Beyond Target: Indirect Impacts of Antidumping

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Abstract

This paper investigates the bilateral impacts of antidumping measures, beyond directly targeted products and exporting firms. It focuses on the country whose exports are most exposed to such measures, China. Product-level analysis shows that export volumes are negatively affected for products similar to a product targeted by an antidumping case, i.e. belonging to the same tariff heading. Using firm-level data, we show that this impact is driven by within-firm contagion: targeted firms not only cut their exports of targeted products, they also reduce significantly their exports of non-targeted products. The decrease is half as large for the latter than for the former, but the total impact on bilateral trade is far larger, because the value of export flows affected by these indirect impacts is ten times larger than the value of directly targeted export flows. In addition, interestingly, this effect is more pronounced for small and private firms.

JEL-Codes: F120, F130, F140, F150.

Keywords: antidumping, spillovers, multi-product firms, China.

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1 Introduction

Antidumping (AD) actions might be considered as second-order issues in world trade, to the extent that they are supposed to redress specific situations of unfair competition. That would be a mistake: to paraphrase Blonigen and Prusa (2016, p. 107), "in terms of trade policy, AD is where the action is". As a matter of fact, while decades of trade liberalization have reduced tariff duties to a fairly low level, with rules and commitments frequently leaving limited space to increase them, AD actions allow increasing trade protection in a rapid, targeted, yet significant way. The trade consequences are significant, because the share of imports covered by such measures, while limited, is not negligible. This is especially true for Chinese exports: more than 10% of imports from China were subject to AD duties in the US in 2020 (Bown, 2021). In the EU, this share was close to 5% in the EU in 2021 according to our calculations.[1]

However, taking the full measure of the trade-restrictiveness of AD actions on trade flows requires identifying all their impacts. And, for such a powerful trade policy tool, they may well spill beyond directly targeted flows.[2] Such indirect impacts have been evidenced for trade flows with third countries, as we recall below, but their existence for other products exported by the target country to the complaining one remains not fully understood. This is an important question, because such spillovers might magnify the restrictive impacts of AD actions on bilateral trade. They would also imply that AD actions protect the complaining country from exporters under investigation beyond the initially intended objective. This

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[1]Based on the GAD database, described below, and Comext data on EU foreign trade, we compute this coverage rate for the EU as equaling 4.6% in 2021. Noteworthily, it has been significantly larger (between 8 and 10%) when the large case against solar panel imports was active, between 2013 and 2018. These shares are computed based on pre-investigation imports. Since targeted trade flows are heavily hit by the duties, their importance is mechanically reduced subsequently, so that current imports cannot be considered as a fair measure of their weight in trade relationships (see Bown, 2011).

[2]While AD activity usually targets a firm-product-destination triplet, we define targeted flows as product-destination specific. Indeed, AD activity targeting Chinese exports between 2000 and 2011 have a broader scope due to the non-market economic status of China at the WTO during this period of time. Chinese cooperating firms may be subject to firm-specific duties, but other exporters of the same product face the "all other firms" AD duty.

paper attempts to address these questions, focusing on Chinese exports.

Several indirect impacts of AD cases have already been documented. Some have to do with political economy, such as mechanisms of "cascading protection", through which AD initiation in an upstream industry increases the probability of downstream industries petitioning for AD duties (e.g., Hoekman and Leidy, 1992; Feinberg and Kaplan, 1993; Erbahar and Zi, 2017). The increased likelihood of additional AD petitions ensuing from previous initiations may also materialize in other markets; such "echoing" in AD cases may be motivated *inter alia* by the willingness to protect from trade deflection effects, by interactions between politically-motivated governments, or by links through multinational firms (e.g., Maur, 1998; Tabakis and Zanardi, 2016). Other indirect impacts relate to behavioral responses of exporters, which adapt to AD duties by modifying their pricing and marketing policies on third markets. Bown and Crowley (2007) show how US AD measures both deflect and depress Japanese export flows to third countries, as reflected in their larger volumes and lower prices. Signaling effects may also spur a reaction from exporters, to the extent that an AD case in one market may be interpreted as a warning of uncertain protection for the targeted products on other markets; Crowley et al. (2018) show that the result is reduced entry and increased exit in other countries for those products.

While insightful about the consequences of AD duties, none of these indirect effects has to do with the immediate impact on bilateral trade between the countries directly concerned. To our knowledge, the only evidence of such indirect, bilateral effects is found in Baylis and Perloff (2010), which shows how a US AD investigation on raw Mexican tomatoes spurred an increase in Mexican exports of processed tomatoes. This is typically a trade deflection effect: being prevented from exporting profitably raw tomatoes, exporters transform the nature of their output so as to be able to shift the tariff heading under which their exports are recorded. This is a straightforward version of the kind of spillover effects along the value chain that motivate the demand for cascading protection. In this case, the immediate consequence is

that, at the sector level, the restrictive impact of AD duties is alleviated by these indirect effects.

Nevertheless, AD duties are also likely to have indirect effects that magnify their restrictive impacts on bilateral trade flows. They might, in particular prompt actual or potential exporters to restrain their ambitions for this market, because of their signaling effect. Indeed, an AD initiation suggests that other measures are likely to follow soon in the same country for similar products, for several reasons. The already mentioned cascading demand for protection is a first one: it means that an AD initiation for a given product increases the probability of subsequent initiations in downstream industries. Another, more general reason is that the probability of an AD case being initiated depends significantly on bargaining power and coordination costs among domestic producers (Zanardi, 2004; Blonigen, 2006; Blonigen and Prusa, 2016), characteristics that are generally common to most products within a sector, and strongly persistent over time. In addition, to bring an AD petition to fruition requires specific knowledge from the plaintiff side, implying that recent experience is an asset for future cases. Because exporters are not familiar with these factors and because of the resulting likelihood of an AD case being successfully filed against them, they are likely to interpret AD cases on products similar to the ones they export as the meaningful signal of a heightened probability of facing an AD measure in the near future. When this is the case, exporters may readjust their optimal strategy, factoring in increased AD threat, which may lead them to voluntarily restrain their export performance and/or to increase their export prices.

The bottom line is that there are several reasons why an AD case may influence bilateral trade flows between partner countries beyond the products and firms directly targeted. Understanding better the ensuing effects requires an analysis of the way exporters may adapt.

Since impacts may cut both ways, identifying the resulting consequences remains an empirical question. A few studies have already brought useful insights. Vandenbussche and Zanardi

(2010) show that the adoption of an AD law by a country reduces significantly its aggregate imports (by 5.9% on average according to their estimates), provided it is used frequently. They emphasize that this impact goes beyond the direct consequences, because imports are "reduced due to a variety of 'spillover' effects", and refer to this indirect impact as a "chilling effect" (which is not bilateral, but applies to all partners). Egger and Nelson (2011) also analyze the aggregate trade impact of AD, as measured through the number of AD investigations in force (direct effect) and through the stock of past investigations (long memory in trade responsiveness to AD). They conclude that the impact is rather small, resulting in a cut by slightly more than one-tenth of a percentage point of bilateral exports, for the average country pair. For both studies, the focus on aggregate imports means that any indirect impact of AD beyond targeted products would be included in the assessment. However, it is not possible to disentangle such possible indirect effects from direct ones. Hence, the nature, scope and magnitude of indirect effects cannot be assessed at this aggregate level. In contrast, focusing on EU imports, Bellora and Jean (2016) assess to what extent an AD measure on one product affects imports of other products, within the same sector. They find such indirect impacts to be sizeable and significant, and emphasize that they may increase considerably the trade-restrictive impact of AD measures. However, their study is limited to EU imports from China, and their focus on product-level data does not make it possible to analyze firm-level impacts in this context. In a study that is the closest to the present one, Bao et al. (2021) focus on the way multi-product firms adjust to AD investigations. They find that the impact on targeted products (increased prices, decreased sales) extend not only to directly targeted markets, but also to other markets served by the exporting firm, in what they call a "within-firm chilling effect". In contrast, other products from a targeted firm face opposite effects (lower prices, higher sales), in all markets. However, the paper focuses more on the adjustment process within multi-product firms than on the indirect impacts of AD investigations, which also concern single-product firms.

