Destruction and Deflection: Evidence from American Antidumping Actions against China

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Abstract

With a decrease in tariffs around the world, antidumping duties, as an important part of temporary trade barriers, have increased dramatically to take their place. China and the United States (US) are the two heaviest targets and users of antidumping investigations respectively. In this paper, using Chinese annual transaction-level export data from 2000 to 2017, we study trade destruction effect and trade deflection effect of all antidumping investigations initiated by the US against China. We find strong evidence of both destruction and deflection effects. American antidumping actions reduce China's exports to the US, while increasing exports to non-US countries. Critically, trade destruction and deflection effects are long-lived, and industry indicators (including industry employment, industry concentration and capital intensity) play significant roles in deflecting trade. In general, the impact of antidumping actions could be greater than what the direct effect alone might suggest.

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1. Introduction

Antidumping investigations have surged since the inception of the WTO. It is recognized that the WTO has played an active role in reducing traditional tariff barriers and promoting trade liberalization (Ossa, 2011). However, while the use of traditional trade barriers was restrained, less transparent nontariff barriers (NTBs), including antidumping duties, countervailing duties and safeguards, emerged as the trade policy of choice for developed and developing nations alike (Prusa, 2001). According to a WTO report, 57 countries initiated 5725 antidumping investigations against 106 countries during the period from 1995 to 2018 (WTO, 2019). In addition to traditional antidumping users, including the European Union and the US, new users (primarily developing countries) have initiated antidumping investigations at unprecedented rates.

China has been the world's major target country of antidumping investigations for many years, according to the antidumping statistics of the WTO, mainly due to China's rapid export growth after its accession to the WTO. In 1995, antidumping investigations and measures against China accounted for 13 and 23 percent of global antidumping investigations and measures respectively. By 2018, these values had risen to 30 percent. A large part of the growing number of antidumping investigations and measures against China is initiated by the US (Lee et al., 2016). Between 1995 and 2018, the US launched approximately 165 antidumping investigations and implemented nearly 129 antidumping measures against China, that is, 78% of American antidumping investigations against China led to the implementation of antidumping measures, higher than the world average (74%). According to GATT 1994, 'dumping' is defined as the practice of marketing a given product in an importing country for a price that is less than its 'normal value' in the exporting one (WTO, 2019).

Given the above observations, two important questions arise: What happens to China's exports once they face antidumping investigations or even antidumping measures initiated by the US? Do these effects differ significantly across industries? The aim of our paper is to provide answers to these questions. Although it might seem intuitive that antidumping duties might affect the trade flows of the named country and the country that issued an antidumping duty in the form of trade destruction (decreased exports of the targeted product to the duty-imposing country), upon further reflection, a host of other possibilities also emerge. Antidumping duties might affect the trade flows of the targeted and non-involved countries in the form of trade deflection, that is, named countries begin exporting the product involved to other countries where they are not subject to the antidumping duty, or the targeted countries instead start selling more domestically. Therefore, to analyze the impact of American antidumping actions against China on the exports of the products involved, our paper focuses on the trade destruction and deflection effects.

As the most direct effect of antidumping actions and the one that can best reflect the purpose of duty-imposing countries, the trade destruction effect has attracted research interest of various scholars. Substantial amounts of research on the trade destruction effect has been undertaken with initial research focused on developed countries (Prusa, 2001). Sandkamp (2020) took the EU enlargement as a natural experiment to estimate the antidumping duties effects on prices and volumes of imports through difference-in-difference method. Empirical results indicated that trade destructing effects may be larger than previously thought, especially for those imports from non-market economies, which fall much more due to the larger average antidumping duties they receive. As nontraditional users such as China and India have become the leading users of antidumpting complaints (Bao and Qiu, 2011), research on trade destruction effect has expanded to developing countries (Lee, Park and Cui, 2013). Park (2009) investigated the impacts of China's antidumping activities on trade and trade patterns, with significant trade depressing and trade diversion effects found. Aggarwal (2010) studied trade effects of antidumping duties levied by India over the 1994-2001 period based on difference generalized method of moments (DIF-GMM) method. Empirical results showed evidence of both restrained trade (both volume and value) and raised import prices. The research subject has also deepened from measuring the impact magnitude at the national level (Ganguli, 2008) to that on the heterogeneous firm level (Lu, Tao and Zhang, 2013). Chandra (2017) used DIF-GMM method to analyze the trade effects of antidumping measures from the national level and found strong evidence of trade destruction and diversion effects. Based on a firm-level gravity model, Felbermayr and Sandkamp (2020) looked at how firms response dissimilarly to antidumping measures. They found that smaller exporters are more heavily affected than larger ones. Antidumping measures induce firms exit without affecting producer prices.

