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Abstract

With over 1,600 measures in force in 2017, antidumping (AD) duties constitute a frequently used trade defence instrument. Theory predicts that, unlike normal tariffs, AD duties raise producer prices. However, empirical evidence remains inconclusive. This paper exploits the EU enlargement of 2004 as a natural experiment. Following their accession to the EU, the new member states inherited the Union's AD duties. Under plausible assumptions, these duties are exogenous to new members' trade shocks. In line with theoretical considerations, the paper shows that AD duties raise producer prices, but only for imports originating from countries with Market Economy Status (MES). Import prices from non-MES countries remain unchanged, while quantities fall by more. Furthermore, this paper presents evidence that the trade dampening effects of AD persist over time and that duties also indirectly affect non-targeted exporters.

JEL Code: F13, F14

Keywords: Antidumping, trade, European Union, market economy status

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1 Introduction

Since 2007, the number of antidumping (AD) cases initiated has increased from 165 to 300 in 2016, culminating in more than 1,600 measures being in force worldwide in 2017.¹ In December of the same year, the EU has adjusted its AD regulation,² abandoning the much disputed Non-Market Economy Status (NMES). This may have important implications because Market Economy Status (MES, assigned to the exporter by the imposing country) determines the way AD duties are calculated.³

Theory predicts that AD duties incentivise producers to raise prices in an effort to reduce the applied duty following reviews in consecutive periods. Over time, this results in a worsening of the importer's terms of trade as rents shift from the customs authority of the imposing country towards exporters. Hence, measuring price responses of exporters constitutes an important component when evaluating the effects of AD duties on welfare. However, with the exception of a prominent paper by Blonigen and Haynes (2002), the empirical literature has not found any evidence in support of the theory.⁴ Furthermore, the question of whether the price effects of AD duties depend on whether or not the exporter enjoys MES has so far been completely ignored by existing studies.

This paper aims to fill the gap by exploiting the EU enlargement of 2004 as a natural experiment to investigate the trade effects of AD duties. The accession countries were required to adopt the existing EU AD policy at the time of joining the EU. Under the identifying assumptions that the decision to join the EU is independent of existing AD duties and that the EU did not adjust its AD regulation in anticipation, the enlargement constitutes an exogenous treatment of new member states. The effect of AD duties can hence be estimated without simultaneity and omitted variable bias by applying a simple difference-in-differences regression with fixed effects, exploiting the change over time in import prices and quantities of treated country-product combinations relative to non-treated ones.

¹Data on global AD measures in force is taken from the WTO's I-TIP database (WTO, 2018). Dumping is defined as exporting a product at a price below its "normal value" (WTO, 1994), where normal value is typically the domestic price of the product in the exporting country (for a detailed discussion see for example Felbermayr et al. (2016) or Sandkamp and Yalcin (2016)). It is a common phenomenon in international trade, that can have many causes, such as international price discrimination (Viner, 1923), production under demand uncertainty (Ethier, 1982), reciprocal dumping with oligopolistic firms (Brander and Krugman, 1983), dynamic competition (Gruenspecht, 1988; Clarida, 1993), subsidies (Dixit, 1988; Blonigen and Wilson, 2010) or cyclical aspects (Staiger and Wolak, 1992). WTO rules allow member states to counteract dumping practices with antidumping duties.

²Regulation (EU) 2017/2321 (European Parliament, 2017).

³NMES has been abandoned by the EU only for WTO exporters. Other countries such as the US are still applying the NMES methodology to WTO exporters.

⁴In contrast to price effects, the effect of AD duties on import volumes has already drawn significant research attention. For an overview see for example Blonigen and Prusa (2003, 2016) and Nelson (2006).

Beyond this methodological contribution, the paper demonstrates that the missing evidence for positive price effects in the literature is driven by the MES of the exporter investigated in the respective studies. By looking at the universe of European imports, it is shown that AD duties do raise producer prices on average by 25%, but only for imports originating from countries with MES. Producer prices of imports from non-market economies remain unchanged, while quantities fall by more (on average 85% compared to 68% for MES exporters). Estimated coefficients are not sensitive to several fixed effects specifications, suggesting that the experiment itself also addresses omitted variable bias. The third key contribution of this paper is to show that price as well as quantity effects of AD duties persist over time, even beyond their revocation. Finally, evidence for spillover effects is provided. Producer prices of imports from countries not targeted by AD duties also increase, indicating that AD duties imposed against one country induce exporters in non-targeted countries to update their beliefs regarding the likelihood of becoming subject to AD investigations and raising prices in anticipation.

This paper relates to three strands of literature, namely the impact of AD duties on producer prices, on quantities as well as effects on third countries. Regarding the first, AD duties can affect import prices through two channels. Like tariffs, they directly increase consumer prices (assuming positive pass-through). In addition, and in contrast to ordinary tariffs, they incentivise exporters to raise their prices. Having the official objective to protect the importer's domestic market from "unfair" foreign competition,⁵ AD duties are adjusted if the exporter increases ex-factory prices (Feenstra, 2008).⁶ Consequently, theory predicts pass through rates larger than 100 % as exporters increase prices to achieve a reduction of AD duties in subsequent periods (Blonigen and Haynes, 1999; Blonigen and Park, 2004).

This has important welfare implications. While traditional tariff revenue accrues to the customs authority of the importer, the adjustment of AD duties means that if exporters raise prices and the duty is lowered as a result, rents that first went to the customs authority of the importer are transferred to the foreign exporter by means of increased producer prices. If consumer prices (including duties) in the importing country stay constant following a reduction of the duty, the dynamics of AD duties imply a welfare reduction beyond trade destruction over time in the importing country relative to a classic tariff.⁷

⁵See for example the EU's position on AD in European Parliament (2017) and European Commission (2016).

⁶As explained further down, the effectiveness of this channel however depends on the MES of the exporter.

⁷Duties typically remain in place for at least five years (European Commission, 2013). It will be shown further down that the estimation strategy draws on this persistence.

Empirically, Blonigen and Haynes (2002) find that AD duties indeed lead to higher import prices (excluding duties) from the point of view of the AD imposer. However, their study looks at a very specific example, namely US iron and steel imports from Canada. Lu et al. (2013) use Chinese customs data to investigate the effect of US AD duties on Chinese exports to the US. The authors do not find positive price effects. Beyond these studies with their focus on a single country pair, investigations of price effects of AD duties remain scarce.⁸ This paper adds to the literature by investigating the universe of EU imports, thus extending the scope to many exporting countries. It also examines the effects of AD duties over time and across targeted and non-targeted exporters.

By investigating several exporters, this paper aligns the seemingly conflicting results of Blonigen and Haynes (2002) (increasing producer prices following AD duties) with those of Lu et al. (2013) (no producer price effects) by showing that this difference is driven by China's Non-Market Economy Status (NMES). The way EU and US AD duties against NMES countries are constructed does not incentivise exporters to raise prices. Specifically, exporters in countries with MES (such as Canada) receive firm specific AD duties that are adjusted when the exporter raises prices. In contrast to that, exporters situated in countries with NMES often only receive a duty constructed using average dumping margins across all firms exporting the same product. Hence, adjusting own export prices does not change the duty the exporting firm faces, providing no incentive to raise prices.⁹

The hypothesis that price effects depend on the AD methodology applied to calculate dumping margins (i.e. MES or NMES) can be tested, and this paper provides evidence in its support, comparing price effects of AD duties for exporters from countries with MES with those from NMES countries. It finds that price increases are driven by exporters from MES countries, indicating that the NMES methodology does not incentivise exporters to raise their prices.¹⁰ By doing so, it is the first study to identify differential trade effects of AD duties by applied AD methodology.¹¹ This is relevant for policy makers as it allows

⁸Gourlay and Reynolds (2012) and Nita and Zanardi (2013) provide indirect evidence for price effects by looking at the change in AD duties following reviews.

⁹In addition, the theory of heterogeneous firms (Melitz, 2003) suggests exit of firms with high marginal costs, which would even push average prices down.

¹⁰An alternative explanation however could be that MES exporters with low prices receive higher AD duties which force them to exit the market. Even if the remaining high price firms do not adjust prices, this selection would raise average prices. In contrast, exporters in NMES countries all receive the same duty. Consequently, low price exporters are not necessarily more likely to be forced to exit the market than high price exporters, leaving average prices unchanged. Testing whether the within firm or between firm effect dominates the results however requires the use of firm level data. As both channels work in the same direction, the exact channels at work are not the primary concern of this paper.

¹¹Existing studies are either descriptive, comparing levels of AD duties for MES and NMES exporters (Detlof and Fridh, 2006; Felbermayr et al., 2016, 2018) or look at the effect of MES on the number of AD investigations (Urdinez and Masiero, 2015).

making predictions on the likely effects of applying either MES or NMES on import prices and quantities.

The second strand of literature to which this paper contributes relates to the effects of AD duties on import values and quantities. Prusa (1997, 2001) investigates the implementation of US AD duties, showing that they reduce US imports from targeted countries by up to 50%. In contrast to that, Egger and Nelson (2011) find much smaller effects.¹² For the European Union, Messerlin (1989); Lasagni (2000) and Konings et al. (2001) estimate treatment effects similar in magnitude to those of Prusa (1997, 2001).¹³ Vandebussche and Zanardi (2010) look at several AD imposing countries, finding that AD duties imposed by the so called “new adopters” have trade chilling effects on bilateral trade flows. Following the availability of firm level export data, a growing literature is also starting to look at impacts of AD duties on exporting firms.¹⁴

The above studies potentially suffer from endogeneity bias due to simultaneity of AD duties and imports. AD duties typically increase consumer prices and thus reduce import quantities of targeted products. However, they are by no means exogenous. Being designed to protect domestic industry, they are more likely to be imposed on products with low prices and high import quantities. This simultaneity of imports and AD duties violates the exogeneity assumption as the independent variable is no longer uncorrelated with the error term. OLS results in biased estimates of the treatment effect (Bown and Crowley, 2013), more specifically, an underestimation of the effect of AD duties on import quantities and prices (the latter being the case under the assumption that AD duties do indeed raise prices).¹⁵ This paper adds to the literature by exploiting the EU enlargement of 2004 as a natural experiment to tackle simultaneity and obtain unbiased estimates of the effect of AD on imports. Estimated effects are larger than those found by previous studies, indicating that these may indeed suffer from simultaneity bias, which results in

¹²Other studies include the investigation of individual stages of the AD process (Staiger and Wolak, 1994) as well as particular sectors (Carter and Gunning-Trant, 2010).

¹³The AD process itself also plays a role for the EU, with Baran (2015) finding that withdrawn or rejected cases only have temporary effects, while trade effects of final duties are strong and lasting.

¹⁴At the firm level, Besedeš and Prusa (2013) find US AD to induce firm exit. Lu et al. (2013) use firm level data to estimate semi-elasticities for the effects of US AD duties on Chinese exports to the US, showing that a one percentage point increase in preliminary (final) US AD duties reduces Chinese exports to the United States by 0.27% (0.6%). The effects are driven both by reduced firm exports as well as firm exit. Jabbour et al. (2016) show that Chinese exporters reduce exports to the EU following the imposition of EU AD duties, but also become larger and more productive. Felbermayr et al. (2018) look at the universe of Chinese firm level exports, showing that both EU and US AD duties decrease firm exports and induce exit, with small firms being affected most severely. Overall Chinese export values of targeted products to the US (EU) fall by 62% (41%) following the imposition of AD duties.