Against this backdrop, the indirect impacts of AD cases on the bilateral trade relationship

between plaintiff and defendant deserve further analysis. Even though the studies just mentioned suggest that such impacts might be significant, many questions remain about their magnitude and scope, as well as underlying mechanisms.

This paper proposes a close examination of these indirect impacts, based on firm-level data of Chinese exports. Using firm-level data is necessary to analyze underlying mechanisms because, as we make clear below, some of them may stem from adjustments within multi-product firms, while others operate through the reshuffling of market shares or export participation across firms, within sectors.

We focus on Chinese exports for two main reasons. First, China is increasingly the main target of AD cases worldwide. From the GAD database (Bown, 2016), we calculated that China was involved as a target in more than 35% of all active AD cases in 2016 (excluding those initiated by China itself). This is far more than in the decade preceding China's WTO accession, when the country was a target in approximately 15% of all cases, except their own. Secondly, China has been treated so far as a non-market economy by almost all its partners. The consequence of this status is that it makes it possible for the partner to follow a specific methodology when carrying out AD investigations against Chinese exporters, whereby prices observed in "analog countries" are used to define the "fair price" against which dumping can be assessed. Noteworthily, even in the reformed AD methodology adopted by the EU in December 2017, the reference to non-market economy status was dropped, but the option to apply the analog country method was preserved when markets are significantly distorted. The direct consequence of making this methodology available is to increase the wiggle-room available to the importer in characterizing dumping (Bellora and Jean, 2016). This context can only increase the signaling effect of AD duties, and therefore their potential indirect impacts.

In practice, we first focus on the product level and assess how an AD case targeting one or more similar products, understood as a product belonging to the same tariff heading (i.e.,

HS4 position), influences export participation, volumes and prices. We then dig further, using firm-level data to ask the same question. This makes it possible to consider further questions, in particular whether these indirect, neighbouring impacts spill over to similar products (within-sector indirect impacts), to other products exported by targeted firms (within-firm indirect impacts), or to both. To this end, we match Chinese custom data for the period 2000–2011 to detailed AD information from the World Bank (Bown, 2016), including all investigations against Chinese firms.

Our identification strategy exploits both the panel dimension – time variation before and after the AD investigation for a given firm-product-destination triplet – and the cross-section dimension by comparing simultaneous targeted and untargeted exports flows to various destination markets. We control for underlying differences in quality and productivity across firms, differences in yearly product-specific global demand, and differences in yearly industry-destination unobservables, by analysing first, differences of the log of dependant variables and by including an extensive vector of (i) product-time fixed effects, (ii) product-destination fixed effects, (iii) destination-time fixed effects, and (iv) the direct impact of AD investigation on targeted firms.

We find robust evidence that AD duties affect Chinese bilateral exports beyond targeted products. Multi-product exporters reduce their export volume on their entire product basket. In contrast, indirect impacts on export participations are not found to be statistically significant. These impacts are robust to several specifications.

The next section describes the theoretical mechanisms at stake. Section 3 presents the data. Section 4 lays out our product-level empirical strategy and presents the results. Section 5 is devoted to the firm-level analysis. Several extensions analyzing within-firm AD spillovers, the impact of AD over time, the AD duties and the economic magnitude are presented in Section 6. Section 7 concludes.

2 Theoretical mechanisms

To understand how AD actions may have indirect impacts on bilateral trade flows, beyond directly targeted products, several theoretical mechanisms are worth considering.

Demand effects. Demand levels for different products are linked through both income and substitution effects. As a result, imposing additional duties on targeted products may alter demand for other products. Since AD actions focus on a limited set of products, the income effect of a given action is most often very small, if not negligible. The impact on demand for untargeted products is thus likely to be negligible for most other products, only reaching significance for those products for which the cross-price elasticity of demand is large enough in absolute value. The corresponding impact on bilateral trade flows will be positive for products that are substitutable to the targeted one (positive cross-price elasticity of demand); it will be negative for complementary products. Assessing cross-price elasticities of demand by product pair is beyond the scope of this paper, which makes it challenging to identify properly these effects. However, since classifications are built by grouping together similar products, a reasonable working assumption is that the products for which the cross-price elasticity of demand reaches significance are those belonging to the same semi-aggregate classification categories as targeted products. This would be consistent with a situation where tariff-heading-level preferences would be separable, so that demand would stem from two-stage budgeting, a standard assumption in applied trade models. Recent estimates by Fajgelbaum et al. (2019) are consistent with this assumption, since they find substitution elasticities to be significantly lower between sectors (1.19) than between products within the same sector (1.52). In the empirical analysis below, this assumption is applied based on tariff headings (i.e. 4-digit positions of the Harmonized System of classification, referred to as sectors in what follows); within-sector products, defined as products belonging to the same tariff heading as products targeted by an AD action, will be considered separately from

other products when the impact of this AD action is being analyzed, given their likely higher degree of substitutability with targeted products. Another sensible assumption, to which we return below, is that these indirect effects are likely to be much stronger within firms.

Cross-firm supply effects. Even for firms that are not directly targeted, an AD initiation may be of significance because of its signaling effect, when it implies that the probability of facing a serious disruption in market access in the future is significantly increased. The profitability expected from exporting on a market that initiates an AD investigation is then altered for products other than those targeted as a result of the combination of these two effects, on demand and through signaling. This altered expected profitability may have an impact on the extensive margin, because it modifies the incentives to pay the sunk costs required to enter this export market (as Crowley et al., 2018, show to be the case, across markets for a given product, in response to the probability of tariff echoing); it can also influence the intensive margin, when it leads exporters to change the amount of marketing expenses they are prepared to incur on this market (Arkolakis, 2010). The magnitude of these effects is difficult to characterize in principle, but this signaling effect is likely to be significantly larger within a given sector, because this is the level at which firms can organize collectively to bring about AD cases, depending on their experience, bargaining power and coordination costs, as confirmed by the above-cited literature (Zanardi, 2004; Blonigen, 2006; Blonigen and Prusa, 2016).

Within-firm supply effects. Additional indirect effects are likely to occur within multi-product firms, when one of their export products is targeted by an AD case, for several reasons. A first one is that the channels already described are likely to be more intense in such a case, either because of strong complementarities between the targeted firm's products (fully compatible with each other, and in some cases designed to be used jointly), or because the probability of facing another AD case might be larger for other products of the same firm

(which would be the case if the firm were identified in the partner country as conducting unfair competitive practices).

