% have resulted in some measures being adopted and, moreover, when this has happened the EU has imposed higher duties on China than on other trading partners. In fact, the average duty levied on Chinese goods is 43%, more than 20 percentage points above the average rate imposed on other trading partners, most of which are classified as market economies.

Something similar happens in the US, where China represents 36% of all cases initiated between 2004 and 2015. Here as well, 76% of investigations have resulted in the imposition

Table A3: The top 10 targets of the EU and the US anti-dumping measures, 1980–2015

	EU			US	
Country	AD cases	Percent	Country	AD cases	Percent
China	161	20.7	China	190	14.1
South Korea	54	6.9	Japan	123	9.2
India	45	5.8	South Korea	84	6.3
Russia	36	4.7	Taiwan	71	5.3
Taiwan	36	4.7	Brazil	55	4.1
Japan	35	4.5	Canada	54	4.0
Thailand	33	4.2	Mexico	47	3.5
Turkey	33	4.2	Italy	46	3.4
Malaysia	24	3.1	France	45	3.4
Indonesia	23	3.0	India	43	3.2
total (top10)	480	61.7	total (top10)	758	56.4
total EU	778		total US	1,343	

Notes: Total number of AD cases initiated against different countries between 1980–2015 by the EU and the US. Authors' calculations using Global Antidumping Database (Bown, 2015).

of a final AD duty whose average level (158%) is almost 4 times as high as the average tariff facing all other exporters subject to AD measures.

Table A4: Anti-dumping cases initiated and in measures against China between 1980–2015, by the EU and the US

	EU cases against China		US cases against China	
year	initiated	measures imposed	initiated	measures imposed
1980			1	
1981	1	1		
1982			3	2
1983			4	3
1985			6	5
1986	1	1	1	1
1987	1	1		
1988	7	5	1	
1989	5	5	1	
1990	4	4	11	1
1991	4	4	6	3
1992	7	4	5	3
1993	4	4	7	4
1994	5	4	12	7
1995	5	4	2	1
1996	6	3	6	6
1997	5	2		
1998	1	1	1	1
1999	12	4	7	4
2000	6	4	7	5
2001	1	1	8	4
2002	4	3	9	7
2003	3	3	10	7
2004	9	9	6	5
2005	8	5	4	3
2006	12	9	4	2
2007	6	5	12	1
2008	6	5	11	1
2009	6	6	12	1
2010	8	5	4	3
2011	6	4	5	3
2012	4	3	5	3
2013	3	1	6	4
2014	5	3	6	5
2015	6		7	
Total	161	113	190	134

Notes: AD cases against China initiated and measures taken, by the EU and the US (1980–2015). For some cases initiated in 2015, the decision was still pending at the time of the data collection, so that the number of measures implemented for 2015 is not reported. Authors' calculations using Global Antidumping Database (Bown, 2015).

Appendix C. Estimation on restricted sample of products subject to AD duties

Table A5: The effect of AD measures on Chinese exports: affected HS-6 products only

dep. var (logs):	Exports (1)	NF (2)	Avg. Exports (3)	Quantity (4)	Price (5)
AD_{pdt}	-0.352***	-0.156***	-0.196***	-0.410***	0.058***
	(0.025)	(0.009)	(0.021)	(0.027)	(0.010)
N	909,154	909,154	909,154	907,805	907,805
adj. R^2	0.692	0.857	0.549	0.749	0.857

Note: Sample restricted to Chinese products affected by AD duties in any destinations (28 countries impose AD duties against China in the sample period). The unit of observation is a product-destination-year triplet, with products defined at the 6-digit HS level. All regressions include product-destination, destination-year and product-year fixed effects. The robust standard errors in parentheses are clustered at the product-destination level. Asterisks denote significance level: *** < 0.01.

Appendix D. Propensity Score Matching

To select from the sample of untreated observations a suitable control group, we use a propensity score matching. First, we estimate the probability of being targeted by the introduction of AD measures based on a set of observable characteristics:

$$Pr(AD = 1)_{pd} = \beta_0 + \beta_1 IP(China)_{pdt-1} + \beta_2 Imp(Price)_{pdt-1} + \beta_3 GDP_{dt} + \beta_5 RER_{dt} + \delta_{hs2} + \delta_d + \delta_t + \epsilon_{pdt}.$$

The dependent variable AD_{pd} is a binary indicator that equals 1 if product p faces AD duties in destination d, and 0 otherwise. The explanatory variables include the (lag) import penetration from China, which is defined as the share of imports from China over total imports of product p in destination d; (lag) average import price of p from China, captured by the unit value (based on CEPII-BACI data). The use of lag values accounts for the fact that AD decisions are based on past trade performance and in order to minimize endogeneity concerns. We also add GDP growth in the destination country, the log of the real exchange rate (foreign currency per Chinese RMB) to control for macroeconomic shocks, industry, year and destination fixed effects. The estimation is performed using a logit model.

Then, we match treated and control observations by applying nearest-neighboring algorithm to untreated products within the same 2-digit HS chapter, and identifying the five nearest neighbors for each treated product. We impose a common support condition and drop the treated observations whose propensity score are larger or smaller than the maximum or minimum of those never affected. Tables A6 and A7 present the results of the propensity score estimation, and the quality of the matching.

In particular, Table A7 reports the mean values of the matching argument for treated and matched products, and t-tests to examine the quality and the precision of the matching algorithm. The tests validate the quality of the matching procedure, since none of the median standard bias across all the covariates exceed the 5% threshold (column 3).