¹⁵Felbermayr et al. (2018) tackle this problem by combining firm level data with an extensive fixed effects estimation strategy, as time varying product characteristics can be controlled for, so that the treatment effect is identified using variation in duties within products across firms. However, this methodology requires firm level data which is not available for all countries exporting to the EU.

an underestimation of the treatment effect.

Third, the paper contributes to the literature on trade deflection and other effects of trade policies on third countries.¹⁶ Bown and Crowley (2007) find that the imposition of US AD duties on Japanese exports increases Japanese exports to third countries by 5 - 7%. Similarly, Nguyen et al. (2016) show that EU duties imposed on Vietnamese footwear increase Vietnamese exports to the US. The same is true for Mexican exports of tomatoes, which were diverted to Canada following the imposition of US AD duties (Baylis and Perloff, 2010). Chandra (2016) finds evidence for trade deflection following the imposition of US temporary trade barriers against China.¹⁷ In contrast, other studies do not find systematic evidence for larger export volumes to third countries following the imposition of US AD duties (Lu et al., 2013) and more general EU and US import restrictions (Bown and Crowley, 2010) against China.

In light of the above literature, it is possible that the estimated treatment effect of EU AD duties on imports using the natural experiment of the EU enlargement captures not only trade destruction but also a reversal of trade deflection. This would threaten the identification of the treatment effect. If imports targeted by the EU were deflected from EU15 countries to accession countries before 2004, then imports of new member states would be larger in the pre-treatment period than what they would have been without the EU AD duty. An investigation of the pre-treatment period however provides no evidence for trade deflection by means of lower prices or higher import quantities. It also rules out anticipation effects.¹⁸

Finally, this paper also looks at spillover effects of AD duties on import prices from non-targeted countries. It thus relates to the work of Blonigen and Park (2004), who discuss the role of firms' expectations of AD investigation outcomes in explaining AD recalculations. Dumping allegations for the same product are often investigated separately for different exporting countries. Given the uncertainty surrounding the AD investigation process as explained by Blonigen and Park (2004),¹⁹ the imposition of AD duties against one

¹⁶Following Bown and Crowley (2007), trade deflection is defined as an increase in exports from country B to country C, following the imposition of AD duties of country A on imports from country B. Country B's exports are thus deflected from country A to country C. This is in contrast to import diversion, which is defined as an increase in exports from country C to country A following the imposition of AD duties of country A against country B. Country A's imports are thus diverted from country B to country C.

¹⁷Felbermayr et al. (2018) show that trade deflection of AD duties is driven by market entry of exporters into third countries as well as by increased exports to these countries by established exporters.

¹⁸Anticipation effects could go in both directions. On the one hand prices could fall shortly before the accession to sell as much as possible before AD duties are implemented. On the other hand, prices could be increased to avoid the imposition of AD duties following the accession. Neither effect is observed in the data.

¹⁹According to Blonigen and Park (2004), uncertainty surrounding the AD investigation process is also the reason why dumping takes place at all. If exporters had perfect foresight and knew they would become subject to AD duties, they would have increased their prices preemptively. Consequently, depending on

exporting country may induce producers of the same product in other exporting countries to update their beliefs about the likelihood of being investigated and becoming subject to duties. This paper finds evidence for such behaviour, as producer prices of imports from non-targeted countries increase following the imposition of AD duties against another country.²⁰

The remainder of this paper is structured as follows. Section 2 presents the estimation strategy, including potential threats to identification and ways to address them. This is followed by an overview of the data used (Section 3). Section 4 presents descriptive evidence, while Section 5 provides the core results of the paper. Section 6 offers several extensions and robustness checks and Section 7 concludes.

2 Estimation Strategy

Identification of the treatment effect relies on a difference-in-differences estimation exploiting the change over time in import prices and quantities of treated exporting country-product combinations relative to the same product imported from untreated exporting countries (within product across country variation) and relative to untreated products imported from the same exporting country (within country across product variation).²¹ For the baseline analysis, EU15 importers are dropped and the ten accession states aggregated to one entity.²² The years 2003 and 2005 are chosen as pre- and post-treatment period respectively, as they constitute a symmetric time period around the accession of the ten new member states in May 2004. The panel is balanced by dropping exporting country-product combinations that were only observed in one year.²³

Since the time dimension of the panel only consists of two years (a pre- and a post-

expectations, some exporters already set higher prices compared to a scenario without the presence of AD, thus affecting welfare in the importing country.

²⁰This finding also relates to the work on AD echoing by Tabakis and Zanardi (2016). The authors find that different importing countries tend to echo each others AD policies in the sense that they impose AD duties on products from the same exporter, either simultaneously or consecutively. In contrast, this paper finds evidence for non-targeted exporters echoing price responses of targeted exporters. The possibility of AD echoing would provide further incentives for exporting firms to raise prices.

²¹Unit values are constructed by dividing import values by quantities. Import quantities rather than values are investigated since they provide a clearer picture of changing trade flows. Import values incorporate prices effects, so that changing prices would disguise the impact on real trade flows. Value effects are however estimated as a robustness check.

²²These are Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Bulgaria, Romania and Croatia, who joined the EU in 2007 and 2013, are dropped. Treating individual countries as separate entities does not offer any additional information as treatment takes place at the EU level. A robustness check performs the same estimation with individual importing countries. Estimated coefficients remain similar.

²³Dropping singletons may bias the results if zero trade flows contain information. This is addressed in a robustness check.

treatment period), the difference-in-differences specification can be estimated with a first differences regression. The baseline estimation equation is given by

$$\Delta \ln y_{ih} = \delta \Delta AD_{ih} + \nu_i + \nu_h + \epsilon_{ih}. \quad (1)$$

The dependent variable $\Delta \ln y_{ih}$ is the change in the natural logarithm of import price (quantity) of product h imported from exporting country i between 2003 and 2005. ΔAD_{ih} is the treatment dummy that equals one if an exporting country-product combination becomes subject to AD duties in 2005.²⁴ It tells how import prices (quantities) of treated country-product combinations (for which $\Delta AD_{ih} = 1$) change relative to untreated country-product combinations (for which $\Delta AD_{ih} = 0$) once the AD duty is implemented through accession to the EU. ν_i and ν_h are exporter and product fixed effects respectively.²⁵ ϵ_{ih} is an error term.

In order to test for differential effects of duties on imports by applied AD methodology, the treatment dummy is nested by AD regime. This is done by interacting the treatment dummy ΔAD_{ih} once with a dummy that is equal to one if the exporter has MES and once with a dummy identifying if the exporter has NMES.²⁶

Once implemented, AD duties typically remain in force for at least five years (European Commission, 2013), which allows their effect on trade to be estimated. For the experiment, the paper only considers AD cases for which final duties were implemented by the end of 2003 (i.e. before the accession) and that were in force throughout 2005 (i.e. not revoked in 2005 or before). This yields a clear pre- and post-treatment period. All duties considered were in force in EU15 countries but not in accession states in 2003 (pre-treatment period), entered into force at the same time in 2004 from the perspective of new member states and still were in force in 2005 (post-treatment period).²⁷

The advantage of the natural experiment is that the implementation of AD duties already in force in the EU is exogenous from the perspective of new member states. Member states were required to adopt the existing AD policy (treatment) because they joined the EU. Under the plausible identifying assumption that accession states did not

²⁴The dummy AD is zero for all ih in 2003 and changes to one in 2005 only for those ih that are subject to EU AD duties.

²⁵The first differences approach eliminates all unobserved time invariant country-product variation. Adding exporter (product) fixed effects after taking first differences additionally controls for the change in unobserved exporter (product) characteristics over time.

²⁶The resulting estimation equation becomes

$$\Delta \ln y_{ih} = \delta^{MES} MES \Delta AD_{ih} + \delta^{NMES} NMES \Delta AD_{ih} + \nu_i + \nu_h + \epsilon_{ih}.$$

²⁷This is also the reason why the 2007 accession round is not considered. If 2008 was chosen as the post-treatment period so as to include Romania and Bulgaria, all duties implemented or revoked between 2005 and 2008 would have to be removed from the sample. As several duties were revoked during this time period, this would have reduced the size of the treatment group significantly.

join the EU because of its AD policy (independence of decision to join EU and existing EU AD regulation), the difference-in-differences strategy yields unbiased estimates of the treatment effect.²⁸

Even though the experimental setup reduces endogeneity bias by addressing simultaneity (new member states' imports do not determine whether AD duties are introduced by EU15 countries before 2004), a threat to clear identification may remain if imports of EU accession states correlate with those of EU15 countries, for which endogeneity is suspected. In order to address this potential problem, this paper additionally uses product fixed effects to control for unobserved demand side variables such as changes in tastes and preferences.²⁹ They also capture average changes in MFN tariffs over time.³⁰

All time invariant unobserved country-product characteristics are eliminated by the first differences approach. Potentially omitted time varying supply side factors are additionally controlled for through exporter country fixed effects. In the context of a first differences estimation, country fixed effects capture time varying exporter characteristics such as non-product specific market distortions and changes in the price index of intermediates in individual exporting countries as well as time-varying multilateral resistance terms (Feenstra, 2008). To sum up, the combination of first differences with country and product fixed effects controls for all unobserved variables that vary across the exporter-product, exporter-time or product-time dimension.

Omitted supply side factors which vary across the exporter-product-time dimension and may cause omitted variable bias cannot be controlled for with fixed effects because this variation is required to estimate the effect of AD duties. However, they should not play a role in the context of the natural experiment. For example, an exporter-product specific subsidy which increases EU imports and consequently induces the EU to impose AD duties would constitute a source of endogeneity. However, only AD cases imposed by (and hence initiated before) 2003 are included in the sample. Their implementation in the past (including possible reactions by the exporter) should not be correlated with time varying country-product characteristics in 2003 and 2005. The fact that they are inherited by the

²⁸This exogeneity is not trivial as Bown and Crowley (2013) show. In the presence of simultaneity (AD duties reduce imports but higher imports increase the likelihood of AD implementation), estimated coefficients may suffer from endogeneity bias. For quantity effects, the bias is likely to be positive, leading to an underestimation of the (negative) treatment effect. For prices, the bias is likely to be negative, as AD duties are more likely to be implemented in sectors where dumping exists, i.e. import prices are low. Felbermayr et al. (2018) show explicitly that not accounting for demand side effects that are correlated with the decision to implement AD duties results in an underestimation of the true treatment effect.

²⁹Since the initial panel only consists of two time periods, the time dimension disappears after taking first differences. Product fixed effects in the first differences model hence capture the change in product specific demand and supply side variables between the two time periods.

³⁰Moore and Zanardi (2009, 2011) show a correlation between antidumping and trade liberalisation, i.e. an increase in the use of AD following a reduction in MFN tariffs.

new member states from 2004 onward does not imply a change in unobserved exporting country-product characteristics between 2003 and 2005. Nevertheless, the potential for unobserved time varying exporting country-product specific variables that correlate with imports and AD duties and may cause omitted variable bias is addressed in a robustness check.