A second reason for cross-product linkages being stronger within a given firm is the existence of economies of scope, when multi-product firms exploit the option of combining profitably production and/or export of different products (Panzar and Willig, 1981; Arkolakis et al., 2021). In such a case, the setback on exports of targeted products directly reverberates on associated products, by limiting the extent of these economies of scope. More generally, the literature about multi-product firms has shown how that trade liberalization may affect product scope in many different ways (see for instance Forslid and Okubo, 2023 and the references therein); this suggests that an AD action may affect multi-product firms beyond directly targeted products, with the consequences depending on the form of the joint production function. Bao et al. (2021), for instance, note that the within-firm chilling effect that they find is consistent with the case of a multi-product firm exhibiting a joint production function with increasing costs.

A third reason has to do with the firm's financial constraint: facing an AD initiation is bad news for an exporter, and it may weaken the firm's financial situation, leading it to reduce its risk exposure, and possibly to reconsider its export presence, so as to reduce the amount of associated fixed costs.

3   Data and empirical strategy

To analyze empirically these indirect impacts of AD actions, we combine two different sets of data. The first one, produced by China's General Administration of Customs, includes Chinese customs data for 2000 to 2011. It covers annual import and export transactions of every Chinese exporter and importer, with information on the firm (including identity, status and

location, but without any information on its production account or balance sheet), product (under Chinese 8-digit level classification, aggregated at the HS6 digits level), trade volume, trade value (FOB - free on board) and destination market of each transaction. The second set of data is the Global Antidumping Database (Bown, 2016), which provides detailed information on each AD investigation between 1980 and 2019. This information covers targeted product(s), investigating country, investigated country (or countries), investigation date, preliminary and final decision, and preliminary and final duty. Since this latter information on preliminary and final duties is available for a very limited number of investigations, we do not use it in our estimates. Similarly, we focus on AD investigations that result in trade sanctions.[3]

Our data does not allow to match the differentiated treatment faced by Chinese exporters in AD procedure. However, the background minimizes the concerns resulting from this missing information. Indeed, China's WTO Accession Protocol provided for a specific treatment of imports of Chinese origin for a transition period of 15 years. During this period, based on the premise that market economy conditions could not be assumed to hold in China unless they were "clearly show[n]" to "prevail" (Article 15, a, ii), the importer could use the so-called "analogue country" method to determine whether dumping had taken place or not. This status not only leaves much more wiggle-room to the importing country to prove the existence of dumping, it also limits the possibility for Chinese firms to require an individual treatment in AD cases. Accordingly, we will assume in the empirical analysis below that AD actions concern all exporters of targeted product(s). Should that assumption prove inaccurate in some cases, it would bias downward our estimates of within-firm impacts, by extending identification to a set of firms beyond those actually covered. Even in such a case, our estimates could be considered as lower bounds.

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[3]We thus disregard those cases abandoned during investigation or upon first judgement, i.e. generally within 18 months of initiation (11 months on average). In practice, it is often difficult to judge whether such a situation reflects a win by the defendant, or an unreported agreement reached between the parties.

The antidumping database is merged with firm-level customs transactions at the 6-digit level of the Harmonized System classification, the most detailed level available. Because of changing product classifications over time, we further adopt a concordance procedure that brings products defined in the HS6 nomenclature into a common classification that is consistent over time (Pierce and Schott, 2012; Beveren et al., 2012).

Because our analysis covers Chinese firm-level exports by destination and by product over 12 years, it relies on a large number of observations. Since we want to control for some unobserved determinants, many dummy variables are also going to be included, which raises concerns about computational feasibility. To ease constraints, we restrict the sample of Chinese exports to their top 30 destination markets (in value, over the entire period). These destinations account for 92.5% of Chinese exports. Since we want to control for three-way, firm-product-destination fixed effects, we further restrict the sample to firm-product-destination triplets for which exports are positive in at least two years over the period 2000–2011.[4]
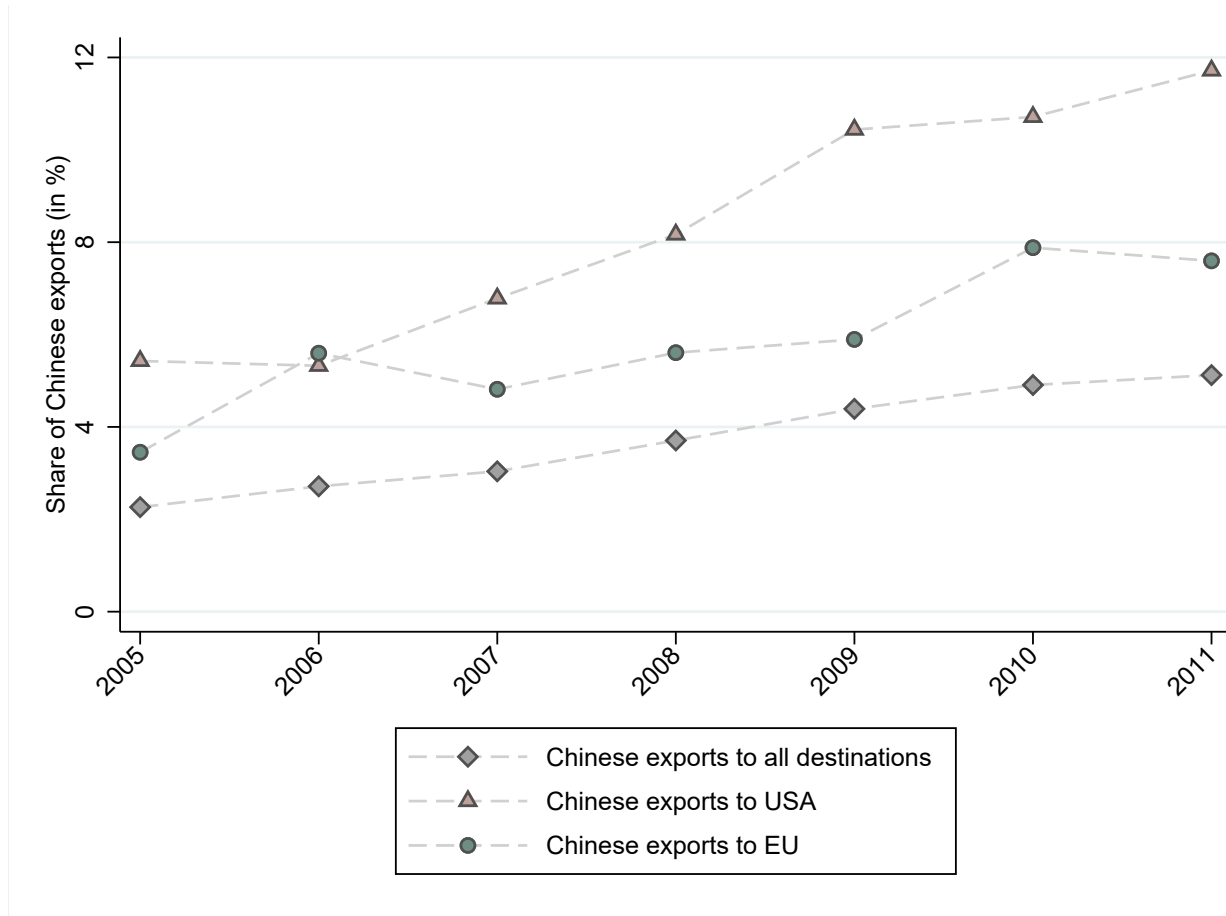
The resulting database includes 18.1 million observations, covering around 4 million firm-product-destination triplets; 57,686 firm-product-destination triplets are targeted at least once by an AD action. On average, newly targeted export flows in a given year account for 1.4% of Chinese exports during the pre-investigation year. This proportion is far lower than the coverage rate of AD actions, however, because actions are active for a variable (and often large) number of years. In fact, our database makes it possible to compute the coverage of AD actions on Chinese exports, based on pre-investigation shares in exports.[5] As illustrated in 1, this coverage rate has been increasing over time for total exports, reaching 5.1% in 2011. However, it was significantly larger in both the USA (11.7% in 2011) and the European Union

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[4]Keeping a triplet with only one observation would not change estimation results, since it would serve only to identify the corresponding fixed effect.