In recent years, the trade deflection effect has gradually generated attention from scholars, especially those who want to do further research in reactions of targeted countries to antidumping measures. However, there are inconsistent conclusions for various research subjects and periods. Durling and Prusa (2006) found weak evidence of the deflection effect in an analysis of global hot-rolled steel market from 1996 to 2001. Similarly, Bown and Crowley (2006) and Avsar (2017) confirmed international externalities associated with antidumping measures using Japanese and Brazil export data, respectively. By contrast, Bown and Crowley (2010) found no systematic evidence of trade distortions to third market for antidumping measures imposed to China prior to its accession to WTO. As we focus on data after China's WTO accession, we do not intend to compare their results with ours. China is no longer a "new" entrant to the global trading system, and it is interesting to use the latest data to investigate whether Chinese firms have established the necessary networks to deflect trade to alternate markets. In other words, our research can be used as a supplement to previous studies.

There are several papers investigating China's deflection effect after its accession to WTO, with inconclusive results. For example, Liu and Shi (2018) found evidence of the deflection of China's exports to certain third countries, while Lu et al. (2013) found no evidence of trade deflection when exploring China's exports to the rest of the world (all countries except for the duty-imposing country). Considering the research gaps in these papers, it is necessary and meaningful to conduct further research. Firstly, a vast majority of papers only investigate exporters' responses to antidumping investigations at different stages without considering the effect of industry characteristics, which is a crucial factor to consider when exploring trade effects of antidumping actions (Sabry, 2000). Bown and Crowley (2007) and Chandra (2016) used labor productivity to measure industry-level production cost. Apart from labor productivity, industry climate is also a crucial factor measuring cost of production. Therefore, this paper employs industry concentration, capital intensity and industry employment to measure industry characteristics and cost difference across industries. Second, most papers focus solely on the trade deflection effect in the initiation, preliminary duties and final duties stages, without considering long-lived impact of antidumping measures. In view of the possible lag in the deflection effect, such as time required to establish a branch overseas to bypass trade barriers, deflection effects must be measured over the longer term.

Overall, there are two important contributions in this paper. Firstly, this paper fully explores the correlation between industry characteristics and targeted countries' response to antidumping measures on the basis of latest trade data since China's accession to WTO. Our analysis uses a data set at the product-industry-year level, so we can identify the effects based on certain industry-specific characteristics. Secondly, most of the papers listed above fail to look at the year-by-year trade impacts during the implementation of antidumping duties. This paper comprehensively measures trade effects from the initial stage to the three years following antidumping implementation, thereby avoiding the inaccurate estimation results caused by the possible lag.

Using Chinese annual transaction-level export data from 2000 to 2017, classified at the 6-digit Harmonized System (HS) commodity level from the US International Trade Commission, we study the destruction and deflection effects of all antidumping investigations initiated by the US against China between 2003 and 2014. Following the methodology first developed by Bown and Crowley (2007), we find strong evidence of both the destruction effect and the deflection effect. These results are found to be robust in a series of checks on various potential data and estimation issues, such as validity checks on the DIF-GMM estimation, export quantity data (instead of value data), the exclusion of antidumping duty rate deviations, the exclusion of antidumping cases under investigation by the US, and differential effects across industries with different industry characteristics.

The remainder of this paper is organized as follows. Section 2 presents a brief sketch of the theoretical model underlying our hypotheses and describes our econometric methodology. Section 3 reports the sources of data used in this paper and variable construction. In section 4, we report and discuss our main results, and section 5 provides concluding remarks.