The difference-in-differences setup also ensures that results are not driven by trade diversion effects due to the EU enlargement.³¹ As AD duties vary by exporter and product, effects are estimated by exploiting variation across these two dimensions. On the one hand, the change in imports of targeted products from a particular country is compared to the change in imports of a non-targeted product by that same country, exploiting within exporter across product variation. This channel is not affected by trade diversion as long as trade diversion is not systematically larger for products subject to AD duties. On the other hand, the change in imports of a specific product from a country targeted by AD is compared with the change in imports of the same product exported from another un-targeted (EU or non-EU) country. This channel could indeed be affected by trade diversion, which is why all EU exporters are excluded in a robustness check. As a consequence, imports from targeted countries are only compared to imports from non-targeted non-EU countries.

The possibility of the reversal of trade deflection resulting in an overestimation of the treatment effect was already discussed in Section 1. Similarly, the existence of anticipation might also constitute a threat to identification. The accession of the ten member states and its consequences for their AD policy was known by importers and exporters years before 2004. If the change in AD regulation was anticipated it is hence possible that firms exporting to the new member states may have adjusted their prices before 2004 in order to avoid the imposition of AD duties once the EU AD rules are in force. Only looking at post-treatment price effects would hence underestimate the treatment effect. Similarly it is also possible that exporters engaged in excessive dumping before 2004 to sell as many dumped products as possible before the regulation enters into force. By looking at treatment effects over time, this paper shows that trade deflection and anticipation effects were absent for duties implemented before 2003.

A final threat to identification worth discussing is anticipation of the EU enlargement by EU trade authorities in charge of AD investigations. Knowing that the new members states were about to join the EU in 2004, it is possible that EU AD decisions were adjusted even before 2004 in order to accommodate the need for protection of future member states. AD duties imposed before 2004 would thus not be exogenous from the perspective of the

³¹Trade diversion exists if imports of EU accession countries from non EU countries are diverted to EU15 countries, i.e. accession states substituting non EU imports for EU imports following accession.

accession countries. This claim can however be rejected for three reasons. According to the EU AD legislation, duties can only be imposed if there is proof for material injury of the domestic (i.e. EU15) industry. From a legal perspective, AD duties can therefore not be imposed if only the domestic industry of EU accession states is affected by dumping practices. Second, only four out of the ten new member states imposed AD duties before joining the EU, indicating limited interest in the instrument.³² Finally, for almost all AD cases that were successfully imposed by the accession states, the EU imposed no case covering similar products and exporting countries, indicating that the EU did not adjust its AD policy before 2004.³³

3 Data

Data on EU trade is obtained from the Eurostat Comext Database (Eurostat, 2017). It supplies data on annual bilateral import values and quantities for all EU member states at the CN8 digit product level. This paper uses data for the years 1999 to 2009, with a focus on 2003 and 2005.³⁴ For 2003 and 2005 the dataset covers imports of 10,636 CN8 products from 223 countries.

Information on EU AD duties is taken from the World Bank's Global antidumping Database (Bown, 2015). The European AD process involves three stages: Initiation of a case, preliminary (temporary) duties and final duties. Only cases in which final duties were implemented are considered. The estimation strategy requires a degree of persistence of AD duties, meaning they have to remain in force for several years. More specifically, only cases for which final duties were implemented by the end of 2003 and that remained in force until at least 2005 (i.e. not revoked in 2005 or earlier) are considered. This leaves 87 AD cases covering 82 CN8 products from 17 exporting countries.³⁵ The persistence of AD duties implemented by 2003 is illustrated in Figure 1 below.

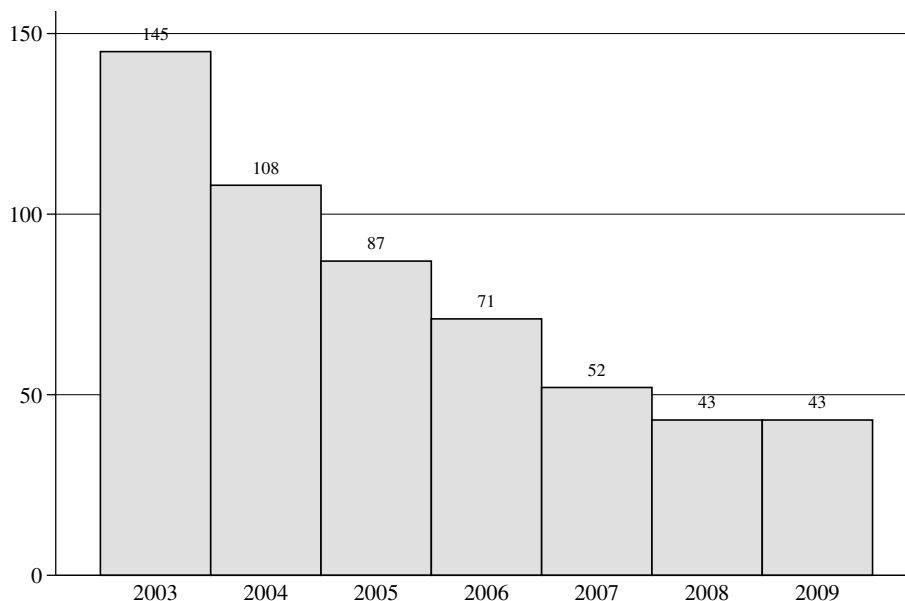
³²These are the Czech Republic (one case), Latvia (one), Lithuania (seven) and Poland (nine). Slovenia started one investigation which however was withdrawn. All data from Bown (2015).

³³One exception is the case of graphite electrodes from India that were investigated by Poland and the EU simultaneously in 2003 and became subject AD duties by both economies. On the other hand, pocket lighters exported by China, Taiwan, Indonesia and Vietnam that became subject to Polish AD duties in 2000 were investigated by the EU in 2002. However, no final duties were imposed by the EU. Similarly, styrene-butadiene rubber from Russia became subject to Polish AD duties in 2003 and was subsequently investigated by the EU in 2004 and 2005. Even though dumping was determined to take place, no evidence for injury was found so that no duties were imposed.

³⁴1999 is the first year for which Eurostat provides trade data for EU member states that joined in 2004. Using data until 2009 provides a symmetric five year window around the treatment year 2004.

³⁵Overall, 145 (115) cases were in force in 2003 (2005). Only those in force in both years are included in the analysis. Each case can cover several products, while several cases may cover the same product, but for different exporting countries. Except for one case, all AD cases involve duties imposed at the CN8 digit level.

Figure 1: The persistence of EU AD duties: Cases imposed by 2003 and remaining in force



Note: Cases in force both in 2003 and onward (several products per case)

The datasets are merged by exporting country, CN8 product and year. Using import (rather than export) data has the advantage that the importer's product nomenclature is used, which coincides with the nomenclature reported in Bown (2015) who also relies on importers' declaration of AD duties. As HS codes are only comparable across countries up until the HS6 digit level (Lu et al., 2013; Bown and Crowley, 2016), studies using exporter data have to restrict their analysis to this higher level of aggregation. Since AD duties are however often implemented at a more disaggregated level, using aggregated data means that HS6 products which are assigned AD treatment incorporate trade flows that are in fact not subject to AD duties, leading to attenuation bias and hence an underestimation of the treatment effect. After the merge, the balanced baseline sample includes imports of 8,366 CN8 products from 149 countries.³⁶ 55 products imported from 13 countries are subject to EU AD duties.³⁷ Information on NMES of exporters is taken from Detlof and Fridh (2006) and (Felbermayr et al., 2016).³⁸

³⁶Not every product is exported by every country.

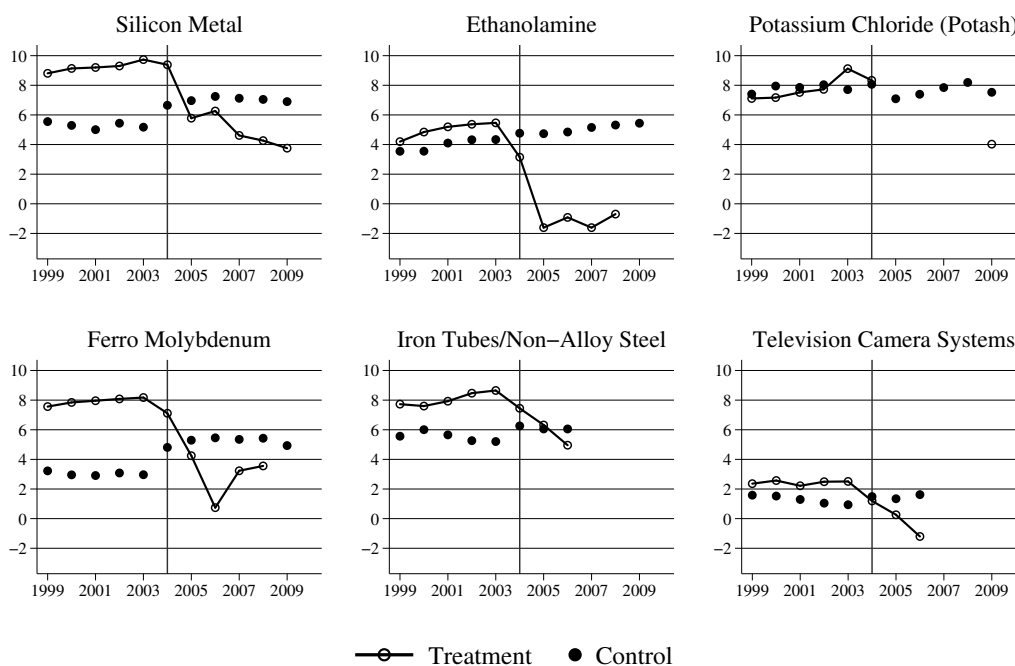
³⁷AD duties are product and country specific, so that the same product may be subject to AD duties if imported from one country, but not the other.

³⁸Countries that are assigned NMES by the EU in the period of investigation are Albania, Armenia, Azerbaijan, Belarus, China, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Mongolia, North Korea, Tajikistan, Turkmenistan, Uzbekistan and Vietnam. Out of these 15 countries, only five (Armenia, Belarus, China, Kazakhstan and Vietnam) have ever become subject to EU AD duties and two (Belarus and China) are targeted in the sample period.

4 Descriptive Evidence

Figures 2 and 3 present an event analysis, providing descriptive evidence for the effect of AD duties on import quantities and prices.³⁹ For the years 1999 to 2009, they show average quantities (prices) in logarithms of imports into the ten EU accession states (grouped together) of six specific products that are subject to EU AD duties. The treatment group consists of imports of the respective CN8 product from the country (countries) targeted by EU AD duties, while the control group is given by the same product, imported from non targeted countries.⁴⁰ Looking at the top left panel of Figure 2, it can be seen that imports of Silicon Metal from targeted and non targeted countries followed the same trend before the year of accession (2004). However, once the new member states joined the EU in 2004 and EU AD policy was implemented, imports from targeted countries drop, while those from non targeted countries increase. The other panels of Figure 2 illustrate similar developments.