[5]We rely on shares computed for the year before investigation, because we deem it less distorted by the AD action itself, but other calculations, for instance in Bown (2021), are based upon the investigation year itself, which is a sensible alternative.

markets (7.6%).

Figure 1: AD coverage rate of Chinese exports

Notes: We plot the AD coverage rate of Chinese exports weighted by the value of targeted flows the year preceding the AD investigation. This coverage rate is under-estimated for the beginning of the period since we do not have trade data for AD cases initiated before 2001. We then plot the AD coverage from 2005 to 2011 .

For indirect impacts, we will be interested in two other categories of export flows: those within the same sector and the same destination country as products targeted by an AD action (within-sector)[6]; and those export flows emanating from a firm that is targeted by

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[6]The within-sector category includes multi-products firms exporting a product in the same sector as the targeted one, as well as firms exporting only non-targeted products in the same sector as the targeted one

Table 1: Descriptive statistics

	Number of observations				Export share (%)		
Year	All	T	WS	WF	T	WS	WF
2000	429,315	6,564	9,446	80,980	(.)	(.)	(.)
2001	595,304	9,812	15,241	116,595	0.44	0.74	8.01
2002	824,941	17,446	18,934	159,288	1.16	1.39	14.32
2003	1,026,183	17,949	19,852	183,826	1.24	1.00	15.14
2004	1,253,689	25,484	30,507	243,169	1.57	1.31	20.96
2005	1,474,550	34,133	39,539	310,126	1.90	1.27	23.57
2006	1,683,887	44,514	54,515	364,106	1.97	1.82	24.68
2007	1,882,224	55,678	65,611	399,846	2.22	2.10	26.61
2008	2,006,202	54,444	74,035	425,670	2.53	2.84	29.46
2009	2,091,107	67,668	85,204	449,320	2.98	3.12	29.60
2010	1,939,647	63,164	82,289	411,344	3.25	6.30	31.89
2011	1,700,652	59,294	75,748	373,179	2.99	3.18	30.05

Notes: T=Target; WS=Within-sector; WF=Within-firm. An observation refers to a firm-product-country non-zero export flow. By definition, the categories "Whithin-sector" and "Whithin-firm" in the columns 4, 5, 7 and 8 are non-exclusive from one another. Export share are constructed with respect to I-1, the year preceding the year of investigation. Consequently, our data sample (2000-2011) does not allow us to account for AD investigations occurring before 2001. The first years of the sample are thus underestimating the export coverage of AD investigations ans their spillovers.

an AD action on another of its export products, in the same destination country (within-firm). Summary statistics show that each of these three categories of exports (defined as non-exclusive from one another for the purpose of Table 1), possibly indirectly affected by AD actions, is quantitatively significant: compared to the value of targeted exports the year preceding the investigation, flows which are "within-sector" amount to 112% of the targeted value, while "within-firm" flows exceed the value of targeted ones by a factor of 10 (see Table 1).

Note that, each of these categories indirectly linked to an AD investigation displays, in the year before initiation, a trend in export growth significantly higher than the one observed for the control category. In this respect, they do not differ much from targeted exports, which does not come as a surprise since it has been well documented that AD investigations tend to target the most dynamic export categories, for obvious reasons (Blonigen and

Prusa, 2016). Still, this observation warrants using a difference-in-differences specification, as already emphasized.

Our interest lies in assessing the impacts of AD actions. Since we rely on yearly observations, the year in which the AD case is initiated, denoted I in what follows, tends to provide mixed evidence: depending on the month in which the investigation was initiated, variations observed over the full year may only partially reflect its impact. We thus discard observations for the initiation year in our baseline estimates, and identify the impact of AD actions based on the analysis of changes between the year immediately preceding $(I-1)$ and the one immediately following the investigation $(I+1)$.

Our task is further complicated by the fact that AD cases differ widely in duration. While we have information on the number of years covered by each investigation and by provisional or final duties, it is doubtful that the situation returns immediately to normal when sanctions lapse. To prevent such persistent effects from biasing estimates, we disregard observations concerning products directly or indirectly affected by an AD action, for years following the year after investigation.[7]

To limit the computational burden, most of our estimates are expressed in differences, instead of levels. This specification limits considerably the number of fixed effects to be estimated, thus alleviating the computational burden, and reducing drastically the number of nuisance parameters. This is of special relevance for firm-destination-product triplets involved directly or indirectly with an AD case, because only observations before initiation can be used to identify the three-way fixed effects. Placebo tests confirm that a strategy based on estimations in levels, involving a full set of fixed effects, is not reliable, presumably because of the difficulty of getting unbiased fixed effect estimates; in contrast, we will show estimations in differences to be consistent. The downside of this approach is that only one time-horizon can

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[7]Our final sample includes 1,058 product-destination pairs subject to AD between 2000 and 2011. A total of 27,700 Chinese firms are directly targeted by an AD investigation or sanction during this period.

be considered at a time (because the difference has to be computed with respect to the year before initiation of the AD investigation). Our baseline estimates thus consider a two-year difference and disregard observations after the time-horizon we are interested in. Longer time horizons will be considered subsequently, extending the same principles accordingly.

4   Product-level estimates

The empirical analysis is first carried out at the product level, *i.e.* based on Chinese trade statistics at the most detailed level of the Harmonized System (6-digit classification). Since the theoretical analysis above pointed out that AD actions' indirect impacts are likely to be significant mainly with products belonging to the same sector, the econometric assessment relies on the following empirical specification:

$$\triangle y_{pct} = \alpha_{pt} + \alpha_{ct} + \underbrace{\beta_1 \times Target_{pct}}_{\text{Direct effect}} + \underbrace{\beta_2 \times WithinSector_{pct}}_{\text{Spillover}} + \epsilon_{pct}, \tag{1}$$

where subscript p refers to the product (HS6 subheading) and c to the destination country, for year t. The dependent variable is computed as a difference-in-differences, based on a two-year time step in our baseline specification, so that $\triangle y_{pc,t} = (y_{pc,t} - y_{pc,t-2}) - (y_{pc,t-2} - y_{pc,t-4})$ in this case, which allows factoring in product-destination specific pre-trends (Finkelstein, 2007; Flaaen et al., 2020). This choice is warranted by two concerns. One is that information for the year of initiation of the AD investigation is difficult to interpret; while many papers have shown that imports are affected as of initiation (e.g., Li and Whalley, 2015; Besedeš and Prusa, 2017), with our yearly data it is not possible to differentiate cases based on the month when it was started, which is an obvious source of heterogeneity. Accordingly, we ignore the year of initiation, and focus on the year after. The second concern is that, far from being random, AD investigations tend to focus on dynamic imports (as discussed for

instance in [Blonigen and Prusa, 2016](#)). Pre-investigation trends should thus be taken into account if post-investigation outcomes are to be meaningfully interpreted.

Four outcome variables, y, are considered alternately, always in reference to Chinese bilateral, product-level export flows: (i) the log of the number of exporters, (ii) the log of export value, (iii) the log of export quantity, and (iv) the log of average export unit value. Product-time specific fixed effects α_{pt} control for product-level supply shocks affecting all Chinese exporters, while destination-time fixed effects α_{ct}, control for demand shocks.

