THE IMPACT OF ANTIDUMPING ON EU TRADE

This paper investigates the impact of antidumping on EU trade. Compared to previous studies, this paper moves the time horizon of analysis forward, covering the period from 1992 to 2010. Information on antidumping investigations is taken from relatively new Global Antidumping Database. The theoretical model suggests that both import and export flows should be affected. The econometric investigation shows that the use of antidumping significantly distorts imports. A strong and long-lasting effect of trade destruction is identified for AD cases ending with the imposition of final protection. For AD cases withdrawn by applicants or rejected by AD authority, the trade destruction effect is short-lived, and is limited to the duration of provisional measures. The introduction of AD protection also causes an increase in imports from countries not covered by the AD investigation (the trade diversion effect). The results obtained from the model augmented with leading variables reveal that EU antidumping is used against aggressive exporters that rapidly increase their sales on the European market. There is no convincing evidence of antidumping having an impact on EU exports. Although there is a decline in exports, it cannot be associated with antidumping as it starts before the initiation of AD.

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Abstract

This paper investigates the impact of antidumping on EU trade. Compared to previous studies, this paper moves the time horizon of analysis forward, covering the period from 1992 to 2010. Information on antidumping investigations is taken from relatively new Global Antidumping Database. The set of adjustments in the trading system in response to the introduction of AD tariffs is derived from the simple trade model of Cournot oligopoly. The theoretical model suggests that both import and exports flow should be affected. However, the hypothesis about the negative impact of antidumping on the exports of the country initiating AD has not been addressed in detail in the literature. The econometric investigation shows that the use of antidumping significantly distorts imports. A strong and long-lasting effect of trade destruction is identified for AD cases ending with the imposition of final protection. For AD cases withdrawn by applicants or rejected by AD authority, the trade destruction effect is short-lived and is limited to the duration of provisional measures. The introduction of AD protection also causes an increase in imports from countries not covered by the AD investigation (the trade diversion effect). The results obtained from the model augmented with leading variables reveal that EU antidumping is used against aggressive exporters that rapidly increase their sales in the European market. There is no convincing evidence of antidumping having an impact on EU exports. Although there is a decline in exports, it cannot be associated with antidumping as it starts before the initiation of AD.

Keywords: antidumping, trade policy, international trade, trade destruction, trade diversion.

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Introduction

Antidumping is one of most frequently used trade protection instruments. The use of antidumping has intensified over the last thirty years with more countries being active antidumping users. Although antidumping is aimed at fighting unfair trading practices, the proliferation of antidumping has turned out to be a problem for global trade itself (Zanardi 2006). The popularity of AD comes from its flexibility compared to other trade instruments. The imposition of AD tariffs, at least provisional ones, is immediate and does not need to be accepted by the World Trade Organization. Antidumping is precise as it applies to specific suppliers rather than a whole country. Consequently, it makes antidumping potentially less trade-distortive than regular tariffs. The quasi-judicial nature of antidumping investigations means that they are perceived as a just protection measure to counteract unfair behaviour by foreign suppliers. Textbook justification of using antidumping invokes prevention of predatory actions by foreign firms, but this argument fails since AD reviews show that the predation threat is uncommon (Niels 2000). Critics of antidumping argue that it might promote collusive behaviour and restrict competition.

The European Union is one of most frequent users of antidumping in the world. In 1995-2011, the European Union initiated 437 AD cases, over 10% of all cases worldwide. EU-initiated antidumping cases challenge mainly suppliers from Asia, especially from China (107 cases), India (33 cases), and Korea (28 cases) (cf. Table 1). Antidumping cases are concentrated in a few product groups, with most cases concerning metals, chemicals, plastics, machinery and electrical appliances.

Table 1. Main antidumping users and the country of origin of the suppliers targeted in the antidumping investigation.

	EU		**USA**		**India**		**World**	
1	China	107	China	107	China	147	China	853
2	India	33	Japan	33	Korea	49	Korea	284
3	Korea	28	Korea	31	EU	48	USA	234
4	Taiwan	24	Taiwan	23	Taiwan	47	Taiwan	211
5	Thailand	20	India	23	Thailand	38	Indonesia	165
6	Russia	20	Mexico	20	USA	33	Japan	165
7	Malaysia	17	Indonesia	18	Japan	32	Thailand	164
8	USA	15	Germany	16	Indonesia	27	India	155
9	Indonesia	13	South Africa	16	Malaysia	23	Russia	124
10	Ukraine	13	Canada	15	Singapore	23	Brazil	114
...								
Σ		437		458		656		4010

Note: Data covers the period 1995-2011.
Source: Own elaboration using WTO data.

The aim of this study is to assess the impact of antidumping investigations initiated by the European Union on its external trade. This study uses similar methodology to Prusa (2001), Brenton (2001), Konings et al. (2001), etc. The occurrences of antidumping are introduced to the econometric model using a set of dummy variables. This study uses disaggregated trade data with a 6-digit breakdown according to the HS classification. There are a few novelties compared to previous studies. First of all, the time span covered in the study is significantly extended, and it covers the period 1992-2010.

Secondly, I use a relatively new dataset on antidumping investigations, the Global Antidumping Database, compiled by Chad Bown (2014). I then empirically address the hypothesis that antidumping might have a negative effect on exports of the country initiating AD. This hypothesis has attracted little attention in literature even though it can be easily traced as a consequence of global adjustments to the introduction of AD.

Table 2. Product structure of antidumping investigations by the main AD users.

Section	EU	USA	India	World
Section XV: base metals and articles of base metal	34.3%	52.6%	13.3%	27.5%
Section VI: products of the chemical or allied industries	19.2%	14.2%	41.9%	20.6%
Section VII: plastics and articles thereof; rubber and articles thereof	8.0%	8.1%	14.3%	12.8%
Section XVI: machinery and mechanical appliances; electrical equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers	13.0%	6.1%	11.6%	8.7%
Section XI: textiles and textile articles	9.8%	3.1%	9.9%	7.6%
Other products	15.6%	15.9%	9.0%	22.9%

Note: Data for 1995-2011.
Source: Own elaboration based on WTO data.

The paper is structured as follows. Part 1 presents a simple model of trade based on Cournot oligopoly. This model is used to predict changes in trade flows resulting from the use of antidumping and implies that both import and export flows should adjust. Part 2 discusses other possible effects associated with the use of antidumping. Part 3 reviews empirical papers investigating the impact of antidumping on trade flows. Parts 4 and 5 discuss the data collection and research method. And finally, part 6 presents the results of the econometric analysis.

1. Simple Cournot oligopoly trade model with increasing marginal costs

In this section I present a theoretical model that is used to predict the directions of trade flow changes in response to the introduction of antidumping protection. This model is based on Bown and Crowley (2007), and is a modification of the reciprocal dumping model by Brander and Krugman (1983).

In the model, we assume that there are four trading blocks. They are denoted by the following abbreviations: *eu* (old member states of the EU), *nm* (new member states of the EU), *nd* (named countries, i.e. countries facing an AD investigation), *nn* (non -named countries, i.e. non-EU countries that are not covered by an AD investigation). In each block there is only one producer. A producer can sell its product on its own domestic market and on foreign markets. Let assume that the country of production is denoted with the lower subscript *i* and the country of sale is denoted with the upper subscript *j*. Hence the product volume originating from *i* and sold in *j* is denoted as Q_i^j. We assume that products manufactured by different producers are perfect substitutes. The inverse demand function for each market *j* is a decreasing function of the total sales on this market and is described with the following formula:

$$p_j = a - b \sum_i Q_i^j \qquad a, b > 0 \tag{1}$$

For the sake of simplicity, we assume that the demand functions are symmetrical. Markets are separated, i.e. sales in one market do not affect demand in another market. Companies compete in quantities as in the Cournot oligopoly model. We assume a quadratic cost function:

$$\mathrm{C_i} = \mathrm{c}\left(\sum_\mathrm{j} \mathrm{Q_i^j}\right)^2 \tag{2}$$

where *c* is a positive parameter. Thus the marginal cost is an increasing function of the production quantity. An assumption of the increasing marginal costs is necessary for model predictions. Thanks to this, a change in the tariff rate against a single supplier delivers a number of adjustments throughout the whole trading system. We assume that the company in country *i* and selling on market *j* is levied with a specific duty, T_i^j, per unit of sales. Each company maximizes its profit function:

$$\pi_\mathrm{i} = \sum_j (\mathrm{p_j} - \mathrm{T_i^j})\, \mathrm{Q_i^j} - \mathrm{c}(\sum_\mathrm{j} \mathrm{Q_i^j})^2 \tag{3}$$

We obtain first order conditions after differentiating the profit function with respect to the volume of sales in each market and equalizing it to zero:

$$a - b \sum_i Q_i^j - T_i^j - bQ_i^j - 2c \sum_j Q_i^j = 0, \ \forall i, j \tag{4}$$

From the first order conditions we see that company sets sales in each market so that the marginal revenue from this market equals the marginal cost. By solving the system of equations formed by sixteen first order conditions (four producers x four markets) we obtain the volume of sales in each market describing the equilibrium point. At sufficiently low tariff rates a company both sells products on its domestic market and exports to foreign markets at the same time.