Figure 2: Average import quantities of treated and untreated country-product combinations



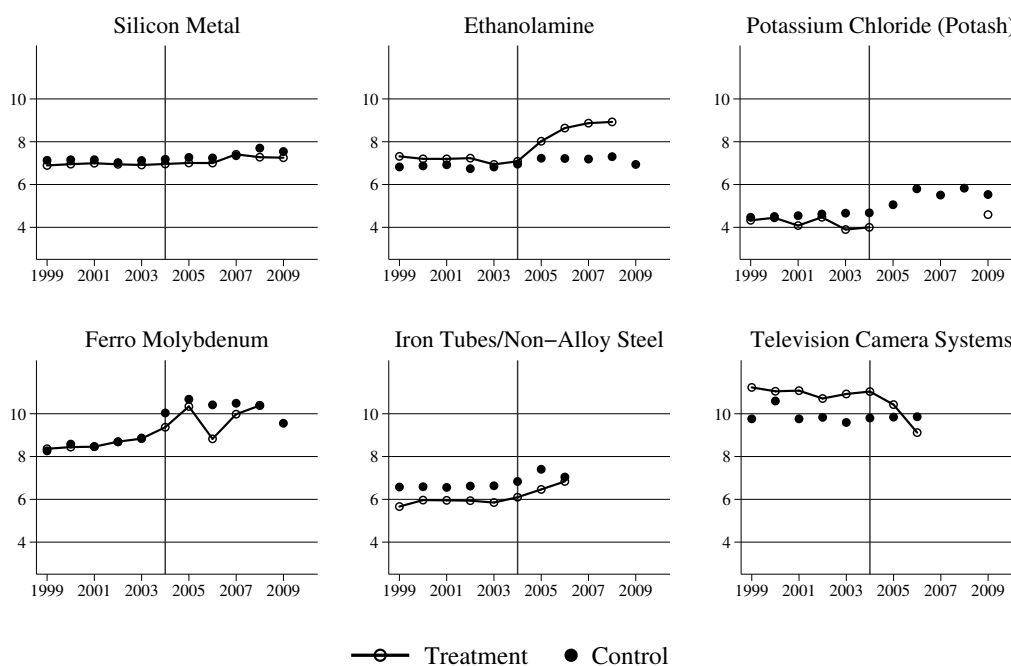
Note: EU accession (beginning of treatment) in May 2004. Ln import quantity on vertical axis, year on horizontal axis. For example, a change in imports of Silicon Metal from almost 10 in 2003 to 4 in 2009 indicates a trade reduction of $\frac{e^{10}-e^4}{e^{10}} * 100 = 99.75\%$ Missing observations represent non-reported quantities and can be interpreted as zero trade flows.

³⁹Value effects are similar to quantity effects. They are illustrated in Figures A.1 (including EU exporters) and A.4 (excluding EU exporters) in the Appendix.

⁴⁰The descriptive analysis hence ignores the second identification channel of variation within countries across products.

The impact of AD duties on prices is not that clear. Looking at the top middle panel of Figure 3, it can be seen that prices of targeted Ethanolamine imports increased rapidly relative to the control group following the imposition of AD duties in 2004. On the other hand import prices of television camera systems and parts fell following the imposition of AD duties (bottom right panel). In addition prices of both treated and untreated imports of iron tubes (bottom middle panel) increased following the accession. This could be evidence for spillover effects from treated to untreated countries.

Figure 3: Average import prices of treated and untreated country-product combinations



Note: EU accession (beginning of treatment) in May 2004. Ln import price on vertical axis, year on horizontal axis. Missing observations represent non-reported prices and can be interpreted as zero trade flows.

Prices may also be affected by exchange rate fluctuations. This should however only be the case if the currency of countries subject to AD duties reacted differently to the EU enlargement than currencies of countries not subject to AD duties. The difference-in-differences specification relies on variation within countries across products as an additional identification channel which is not affected by exchange rate fluctuations. In addition, country fixed effects capture average exchange rate fluctuations by exporting country.⁴¹

⁴¹Since most EU accession states had their own currencies during the period of investigation, exporter fixed effects only capture average changes in the currency of the exporter relative to all currencies of the importing countries. When importing countries are assessed individually in a robustness check, additional importer fixed effects however also control for each importer's individual currency.

It is, however, not obvious whether the drop in imports of treated products stems from AD or is simply a consequence of the EU accession. As imports of untreated products include imports from EU countries, the graphs above could simply show import diversion from non EU exporters towards EU exporters. Figures A.2 and A.3 in the Appendix hence show import quantities and prices for the same products, excluding imports from EU exporters. The control group only consists of non EU exporters not subject to AD and exporting the same product. The overall picture remains similar, indicating that results are not driven by trade diversion following the accession.

Table 1: Import prices and quantities by EU accession states of products subject to AD duties, 2003 and 2005

Dependent variable	(1) ln price	(2) ln price	(3) ln quantity	(4) ln quantity
AD (2003)	-0.4716*** (0.0886)		2.0112*** (0.2603)	
AD (2005)	-0.2658*** (0.0960)		0.9756*** (0.2847)	
AD (MES, 2003)		-0.4251*** (0.1066)		1.8357*** (0.3009)
AD (MES, 2005)		-0.1615 (0.1236)		0.9526*** (0.3276)
AD (NMES, 2003)		-0.5802*** (0.1452)		2.4266*** (0.4768)
AD (NMES, 2005)		-0.5123*** (0.1120)		1.0278* (0.5427)

Note: OLS regression with product fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. Same products subject to AD duties in 2003 and 2005. 144,998 observations per year. The sample is the same used in the baseline regression (before first differencing).

Table 1 provides results of a descriptive regression of import prices and quantities on an AD dummy (nested by year) with product fixed effects.⁴² It thus shows prices and quantities of products that become subject to AD duties in 2005 relative to the same product exported from countries not targeted by AD duties (within product across countries), both in the pre- and post-treatment period. Looking at Column (1), the coefficient of the AD dummy is negative and statistically significant in 2003, indicating that products subject to AD duties were on average 38% cheaper than the same product exported from a country not subject to AD duties.⁴³ This difference shrunk to 23% in

⁴²The sample is the same as the one used in the baseline regression, before taking first differences.

⁴³ $100 * (e^{\delta} - 1)\%$

2005 following the imposition of the AD duty, providing some preliminary evidence that the imposition of AD duties is associated with higher exporter prices. The difference is statistically significant at the 5% level.⁴⁴

When interacting the time invariant dummy with market economy status of the exporter (Column 2), it can be seen that the NMES coefficient is larger in terms of magnitude than the MES coefficient both in 2003 and in 2005. Interestingly, the difference in the size of the coefficient between MES and NMES countries is not statistically significant in 2003, while it increases and turns significant in 2005 (5%). This provides preliminary evidence that the imposition of AD duties correlates with an increase in import prices from MES exporters, going so far as to eliminate the price differential relative to products not subject to AD duties (as indicated by the insignificant coefficient of AD for MES exporters in 2005). This is not the case for NMES exporters, for whom the coefficient hardly changes between 2003 and 2005.

Regarding import quantities, Column (3) shows that the AD coefficients are positive and significant, indicating that country-product combinations targeted by AD duties experience higher import quantities. The coefficient is significantly smaller in 2005, indicating that the gap in import quantities between targeted and non-targeted products falls following the imposition of AD duties.⁴⁵ The same difference between pre- and post-treatment is true when looking at exports from NMES and MES countries separately. In contrast to prices, the difference between MES and NMES coefficients of the same year is not statistically significant.

5 Econometric Baseline Results

5.1 Effects on Prices

Table 2 provides the baseline estimation results, with the change in the logarithm of import price, quantity and value as dependent variable. Column (1) of Table 2 shows the price effects of AD duties following the basic difference-in-differences estimation as given in Equation 1. The coefficient of the AD dummy (0.2206) is positive and statistically

⁴⁴When not controlling for product fixed effects, the coefficient becomes even more negative. This indicates that products subject to AD duties are both cheaper than products of the same CN8 product classification not subject to AD (within product) and cheaper than untargeted products of different CN8 product classifications (across product), providing some insights regarding the type of product typically targeted by AD.

⁴⁵Similar to the price effects discussed before, the magnitude of the estimated coefficient increases when not controlling for product fixed effects, indicating that it is driven both by within product variation (higher import quantities of products imported from countries subject to AD compared to the same product imported from countries not subject to AD duties as shown in the table) as well as across product variation (larger ex ante import quantities of products subject to AD duties).

significant. It indicates that import prices (before tariffs and duties) increase by 25% following the imposition of AD duties.⁴⁶

The baseline estimation already includes product and exporter fixed effects. Interestingly, not controlling for these fixed effects does not significantly alter the results.⁴⁷ The positive estimated treatment effect is robust to all possible fixed effects specifications. This indicates that the quasi-experimental setup addresses omitted demand and supply side variables that typically have to be controlled for using fixed effects.

Table 2: The effects of AD duties on imports

Dep. var.	(1) $\Delta \ln price$	(2) $\Delta \ln price$	(3) $\Delta \ln quantity$	(4) $\Delta \ln quantity$	(5) $\Delta \ln value$	(6) $\Delta \ln value$	(7) $\Delta \ln value$	(8) $\Delta \ln value$
AD	0.2206** (0.0943)		-1.3518*** (0.2362)		-1.1312*** (0.2174)		-1.1384*** (0.2179)	
AD*MES		0.2518** (0.1151)		-1.1253*** (0.2934)		-0.8736*** (0.2589)		-0.9057*** (0.2593)
AD*NMES		0.1471 (0.1578)		-1.8852*** (0.3448)		-1.7381*** (0.3525)		-1.7582*** (0.3504)
R^2	0.1223	0.1223	0.1359	0.1359	0.1703	0.1704	0.1420	0.1420

Note: OLS regressions (first differences) with exporter and product fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. (1) - (6): 144,998 observations. (7) - (8): 184,889 obs.

The results are in line with Blonigen and Haynes (2002), who also find pass-through rates of more than 100%, but not with Lu et al. (2013), who do not find any price effects for imports from China. To check whether this difference stems from the specific AD procedure applied to non-market economies such as China, the AD dummy is additionally interacted with a dummy indicating whether the exporter has MES, and a (mutually exclusive) dummy indicating whether the exporter has NMES.

The results are presented in Column (2). When comparing the estimated coefficients for MES and NMES countries, it is evident that aggregate results presented in Column (1) are driven by MES countries. The interaction coefficient of the treatment dummy and the MES dummy is positive and statistically significant, while the interaction coefficient of the treatment dummy and the NMES dummy is smaller and not statistically significant. This provides evidence that producer prices of products imported from MES countries increase following the imposition of AD duties. On the other hand, one cannot reject the hypothesis that producer prices of products exported from NMES countries do not change following the imposition of AD duties. The policy implication of this finding is that the MES methodology increases the likelihood that AD duties achieve an increase in import

⁴⁶ $100 * (e^\delta - 1)\%$

⁴⁷Results for varying fixed effects specifications are provided in Table B.1 in the Appendix.

prices, which is the official objective of the instrument.⁴⁸

5.2 Effects on Quantities

Columns (3) and (4) of Table 2 summarise the effects of AD duties on import quantities. Column (3) shows regression results for the basic difference-in-differences specification following Equation 1. The coefficient of the AD dummy is negative and statistically significant at the 1% level, indicating that the imposition of AD duties reduces import quantities of EU accession states. As with price effects, the result is robust to all possible fixed effects specifications. In terms of magnitude the coefficient of -1.3518 in Column (3) indicates that imports fall by 74% following the imposition of AD duties.⁴⁹ This estimate is at the high end of the existing literature.