The impacts of AD actions are assessed through two dummy variables: $Target_{pct}$, equal to one if product p exported from China is being subject to an AD investigation or sanction at time t in destination country c; and $WithinSector_{pct}$, our main variable of interest here, equal to one if an AD action is targeting at least one product belonging to the same heading as product p itself in the same destination country, while p itself is not directly targeted. Note that this indirect, within-sector effect is defined on a destination-specific basis.

In accordance with this empirical strategy, when an AD case is initiated for a given product in year I, observations are discarded for year I as well as for year $I + 2$ and following ones, for all products under the corresponding heading, because we deem them to be potentially contaminated by the indirect impacts of the AD case, in a way that we are not able to control for properly. AD actions' impacts in the year of initiation and two years down the road are studied separately below, with the strategy (based respectively on one-year and three-year time steps) being adapted correspondingly.

Direct impacts. No significant impact is found on the average unit value of targeted export products (column $\Delta UnitValue$, Table [2](#)). This finding may seem surprising, given that the regular reviews to which AD duties are subject might create an incentive for exporters to increase their price, in the hope that it would increase the odds of obtaining subsequently a decrease in the AD duty they are facing ([Blonigen and Park, 2004](#)). However, it is in line

Table 2: Product-level estimations of the impact of an AD investigation and its within-sector spillovers

Dependent variable:	$\triangle$#Firms	$\triangle$Value	$\triangle$Quantity	$\triangle$Unit Value
AD target in $I+1$	−0.15***	−0.36***	−0.39***	0.02
	(0.03)	(0.09)	(0.10)	(0.04)
AD within-sector in $I+1$	−0.02	−0.14**	−0.13**	−0.01
	(0.02)	(0.06)	(0.07)	(0.03)
Fixed-effects	pt ct	pt ct	pt ct	pt ct
Std. err	robust	robust	robust	robust
N	424,765	424,765	424,765	424,765
r2	0.20	0.17	0.18	0.20

Notes: All estimates include product-destination, product-time and industry-destination-time fixed effects. I refers to the initiation year of the AD action considered. Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

with Lu et al. (2013) and Felbermayr and Sandkamp (2020), who find no impact of AD duty on the export price of Chinese firms. And this does not dismiss the potential role of reviews, to the extent that downward re-evaluations of AD duties are less frequent when exports come from Chinese exporters, as shown by Nita and Zanardi (2013) for the EU. Noteworthily, in the context of the US-China tariff war, Amiti et al. (2019) show that Chinese exporters tend to pass on almost all additional tariffs to importers and consumers, a pass-through behavior that is consistent with the one evidenced in the present case.

For the other dependent variables, as expected, the assessed direct impacts of AD actions are strong and statistically significant. The number of Chinese exporters is reduced by 14% ($exp(-0.15) - 1 = -0.14$) in the year following an AD initiation, while exported values and quantities of targeted products fall by 30% and 32% respectively in the first year following the initiation of the AD investigation ($I+1$), compared to what their pre-investigation trend would have suggested. By any standard, these are substantial impacts.

Indirect impacts. Given our empirical specification, the indirect impacts of AD actions are assessed through the coefficients for the within-sector dummy variable. This indirect impact is not significant for unit values, which does not come as a surprise since even the direct impact was not found to be statistically significant in this dimension. Nor is any significant indirect impact found on the number of exporters. Strikingly, however, the indirect impacts are statistically significant and of the same sign as direct impacts for the two other variables: values and quantities. They are also substantial: exported values fall by 13%, and quantities by 12%. These magnitudes are rather large, amounting to more than a third of direct impacts. The fact that these impacts are qualitatively similar to direct ones also suggests that the substitution effects in demand mentioned above are not dominant in framing indirect impacts.

5 Firm-level estimates

Firm-level data allow a refining of the analysis, making it possible to investigate to what extent these indirect impacts manifest themselves within targeted firms. For the intensive margin of trade (export value, volume or unit value), the analysis relies on the following baseline specification:

$$
\triangle y_{fpct} = \alpha_{fpt} + \alpha_{ct} + \underbrace{\beta_1 \times Target_{pct}}_{\text{Direct effect}}
$$

$$
+ \underbrace{\beta_2 \times WithinSector_{pct}}_{\text{Within-sector spillover}} + \underbrace{\beta_3 \times WithinFirm_{fpct}}_{\text{Within-firm spillover}} + \epsilon_{fpct} \tag{2}
$$

This specification is a logical extension of equation 1. Here, subscript f refers to the exporting firm. As before, $\triangle$ refers to a two-year difference-in-differences. Note that firm-specific characteristics constant over time are absorbed through this differencing, meaning that only

variance over time is used for identification.

In addition to the already described $Target_{pct}$ and $WithinSector_{pct}$ variables,[8] a dummy variable is introduced to identify within-firm spillover effects: $WithinFirm_{fpct}$ is equal to one if firm f, while not being subject to any AD action on product p, is facing an AD action in country c on another product in year t (note, again, that this definition is destination-specific).[9]

The specification is slightly altered when analyzing the extensive margin. In this case, the dependent variable is not expressed as a difference; it is an export participation dummy equal to one if the firm did export the corresponding product on this market, during this year. Since this dependent variable is measured in level, three-way, firm-product-destination fixed effects are included so that, here again, only the longitudinal variance is used for identification.[10]

5.1 Baseline results

Direct impacts. In accordance with product-level results, the estimated direct impact on the unit value of targeted exports is not statistically significant (column $\Delta UnitValue$, Table 3). On the extensive margin, the participation probability is decreased by 3 p.p. for targeted exports. Given the average participation level among the universe of firm-product-destination triplets exhibiting at least one non-zero export flow over the period considered here (16.1%), this corresponds to a decline in participation of 19% in relative terms.

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[8]As already mentioned, any AD case is assumed to concern all exporters of targeted products. Accordingly, the $Target$ variable is not firm-specific, but only product-specific.

[9]We also included the interaction between $WithinFirm_{fpct}$ and $WithinSector_{pct}$, in order to investigate whether indirect effects of AD actions might be different for other products exported by targeted firms, within the same sector as the target. The interaction is not significant in all estimations. Results are available upon request.

[10]Only firm-product-destination triplets that export at least twice during the sample period are considered in the estimation, since other observations would not contribute to identifying the coefficients of the variables of interest, given the structure of fixed effects.

Table 3: Firm-level estimations of within-firm and within-sector AD spillovers

Dependent variable:	Participation	$\triangle$Value	$\triangle$Quantity	$\triangle$Unit Value
Target in $I+1$	−0.03***	−0.21***	−0.23***	0.02
	(0.00)	(0.05)	(0.06)	(0.02)
Within-sector in $I+1$	−0.00	0.00	0.01	−0.01
	(0.00)	(0.06)	(0.06)	(0.02)
Within-firm in $I+1$	0.00	−0.09**	−0.08*	−0.01
	(0.00)	(0.04)	(0.04)	(0.01)
Fixed-effects	fpc fpt ct	fpt ct	fpt ct	fpt ct
Std. err	robust	robust	robust	robust
$r2$	0.70	0.35	0.36	0.42
N	6,870,637	549,257	549,257	549,257

Notes: We estimate the direct (first variable) and indirect (three last variables) impact of AD investigation on the participation (column 1), the log first difference of bilateral firm-level export value (column 2), export volume (column 3) and unit value (column 4) from China to its 30 largest destination markets the year following an AD investigation ($I+1$) through OLS estimator over the period from 2000 to 2011. We include firm-product-destination, firm-product-time and importer-time fixed effects in each estimation and firm-product-destination fixed effects to estimate participation. Standard errors in parentheses are robust. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

On the intensive margin, estimated direct impacts are consistent with product-level estimates, keeping in mind that only firms maintaining their export presence on the market concerned in the year following the investigation are considered here: in terms of both values and quantities, their exports are decreased by approximately 20%, a result in line with recent studies (Chandra and Long, 2013; Lu et al., 2013; Felbermayr and Sandkamp, 2020). Given the insignificant impact on unit values, it is logical to find similar results for outcomes expressed in value and in quantity.