The model can help us to discuss the impact of the introduction of unilateral tariff protection. To be more precise, we are interested in a situation where two countries (old and new member states of the EU) simultaneously introduce the same duty on products imported from the named country, but the duty does not apply to the rest of suppliers. In order to analyse a case of this kind the model is further simplified by assuming that tariff rates are zero except for the duty levied on products originated in *nd* country and sold in *eu* and *nm*: $T_{nd}^{eu} = t$ and $T_{nd}^{nm} = t$. Thereby the formulas for companies' equilibrium sales in each market only depend on the constants *a*, *b*, *c* and the variable *t* (the solution is presented in the appendix). In the next step, optimum sales volumes were differentiated with respect to *t* to provide information about sales adjustments in each market in response to the changing level of *t*. The results are presented in the Appendix and in Table 3.

The imposition of a tariff rate *t* by EU countries (*eu* and *nm*) on imports from the named country decreases the imports from this country. This effect is called *trade destruction*. In Table 3, trade destruction corresponds to the minuses in first two cells of the bottom row.

Table 3. Change in trade flows in response to the imposition of tariffs on trade from *named* to both *eu* and *nms*

		Country of sale			
		eu	*nms*	*non-named*	*named*
Country of origin	*eu*	+	+	–	–
	nms	+	+	–	–
	non-named	+	+	–	–
	named	–	–	+	+

Note: The "+" denotes trade expansion, whilst "-" denotes trade decline.

Source: Author's own elaboration.

The decrease in sales from the named country results in reduced competitive pressure in EU markets (*eu*, *nm*). This creates an opportunity for the rest of the suppliers to take the position vacated by the named country. They respond by expanding their sales. Growing imports from non-named countries is named as *trade diversion*. In more formal reasoning, a drop in sales by one supplier increases the marginal revenue for other suppliers. As a result, suppliers expand their sales until the marginal revenues once again equals marginal costs. For the same reason, EU companies thereby increase their sales on their own domestic markets. Moreover, trade diversion also means that trade between new and old EU member states is intensified. In Table 3, trade diversion corresponds to the pluses in upper-left part of the table.

Exports from the country subject to antidumping duties is shifted from EU markets to non-EU markets (see bottom right of Table 3). Because of the duties, the named supplier faces lower marginal revenue in European markets and relatively higher revenue in non-EU markets. To restore equilibrium the named company increases its sales in non-EU markets and decreases sales in EU markets so that marginal revenues in all markets are again equal. The expansion of the named country's exports to third markets is called *trade deflection* by Bown and Crowley (2007). For the same reason the supplier expands its sales on its domestic market. The trade deflection is presented in Table 3 as pluses in the two bottom-right cells.

Trade deflection exacerbates the competitive pressure in non-EU markets. As a result, the sales of other suppliers drop (see the minuses in the upper-right part of Table 3). Let us call this effect the *crowding-out of trade*.[1] The crowding-out effect of trade, suggested by the theoretical model, implies that the imposition of antidumping duties by the EU has a negative impact not only on imports to the EU but also on exports from the EU. However, the relationship between the use of antidumping and exports has so far not been addressed much in the literature.

A theoretical model gives us a set of hypotheses that are verified in the next part of the study. We expect that antidumping measures are used to reduce imports from the named countries (trade destruction effect), while increasing imports from the new Member States and third countries (trade diversion effect). Furthermore, the model implies a decline in exports from the EU to non-EU countries, both those covered by the AD and third countries (crowding-out effect).

[1] To my knowledge, the term *crowding out* effect has not yet appeared in the literature on international trade.

2. Other channels of antidumping affecting trade flows

An important strand of literature on antidumping addresses strategic behaviour, i.e. a situation whereby participants of an AD investigation alter their economic behaviour in order to improve their chances of achieving a preferred outcome of the investigation.[2] A foreign supplier facing dumping allegations has the incentive to increase its price on the export market in order to reduce the margin of dumping. Alternatively it can reduce the volume of sales to minimise the chances of injury being confirmed. Both behaviour adjustment strategies minimize the likelihood of definitive AD measures being imposed. However, in both cases the outcome is that the foreign supplier restricts its sales on the local market even before trade protection is introduced. In line with this argument, Staiger and Wolak (1992) notice that the initiation of an AD investigation is sufficient to lower the volume of imports. The immediate negative reaction of imports in response to the initiation of AD is called a *harassment effect*.

A strategic adjustment in the behaviour of the foreign supplier can occur even without the initiation of an AD investigation. It is sufficient that country is a frequent user of antidumping so that the perceived risk of AD initiation is high. In this situation a foreign supplier might preventively increase prices, or lower sales, to avoid future accusations of dumping. Consequently, exports to economies intensively using antidumping should be lower compared to countries where AD protection is used rarely or never. This channel is called the *reputation effect*. See Vandenbussche and Zanardi (2006) for an empirical investigation of reputation effect.

AD investigations ending with an agreement between the foreign supplier and local industry are also restrictive to trade. The agreement may take the form of a price undertaking, i.e. a formal price commitment notified to the AD authority, although it is also likely to be an informal agreement. The existence of the latter is indirectly shown by the large number of cases withdrawn by applicants prior to a final decision by the antidumping authority. Withdrawing an AD petition before the investigation is finished may seem irrational, unless it is preceded by an informal agreement in which a foreign supplier agrees to follow a less aggressive sales policy in exchange for the withdrawal of the antidumping petition. Prusa (1992) demonstrates that price undertakings and withdrawn petitions restrict imports as strongly as the imposition of antidumping duties.

Retaliation is another source of trade flow distortions associated with antidumping. Retaliation may not be easy to identify as retaliatory actions can take the form of non-antidumping protection measures, or hit different products than the initial AD investigation. As a consequence of the retaliation, the exports of the country initiating the AD drops. It seems that the retaliatory policy plays an important role in the proliferation of antidumping. Prusa and Skeath (2002) note that ⅔rds of countries that established their own AD legislation in the eighties and nineties had previously been intensively challenged with AD cases by other countries. Retaliation might be confused with the trade crowding-out effect. In both cases we see a decline in the exports of the country initiating the AD to the country which is subject to the AD investigation. Furthermore, Bown and Crowley (2007) argue that the trade deflection effect, whereby more trade is shifted to third markets, can force those countries to increase trade barriers in order to protect their own markets. Consequently, the introduction of AD measures by one country might increase the likelihood of more AD measures

[2] A literature review on strategic behaviour in the context of antidumping can be found in Blonigen and Prusa (2001).

being introduced throughout the whole trading system, resulting in cascading antidumping. An "outburst" of antidumping measures of this kind occurred in the steel sector as a response to the crisis in Russia in 1997 (cf. Durling and Prusa, 2006).

Paradoxically, the high risk of retaliation may limit the use of antidumping and therefore actually promote free trade. If a domestic industry is also an exporter, it might avoid applying for AD protection as this might lead to retaliatory measures in foreign markets. Blonigen and Bown (2003) demonstrate that the probability of the initiation of antidumping procedures is lower when the partner country is also the recipient of a large share of the country's exports. They conclude that the outcome of this behaviour is the possibility of an equilibrium where the fear of retaliation blocks both sides.

The *safety valve* argument is another channel where the existence of antidumping might promote more trade. AD rules allow for the immediate introduction of trade protection on a discriminatory basis, i.e. only affecting certain suppliers. Consequently, antidumping poses a more flexible protection measure than regular tariffs. With antidumping at their disposal, governments are more likely to make greater commitments to trade liberalisation for regular tariffs. Presumably without the existence of antidumping and other conditional protection measures, the liberalisation of world trade would proceed more slowly. This effect is called a *substitution hypothesis*. As an argument in favour of the hypothesis, Vandenbussche and Viegelahn (2011) demonstrate that the EU uses antidumping frequently in product groups that have been given preferential tariff rates.

3. Empirical evidence

The paper by Prusa (2001) started a series of empirical studies investigating the impact of antidumping on trade flows. Prusa uses information on AD proceedings in the United States. The results show that antidumping has a strong impact on imports of products which are subject to AD investigations. AD cases that ended with the imposition of AD duties restrict imports from the named country by about 65%. At the same time there is a strong trade diversion effect. Imports from non-named countries, not covered by AD measures, increases by 40% in the year of initiation and rise by up to 116% in the third year. Proceedings which are settled with an agreement lead to strong trade destruction whilst rejected AD investigations have no impact on imports.

Papers by Brenton (2001) and Konings et al. (2001) respond to Prusa using data for the European Union. In Brenton's paper (2001) the use of antidumping has a strong trade destruction effect, no matter what the final outcome of the AD investigation is. Brenton observes that a decrease in imports does not appear immediately after the initiation of AD, but two years later. The study reveals a significant trade diversion effect, however, while the rise in imports applies to countries outside the European Union and no effect is shown on intra-EU trade.

In the study by Konings et al. (2001), the imposition of AD duties results in a trade destruction effect that varies from 19% to 67% within five years after initiation. In the case of voluntary price undertakings, a decrease in imports ranges from 23% to 53%. Withdrawn proceedings have little or no effect on the volume of imports. Contrary to Prusa and Brenton, Konings et al. (2001) find little evidence of a trade diversion effect.

Ganguli (2008) analyses the impact of antidumping duties using Indian data. The study confirms the presence of trade destruction and trade diversion. The author obtains similar results to Brenton (2001), indicating that the strongest effect of antidumping takes place in the second and third year after the initiation of AD. Ganguli demonstrates that imports from the named country decreases by 25% in the year of initiation and up to 44% in the second year after initiation. The diversion effect is weaker and ranges from 18% in the year of initiation to 29% in the following year. The papers by Niels (2003) and Niels and Kate (2006) present the preliminary results for Mexico. Their analyses indicate that there is a strong effect of destruction. The imposition of antidumping duties results in a drop in imports from the named country by 73% on average. At the same time the study shows no evidence of trade diversion.