2. Econometric methodology

2.1 Theoretical model

Our main hypothesis is that (i) imposition of an NTB would reduce the exports of the named country to the policy-imposing country (trade destruction) and increase its exports to non-involved countries. The reduced-form theoretical model underlying our hypothesis is based on Bown and Crowley (2007).

Following Bown and Crowley (2007), let us assume that there are three countries (A, B and C), each with a single firm producing a single good. Then assuming further that each firm faces an increasing marginal cost, that each firms are engaged in Cournot competition in the other firms' markets, and their products produced for domestic consumption and export are strategic substitutes. The objective of each firm is to choose the levels of output and sales for each market to maximize its profits:

$$\max_{mij} \pi_i = \sum_j \left[p(Q_j) m_{ij} - \tau_{ij} m_{ij} \right] - c(x_i), \quad (1)$$

where x_i is firm i's total sales in each market, m_{ij} is firm i's output sold in market j,

$p(Q_j)$ is the inverse demand in country j, τ_{ij} is the antidumping duty imposed by country j on imports from country i, and $c(x_i)$ is firm i's cost function. Taking the first-order conditions, we obtain:

$$\frac{\partial \pi_i}{\partial m_{ij}} = P(Q_j) + P'(Q_j)m_{ij} - \tau_{ij} - c'(x_i) = 0. \tag{2}$$

By solving first order conditions for each $j \in \{A, B, C\}$, firm i can get its best response to the sales decision of the other two firms. Solving the nine response functions simultaneously yields the Cournot Nash equilibrium quantities sold by each firm in each country. Specifically, the nine first order conditions are totally differentiated and divided by $d\tau_{ba}$, then Cramer's rule is applied to yield the signs of the comparative static effects on the domestic output and exports of all three firms of an increase in τ_{ba} (country A's tariff on country B's imports). It is shown that $dm_{ba}/d\tau_{ba} < 0$; that is, a tariff imposed by country A against country B would reduce country B's exports to country A (trade destruction). Moreover, $dm_{bc}/d\tau_{ba} > 0$; that is, a tariff imposed by country A against country B would increase country B's exports to country C (trade deflection).

2.2 Basic empirical model

To investigate the questions identified by the theoretical model, we develop the following reduced-form specification for the Chinese export value of product i based on equation (3):

$$\ln export_{i,t_j} = \beta_0 + \beta_1 \ln export_{i,t_j-1} + \beta_2 \ln RE_{i,t_j} + \beta_3 \ln GDP^{im}_{i,t_j} + \beta_4 \ln GDP^{ex}_{i,t_j} + \beta_5 initial_i$$
$$+ \beta_6 t_j \ln duty_i + \beta_7 \ln Share_{i,t_j} + \beta_8 \ln C_{k,t_j} + \mu_i + \gamma_{t_j} + \varepsilon_{i,t_j}, \tag{3}$$

where i denotes a 6-digit HS product and t_j (j=-3,-2,-1,0,1,2,3) denotes time in years. Specifically, t_0 corresponds to the antidumping investigations period, t_j (j=1, 2, 3) corresponds to the three years following the final antidumping decision, and t_j (j=-3, -2, -1) denotes the three years before antidumping investigations. The index k denotes an industry aggregated at the 2-digit HS level, i.e., the products $i = 1 \ldots i'$ map into the industries $k = 1$, $i = i' \ldots i''$ map into $k = 2$, and so on until $i = h^* \ldots H$ map into k = K.

The variable $export_{i,t_j}$ denotes the value of exports from China of product i at time t_j, GDP^{im}_{i,t_j} denotes the importing country's real GDP index, while GDP^{ex}_{i,t_j} denotes the exporting country's real GDP index, and $RE_{i,tj}$ is the real exchange rate between the dollar and RMB. The variable $initial_i$ is a dummy variable that takes value one if product i was investigated in a certain year, zero otherwise, and $duty_i$ denotes the AD duties imposed by the US on Chinese export i. To avoid the antidumping duties taking value zero in the t_j (j=-3,-2,-1) period, which would make it impossible to take the logarithm, we add one percent to each period's antidumping duties. The variable $share_{i,tj}$ represents the market share of product i in the US market, which is the ratio of the import value of product i from China to its total import value. Finally, China's exports of a given product could also be affected by industry-specific variables (C_{k,t_j}) such as a cost or a productivity shock in China.