Indirect impacts. The nature and magnitude of indirect impacts differ substantially across the three dimensions considered here. No significant impact is found on any of the dimensions considered here for the within-sector category, *i.e.* for exports of products belonging to the same sector as a product targeted by an AD action, by a firm that is not directly targeted on any of its export products. Judging by these estimates, potential linkages associ-

ated with belonging to the same classification subheading are not strong enough to warrant any specific impact on these flows, once within-firm linkages are taken into account.

The results are more conclusive for targeted firms' exports of products other than targeted ones ("*Within-firm*"). While export participation and unit values are not found to be significantly affected for these flows, export values and quantities are estimated to be reduced by 9% and 8%, respectively. These statistically significant negative impacts, worth slightly less than half the direct impacts on targeted products, are quite substantial if one considers that the flows concerned are, by definition, not directly hit by the AD action.

Given that differences between impacts on export values and quantities are of limited interest in this context (since unit values are not meaningfully affected), we focus in what follows on export values.

6   Extensions

6.1   Alternative specifications

To investigate further the indirect impacts on export volumes within firms, we conduct estimates relying on alternative specifications. Given that the interaction term is not statistically significant in the baseline estimate, we first drop it in order to check whether it makes a significant difference for other variables; this is not the case (we checked that this also holds true on the other dependent variables presented in Table 3).

One might wonder whether these estimates, exhibiting insignificant within-sector indirect impacts, are consistent with product-level ones. The difference is likely explained by the collinearity between the within-sector and within-firm variables; a significant share of within-firm export flows actually belong to the same sector as targeted products, and thus are also

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Table 4: Firm-level estimations of within-firm and within-sector AD spillovers

Dependent variable:	$\triangle$Value	$\triangle$Value	$\triangle$Value	$\triangle$Value
Target in $I+1$	−0.25***	−0.21***	−0.25***	*n.d.*
	(0.04)	(0.05)	(0.05)	
Within-sector in $I+1$	−0.12***	−0.00		
	(0.04)	(0.05)		
Within-firm in $I+1$		−0.09**	−0.12***	−0.13**
		(0.04)	(0.03)	(0.05)
Fixed-effects	fpt ct	fpt ct	fpt ct	fpt pct
Std. err	robust	robust	robust	robust
$r2$	0.35	0.35	0.35	0.50
N	494,855	549,257	508,938	426,027

Notes: We estimate the direct (first variable) and indirect (two last variables) impact of AD investigation on the log first difference of bilateral firm-level export value from China to its 30 largest destination markets the year following an AD investigation ($I + 1$) through OLS estimator over the period from 2000 to 2011. We include firm-product-time and importer-time fixed effects in each estimation and product-importer-time fixed effects in column (4). Standard errors in parentheses are robust. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

within-sector export flows. In fact, we checked whether removing the within-firm dummy variables in the estimation resulted in a significantly negative estimate of within-sector indirect impacts. Our finding suggests that the product-level estimate of significant within-sector indirect impacts actually reflects within-firm, rather than specifically within-sector, linkages. Put differently, products belonging to the same sector but exported by firms that do not export targeted products are not found to be significantly affected. It is therefore consistent, based on firm-level data, to consider that within-sector indirect impacts are insignificant.

Accordingly, we then drop the within-sector variable, which is not significant either and is likely to present some multilcollinearity with the within-firm variable. Estimates are not qualitatively changed in this case, but the estimated within-firm indirect impact is slightly higher (-0.12 log points, *i.e.* -11%).

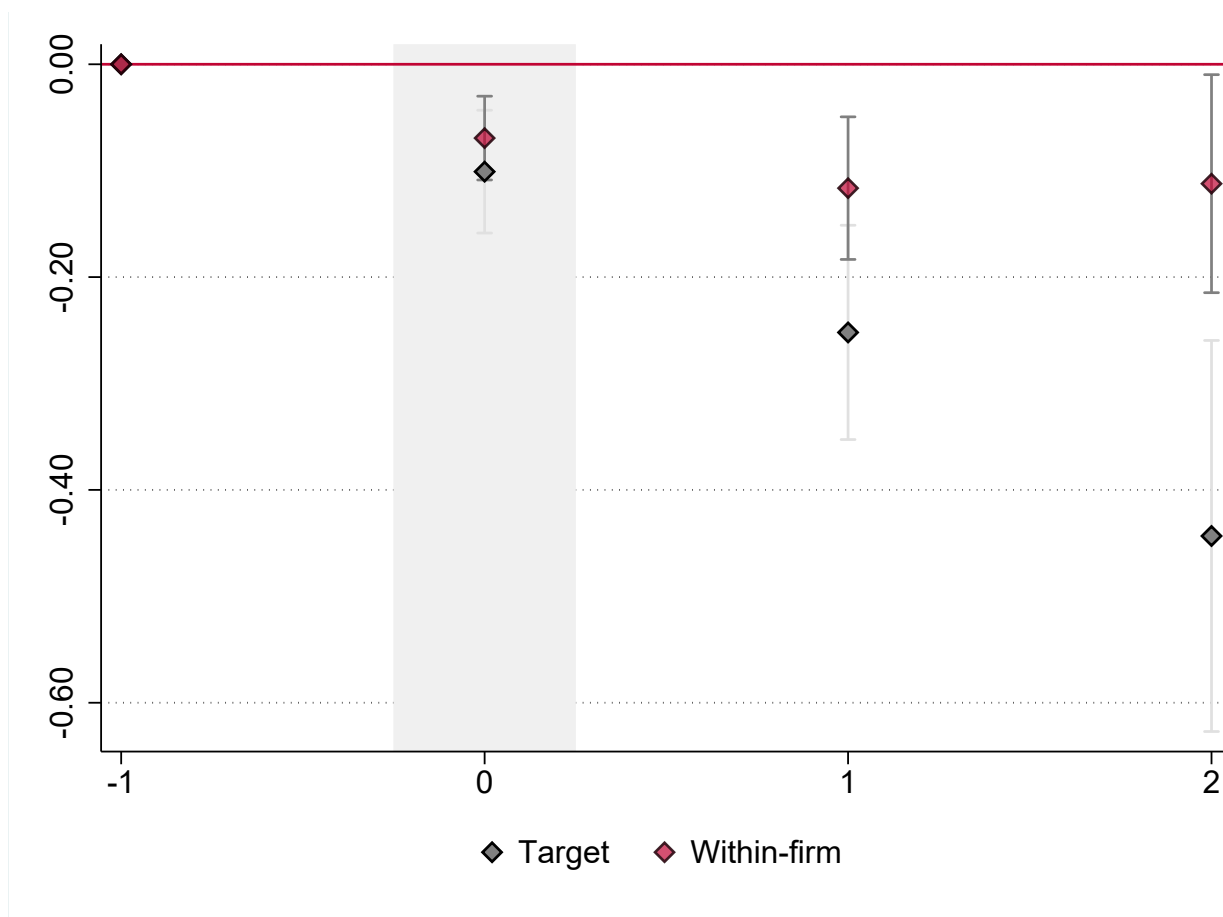To check further the robustness of our estimates, we then included an even more complete

structure of fixed effects, by adding three-way product-country-time fixed effects, instead of the country-time fixed effects used previously. Such fixed effects may control possible demand effects specific to a given product in a given country. They would make it impossible to identify either within-sector indirect impacts such as the ones considered before, or impacts on targets, which would both be absorbed in fixed effects; however, they do not prevent using differences across products within a given exporting firm to identify within-firm indirect effects. As a matter of fact, estimated within-firm indirect effects are not meaningfully altered under this alternative specification.