Column (4) presents the estimated effect of AD duties on import quantities separated by MES and NMES. It shows that while both coefficients are highly statistically significant, the estimated treatment effect for NMES countries is larger in terms of magnitude than the one for MES countries. The difference is statistically significant at the 10% level. This result is to be expected given the higher average AD duties imposed on NMES exporters observed in the literature.

5.3 Effects on Values

The baseline regression focuses on quantity effects to estimate the impact of AD duties on real trade flows. For completeness, value effects (in EUR) are also estimated. By construction, $value = price * quantity$ so that $\Delta \ln value = \Delta \ln price + \Delta \ln quantity$. This is also true for the estimated coefficients which are reported in Columns (5) and (6) of Table 2. They are similar to quantity effects but smaller in magnitude. This is due to the positive price effects of AD duties which are incorporated in the value effects and reduce the magnitude of the (negative) coefficient. The difference between estimated coefficients for MES and NMES countries increases in significance (5%) relative to the quantity regression. An advantage of using import values is the resulting increase in sample size, as information on import values is more frequently available than information on import quantity. Running the same regression with a larger sample (Columns 7 and

⁴⁸As mentioned before product level data does not allow the determination of whether the price increase for MES exporters stems from exporting firms increasing their prices or from low price exporters receiving high duties and thus exiting the market, leaving only high price exporters behind. From the perspective of the importer, the result is the same. It may nevertheless have long term implications if the exporter composition is affected (e.g. inefficient exporters driven out of the market, leaving only efficient ones behind. See for example Lu et al. (2013), Jabbour et al. (2016) and Felbermayr et al. (2018) for a more detailed discussion).

⁴⁹ $100 * (e^\delta - 1)\%$

8) however yields coefficients of similar magnitude, indicating that results are robust to a change in sample composition.

5.4 Effects over Time

By comparing import flows in 2003 and 2005 for treated and untreated products, the baseline regression provides a snapshot of the trade effects of AD duties. In order to investigate whether the effect of AD duties persists over time, the sample is extended, covering trade flows for the years 1999 to 2007. The AD cases included in the sample are the same as in the baseline. Instead of estimating one treatment effect, separate treatment effects are estimated for each year from 2001 to 2007.⁵⁰ This is done by interacting the AD dummy (which varies across products and exporters) with year dummies. Each of the resulting dummies hence only switches from zero to one in one year, identifying the effect of AD duties on import prices and quantities in that specific year.⁵¹

The results are illustrated graphically in Figure 4.⁵² The graph already provides transformed effects, so that the point estimates depicted show percentage changes in import prices and quantities of treated exporting country-product combinations for each year relative to non treated ones.⁵³ It can be seen that both price and quantity effects are not statistically significant before the new member states joined the EU in 2004. Both coefficients become significant in 2004 (the new member states officially joined the Union in May 2004) and increase in magnitude in 2005. From 2005 onwards, effects remain stable. Since only a part of 2004 is treated, the smaller coefficient for this year is to be expected. The results imply that AD duties quickly unfold their full effect on trade. Small delays could be driven by contracts which fix prices and quantities in the short run. On the other hand the results could be taken as evidence that exporters adjust their prices in steps. Firm level data is necessary to decompose these potential channels.

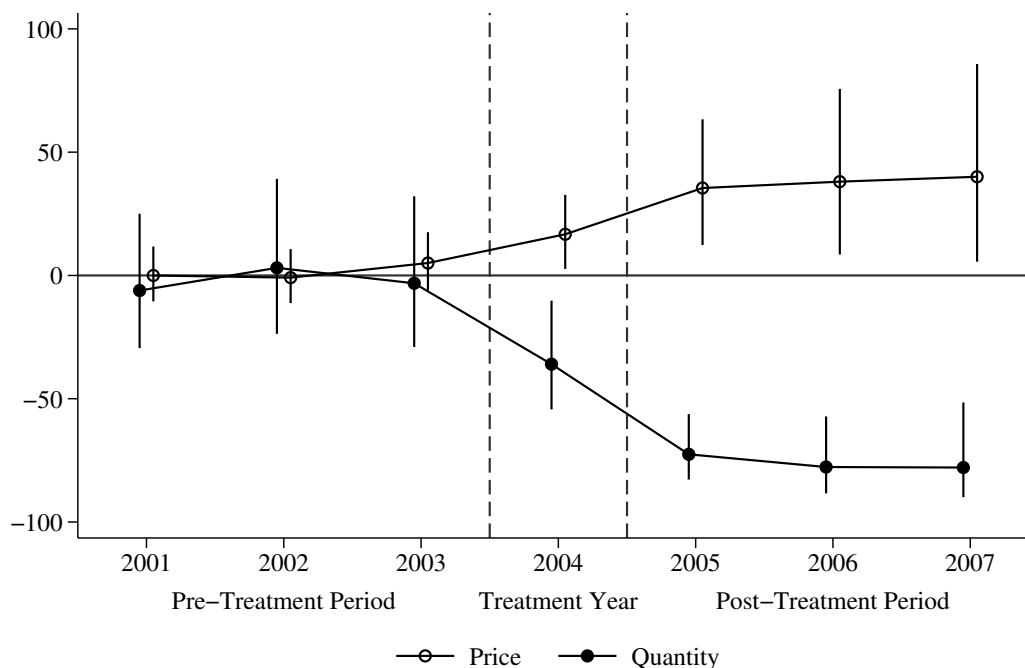
⁵⁰Symmetric around the treatment year 2004, relative to 1999 and 2000.

⁵¹Effects over time are estimated using fixed effects rather than first differences. With $t=2$, first differences and fixed effects estimations are identical (Wooldridge, 2010). The fixed effects specification is given by $\ln y_{iht} = \delta(AD_{ih}post_t) + \nu_{ih} + \nu_{it} + \nu_{ht} + \epsilon_{iht}$. The dependent variable $\ln y_{iht}$ is the natural logarithm of import price (quantity) of product h imported from country i at time t . AD_{ih} identifies the treatment group and is a time invariant dummy that is equal to one if imports from country i of product h are subject to EU AD duties and zero otherwise. $post_t$ is a time dummy that equals zero in 2003 and one in 2005 and $AD_{ih}post_t$ is the treatment dummy that is an interaction of the AD dummy and the time dummy so that δ identifies the treatment effect. ϵ_{iht} is an error term. ν_{ih} , ν_{it} and ν_{ht} are exporter-product, exporter-time and product-time fixed effects respectively. Effects over time are estimated using the specification $\ln y_{iht} = \sum_{T=2001}^{2007} \delta^{year_T}(AD_{ih}year_T) + \nu_{ih} + \nu_{it} + \nu_{ht} + \epsilon_{iht}$ with $year_T = 1$ if $t = T$ and zero otherwise. The three two dimensional fixed effects are implemented simultaneously using the “reghdfe” stata command by Correia (2016) for OLS and the “poi2hdfe” stata command by Guimarães and Portugal (2010) and Figueiredo et al. (2015) for PPML.

⁵²Detailed coefficients for each year are provided in Columns (1) and (2) of Table B.2 in the Appendix.

⁵³ $100 * (e^\delta - 1)\%$

Figure 4: Effect of AD duties on import prices and quantities, by year



Note: EU accession (beginning of treatment) in May 2004. Percentage change in import prices and quantities of treated products on vertical axis, year on horizontal axis. The plot shows point estimates with 95% confidence intervals, indicating large and significant price and quantity effects of AD duties since their introduction in 2004.

6 Extensions & Robustness Checks

6.1 The Persistence of AD Duties

Figure 4 has illustrated that the trade dampening effects of AD duties persist over several years. The estimated coefficients show the average effect over time of AD duties that were in force 2005. However, they may underestimate the treatment effect for the years 2006 and 2007 because the baseline sample only includes AD cases that were in force until at least 2005. Cases revoked in 2006 or 2007 are still treated as being subject to AD duties in the baseline sample, even though they are not in force anymore. A robustness test hence performs the same regression, estimating treatment effects by year, but only including cases in force until at least 2007. The results (provided in Columns (3) and (4) of Table B.2 in the Appendix) show that estimated treatment effects on quantity and price increase for all post-treatment years. Estimated coefficients for 2004 become insignificant, which is not surprising given the smaller number of cases used to identify the treatment effect and since some products that were treated in 2004 and 2005 are not assigned treatment anymore.

In order to investigate an even longer time horizon, treatment effects are also estimated for the years 2000 - 2008 (using the baseline sample) as well as for 2000 - 2009. Results are reported in Columns (5) to (8) of Table B.2 and graphically in Figure A.5 in the Appendix. Both price and quantity effects remain significant until the end of the sample period, despite half of the cases being revoked before (Figure 1). The magnitude of the price coefficient remains almost constant between 2005 and 2008, indicating that the effect of AD duties on prices persists beyond their revokement. Even though the estimated quantity coefficient falls over time, it does by no means halve, as would be expected if AD duties only affected trade as long as they are in force.

In fact, the removal of AD duties constitutes a source of variation that has so far not been used to identify the treatment effect. An extension hence departs from the baseline setting and only looks at cases that were revoked between 2006 and 2009. The treatment dummy switches from one to zero in the revoke year and remains zero afterwards. Columns (1) and (2) of Table B.3 in the Appendix report the results. Estimated coefficients of the time varying AD dummy are insignificant, implying no change in import prices and quantities following revokement of AD duties. One possible explanation for this observation is that large AD duties completely eliminate imports, as indicated by the large coefficients reported in Table 2. Once an exporter is eliminated, it is impossible for her to re-enter the market quickly following the elimination of the duty. The trade destructing effect of AD duties thus persists beyond their duration. This could be due to market entry costs or a strengthening of the domestic industry during the protection period. Looking at lagged effects provides some evidence that import values recover slightly one year after a case is being revoked, while producer prices fall only three years after the AD duty has been removed (Columns 3 - 5 of Table B.3 in the Appendix).

6.2 Elasticities & Semi-Elasticities

By using dummies to identify the treatment, the baseline regressions estimate average changes in import prices and quantities following the impositions of AD duties. These effects depend on the average size of the duty as well as the implied elasticity. To investigate how import prices and quantities react to a change in the size of AD duties, an extension uses information on average product specific duty rates to estimate elasticities.⁵⁴ Columns (1) to (4) of Table 3 provide estimates for semi-elasticities. The estimated coefficient in Column (1) shows that a one percentage point increase in AD duties leads to an increase in (producer) import prices of 0.34%. As was the case in the baseline regression, the

⁵⁴As duties are often firm specific, the duties used in the regression are averages as provided by Bown (2015).

results are driven by MES countries (Column 2). There is no evidence that import prices from NMES countries react to AD duties.

Looking at the impact of AD duties on import quantities (Columns 3), the coefficient of -0.02 means that import quantities fall on average by 2% for each percentage point increase in AD duties. Coefficients for MES and NMES countries are not significantly different from each other (Column 4), indicating that the difference observed in the baseline regression is indeed driven by differences in average AD duty rates. Given the same estimated elasticity, imports from NMES countries on average fall by more following the imposition of AD due to the higher average duty rates they face. Elasticity estimates provided in Columns (5) to (8) show similar results.