Bown and Crowley (2007) analyse the changes in Japanese exports in response to US introduced protection measures, both antidumping and safeguards, against Japanese suppliers. The results confirm the presence of a trade deflection effect. The imposition of antidumping duties by the US increases Japanese exports to third markets by more than 5%. Furthermore, the analysis reveals that Japanese exports decreases by 5-19% when the United States introduces antidumping duties on suppliers from other countries - this is probably the result of the named country's exports crowding out Japanese exports.

Durling and Prusa (2006) analyse the impact of antidumping on the hot-rolled steel sector. An advantage of this market is the high level of product homogeneity and large number of global suppliers. In addition, the steel sector is characterised by a high frequency of antidumping investigations. The results of Durling and Prusa demonstrate that the initiation of antidumping proceeding causes a decrease in imports from the named country by 74% in the year initiation and by 87% in the following year. The strong trade destruction effect, higher than that obtained by Prusa, suggests that steel is especially vulnerable to trade distortions induced by antidumping proceedings. Moreover, exports from non-named countries declines by 48% in the first year after the initiation of AD, which clearly contradicts the trade diversion effect. The plausible explanation of this unexpected change is a so-called *fear effect,* which is a kind of strategic behaviour. Starting an AD investigation in one country increases the risk of new AD investigations, so suppliers from non-named countries respond by reducing their sales to minimise the risk of AD proceedings being launched against them. Durling and Prusa also observe a trade deflection effect resulting in an increase in exports from a named country to third countries by 29% in the first year after initiation.

Konings and Vandenbussche (2010) is the first paper that directly addresses the relationship between antidumping and export activity. The study reveals a negative impact of AD measures on French exports, both in the case of individual producers and aggregate trade flows. An analysis based on a heterogeneous company model shows that antidumping introduced by the EU reduces the sales of French exporters in foreign markets by 8%. For French exporters with foreign-based subsidiaries the decline in exports is even greater and amounts to 17%. The analysis of aggregate trade flows indicates that AD measures cause a fall in the volume of exports by 28% for exports to other EU countries, and about 37% for exports outside the EU. However, a major limitation of the study by Konings and Vandenbussche is the small sample and very short time-span of analysis.

In summary, recent studies confirm the existence of a strong trade destruction effect associated with antidumping. According to Prusa (2001) and Konings et al. (2001) trade destruction causes a fall

in imports by approx. 65% in the product groups subject to AD duties. There is less agreement on the trade diversion effect, however. Prusa (2001) and Brenton (2001) confirm the presence of a diversion effect, while Konings et al. (2001) and Durling and Prusa (2006) find no evidence of it. Trade deflection was identified in papers by Durling and Prusa (2006) and Bown and Crowley (2007). Konings and Vandenbussche (2010) is the only attempt to investigate the impact of antidumping on export performance. They find that using of AD measures decreases the country's exports.

4. Description of the econometric model

In this section we discuss the econometric model used in this study. The basic regression equation takes the following form:

$$\ln imp_{c,p,t} = \alpha + \beta_1 \ln imp_{c,p,t-1} + \sum_{i=0}^{i=5} \gamma_i^{nd} init_{c,p,t-i} + \sum_{i=0}^{i=5} \gamma_i^{nn} init\_nn_{c,p,t-i} + \sum_{i=0}^{i=5} \gamma_i^{nm} init\_eu_{c,p,t-i} + \beta_2 \ln gdp_{c,t} + \beta_3 \ln pop_{c,t} + \beta_4 rta_{c,t} + \beta_5 nm\_eu_{c,t} + \beta_5 rer_{c,t} + \sum_{t=1992}^{t=2010} \delta_t year\_dummy_t + v_{c,p} + \varepsilon_{c,p,t} \quad (4.1)$$

A dependent variable is the logarithm of imports, $\ln imp_{c,p,t}$,. The subscripts denote the following: *c* for partner country, *p* for product, and *t* for year. The model is an autoregressive model due to the inclusion of a lagged dependent variable, $\ln imp_{c,p,t-1}$ (cf. Prusa 2001; Brenton 2001; Konings et al. 2001). The initiation of an AD investigation in product group *p* is reflected in the set of dummy variables. The variable $init_{c,p,t}$ takes the value 1 if, in a given year *t*, and product group *p*, the European Union starts an AD investigation against a supplier from country *c*. At the same time, the variable $init\_nn_{c,p,t}$ takes the value 1 for non-named countries outside of the EU. The variable $init\_eu_{c,p,t}$ takes the value 1 for non-named new member states of the European Union.[3] Moreover, each dummy is followed by five lags. Lagged dummy variables are intended to capture the long-lasting effect of antidumping protection. The number of five lags is chosen because antidumping duties are usually imposed for a period of five years.[4] The extended model also comprises leading dummy variables covering the period up to three years before the initiation of an AD investigation. Introducing leading variables enables us to observe the change in imports prior to the start of an AD investigation. Hence we are able to distinguish changes that occur in response to an AD investigation from 'false positives', i.e. a situation where imports falls but the decline actually starts before the initiation of AD, so it cannot be associated with the impact of AD protection.

Besides the model for imports, I build a model for exports in order to verify the trade crowding-out hypothesis. The initial model for exports is the same as for imports *mutatis mutandis*. However, I also address the situation where exports might decline due to antidumping cases initiated by a foreign country against suppliers from the EU. To do so, I introduce the dummy variable $expinit_{c,p,t}$ that takes the value 1 when country c initiates an antidumping investigation against

[3] For the purpose of the study, I define the new member states as countries that have joined the EU since 1992.
[4] According to the *sunset clause,* included in Article 11 of the Antidumping Agreement, antidumping measures (tariffs and price undertakings) should not last longer than five years, unless their termination would make dumping reoccur. Vandenbussche and Viegelahn (2011) report that in the EU, 63% of antidumping measures last five years, 13% last shorter, and 24% last longer than five years.

suppliers from the EU, while at the same time the variable $expinit\_n_{c,p,t}$ takes the value 1 for all other countries. This modified model takes the following form:

$$\ln exp_{c,p,t} = \alpha + \beta_1 \ln exp_{c,p,t-1} + \sum_{i=0}^{i=5} \gamma_i^{nd} init_{c,p,t-i} + \sum_{i=0}^{i=5} \gamma_i^{nn} init\_nn_{c,p,t-i} + \sum_{i=0}^{i=5} \theta_i expinit_{c,p,t-i} + \sum_{i=0}^{i=5} \mu_i expinit\_n_{c,p,t-i} + \beta_2 \ln gdp_{c,t} + \beta_3 \ln pop_{c,t} + \beta_4 rta_{c,t} + \beta_5 rer_{c,t} + \sum_{t=1992}^{t=2010} \delta_t year\_dummy_t + \nu_{c,p} + \varepsilon_{c,p,t} \quad (4.2)$$

There is a set of the following control variables: a logarithm of the GDP of country *c*, $\ln gdp_{c,t}$; a logarithm of the population of country c, $\ln pop_{c,t}$; dummy variables if country c has a preferential trade agreement with the EU, $rta_{c,t}$; dummy variables for the EU new member states, $nm\_eu_{c,t}$; the real exchange rate, $rer_{c,t}$. To control for business cycle fluctuations that might affect imports, the model includes dummy variables for years. α denotes a constant in the model, $\nu_{c,p}$ is an unobserved individual effect, and $\varepsilon_{c,p,t}$ is an error term.

5. Data collection and estimation method

The Global Antidumping Database (GAD) is the source of data on antidumping investigations initiated by the European Union. The database has been recently compiled by Chad Bown (2014). It is the most comprehensive, publicly available database on antidumping investigations.[5] In the study I look at antidumping investigations initiated by the EU in the period 1992-2010. They form 1007 cases, i.e. unique combinations of named country-product-year of initiation. 527 of these cases ended with final AD protection being introduced, either a definitive AD duty or a price undertaking. 329 cases ended with no formal protection: they were either withdrawn by applicants or the case was rejected by the AD authority. For the remaining 151 cases there is no information about the outcome of investigations, which is why they are not taken into account in the econometric analysis.

Data on EU trade were taken from the Comtrade database. The reporting country is the EU 12 which formed the members of the EU prior to 1992. Trade flows are presented as six-digit codes in the Harmonised Standard classification. The study only includes product codes which were covered in EU antidumping cases during the period 1992-2010. There is a total of 482 product codes from the HS classification. The coverage of the trade data is associated with the problem of an unbalanced panel. Since 1992 the HS nomenclature has been revised several times. These revisions imply that some codes are no longer reported, whilst new codes which were absent in previous versions have been added. Consequently, trade data in the database is comprised of data obtained from four classifications (HS nomenclature from 1988 to 1992 as the base, as well as: HS 1996, HS 2002 and HS 2007). The second reason for an unbalanced panel is zero trade, i.e. the product group is present in the dataset but there is no trade between the EU 12 and country *c*. Since highly disaggregated data is used, there is quite a high probability of zero trade. Because of these two reasons, approximately ½ of the observations in the imports sample are missing values. In one estimation I restricted the sample to the cases in chapter 72 of the HS classification concerning steel and iron.

[5] Apparently, however, the database is not free from errors. About 8% of the product codes of EU investigations in the database are probably corrupted, as they cannot be found in any version of the HS classification.