6.2 Impact over time

As already mentioned, the dependent variable in our baseline specification is expressed as a difference-in-differences; combined with doubts about the reliability of information about the initiation year, which may be differently affected by the AD action depending on the month of initiation, this led us to use two-year differences in this default specification, and focus on impacts in the year following initiation $(I + 1)$, as compared to the year before $(I - 1)$. However, this approach can be adapted to analyze impacts in the year of initiation (based on one-year differences), or in the second year following initiation (based on three-year differences).[11]

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[11]We refrained from extending further time lags, because that would limit excessively the number of usable observations.

Figure 2: Estimated direct and (within-firm) indirect impacts over time of AD investigations of Chinese bilateral exports

Notes: The graph reports the direct (Target) and indirect (Within-firm) impacts of AD investigations, as estimated based on equation (2). The bars represent 95% confidence intervals.

The estimates point to indirect impacts that are smaller during the initiation year (export volumes decreased by 7%), and more or less constant during the following two years (-11% to -12%, see Figure 2). They are always smaller than direct impacts, which, in addition increase more steeply over time, with export values decreased by 10% on the year of initiation, 22% one year later and 36% the following year. These results show that, consistently over time, indirect impacts amount to a significant proportion of direct impacts in terms of intensity, between one quarter and two thirds.

6.3 Heterogeneity across firms

To investigate how the impacts of these AD actions vary across export flows and firms, we use alternative classifications of export flows, allowing in each case AD impacts to differ across categories.

The first classification refers to unit values, distinguishing between flows for which it is lower than the product-specific median for the year concerned ($"Cat_0"$) and the rest. Unit value is a natural dimension to consider, to the extent that dumping itself is defined on this basis. In addition, as already mentioned, the prospect of future reviews of AD duties influences firms' reactions, and may lead them to increase prices more for underpriced exports, with negative consequences on sales (Blonigen and Park, 2004). In fact, we find export flows with below-median unit value to be more strongly affected, when they are directly affected, than flows with above-average unit value (Table 5). In contrast, however, the magnitude of indirect impacts does not differ significantly across these two sub-categories.

The second classification is based on export flows' value, with the default category ($"Cat_0"$) including firm-level flows with a value lower than the yearly product-specific median. This shows that both direct and indirect impacts are significantly larger (by a factor of 2 and 3, respectively) for small flows than for large ones. This pattern may simply reflect the larger inertia and market power associated with larger export flows. Interestingly, this differential response is similar for indirect and direct impacts.

Finally, given the specific nature of the Chinese economy, it is also worth considering whether state-owned enterprises (SOEs) behave differently from other firms. Our estimates suggest this is indeed the case: private firms (the default category in this case) are more strongly affected than SOEs, both through direct impacts on targeted products and through indirect impacts on their other, untargeted export products. This difference might reflect differences in objectives and constraints, between SOEs and private firms.

Table 5: Firm-level heterogeneous impact of within-firm and within-sector AD spillovers

Dependent variable: $Category_{0/1}$ based on:	$\triangle$Value Unit value	$\triangle$Value Value	$\triangle$Value SOE vs non-SOE
Cat_0	0.20*** (0.01)	2.97*** (0.01)	0.00 (.)
$Cat_0 \times$ Target in $I+1$	−0.28*** (0.07)	−0.44*** (0.16)	−0.59*** (0.19)
$Cat_1 \times$ Target in $I+1$	−0.23*** (0.07)	−0.21*** (0.05)	−0.22*** (0.05)
$Cat_0 \times$ Within-firm in $I+1$	−0.10** (0.05)	−0.18* (0.09)	−0.17*** (0.06)
$Cat_1 \times$ Within-firm in $I+1$	−0.13*** (0.04)	−0.06* (0.03)	−0.10** (0.04)
Fixed-effects	fpt ct	fpt ct	fpt ct
Std. err	robust	robust	robust
$r2$	0.35	0.46	0.35
N	508,938	508,938	508,938

Notes: Estimates are based on equation (2), adapter for the change in independent variables. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

7 Conclusion

For a powerful yet focused instrument such as AD, it is logical to suspect that bilateral exports might be affected beyond directly targeted products. Figuratively, one can suppose a kind of blast effect, through which the punctual protectionist effects on targeted products spill over neighboring ones; but diversion effects are also possible, whereby exporters would switch their efforts to different products, thus alleviating the restrictive impact on total exports.

Based on detailed product- and firm-level data about Chinese exports over the period 2000–2011, we find evidence of such indirect impacts on bilateral exports: our estimates suggest that AD investigations significantly reduce exports by targeted firms of products other than directly targeted ones. The impact is substantial, amounting to a 9% decline of export value

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for these untargeted, within-firm exports, in comparison to pre-investigation levels. This is almost half the estimated impact on average on targeted products (although those are also affected on the extensive margin, through reduced export participation). This indirect impact is also larger for export flows that are initially smaller, and it is smaller for SOEs. The extensive margin (the scope of exported products) is not significantly affected.

The resulting impact on exports is sizeable, because for firms targeted by an AD investigation, the total value of exports of untargeted products is approximately ten times larger than exports of targeted products (see descriptive statistics in Table 1). This means that, while being shallower, these indirect impacts may actually restrict bilateral exports far more than direct impacts, with a total magnitude about five times larger according to our estimates. While further research is warranted to extend and deepen the analysis, these findings give concrete substance to the often-heard argument that AD investigations, beyond their direct effects, also have a chilling effect.