Table A6: Probability of AD Treatment: Propensity Score Estimation

Dep.Var: Probability of imposed AD measures	
Import penetration$_{pdt-1}$	0.644***
	(0.026)
ln Chinese price$_{pdt-1}$	-0.330***
	(0.006)
GDP-Growth$_{dt}$	-0.005**
	(0.002)
ln RER_{dt}	0.032**
	(0.012)
δ_t	Yes
δ_d	Yes
δ_{hs2}	Yes
Pseudo R^2	0.203
N	1,291,159

Note: Estimation results from a logit model used to identify the matched control group. The dependent variable takes value 1 if product p exported from China is subject to AD measures in destination d. Robust standard errors in parentheses. The unit of observation is a product-destination-year triplet. Significance levels ** < 0.05, *** < 0.01.

Moreover, the probabilities of being affected for treated and untreated observations have similar means, as displayed in columns (1) and (2), and the t-tests in column (4) suggest that, by and large, we cannot reject the null hypothesis that the two groups have equal means, and hence the selected control group is similar to the sample of treated products, at least in terms of observable characteristics.

Table A7: Matching balancing test

	(1) Treated	(2) Control	(3) %bias	(4) t-test
Import penetration$_{pdt-1}$	0.174	0.177	-1.300	-1.920
ln Chinese price$_{pdt-1}$	1.162	1.148	1.000	1.640
GDP-Growth$_{dt}$	2.449	2.476	-0.800	-1.130
ln RER_{dt}	-0.937	-0.871	-1.200	-1.970

Note: Mean value of each variable for product-destination pair in the treated and control groups after the implementation of the matching technique.

Appendix E. Dynamic Effects of AD duties: baseline sample

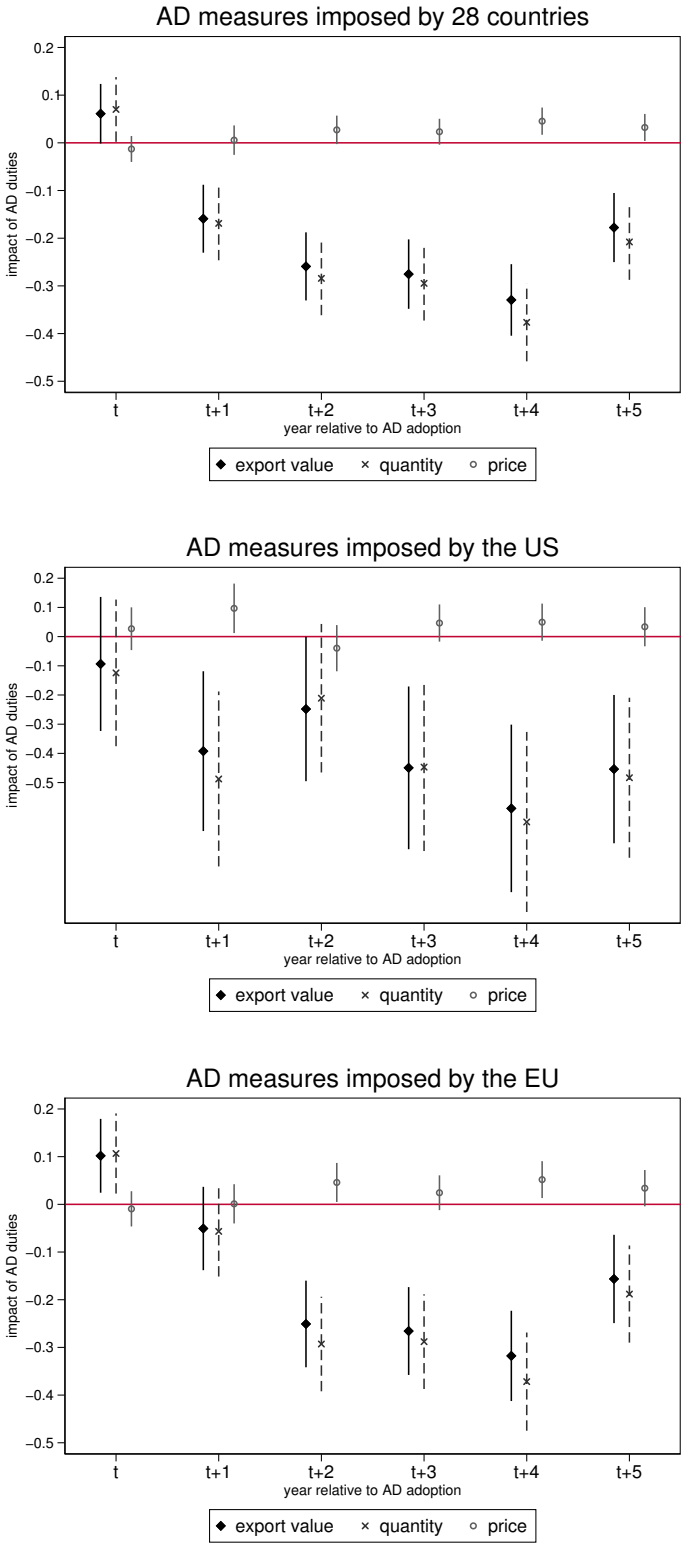

Figure A2: Dynamic effect of AD duties on export values, export quantities and export prices, from the first year of imposition $t = 0$ to five years afterwards $t + 5$. The control group is composed of all products not subject to AD duties.