The World Development Indicators database is the source of data for GDP and population. In the econometric study I ignored countries with a population of less than 300,000. Eliminating economies with small populations reduces the sample heterogeneity and the zero trade problem. Data on free trade agreements is taken from the Preferential Trade Agreements Global Database of the World Bank. An advantage of this database is that it includes both agreements notified to the WTO as well as those not yet notified. The real exchange rates are calculated using nominal exchange rate data from the International Financial Statistics database and inflation figures from the World Development Indicators database.

The estimation method was dictated by the presence of an autoregressive element in the model (lagged dependent variable). Models with lagged dependent variables should not be estimated with a fixed effect estimator because of the correlation between the lagged dependent variable and the error. This would make the FE estimation biased (Greene 2003). In this case it is better to use the Arellano-Bond estimator. The Arellano-Bond estimator works well for panel data of a small time size and large panel size.

6. Discussion of the results of the estimation

This section discusses the results of estimations presented in Tables 4-7 (at the end of the paper). Table 4 contains the basic model results for the impact of antidumping investigations on imports. Table 5 contains the results for the augmented model with leading dummy variables. Tables 6 and 7 present the results of estimations for exports as a dependent variable. In each table, six estimations are presented: three for cases ending with the imposition of definitive AD protection measures and three for cases where no formal protection is imposed.

6.1. The impact of antidumping on EU imports

The results in columns I-II in Table 4 demonstrate that AD investigations ending with the introduction of definitive protection measures significantly restrict imports from the named country to the EU 12 in the concerned product group. In the year of the AD initiation, the trade destruction effect has little statistical significance. In the first year after initiation, the value of imports from a named country decreases significantly by approx. 21%. In the second year, imports is reduced by 37% compared to the average level. Consequently, the trade destruction estimates are somewhat lower than estimated by Prusa (2001) and Konings et al. (2001). Similarly to Brenton (2001), the strongest decline in imports from the named country occurs not immediately after initiation, but the effect is delayed. What is more, the trade destruction effect is long-lasting. Imports from the named country is depressed over a five year period. Trade destruction is much stronger when the analysis is limited to the steel market (column III in Table 4). In the steel market, the introduction of final AD measures results in a decrease in imports by 45% in the first year, and 66% in the third year after initiation. As in the full sample model, the negative destruction effect lasts for five years.

The estimates in columns I-II for dummy variables for non-named countries outside the EU show positive evidence of trade diversion. However, this effect is weaker and less statistically significant than trade destruction. In response to definitive AD measures imposed, imports from non-named countries outside the EU rises in the third and fifth year after initiation. The estimates for other years after initiation are also positive, but not statistically significant. The increase in imports due to the

trade diversion effect is about 6%-7%. Trade diversion also benefits the new member states of the EU. Imports from the new member states rises in the third and fourth year after initiation. The increase ranges from 8% (column I) to 13% (column II). As a result it seems that trade diversion is stronger in the case of intra-EU imports than for imports from outside the EU. Results for the sample limited to the steel market show much a stronger trade diversion effect. Imports from new member states increases by up to 76% in the fourth year. Imports from non-EU non-named countries rises by 15-18%, although these estimates have low statistical significance.

Table 5 presents the results for the model extended with leading dummy variables preceding the initiation of AD procedures. Columns VII-VIII present the results for investigations ending with final protection and for the full product sample. The results indicate that imports from the named country grows strongly in the two years prior to the start of the AD investigation. In the year preceding the AD initiation, imports is about 55% higher than average. I therefore conclude that antidumping is applied to suppliers aggressively expanding their sales on the EU market. After AD initiation, imports decreases significantly. The trade destruction effect in the second year after initiation is about 16% compared to the average, and 13% in the third year. However, when compared to the year before AD initiation, the decrease in imports equals 46%. In subsequent years, the fourth and fifth years after initiation, imports only recovers to the average level and it is below the maximum level before initiation. This means that antidumping completely erases the advantage built by the foreign supplier before AD initiation.

Before initiation, increased imports from the named country causes imports from non-named countries to decline. Countries outside of the EU suffer a drop in sales of 9%, and new member states a drop of up to 14%. The imposition of AD measures helps imports from non-named countries to recover. Consequently, AD restores the position of non-named countries on the EU markets previously lost due to aggressive competition with the named supplier. From this perspective, the trade diversion effect does not constitute an additional advantage for non-named suppliers, but rather re-establishes the conditions as before the sales expansion of the named supplier.

In the steel market (Table 5, column IX), contrary to all product sample estimations, there is no increase in imports before the AD initiation. Nevertheless, after AD measures are introduced imports from the named country declines by up to 63% in the third year (which is almost the same result as presented in Table 4). There is strong trade diversion in the case of suppliers from new member states (imports expands by up to 70% in the fourth year after initiation).

Now we move to discuss AD investigations that do not result in final protection measures, i.e. they are either withdrawn by applicants or rejected by antidumping authority. These results are presented in columns IV-VI in Table 4 (models with lagging dummy variables only) and columns X-XII in Table 5 (models with lagging and leading dummy variables). The results presented in Table 2 show a clear decrease in imports from named countries by approx. 14% in the year when the AD investigation is started and 18% in the following year. In subsequent years, no negative impact of antidumping is observed. Consequently, the destruction effect of rejected and withdrawn cases is limited to around one year, which corresponds to the duration of the provisional measures (the estimation results show statistically significant coefficients for the zero and the first year, which could lead to the erroneous conclusion that the negative effect of antidumping lasts for two years.

However, it should be noted that the study uses calendar years to identify the moment of initiation, so part of investigation initiated in year zero ends in the first year).

For non-EU non-named countries, imports decreases in the second, third and fifth year. It is hard to explain this effect on basis of the theoretical model as we would rather expect small trade diversion effect during provisional AD measures and no change in imports in the long run. The observed reduction in imports may be due to a fear effect. Non-named countries might reduce their sales to minimize the risk of being challenged with antidumping. The fear effect hypothesis is somewhat supported by the lack of a similar reaction by suppliers from new member states (suppliers from new member states would not fear AD measures as antidumping is not applicable within the European Union). Moreover, imports from new member states rises in the initiation year as well in the first, fourth and fifth years (cf. column V in Table 4). The effect is relatively strong and equals 11%-13%. However, those estimates are not robust to specification changes (column IV vs. V).

In the steel market, trade destruction is only observed in the initiation year (Table 4, column VI), corresponding to the time of the provisional AD measures. We also observe a decrease in imports from non-named non-EU countries and a significant increase in imports from new member states, however these effects occur after the provisional measures have expired. As a result, they are problematic to explain and might not be linked to the use of antidumping. More light is shed on these adjustments when discussing the respective results from Table 5.

Columns X-XII in Table 5 present the results for AD investigations which were rejected or withdrawn in the model with leading dummy variables. The results are quite informative. Similarly to the results in columns VII-VIII, imports from the named country rises significantly in the two years prior to AD initiation. In the full product models (columns X-XI), the size of expansion in imports is up to 53%. Consequently, the dynamic growth of imports from the named country precedes AD initiation, regardless of the subsequent outcome. This observation supports the hypothesis that antidumping is mainly used against suppliers who aggressively increase their sales on the EU market.

Provisional measures cause imports from the named country to drop and the previously rising sales fall back to the average level (for each estimation in columns X-XII the variable *init_L1* is not statistically significant). After a negative outcome of the AD investigation, imports grows back above average but still remains below the maximum level observed just before the initiation of AD. A partial reduction of imports may be the result of self-restraining behaviour by the importer to avoid the introduction of final protection measures (see the discussion on strategic behaviour arguments in section II). As a result, withdrawn and rejected AD cases are associated with a short-lasting strong trade destruction effect due to the provisional measures and a long-lasting but weak effect which is probably due to strategic behaviour. For imports from non-EU non-named countries, we observe a decrease in the second and third year after the initiation of AD. A decrease is also observed in the event of imports from new member states in the period before the initiation. In both cases, a decline in imports coincides with periods of expansion in imports from named countries. A similar adjustment pattern is only observed on the steel market. In general, it confirms that imports from the named country rises before the start of the AD investigation (up to about 80% above average). After the expiry of provisional measures, imports grows again partially. At the same time, imports from non-named non-EU countries falls down whilst imports from new-member states rises.

6.2. Impact of antidumping on EU exports

In addition to an analysis of the impact of antidumping on imports, I made a similar analysis for EU exports as a dependent variable. The theoretical model suggests that the imposition of antidumping measures against products imported into the EU should have a negative effect on European exports (a trade crowding-out effect). In favour of this hypothesis, Konings and Vandenbussche (2010) find a strong negative effect of antidumping on exports. However, the results in my study do not confirm this effect. The estimation results are presented in the Tables 6-7.

The estimations results for exports are presented in a similar manner to results for imports. The main difference, of course, is a dependent variable. Moreover, this time the results of the model estimated for the entire sample are contained in columns XIII, XVI, XIX and XXII. The results for the steel market are presented in columns XIV, XVII, XX and XXIII. Columns XV, XVIII, XXI and XXIV include results for a wide group of products, but with dummy variables for antidumping measures used against the EU. They control whether the change in EU exports is a result of another country using AD against the EU. This allows us to disentangle the trade crowding out effect from the effect of retaliatory measures. Unfortunately, the GAD database only contains detailed data for several countries, which significantly reduces the country sample. The GAD base lacks information on new-member states, which is why I exclude the new member states from estimations.