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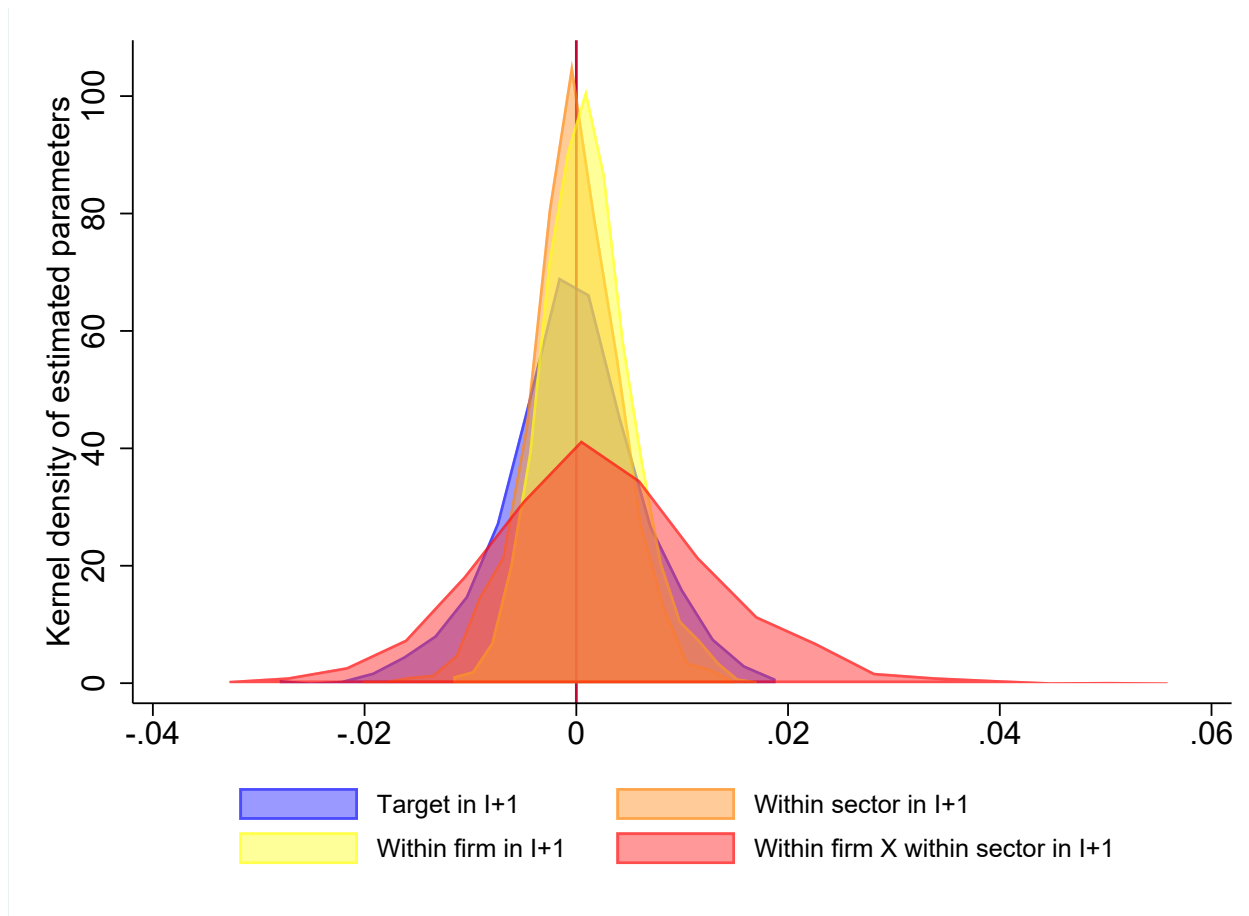
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Given the complex framework in which estimates are carried out, notably the fact that we discard observations for flows directly or indirectly linked to an AD action after the year following initiation, it is useful to check that this specification does not entail any bias.

To do this, we conducted placebo tests, in which we randomly assigned antidumping investigations to product-destination-year triplets, keeping their total number unchanged for the 2000-2011 period. The baseline specification is then re-estimated for each random draw, a process repeated 150 times for estimates on participation (extensive margin, heavier from a data point of view) and 1000 times for estimations on export value (intensive margin).

The densities of coefficient estimates obtained from these placebo tests, presented in Appendix (figures 3 and 4), appear to be well-behaved and centred around zero, supporting the view that our benchmark specification does not entail any systematic bias.
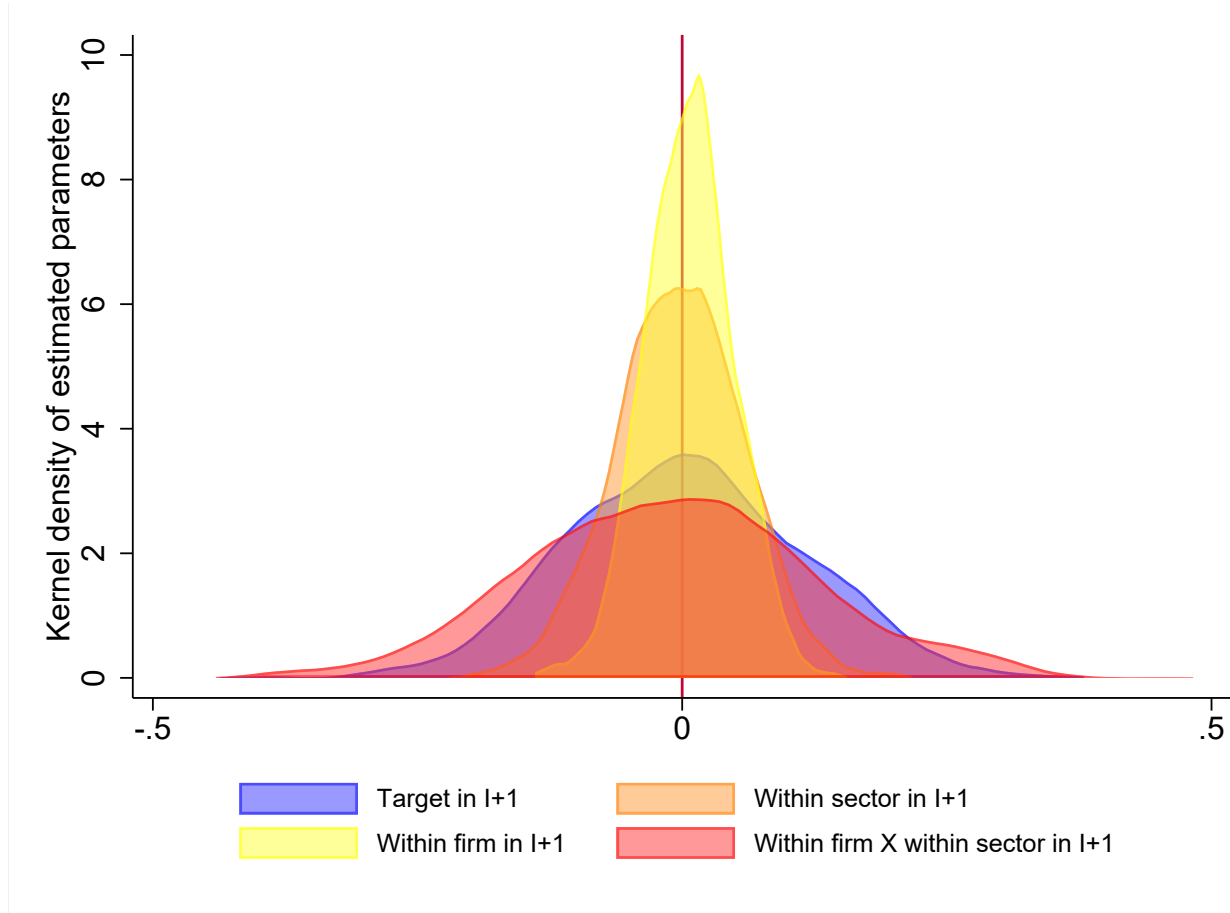
Figure 3: Placebo test, extensive margin

Notes: We plot the density of baseline regression coefficients after randomising product-destination-year triplets facing an antidumping investigation 150 times: (i) target (ii) within-sector (iii) within-firm (iv)

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within-firm X within-sector on firms export participation.

Figure 4: Placebo test, intensive margin

Notes: We plot the density of baseline regression coefficients after randomising product-destination-year triplets facing an antidumping investigation 1000 times: (i) target (ii) within-sector (iii) within-firm (iv) within-firm X within-sector on firms export value.