Table 3: The effects of AD duties on import prices and quantities, elasticities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. var.	$\Delta \ln price$	$\Delta \ln price$	$\Delta \ln quantity$	$\Delta \ln quantity$	$\Delta \ln price$	$\Delta \ln price$	$\Delta \ln quantity$	$\Delta \ln quantity$
Treat. var.	Duty	Duty	Duty	Duty	$\ln(1 + \frac{Duty}{100})$	$\ln(1 + \frac{Duty}{100})$	$\ln(1 + \frac{Duty}{100})$	$\ln(1 + \frac{Duty}{100})$
Duty	0.0034** (0.0015)		-0.0209*** (0.0043)		0.4854** (0.2162)		-2.8718*** (0.5815)	
Duty*MES		0.0038** (0.0017)		-0.0199*** (0.0051)		0.5500** (0.2446)		-2.6858*** (0.7027)
Duty*NMES		0.0023 (0.0033)		-0.0243*** (0.0079)		0.3028 (0.4457)		-3.3973*** (0.9916)
R^2	0.9099	0.9099	0.9016	0.9016	0.9099	0.9099	0.9016	0.9016

Note: OLS regressions with first differences, including exporter and product fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. 144,998 observations.

6.3 Trade Diversion and Spillover Effects

The baseline sample includes imports from EU member countries (both EU15 as well as the ten accession states). If AD duties strengthen intra EU trade relatively more than imports from non-targeted non EU countries, this could affect the results. Similarly, increased imports from EU15 countries as a consequence of the accession (trade diversion) may affect one of the two identification channels, resulting in an overestimation of the treatment effect (see discussion in Section 2).

To exclude this possible channel, the baseline regression is performed on a sample that excludes imports from EU member states. The results are presented in Columns (1) and (2) of Table 4. The estimated coefficient for the effect of AD on import quantities (Column 2) remains stable and even increases in magnitude, indicating that trade diversion does not drive the results.

The estimate for the treatment effect of AD duties on prices (Column 1) remains pos-

itive but turns insignificant, indicating that prices of targeted products increase relative to imports from EU countries (baseline), but not relative to imports from non-targeted non EU countries. This observation can be explained by spillover effects. Allegations of dumping concerning the same product are often split by exporting country and investigated in separate cases either simultaneously or sequentially. If one country is found guilty of dumping a particular product, then other exporters of the same product may expect to become the subject of investigations in the future and raise prices in anticipation. Such spillover effects would mean that non-targeted countries raise prices following the imposition of antidumping duties against one particular country. This would violate the stable unit treatment assumption and cause underestimation of the treatment effect. As EU exporters are never subject to EU AD duties, no anticipation spillovers are to be expected for them.

Table 4: The effects of AD duties on imports, robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	no EU exporters	no EU exporters	non-targeted countries	non-targeted countries	PPML: zero trade flows	excluding China	excluding China
Dep. var.	$\Delta \ln price$	$\Delta \ln quantity$	$\Delta \ln price$	$\Delta \ln quantity$	$quantity$	$\Delta \ln price$	$\Delta \ln quantity$
AD	0.1374 (0.1171)	-1.5504*** (0.2873)	0.1240* (0.0651)	0.1546 (0.1388)	-1.4421*** (0.3223)		
AD*MES						0.2511** (0.1151)	-1.1164*** (0.2939)
AD*NMES						0.1208 (0.1615)	-2.0290** (1.0177)
Obs.	51,962	51,962	144,900	144,900	440,606	140,381	140,3812
R^2	0.9149	0.9014	0.9098	0.9016		0.9103	0.9018

Note: OLS regression with first differences unless indicated otherwise. All regressions include exporter and product fixed effects. PPML regression includes exporter-product, exporter-time and product-time fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

The hypothesis of price spillovers can be tested by investigating the effect of AD duties on imports of targeted products from non-targeted countries. To do this, all product-country combinations subject to AD duties are removed from the sample. AD treatment is then assigned to imports of targeted products from the remaining non-targeted non-EU countries.⁵⁵ Imports of targeted products from EU countries receive a zero treatment. The treatment effect is hence identified by using variation in imports from non-targeted non-EU countries (where spillovers due to anticipation of further AD cases may be expected)

⁵⁵The removal of targeted product-country combinations is necessary due to colinearity within products across countries which would mean that coefficients would be the same as in the baseline, only with opposite sign.

relative to imports from non-targeted EU countries (which will never be subject to EU AD duties).

The results are reported in Columns (3) and (4) of Table 4. The estimated coefficient for the effect of AD duties on import prices from non-targeted countries is indeed positive and statistically significant, indicating that prices of imports from non-targeted countries do increase following the imposition of AD duties against other countries. The magnitude of the price change is roughly half the effect for treated countries (Column (1) of Table 2), indicating significant spillover effects. Quantity effects (Column 4) are insignificant. These results provide evidence that exporting countries react to AD duties imposed against different exporters. AD duties thus seem to have a signalling effect, as they induce non-targeted exporters to raise prices. At the same time, the insignificant quantity coefficient in Column (4) indicates that the baseline results are not driven by import diversion away from non-EU countries towards EU countries following the enlargement as this should result in a significantly positive coefficient in Column (4).

6.4 Further Robustness Checks

In the baseline analysis, zero trade flows are omitted as they are not reported in the trade statistic. If a country-product combination is only observed in one year, it is dropped in order to balance the panel as pre- and posttreatment observations are needed to estimate a treatment effect. However, these non observed zero trade flows potentially contain information, because AD duties are expected to reduce imports. If duties are prohibitively high, eliminating trade flows entirely, the observation drops out of the sample, leading to an underestimation of the treatment effect. Rather than balancing the panel by dropping country-product combinations that are only observed once, the sample is expanded by filling up the missing years with zero trade flows. Since the natural logarithm of zero is not defined and OLS yields unreliable results when zero trade flows are included (Santos Silva and Tenreyro, 2006), quantity effects are estimated using poisson-pseudo-maximum-likelihood (PPML).⁵⁶ The results are reported in Column (5) of Table 4. The estimated coefficient of -1.44 is almost identical to the baseline ppml regression excluding zero trade flows (Column 7 of Table 6 further down) and very similar to the baseline OLS result (Column 3 of Table 2). Within the fixed effects setup, adding zero trade flows hence does not significantly alter the results.

Since China is not only the largest non-market economy, but also the major target of EU AD duties, it is possible that estimated coefficients of the effect of AD duties against

⁵⁶Since PPML does not permit negative dependent variables, a fixed effects estimation is employed instead of a first differences estimation.

NMES countries are driven by China. Another robustness test hence excludes imports from China and re-estimates AD effects for MES and NMES countries. The results, presented in Columns (6) and (7) of Table 4 are very similar to the baseline results in Table 2. Coefficients are thus not driven by China, which provides further evidence that non-market economy status drives the results, not any unobserved China characteristics.⁵⁷

In Section 2 it has been argued that existing studies may suffer from endogeneity bias, resulting in underestimation of the treatment effect. Indeed, baseline estimates provided in Table 2 are at the high end of estimates in the literature. However, it is also possible that this paper overestimates the treatment effect. One channel that constitutes a threat to identification of the treatment effect and may cause overestimation is the potential of AD duties to cause a reversal of trade deflection. This would be the case if the imposition of AD duties by EU15 countries before 2004 has led to increased imports of targeted products into the new member states. The imposition of AD duties in new member states following accession to the EU in 2004 could thus have two effects, firstly the standard trade destruction effect and secondly the reversal of previous trade deflection.

The potential for the reversal of trade deflection can be estimated by testing whether trade deflection has taken place before 2004. Figure 4 has already shown that treated products did not react differently to untreated products before 2004. As an additional robustness check, import quantities and prices of EU accession states are regressed on AD duties imposed by the EU in the pre-accession period 2000 to 2003.⁵⁸ The treatment dummy AD_t switches from zero to one in the year in which final AD duties are imposed and remains equal to one until the end of the sample period. AD cases revoked between 2000 and 2003 are excluded from the sample.

The results of the fixed effects estimation are reported in Columns (1) and (2) of Table 5. The coefficient of the time varying AD dummy in Column (1) is insignificant, indicating no effect of EU15 duties on import prices of new member states in the period before the accession. The estimated coefficient for quantity effects is negative and statistically significant at the 10% level (Column 2). Both coefficients provide evidence for the absence of trade deflection of EU imports towards the new member states. They also indicate that there were no anticipation effects for AD duties imposed in the years before the accession. If exporters had increased prices before the accession to avoid the implementation of AD duties by EU accession states after 2004, one would observe positive price effects.

⁵⁷As discussed in Section 3, only Belarus and China are subject to EU AD duties in the investigation period. Hence excluding China leaves Belarus as the only other NMES country subject to AD duties in the sample period. Excluding Belarus instead of China from the sample yields estimated coefficients that are also very close to the baseline (not reported). This constitutes further evidence that results are driven by the two countries' NMES.

⁵⁸With trade data from 1999 to 2003, only AD duties imposed from 2000 onwards are considered to ensure the existence of a pre-treatment period for each targeted product.

Similarly, if exporters increased exports to new member states before 2004 to sell as many products as possible before the imposition of duties, this would have resulted in a positive coefficient in Column (2). Even though the data does not allow to make a statement on duties implemented before 2000, it does permit the conclusion that EU AD duties imposed between 2000 and 2003 did not cause trade deflection to new member states.

Table 5: Trade deflection and post accession effects

	(1)	(2)	(3)	(4)
Importer	EU Accession	EU Accession	EU 25	EU 25
Sample	pre 2004	pre 2004	post 2004	post 2004
Dep. var.	$\ln price$	$\ln quantity$	$\ln price$	$\ln quantity$
AD_t	0.0489 (0.0448)	-0.2213* (0.1327)		
AD_t^{EU15}			0.0659** (0.0257)	-0.8647*** (0.0910)
$AD_t^{Accession}$			0.0611* (0.0354)	-0.5956*** (0.1041)
Obs.	931,883	931,883	2,467,857	2,467,857
R^2	0.8976	0.8897	0.8890	0.9072
Clusters	239248	239248	436888	436888

Note: OLS regression (fixed effects). Regressor: AD Dummy (time variant). Regressions (1) and (2) include exporter-product, exporter-year and product-year fixed effects. Regressions (3) and (4) include exporter-importer-product, exporter-importer-year and importer-product-year fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample period pre 2004: Import data 1999 - 2003, AD Duties imposed 2000 - 2003, Sample period post 2004: Import data 2005 - 2009, AD Duties imposed 2006 - 2009

The significantly negative coefficient in Column (2) constitutes an interesting result. It is negative but much smaller in magnitude than the coefficient of -1.3518 in the baseline regression (Table 2). It hence should not be interpreted as evidence that the new member states already adopted the EU AD policy before their accession in 2004. If this was the case, the coefficient would be larger in magnitude. In addition, this would have resulted in significant coefficients for the pre-treatment years in Figure 4. In fact, the finding is in line with Bown and Crowley (2010), who also find weak evidence for trade chilling effects of exports of targeted countries to third countries. The authors interpret this finding as a political chilling effect. Regarding the European Market, an alternative explanation would be that EU15 countries constitute the primary market for some exporters. When EU15 AD duties drive them out of this market, they cease production and also stop exporting to other countries, including the new member states. The small negative effect could constitute such a spillover effect.