Columns XIII-XV present the estimation results for cases ending with the imposition of definitive antidumping measures. There is very weak evidence of a negative effect of antidumping on exports. In the full sample estimation (column XIII) exports is negatively affected only in case of non-named countries in the third year after AD initiation. The estimation for the steel market shows a more intensive decline in exports that affects exports to the named country and new member states. However, the decline in exports to new member states is in opposition to the implications of theoretical model presented in part I. The model controlling for AD investigations against the EU shows little-significant decrease in exports to named countries.

Columns XVI-XVIII show the results for cases ending with no definitive measures imposed, i.e. cases which were either rejected or withdrawn. Once again, the results for full-sample and steel market estimations show falling exports to non-named countries and new member states, similar to the results obtained for the estimation for introduced antidumping measures. There is no effect on exports in estimation controlling for the antidumping measures initiated by a foreign country. Estimations for XVI and XVII show decreasing exports to non-named countries and new member states.

Table 7 presents the results for models with leading variables. The results are more conclusive than in the previous table. The estimations from columns XIX, XX, XXII and XXIII show a long-lasting and sizeable fall in exports especially to non-named countries. However, we observe that this decrease starts before the initiation of antidumping investigations, so it cannot be related to antidumping. Alternatively, the plausible explanation is that falling exports of EU producers might make EU firms more likely to apply for antidumping protection. Consequently, there might be a reverse causality problem.

6.3 Summary of the econometric analysis

In summary, the econometric analysis demonstrates that the use of antidumping, whether it ends with the imposition of definitive AD measures or not, significantly distorts imports. The study confirms the presence of a strong and long-lasting trade destruction effect. If the investigation does not result in the imposition of definitive AD protection, there is a short-lasting trade destruction effect, which corresponds to the application of provisional measures. A long-lasting destruction effect is usually associated with a trade diversion effect resulting in increased imports from non-named countries. It seems that the trade diversion is stronger in the case of suppliers from new EU member states than non-EU countries. Models augmented with leading AD dummy variables show that antidumping investigations are initiated against suppliers rapidly increasing their sales on the EU market. Moreover, the econometric analysis suggests the existence of an adjustment in strategic behaviour because imports from named countries does not fully recover after the expiry of provisional measures, even though the AD investigation is terminated without final protection measures being introduced.

On the other hand, the econometric analysis reveals virtually no impact of antidumping on the country's exports. We observe declines in exports especially to third markets, but these declines cannot be associated with antidumping as they start before the initiation of antidumping. A more plausible explanation is the low competitiveness of European manufacturers which causes both decreasing exports and makes EU firms apply for antidumping protection. These results contradict the findings presented by Vandenbusche and Konings (2010). Probably, they could have misinterpreted falling exports as a result of using antidumping instead of falling competiveness.

Nevertheless, we cannot undoubtedly reject the crowding-out effect hypothesis. There are two problems to overcome here. Firstly, the model assumes that imported and exported products are perfect substitutes. This assumption is not generally the case. It is plausible that exported goods differ from imported goods, even though they are included in the same product group. For example, they can be differentiated vertically (differences in quality). The second problem, as has already been mentioned, is endogeneity as falling exports might be a result of using antidumping and vice versa. Consequently, the relationship between antidumping and exports is still an open question and needs more investigation.

Summary

The paper investigates the impact of antidumping on EU trade. In comparison to other studies in the same field, this study moves the time span of analysis forward, covering the period from 1992 to 2010. The study uses disaggregated trade data from the Comtrade database. Information on antidumping investigations is taken from the relatively new Global Antidumping Database by Chad Bown. The analysis starts with simple trade model of Cournot oligopoly with increasing marginal costs. The theoretical model predicts a set of adjustments in the trading system in response to the introduction of AD tariffs. The model suggests that both import and export flows should be affected. Imports is affected by trade destruction and trade diversion effects, both of which are well established in the literature. The *trade crowding-out* effect decreases exports. The hypothesis of the negative impact of antidumping on the exports of the country initiating the AD has been little addressed in the literature, with paper by Konings and Vandenbussche (2010) being an exception.

The econometric investigation is based on the Arellano-Bond estimator for panel data that is more proper strategy than fixed effect method. The results demonstrate that the use of antidumping significantly distorts import streams. It confirms a strong and long-lasting effect of trade destruction due to the introduction of AD measures. Due to the destruction effect, imports decreases by up to 37% in the second year of the initiation of AD proceedings. The trade destruction effect is stronger when the analysis is limited to steel market only, in this case the decline in imports is up to 67%. In the case of proceedings ended without the introduction of definitive AD protection measures, the destruction effect is short-lived and limited to a period of provisional measures. The introduction of AD protection also causes an increase in imports from countries not covered by the AD investigation (trade diversion effect). Trade diversion seems to be more intensive in the case of imports from new member states than from non-EU countries. The results obtained from the model augmented with leading variables reveal that EU antidumping is used against aggressive exporters which rapidly increase their sales on the European market. The results suggest that suppliers who are the subject of an AD investigation reduce their sales on the European market in order to lower the risk of the imposition of antidumping duties. To sum up, although they are limited to specified product groups, antidumping proceedings strongly distort import flows.

The author also investigates the hypothesis of the impact of antidumping on EU exports. The evidence in favour of this hypothesis is very weak. A decline in exports to third countries has been identified but cannot be associated with antidumping since the beginning of the decline precedes the initiation of AD. These results contradict those presented by Vandenbusche and Konings (2010). A more plausible explanation is the low competitiveness of European manufacturers in certain product groups, which causes exports to fall and industries to apply for AD protection. The relationship between antidumping and the exports of the country initiating the AD is still an open question that should be addressed with more research.

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Appendix

Equations A.1 to A.4 present the equilibrium sales for the simple theoretical model, that was discussed in section I. The lower subscripts denote the country of origin, while the upper subscripts denote the country of sale.

$$Q_{eu}^{eu} = Q_{eu}^{nm} = Q_{nm}^{eu} = Q_{nm}^{nm} = Q_{nn}^{eu} = Q_{nn}^{nm} = \frac{5ab^2 + 40abc + 5b^2t + 24bct + 32c^2t}{5b(5b^2 + 48bc + 64c^2)} \quad \text{(A.1)}$$

$$Q_{eu}^{nd} = Q_{nm}^{nd} = Q_{eu}^{nn} = Q_{nm}^{nn} = Q_{nn}^{nd} = Q_{nn}^{nn} = \frac{5ab^2 + 40abc - 24bct - 32c^2t}{5b(5b^2 + 48bc + 64c^2)} \quad \text{(A.2)}$$

$$Q_{nd}^{eu} = Q_{nd}^{nm} = \frac{5ab^2 + 40abc - 20\,b^2t - 116bct - 128c^2t}{5b(5b^2 + 48bc + 64c^2)} \quad \text{(A.3)}$$

$$Q_{nd}^{nd} = Q_{nd}^{nn} = \frac{5ab^2 + 40abc + 76bct + 128c^2t}{5b(5b^2 + 48bc + 64c^2)} \quad \text{(A.4)}$$

After differentiating equations A.1 - A.4 with regards to the tariff rate, *t*, we obtain the corresponding expressions A.5 - A.8 describing the change in sales on each market due to an increase in duty *t*:

$$\frac{24bc + 32c^2}{5b(5b^2 + 48bc + 64c^2)} > 0 \qquad \forall b, c > 0 \quad \text{(A.5)}$$

$$\frac{-24bc - 32c^2}{5b(5b^2 + 48bc + 64c^2)} < 0 \qquad \forall b, c > 0 \quad \text{(A.6)}$$

$$\frac{-20\,b^2 - 116bc - 128c^2}{5b(5b^2 + 48bc + 64c^2)} < 0 \qquad \forall b, c > 0 \quad \text{(A.7)}$$

$$\frac{76bc + 128c^2}{5b(5b^2 + 48bc + 64c^2)} > 0 \qquad \forall b, c > 0 \quad \text{(A.8)}$$

Expression A.5 means that an increasing tariff rate has a positive effect on the sales of all suppliers not subject to the tariff, whereby they expand their sales on EU markets (both eu and nm). It corresponds to the trade diversion effect. Expression A.6 implies a decline in sales on named country and non-named country markets originating from countries not subject to the tariff. This is referred to as a trade crowding-out effect. Expression A.7 depicts the destruction of named country sales on EU markets (trade destruction effect). The last expression, A.8, indicates that the producer subject to the tariff increases its sales on the domestic market and other non-EU markets (trade deflection effect).

Table 4. Estimation results of impact of AD on EU imports

	AD cases ended with definitive protection measures introduced									AD cases withdrawn by applicants or rejected by AD authority								
	I				II			III (steel)			IV			V			VI (steel)	
l.ln_imp	0.331	*-0.04*	***		0.347	*-0.04*	***	0.231	*-0.08*	***	0.297	*-0.04*	***	0.302	*-0.04*	***	0.259	*-0.08*	***
Init	-0.039	*-0.05*		-4%	-0.049	*-0.05*		-5%	-0.228	*-0.20*		-22%	-0.143	*-0.07*	**	-13%	-0.147	*-0.07*	**	-14%	-0.357	*-0.16*	**	-31%
init_L1	-0.233	*-0.05*	***	-21%	-0.244	*-0.05*	***	-22%	-0.566	*-0.22*	***	-45%	-0.202	*-0.07*	***	-19%	-0.201	*-0.07*	***	-18%	-0.198	*-0.17*		-19%
init_L2	-0.456	*-0.07*	***	-37%	-0.46	*-0.07*	***	-37%	-0.62	*-0.23*	***	-48%	-0.036	*-0.06*		-4%	-0.041	*-0.06*		-4%	0.019	*-0.16*		1%
init_L3	-0.358	*-0.06*	***	-30%	-0.357	*-0.06*	***	-30%	-1.06	*-0.20*	***	-66%	0.037	*-0.06*		4%	0.031	*-0.06*		3%	-0.091	*-0.16*		-10%
init_L4	-0.214	*-0.06*	***	-19%	-0.209	*-0.06*	***	-19%	-0.73	*-0.18*	***	-53%	0.003	*-0.06*		0%	0.008	*-0.06*		1%	0.113	*-0.18*		10%
init_L5	-0.170	*-0.05*	***	-16%	-0.168	*-0.05*	***	-16%	-0.447	*-0.16*	***	-37%	0.057	*-0.06*		6%	0.051	*-0.06*		5%	0.282	*-0.14*	*	31%
init_nn	-0.010	*-0.02*		-1%	-0.01	*-0.02*		-1%	-0.09	*-0.09*		-9%	-0.032	*-0.03*		-3%	-0.04	*-0.03*		-4%	-0.184	*-0.08*	**	-17%
init_nn_L1	0.025	*-0.02*		3%	0.026	*-0.02*		3%	0.167	*-0.09*	*	18%	-0.034	*-0.03*		-3%	-0.04	*-0.03*		-4%	-0.084	*-0.09*		-8%
init_nn_L2	0.034	*-0.02*		3%	0.037	*-0.02*		4%	0.146	*-0.08*	*	15%	-0.078	*-0.03*	***	-8%	-0.083	*-0.03*	***	-8%	-0.031	*-0.08*		-3%
init_nn_L3	0.066	*-0.02*	***	7%	0.062	*-0.02*	***	6%	-0.145	*-0.09*		-14%	-0.107	*-0.03*	***	-10%	-0.112	*-0.03*	***	-11%	-0.224	*-0.08*	***	-20%
init_nn_L4	0.030	*-0.02*		3%	0.03	*-0.02*		3%	-0.032	*-0.09*		-4%	-0.001	*-0.03*		0%	-0.007	*-0.03*		-1%	0.11	*-0.09*		11%
init_nn_L5	0.060	*-0.02*	**	6%	0.058	*-0.02*	**	6%	0.116	*-0.09*		12%	-0.051	*-0.03*	*	-5%	-0.057	*-0.03*	**	-6%	0.017	*-0.08*		1%
init_eu	-0.021	*-0.04*		-2%	0.012	*-0.04*		1%	-0.023	*-0.09*		-3%	0.06	*-0.05*		6%	0.104	*-0.05*	*	11%	0.047	*-0.08*		4%
init_eu_L1	-0.038	*-0.04*		-4%	0.005	*-0.05*		0%	0.148	*-0.12*		15%	0.045	*-0.05*		4%	0.107	*-0.05*	**	11%	0.213	*-0.11*	*	23%
init_eu_L2	-0.015	*-0.05*		-2%	0.033	*-0.05*		3%	0.295	*-0.12*	***	33%	0.011	*-0.05*		1%	0.082	*-0.05*		8%	0.246	*-0.1*	**	27%
init_eu_L3	0.075	*-0.05*		8%	0.123	*-0.05*	**	13%	0.488	*-0.12*	***	62%	0.018	*-0.05*		2%	0.083	*-0.05*		9%	0.187	*-0.09*	**	20%
init_eu_L4	0.080	*-0.05*	*	8%	0.119	*-0.05*	**	12%	0.577	*-0.14*	***	76%	0.066	*-0.05*		7%	0.127	*-0.05*	**	13%	0.4	*-0.12*	***	48%
init_eu_L5	-0.011	*-0.05*		-1%	0.017	*-0.05*		2%	0.187	*-0.11*		20%	0.078	*-0.05*		8%	0.119	*-0.05*	**	12%	0.078	*-0.1*		8%
ln_gdp	0.020	*-0.05*			0.04	*-0.05*			-0.634	*-0.15*	***		-0.03	-0.05			-0.061	*-0.05*			-0.399	*-0.14*	***	
ln_pop	-0.148	*-0.23*			-0.246	*-0.24*			0.41	*-1.40*			-0.072	-0.23			-0.262	*-0.23*			-2.402	*-1.11*	**	
rta					-0.016	*-0.05*			-0.144	*-0.18*							-0.008	*-0.06*			-0.285	*-0.22*		
nm_eu					-0.164	*-0.07*	**		-0.3	*-0.22*							-0.239	*-0.08*	***		-0.115	*-0.24*		
rer					0	*0*			0	*0.00*							0	*0*			0	*0*		
year dummies	yes				yes				yes				yes				yes				yes			
Constant	6.032	*-4.05*			7.148	*-4.09*	*		15.608	*-24.54*			6.306	*-3.97*			8.593	*-4.01*	**		56.905	*-19.11*	***	
N	110 317				108 726				8 500				90 846				89 494				11 021			

*Note: For each estimation, the first value in column is estimated coefficient, the second value is standard deviation. Stars denote statistical significance: * for 0.1-0.05, ** for 0.05-0.01, and *** for < 0.01. The last value is percentage change in dependent variable implied by the coefficient.*

Table 5. Estimation results of the impact of AD on EU imports (model with leading AD dummy variables)

	AD cases ended with definitive protection measures introduced												AD cases withdrawn by applicants or rejected by AD authority											
	VII				VIII				IX (steel)				X				XI				XII (steel)			
l.ln_imp	0.325	*-0.04*	***		0.342	*-0.04*	***		0.249	*-0.08*	***		0.296	*-0.04*	***		0.303	*-0.04*	***		0.255	*-0.08*	***	
init_F3	0.059	*-0.06*		6%	0.063	*-0.06*		6%	-0.151	*-0.24*		-17%	0.098	*-0.09*		10%	0.094	*-0.09*		10%	-0.004	*-0.29*		-5%
init_F2	0.193	*-0.07*	***	21%	0.183	*-0.07*	***	20%	-0.324	*-0.24*		-30%	0.292	*-0.08*	***	34%	0.273	*-0.08*	***	31%	0.489	*-0.26*	*	58%
init_F1	0.449	*-0.07*	***	56%	0.432	*-0.07*	***	54%	0.106	*-0.23*		8%	0.431	*-0.09*	***	53%	0.419	*-0.09*	***	52%	0.643	*-0.26*	**	84%
init	0.354	*-0.08*	***	42%	0.33	*-0.08*	***	39%	-0.068	*-0.26*		-10%	0.236	*-0.09*	***	26%	0.222	*-0.09*	**	24%	0.213	*-0.3*		18%
init_L1	0.110	*-0.08*		11%	0.088	*-0.08*		9%	-0.409	*-0.28*		-36%	0.123	*-0.08*		13%	0.117	*-0.08*		12%	0.273	*-0.24*		28%
init_L2	-0.170	*-0.08*	**	-16%	-0.183	*-0.08*	**	-17%	-0.487	*-0.26*	*	-41%	0.229	*-0.07*	***	25%	0.22	*-0.07*	***	24%	0.442	*-0.23*	*	51%
init_L3	-0.138	*-0.07*	**	-13%	-0.144	*-0.07*	**	-14%	-0.966	*-0.23*	***	-63%	0.238	*-0.07*	***	27%	0.229	*-0.07*	***	25%	0.238	*-0.21*		24%
init_L4	-0.057	*-0.06*		-6%	-0.057	*-0.06*		-6%	-0.647	*-0.19*	***	-49%	0.142	*-0.06*	**	15%	0.144	*-0.06*	**	15%	0.37	*-0.21*	*	42%
init_L5	-0.086	*-0.05*		-8%	-0.087	*-0.05*		-8%	-0.429	*-0.17*	**	-36%	0.133	*-0.06*	**	14%	0.126	*-0.06*	**	13%	0.418	*-0.15*	***	50%
init_nn_F3	0.008	*-0.02*		1%	0.003	*-0.02*		0%	0.055	*-0.10*		5%	0.064	*-0.03*	**	7%	0.063	*-0.03*	**	6%	0.101	*-0.09*		10%
init_nn_F2	-0.047	*-0.02*	*	-5%	-0.056	*-0.02*	**	-5%	-0.193	*-0.11*	*	-18%	0.071	*-0.03*	**	7%	0.064	*-0.03*	**	7%	-0.031	*-0.1*		-3%
init_nn_F1	-0.080	*-0.03*	***	-8%	-0.095	*-0.03*	***	-9%	-0.294	*-0.10*	***	-26%	0.028	*-0.03*		3%	0.012	*-0.03*		1%	-0.082	*-0.09*		-8%
init_nn	-0.083	*-0.03*	***	-8%	-0.093	*-0.03*	***	-9%	-0.288	*-0.10*	***	-25%	-0.018	*-0.03*		-2%	-0.034	*-0.03*		-3%	-0.247	*-0.1*	**	-22%
init_nn_L1	-0.039	*-0.03*		-4%	-0.044	*-0.03*	*	-4%	0.009	*-0.11*		0%	-0.026	*-0.03*		-3%	-0.035	*-0.03*		-4%	-0.132	*-0.1*		-13%
init_nn_L2	-0.020	*-0.03*		-2%	-0.022	*-0.03*		-2%	0.012	*-0.09*		1%	-0.075	*-0.03*	**	-7%	-0.081	*-0.03*	***	-8%	-0.075	*-0.09*		-8%
init_nn_L3	0.021	*-0.03*		2%	0.014	*-0.03*		1%	-0.25	*-0.09*	***	-22%	-0.107	*-0.03*	***	-10%	-0.111	*-0.03*	***	-11%	-0.265	*-0.09*	***	-24%
init_nn_L4	-0.001	*-0.02*		0%	-0.004	*-0.03*		0%	-0.08	*-0.09*		-8%	-0.002	*-0.03*		0%	-0.006	*-0.03*		-1%	0.094	*-0.09*		9%
init_nn_L5	0.044	*-0.02*	*	5%	0.043	*-0.02*	*	4%	0.07	*-0.09*		7%	-0.052	*-0.03*	*	-5%	-0.055	*-0.03*	*	-5%	0.018	*-0.08*		1%
init_eu_F3	-0.029	*-0.05*		-3%	0.003	*-0.06*		0%	0.271	*-0.11*	**	30%	-0.059	*-0.06*		-6%	-0.025	*-0.06*		-3%	0.142	*-0.1*		15%
init_eu_F2	-0.126	*-0.05*	**	-12%	-0.068	*-0.05*		-7%	0.009	*-0.16*		0%	-0.233	*-0.06*	***	-21%	-0.176	*-0.06*	***	-16%	-0.046	*-0.13*		-5%
init_eu_F1	-0.219	*-0.05*	***	-20%	-0.151	*-0.06*	***	-14%	-0.203	*-0.15*		-19%	-0.289	*-0.06*	***	-25%	-0.22	*-0.07*	***	-20%	-0.153	*-0.11*		-15%
init_eu	-0.186	*-0.05*	***	-17%	-0.116	*-0.06*	**	-11%	-0.161	*-0.14*		-16%	-0.132	*-0.06*	**	-13%	-0.061	*-0.07*		-6%	-0.07	*-0.12*		-7%
init_eu_L1	-0.167	*-0.05*	***	-16%	-0.101	*-0.05*	*	-10%	0.097	*-0.13*		9%	-0.095	*-0.06*		-9%	-0.025	*-0.06*		-3%	0.133	*-0.13*		13%
init_eu_L2	-0.113	*-0.05*	**	-11%	-0.054	*-0.05*		-5%	0.233	*-0.13*	*	25%	-0.087	*-0.06*		-8%	-0.022	*-0.06*		-2%	0.174	*-0.12*		18%
init_eu_L3	-0.004	*-0.05*		0%	0.051	*-0.05*		5%	0.427	*-0.13*	***	52%	-0.037	*-0.05*		-4%	0.013	*-0.06*		1%	0.098	*-0.11*		10%
init_eu_L4	0.024	*-0.05*		2%	0.065	*-0.05*		7%	0.541	*-0.14*	***	70%	0.046	*-0.05*		5%	0.088	*-0.05*		9%	0.384	*-0.12*	***	46%
init_eu_L5	-0.038	*-0.05*		-4%	-0.012	*-0.05*		-1%	0.149	*-0.12*		15%	0.074	*-0.05*		8%	0.1	*-0.05*	*	10%	0.101	*-0.1*		10%
ln_gdp	0.029	*-0.05*			0.043	*-0.05*			-0.66	*-0.14*	***		-0.021	*-0.05*			-0.008	*-0.05*			-0.419	*-0.14*	***	
ln_pop	-0.159	*-0.23*			-0.243	*-0.24*			0.107	*-1.46*			-0.087	*-0.23*			-0.201	*-0.23*			-2.358	*-1.12*	**	
rta					-0.016	*-0.05*			-0.161	*-0.18*							-0.061	*-0.06*			-0.277	*-0.22*		
nm_eu					-0.141	*-0.08*	*		-0.374	*-0.22*	*						-0.184	*-0.08*	**		-0.109	*-0.25*		
rer					0	*0*			0	*0.00*							0	*0*			0	*0*		
year dummies	yes				yes				yes				yes				yes				yes			
constant	6.057	*-4.05*			7.074	*-4.1*	*		21.335	*-25.63*			6.321	*-3.97*			7.946	*-4.01*	**		56.712	*-19.36*	***	
N	110 317				108 726				8 500				90 846				89 494				11 021			