Felbermayr et al. (2018) show that the effect of AD duties may vary by imposing

country. This raises the question of external validity, more precisely whether the results can be transferred to EU15 countries or whether they are specific to EU accession states. To test if the new member countries react differently to the imposition of AD duties than EU15 states, both EU15 and EU accession states' import quantities and prices are regressed on AD duties (nested by EU15 and EU accession states) imposed after the EU enlargement in 2004. The sample period consists of the years 2005 - 2009.⁵⁹

The results are reported in Columns (3) and (4) of Table 5. Comparing price effects (Column 3) and quantity effects (Columns 4) for EU15 and EU accession state importers reveals coefficients of very similar size, indicating no systematic difference between the two entities. The price coefficients (column 3) are not statistically significantly different from each other. Both are positive and significantly different from zero, while quantity effects in Column (4) are negative and significant. The results are thus in line with the baseline regression, although smaller in magnitude. This provides further evidence for endogeneity leading to underestimation of the treatment effect when not relying on the natural experiment.⁶⁰

Column (1) of Table 5 has shown that AD duties imposed by EU15 countries did not affect import prices in EU accession countries before 2004, although import quantities fell slightly (Column 2). These regressions however rely on a different estimation strategy, as each AD case is implemented at a different point in time and thus has its own pre- and post-treatment period. Another robustness test instead replicates the experiment for different samples. First of all, the baseline experiment is carried out for EU15 countries, with the years 2003 and 2005 as pre- and post treatment period respectively.

The results are summarised in Columns (1) and (2) of Table 6. Both price and quantity coefficients are not significantly different from zero. This shows that EU15 import prices and quantities of products targeted by AD in 2003 and 2005 did not change between the two periods. In addition, it demonstrates the absence of variation over time in any unobserved exporting country-product specific variables that correlate with imports and AD duties and may cause omitted variable bias. Similarly the experiment is carried out for accession states, but with an assumed accession year of 2002, using 2001 and 2003 as pre- and post-treatment periods respectively. Results are provided in Columns (3) and (4). As expected, both coefficients are not significantly different from zero.

To show that results are not driven by the the regression method used, the baseline regressions are also carried out using the poisson-pseudo-maximum-likelihood (PPML)

⁵⁹Only AD duties imposed from 2006 - 2009 are considered to have a pre-treatment period.

⁶⁰Even though the sample is similar to the one used for the natural experiment, it is by no means identical, so that results do not constitute sufficient evidence to say without doubt that estimates obtained without the use of the experiment are biased towards zero. Making such a statement would require a comparison of the two methods using the same sample, which is not feasible.

estimator. Results are provided in Columns (5) to (8) of Table 6. Price effects lose some significance but increase in magnitude by a factor of 3.5. Results continue to be driven by MES countries. Quantity effects remain stable in magnitude and significance.

Table 6: The effects of AD duties on imports: Placebo tests and PPML regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	2004 EU15	2004 EU15	2002	2002	2004	2004	2004	2004
Method	OLS	OLS	OLS	OLS	PPML	PPML	PPML	PPML
Dep. var.	$\Delta \ln price$	$\Delta \ln quantity$	$\Delta \ln price$	$\Delta \ln quantity$	<i>price</i>	<i>price</i>	<i>quantity</i>	<i>quantity</i>
AD	0.0082 (0.0572)	-0.2810 (0.1854)	0.0608 (0.0590)	-0.1013 (0.1520)	0.7668* (0.4105)		-1.4427*** (0.3276)	
AD*MES						0.8301* (0.4261)		-1.5243*** (0.2939)
AD*NMES						-0.2786 (0.3109)		-1.8040*** (0.3311)
Observations	267,578	267,578	151,943	151,943	289,996	290,026	289,996	289,996
R^2	0.9384	0.9382	0.9329	0.9266				

Note: OLS regressions (first differences) with country and product fixed effects. PPML regressions with country-product, country-time and product-time fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

The sample used in the baseline regression does not include AD cases that were revoked before 2006 to make sure only cases actually in force in 2005 are included in the post-treatment period. When including cases that were revoked in 2004 and 2005 (results reported in Table B.4 in the Appendix) estimated coefficients remain significant but become smaller in magnitude. This is not surprising as wrongly assigning treatment to products that are not treated (anymore), leads to an underestimation of the treatment effect.

Since all ten EU accession countries are subject to the same treatment, import values and quantities are aggregated to one single importing entity. As an additional robustness check, the baseline regression is rerun on a sample with ten individual importing countries. The estimation is adjusted by expanding the fixed effects by the importer dimension.⁶¹ This also ensures that bilateral exchange rate fluctuations are controlled for. The results are reported in Columns (7) and (8) of Table B.4 in the Appendix. Coefficients are similar in magnitude and significance to those of the baseline estimation shown in Table 2.

⁶¹The regression hence includes exporter-importer and importer-product fixed effects. Standard errors are clustered by exporter-importer-product.

7 Conclusion

This paper exploits the EU enlargement of 2004 as a natural experiment to estimate treatment effects of AD duties on import prices and quantities. Following their accession to the European Union, the new member states inherited the EU's AD duties. Under the plausible assumptions that the accession countries did not join the EU because of its AD policy and that the EU did not act on behalf of the new member states before their entry, this implementation can be seen as exogenous. The resulting estimation consequently does not suffer from endogeneity bias due to simultaneity (larger import values increasing the likelihood and size of AD duties) that has not sufficiently been addressed in the existing AD literature. Omitted variable bias by means of unobserved changes in preferences or subsidies is also addressed. The paper's main contribution to the literature consists of the estimation of price effects over time and the demonstration that these (together with quantity effects) differ depending on the AD methodology applied.

The paper provides evidence that AD duties do increase producer prices and reduce import quantities. These effects are larger than suggested by previous studies that estimate treatment effects by relying on their direct implementation. With regard to the recent change in European AD legislation, this paper shows that price effects of AD duties are only present when implemented against countries with market economy status, suggesting that the methodology used does play a role in achieving the set policy objective of "fair" prices. This result aligns seemingly contradicting findings of previous studies by showing that differing estimates of price effects are driven by market economy status of the exporter investigated in the respective sample. Imports from non-market economies fall by more following the imposition of AD duties, which can be explained by the larger average AD duties they receive. The paper also finds evidence for spillover effects, as import prices of products from non-targeted countries also increase. This has strategic implications for the use of AD policy, as the imposition of AD duties against one country may affect prices of imports from other countries, too.

Effects are not driven by a reversal of trade deflection and do not seem to be specific to EU accession states, as their imports react similar to those of EU15 countries when using alternative estimation strategies. Finally, evidence is presented that trade dampening effects of AD duties tend to persist over several years and even beyond their revokement, indicating that exporters find it hard to re-enter a market once AD duties are lifted.

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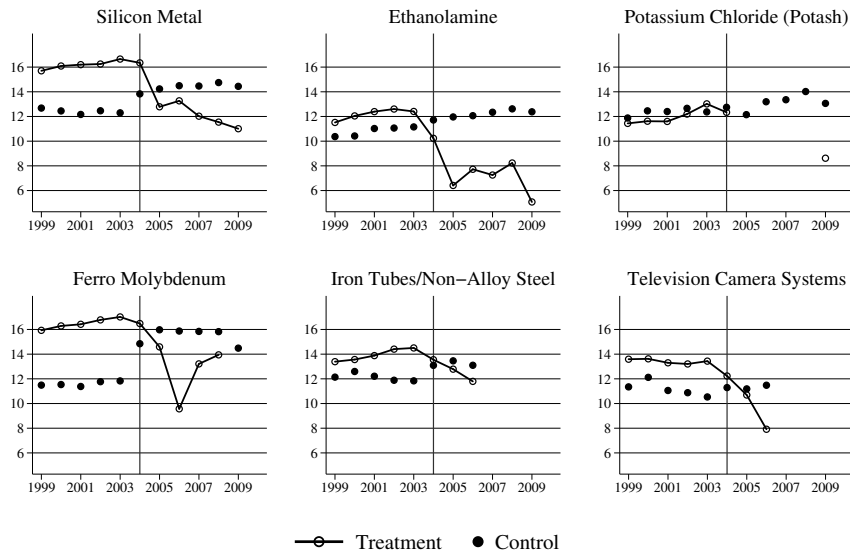
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Appendix

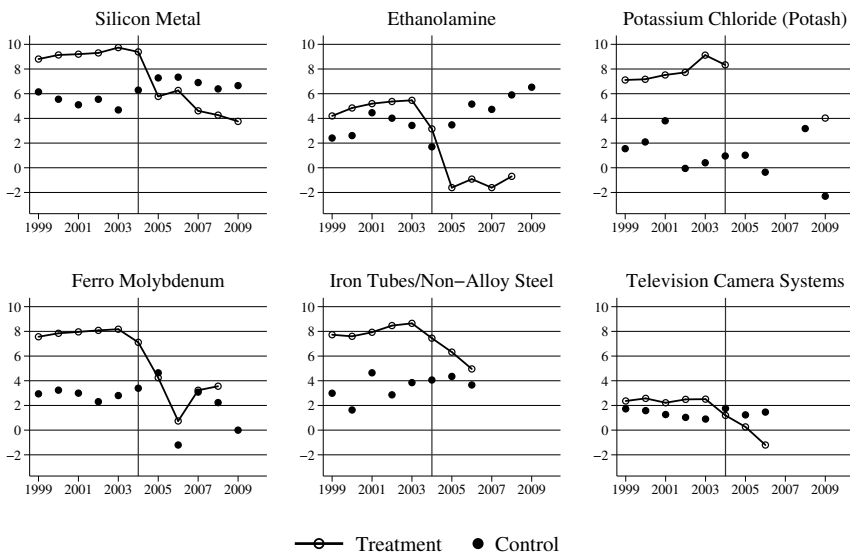
A Additional Figures

Figure A.1: Average import values of treated and untreated country-product combinations



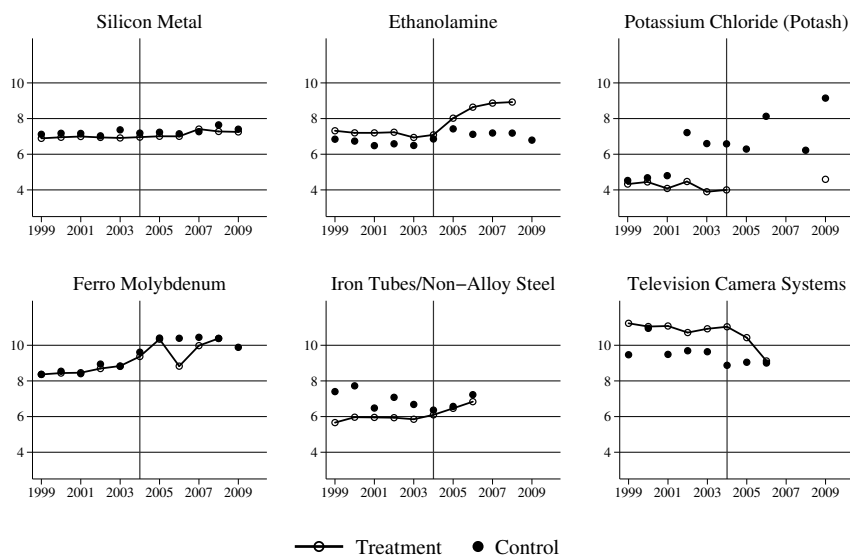
Note: EU accession (beginning of treatment) in May 2004. Ln import value on vertical axis, year on horizontal axis. Missing observations represent non-reported values and can be interpreted as zero trade flows.

Figure A.2: Average import quantities of treated and untreated country-product combinations excluding EU exporters



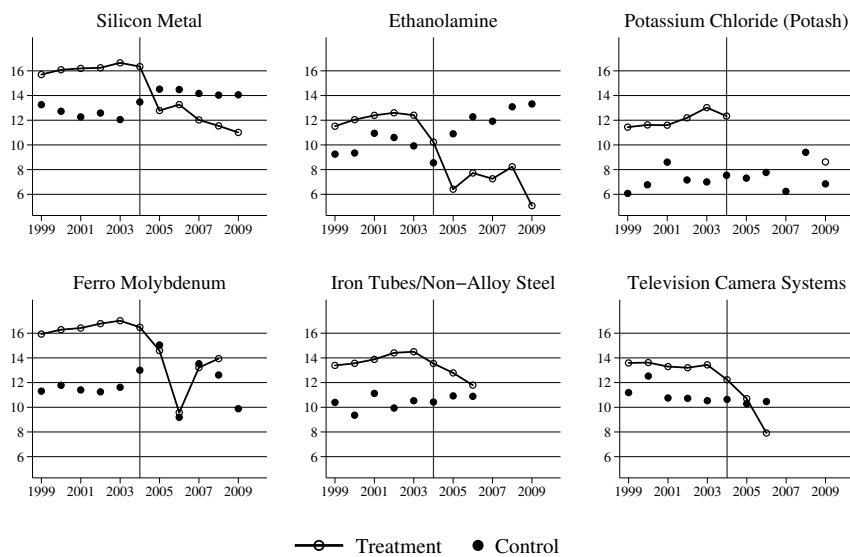
Note: EU accession (beginning of treatment) in May 2004. Ln import quantity on vertical axis, year on horizontal axis. Missing observations represent non-reported quantities and can be interpreted as zero trade flows.

Figure A.3: Average import prices of treated and untreated country-product combinations excluding EU exporters



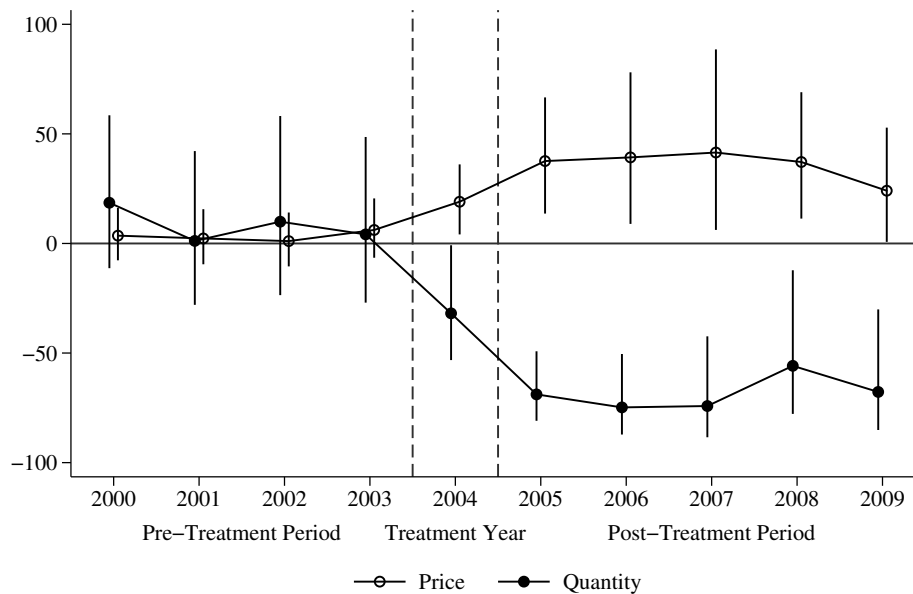
Note: EU accession (beginning of treatment) in May 2004. Ln import price on vertical axis, year on horizontal axis. Missing observations represent non-reported prices and can be interpreted as zero trade flows.

Figure A.4: Average import values of treated and untreated country-product combinations excluding EU exporters



Note: EU accession (beginning of treatment) in May 2004. Ln import value on vertical axis, year on horizontal axis. Missing observations represent non-reported values and can be interpreted as zero trade flows.

Figure A.5: Effect of AD duties on import prices and quantities, 2000 - 2009



Note: EU accession (beginning of treatment) in May 2004. Percentage change in import prices and quantities of treated products on vertical axis, year on horizontal axis. The plot shows point estimates with 95% confidence intervals, indicating large and significant price and quantity effects of AD duties since their introduction in 2004.

B Additional Regressions

Table B.1: The effect of AD duties on import prices and quantities, varying fixed effects

Dep. var.	(1) $\Delta \ln price$	(2) $\Delta \ln price$	(3) $\Delta \ln quantity$	(4) $\Delta \ln quantity$
AD	0.2130** (0.0887)	0.2598*** (0.0860)	-1.3071*** (0.2084)	-1.1357*** (0.2107)
R^2	0.0000	0.0312	0.0003	0.0428
Exporter FEs	NO	YES	NO	YES
Product FEs	NO	NO	NO	NO

Note: OLS regression with first differences. Robust standard errors clustered by Exporter-Product in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 144,998 observations.

Table B.2: The effects of AD duties on import prices and quantities over time

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	1999 - 2007	1999 - 2007	2000 - 2007	2000 - 2007	1999 - 2008	1999 - 2008	1999 - 2009	1999 - 2009
AD Cases	baseline	baseline	if 2007	if 2007	baseline	baseline	baseline	baseline
Dep. var.	$\ln price$	$\ln quantity$	$\ln price$	$\ln quantity$	$\ln price$	$\ln quantity$	$\ln price$	$\ln quantity$
2000					0.0346 (0.0586)	0.1714 (0.1475)	0.0351 (0.0587)	0.1705 (0.1480)
2001	-0.0001 (0.0567)	-0.0631 (0.1461)	0.0669 (0.0811)	-0.0991 (0.1990)	0.0226 (0.0626)	0.0098 (0.1737)	0.0228 (0.0625)	0.0116 (0.1736)
2002	-0.0088 (0.0563)	0.0303 (0.1533)	-0.0237 (0.0782)	0.0898 (0.2146)	0.0127 (0.0620)	0.0953 (0.1847)	0.0108 (0.0619)	0.0948 (0.1855)
2003	0.0492 (0.0574)	-0.0322 (0.1584)	-0.0583 (0.0743)	0.1285 (0.2132)	0.0630 (0.0646)	0.0425 (0.1805)	0.0598 (0.0649)	0.0406 (0.1813)
2004	0.1545** (0.0655)	-0.4459*** (0.1725)	0.0585 (0.0825)	-0.2762 (0.2308)	0.1731** (0.0683)	-0.3729* (0.1907)	0.1743** (0.0683)	-0.3838** (0.1917)
2005	0.3035*** (0.0955)	-1.2927*** (0.2379)	0.3147** (0.1232)	-1.3430*** (0.3055)	0.3240*** (0.0976)	-1.1848*** (0.2496)	0.3192*** (0.0977)	-1.1665*** (0.2497)
2006	0.3224*** (0.1229)	-1.4998*** (0.3326)	0.3435** (0.1735)	-1.7155*** (0.4732)	0.3344*** (0.1253)	-1.3881*** (0.3459)	0.3313*** (0.1254)	-1.3779*** (0.3450)
2007	0.3367** (0.1441)	-1.5096*** (0.4007)	0.4105** (0.2010)	-2.0314*** (0.6034)	0.3531** (0.1464)	-1.3744*** (0.4116)	0.3471** (0.1465)	-1.3535*** (0.4094)
2008					0.3187*** (0.1077)	-0.8147** (0.3562)	0.3161*** (0.1065)	-0.8170** (0.3503)
2009							0.2157** (0.1064)	-1.1313*** (0.3945)
Obs.	1,716,485	1,716,485	1,716,485	1,716,485	1,930,787	1,930,787	2,127,801	2,127,801
R^2	0.8537	0.8471	0.8537	0.8471	0.8498	0.8435	0.8456	0.8388
Clusters	313891	313891	313891	313891	340108	340108	352556	352556

Note: OLS regressions including exporter-product, exporter-year and product-year fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table B.3: Lagged effects of revoked AD cases

	(1)	(2)	(3)	(4)	(5)
Dep. var.	$\ln price$	$\ln quantity$	$\ln price$	$\ln quantity$	$\ln value$
AD_t	0.0261 (0.1777)	-0.4073 (0.2990)			
revoked_0			0.0355 (0.1926)	0.1138 (0.2528)	-0.0809 (0.3125)
revoked_1			-0.0414 (0.2578)	0.6594 (0.4109)	0.6204** (0.2999)
revoked_2			-0.0732 (0.1778)	0.6729 (0.4759)	0.6020 (0.4421)
revoked_3			-0.4085* (0.2099)	0.3889 (0.5118)	-0.0555 (0.4187)
Observations	904,290	904,290	904,290	904,290	1,121,074
R^2	0.8781	0.8910	0.8781	0.8910	0.8734
Clusters	239477	239477	239477	239477	292665

Note: OLS regression (fixed effects). Regressor: AD Dummy (time variant, Columns 1 and 2) and revokement. All regressions include exporter-product, exporter-year and product-year fixed effects. Robust standard errors clustered by Exporter-Product in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Import data 2005 - 2009, revoked cases 2006 - 2009

Table B.4: The effects of AD duties on imports

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	including rev cases	including rev cases	including rev cases	including rev cases	including rev cases	including rev cases	individual countries	individual countries
Dep. var.	$\Delta \ln price$	$\Delta \ln price$	$\Delta \ln quantity$	$\Delta \ln quantity$	$\Delta \ln value$	$\Delta \ln value$	$\Delta \ln price$	$\Delta \ln quantity$
AD	0.1563** (0.0639)		-0.9112*** (0.1707)		-0.7549*** (0.1600)		0.1680*** (0.0620)	-0.9261*** (0.1570)
AD*MES		0.1496** (0.0709)		-0.7232*** (0.1904)		-0.5735*** (0.1748)		
AD*NMES		0.1852 (0.1406)		-1.7249*** (0.3192)		-1.5398*** (0.3287)		
Obs.	144,998	144,998	144,998	144,998	144,998	144,998	337,822	337,822
R^2	0.9099	0.9099	0.9016	0.9016	0.8922	0.8922	0.9154	0.8946

Note: OLS regression with first differences. Robust standard errors clustered by Exporter-Product in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. Columns (1) to (6) include cases revoked in 2004 and 2005 and country and product fixed effects. Columns (7) and (8) include importer-product and exporter-importer fixed effects, with standard errors clustered by exporter-importer-product in parenthesis.

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