*Note: For each estimation, the first value in column is estimated coefficient, the second value is standard deviation. Stars denote statistical significance: * for 0.1-0.05, ** for 0.05-0.01, and *** for < 0.01. The last value is percentage change in dependent variable implied by the coefficient.*

Table 6. Estimation results of impact of AD on EU exports

	AD cases ended with definitive protection measures introduced												AD cases withdrawn by applicants or rejected by AD authority											
	XIII				XIV (steel)				XV				XVI				XVII (steel)				XVIII			
l.ln_exp	0.229	-0.03	***		-0.061	-0.09			0.339	-0.04	***		0.272	-0.03	***		0.054	-0.07			0.32	-0.05	***	
init	0.082	-0.06		8%	-0.395	-0.21	*	-34%	0.058	-0.08		6%	-0.065	-0.08		-7%	-0.073	-0.18		-9%	-0.058	-0.1		-6%
init_L1	-0.105	-0.06		-10%	-0.282	-0.22		-26%	-0.141	-0.08	*	-13%	-0.044	-0.08		-5%	-0.161	-0.2		-17%	0.032	-0.09		3%
init_L2	0.081	-0.06		8%	-0.362	-0.23		-32%	0.059	-0.08		6%	0.046	-0.1		4%	-0.215	-0.27		-22%	0.049	-0.11		4%
init_L3	-0.046	-0.07		-5%	-0.535	-0.27	*	-44%	-0.095	-0.08		-9%	0.157	-0.1		16%	-0.141	-0.25		-16%	0.113	-0.11		11%
init_L4	-0.008	-0.07		-1%	-0.182	-0.32		-21%	-0.1	-0.08		-10%	0.17	-0.1	*	18%	0.26	-0.23		26%	0.091	-0.12		9%
init_L5	-0.073	-0.06		-7%	-0.465	-0.20	**	-39%	-0.098	-0.08		-10%	0.078	-0.1		8%	0.507	-0.25	**	61%	-0.051	-0.11		-6%
init_nn	0.019	-0.01	*	2%	0.002	-0.05		0%	0.045	-0.02	**	5%	-0.009	-0.01		-1%	-0.099	-0.03	***	-9%	0.029	-0.03		3%
init_nn_L1	-0.006	-0.01		-1%	-0.044	-0.05		-4%	0.001	-0.02		0%	-0.055	-0.01	***	-5%	-0.102	-0.04	***	-10%	-0.017	-0.03		-2%
init_nn_L2	-0.018	-0.01		-2%	-0.061	-0.06		-6%	0.007	-0.02		1%	-0.004	-0.01		0%	-0.076	-0.04	**	-7%	0.007	-0.03		1%
init_nn_L3	-0.020	-0.01	*	-2%	-0.075	-0.06		-7%	0.015	-0.02		2%	-0.023	-0.01		-2%	-0.086	-0.04	**	-8%	-0.012	-0.03		-1%
init_nn_L4	0.016	-0.01		2%	0.063	-0.06		6%	0.047	-0.02	**	5%	0.003	-0.01		0%	-0.041	-0.04		-4%	0.008	-0.03		1%
init_nn_L5	0.001	-0.01		0%	0.099	-0.06	*	10%	0.034	-0.02		3%	-0.004	-0.01		0%	-0.004	-0.04		0%	0.019	-0.03		2%
init_eu	-0.007	-0.02		-1%	0.037	-0.08		3%					-0.018	-0.03		-2%	-0.049	-0.06		-5%				
init_eu_L1	-0.019	-0.03		-2%	-0.245	-0.09	***	-22%					-0.095	-0.04	***	-9%	-0.202	-0.06	***	-18%				
init_eu_L2	0.051	-0.03	*	5%	-0.137	-0.1		-13%					-0.052	-0.04		-5%	-0.029	-0.07		-3%				
init_eu_L3	0.011	-0.03		1%	-0.244	-0.13	*	-22%					-0.078	-0.04	**	-8%	-0.13	-0.08		-12%				
init_eu_L4	0.007	-0.03		1%	-0.179	-0.12		-17%					-0.025	-0.04		-3%	-0.012	-0.09		-2%				
init_eu_L5	0.021	-0.03		2%	0.004	-0.08		0%					0.002	-0.03		0%	0.15	-0.07	**	16%				
exp_init									0.126	-0.17		12%									0.018	-0.19		0%
exp_init_L1									-0.194	-0.15		-19%									-0.316	-0.13	**	-28%
exp_init_L2									-0.123	-0.12		-12%									-0.188	-0.13		-18%
exp_init_L3									-0.459	-0.17	***	-38%									-0.373	-0.17	**	-32%
exp_init_L4									-0.024	-0.12		-3%									-0.038	-0.19		-6%
exp_init_L5									-0.386	-0.11	***	-32%									-0.248	-0.16		-23%
exp_init_n									0.049	-0.05		5%									-0.126	-0.05	***	-12%
exp_init_n_L1									0.083	-0.05	*	9%									-0.087	-0.05	*	-8%
exp_init_n_L2									0.076	-0.05		8%									-0.025	-0.05		-3%
exp_init_n_L3									0.112	-0.06	**	12%									0.091	-0.05	*	9%
exp_init_n_L4									0.077	-0.06		8%									0.081	-0.05	*	8%
exp_init_n_L5									0.108	-0.07		11%									0.06	-0.06		6%
ln_gdp	0.539	-0.03	***		0.709	-0.12	***		0.994	-0.05	***		0.468	-0.03	***		0.589	-0.09	***		0.909	-0.06	***	
ln_pop	-0.720	-0.10	***		-2.101	-0.67	***		-2.936	-0.47	***		-0.654	-0.11	***		-1.630	-0.42	***		-3.843	-0.55	***	
rta	0.018	-0.02			-0.232	-0.10	**		0.093	-0.05	*		0.020	-0.03			-0.109	-0.07	*		0.131	-0.06	**	
nm_eu	-0.004	-0.04			-0.046	-0.14							0.018	-0.04			-0.122	-0.10						
rer	0	0	*		0	0			0	0			0	0			0	0			0	0		
year dummies	yes				yes				yes				yes				yes				yes			
constant	2.753	-1.69			23.241	-11.54	**		29.896	-8.1	***		3.337	-1.86	*		18.245	-7.22	**		48.409	-9.56	***	
N	250 797				18 640				63 498				197 185				33 786				49 170			

*Note: For each estimation, the first value in column is estimated coefficient, the second value is standard deviation. Stars denote statistical significance: * for 0.1-0.05, ** for 0.05-0.01, and *** for < 0.01. The last value is percentage change in dependent variable implied by the coefficient.*

Table 7. Estimation results of impact of AD on EU exports (model with leading AD dummy variables)

	AD cases ended with definitive protection measures introduced												AD cases withdrawn by applicants or rejected by AD authority											
	XIX				XX (steel)				XXI				XXII				XXIII (steel)				XXIV			
l.ln_exp	0.227	-0.03	***		-0.065	-0.09			0.339	-0.04	***		0.275	-0.03	***		0.059	-0.07			0.32	-0.05	***	
init_F3	-0.094	-0.07		-9%	-0.068	-0.24		-9%	-0.121	-0.08		-12%	0.024	-0.11		2%	0.326	-0.24		35%	0.043	-0.12		4%
init_F2	-0.087	-0.07		-9%	-0.426	-0.31		-38%	-0.086	-0.09		-9%	0.026	-0.1		2%	-0.064	-0.26		-9%	-0.027	-0.11		-3%
init_F1	-0.022	-0.07		-2%	-0.51	-0.27	*	-42%	0.038	-0.09		3%	0.026	-0.11		2%	0.049	-0.27		1%	0.029	-0.11		2%
init	0.065	-0.08		6%	-0.79	-0.25	***	-56%	0.096	-0.09		10%	-0.041	-0.11		-5%	-0.024	-0.3		-7%	-0.022	-0.11		-3%
init_L1	-0.119	-0.08		-12%	-0.597	-0.26	**	-47%	-0.108	-0.09		-11%	-0.024	-0.11		-3%	-0.117	-0.31		-15%	0.062	-0.10		6%
init_L2	0.069	-0.08		7%	-0.624	-0.26	**	-48%	0.084	-0.09		8%	0.061	-0.12		6%	-0.17	-0.34		-20%	0.071	-0.12		7%
init_L3	-0.056	-0.07		-6%	-0.726	-0.28	***	-54%	-0.075	-0.09		-8%	0.167	-0.10		18%	-0.099	-0.28		-13%	0.129	-0.12		13%
init_L4	-0.013	-0.08		-2%	-0.324	-0.32		-31%	-0.083	-0.09		-8%	0.177	-0.11	*	19%	0.295	-0.26		30%	0.098	-0.13		9%
init_L5	-0.075	-0.06		-7%	-0.54	-0.21	***	-43%	-0.089	-0.08		-9%	0.083	-0.1		8%	0.54	-0.25	**	66%	-0.047	-0.12		-5%
init_nn_F3	-0.002	-0.01		0%	-0.065	-0.06		-6%	0.006	-0.02		1%	0.018	-0.01		2%	-0.079	-0.04	**	-8%	0	-0.03		0%
init_nn_F2	-0.008	-0.01		-1%	-0.19	-0.07	***	-18%	-0.024	-0.02		-2%	0.019	-0.02		2%	-0.05	-0.05		-5%	0.039	-0.03		4%
init_nn_F1	-0.038	-0.01	***	-4%	-0.28	-0.07	***	-25%	-0.034	-0.02		-3%	-0.044	-0.02	***	-4%	-0.048	-0.05		-5%	-0.047	-0.03	*	-5%
init_nn	-0.013	-0.01		-1%	-0.212	-0.07	***	-19%	0.014	-0.02		1%	-0.046	-0.02	***	-4%	-0.146	-0.05	***	-14%	-0.013	-0.03		-1%
init_nn_L1	-0.035	-0.01	***	-3%	-0.207	-0.07	***	-19%	-0.025	-0.02		-3%	-0.086	-0.02	***	-8%	-0.144	-0.05	***	-14%	-0.052	-0.03	*	-5%
init_nn_L2	-0.042	-0.01	***	-4%	-0.192	-0.06	***	-18%	-0.016	-0.02		-2%	-0.031	-0.02	*	-3%	-0.111	-0.05	**	-11%	-0.025	-0.03		-2%
init_nn_L3	-0.04	-0.01	***	-4%	-0.173	-0.07	***	-16%	-0.004	-0.03		0%	-0.044	-0.01	***	-4%	-0.105	-0.05	**	-10%	-0.036	-0.03		-4%
init_nn_L4	0	-0.01		0%	-0.011	-0.06		-1%	0.033	-0.03		3%	-0.011	-0.01		-1%	-0.055	-0.04		-5%	-0.01	-0.03		-1%
init_nn_L5	-0.008	-0.01		-1%	0.065	-0.06		6%	0.027	-0.03		3%	-0.011	-0.01		-1%	-0.014	-0.04		-1%	0.011	-0.03		1%
init_eu_F3	-0.004	-0.04		0%	-0.069	-0.13		-7%					0	-0.04		0%	-0.008	-0.08		-1%				
init_eu_F2	-0.032	-0.03		-3%	-0.046	-0.13		-5%					-0.028	-0.04		-3%	-0.035	-0.09		-4%				
init_eu_F1	-0.049	-0.04		-5%	0.121	-0.15		12%					-0.066	-0.04		-6%	0.053	-0.11		5%				
init_eu	-0.048	-0.03		-5%	0.106	-0.14		10%					-0.076	-0.04	*	-7%	-0.014	-0.1		-2%				
init_eu_L1	-0.055	-0.03	*	-5%	-0.218	-0.12	*	-20%					-0.145	-0.04	***	-14%	-0.18	-0.09	**	-17%				
init_eu_L2	0.02	-0.03		2%	-0.114	-0.13		-11%					-0.095	-0.04	**	-9%	-0.014	-0.09		-2%				
init_eu_L3	-0.014	-0.03		-1%	-0.238	-0.13	*	-22%					-0.112	-0.04	***	-11%	-0.115	-0.09		-11%				
init_eu_L4	-0.013	-0.03		-1%	-0.184	-0.13		-17%					-0.047	-0.04		-5%	0.012	-0.1		1%				
init_eu_L5	0.01	-0.03		1%	-0.011	-0.09		-1%					-0.008	-0.03		-1%	0.141	-0.08	*	15%				
exp_init									0.131	-0.17		12%									0.054	-0.2		4%
exp_init_L1									-0.178	-0.15		-17%									-0.297	-0.13	**	-26%
exp_init_L2									-0.102	-0.12		-10%									-0.163	-0.14		-16%
exp_init_L3									-0.447	-0.17	***	-37%									-0.357	-0.17	**	-31%
exp_init_L4									-0.019	-0.12		-3%									-0.024	-0.19		-4%
exp_init_L5									-0.384	-0.11	***	-32%									-0.251	-0.16		-23%
exp_init_nn									0.05	-0.05		5%									-0.106	-0.05	**	-10%
exp_init_nnL1									0.083	-0.05	*	8%									-0.075	-0.05		-7%
exp_init_nnL2									0.082	-0.05		8%									-0.024	-0.05		-2%
exp_init_nnL3									0.118	-0.06	**	12%									0.1	-0.05	*	10%
exp_init_nnL4									0.081	-0.06		8%									0.091	-0.05	*	9%
exp_init_nnL5									0.109	-0.07		11%									0.056	-0.06		6%
ln_gdp	0.539	-0.03	***		-0.237	-0.1	**		0.994	-0.05	***		0.467	-0.03	***		0.584	-0.09	***		0.911	-0.06	***	

ln_pop	-0.72	-0.1	***	-0.134	-0.15		-2.937	-0.47	***	-0.651	-0.11	***	-1.64	-0.42	***	-3.833	-0.55	***
rta	0.019	-0.02		0.717	-0.12	***	0.093	-0.05	*	0.02	-0.03		-0.11	-0.07	*	0.129	-0.06	**
nm_eu	0.002	-0.04		-2.196	-0.67	***				0.029	-0.04		-0.156	-0.1				
rer	0	0	*	0	0		0	0		0	0		0	0		0	0	
year dummies	yes			yes			yes			yes			yes			yes		
constant	2.776	-1.69		24.598	-11.51	**	29.946	-8.1	***	3.327	-1.86	*	18.552	-7.23	***	48.213	-9.56	***
N	250 797			18 640			63 498			197 185			33 786			49 170		

*Note: For each estimation, the first value in column is estimated coefficient, the second value is standard deviation. Stars denote statistical significance: * for 0.1-0.05, ** for 0.05-0.01, and *** for < 0.01. The last value is percentage change in dependent variable implied by the coefficient.*

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