2.3 Estimation strategy

There are two problems to address in the estimating equation (3). First, the autocorrelation of $export_{i,tj}$ implies that least squares estimation of (3) yields biased estimates. Second, in a short panel, the number of parameters to be estimated (μ_i and γ_{tj}) increases with the number of products and time length. Thus, μ_i and γ_{tj} cannot be consistently estimated.

To address both of these problems, we estimate the first difference of (3) using the DIF-GMM estimator proposed by Arellano and Bond (1991), in which multiple lags of the level of the dependent variable are used as instruments for lags of the first difference of the dependent variable. We thus use GMM to estimate the following:

$$\Delta \ln \exp ort_{i,t_j} = \beta_0 + \beta_1 \Delta \ln \exp ort_{i,t_j-1} + \beta_2 \Delta \ln RE_{i,t_j} + \beta_3 \Delta \ln GDP^{im}_{i,t_j} + \beta_4 \Delta \ln GDP^{ex}_{i,t_j}$$
$$+ \beta_5 initial_i + \beta_6 \Delta t_j \ln duty_i + \beta_7 \Delta \ln Share_{i,t_j} + \beta_8 \Delta \ln C_{k,t_j} + \Delta \varepsilon_{i,t_j}, \tag{4}$$

The validity of the DIF-GMM estimate depends on the validity of the instrumental variables (IVs) and the assumption that the disturbance term does not have a high-order sequence correlation. To improve the validity of the IVs estimates, this paper reduces the possibility of weak IVs by controlling for IVs lag order. In addition, the Sargan test is used to test the validity of IVs. When the p-value of the Sargan test is greater than 0.05, the selection of IVs are valid. Although Hansen test is superior to the Sargan test in terms of robustness, its results are easily affected by the number of IVs. Therefore, this paper employs Sargan test to look at the validity of IVs. Furthermore, to address the autocorrelation problem affecting the disturbance term, we use an autoregressive process of order 2 (AR(2)) test. When the p-value of the AR(2) test is greater than 0.05, there is no second-order autocorrelation in the disturbance term. The following results of these two tests indicate that our DIF-GMM estimates are valid and credible.

Difference in difference method is another commonly used means to look into the impacts of antidumping duties by comparing difference among control group and treated group, whose accuracy depends on the parallel trend premise and the choice of appropriate control group. However, the unique social system and development path making it difficult to choose a comparable control group with China. Also, DIF-GMM is more suitable in cases contain endogenous variables and predetermined explanatory variables. Therefore, this paper chooses DIF-GMM method as the estimation method.

3. Data and variable setting

In this section, we discuss the construction of the variables used in the estimation of equations (3) and (4) and our data sources. Table 1 summarizes variables description and our predictions about the signs of the estimated coefficients, as well as providing summary statistics.

(Insert Table 1 about here)

3.1 Trade variables

First consider the dependent variable in the estimation of equation (4), $\Delta \ln export_{i,t_j}$, which is the annual growth of China's exports of product i. In the analysis of the trade destruction effect, this variable represents the annual growth of China's export value of product i to the US in year t. By contrast, $\Delta \ln export_{i,t_j}$ represents the annual growth of China's exports of product i to non-US countries in year t_j in the analysis of the trade deflection effect. Annual data on the nominal value of exports into US and non-US countries for more than 200 6-digit HS products for the years from 2000 to 2017 comes from the United Nations (UN) Comtrade Database. In our robustness checks, we replace export value with export volume to measure how export quantity will be affected by antidumping duties. $\Delta \ln share_{i,t_j}$denotes changes in the market share of product i in the US market. Import penetration ratio as a crucial international economic factor, has an influence on the decisions on antidumping investigation (Mah and Kim, 2006) and the trade volume of targeted goods during the implementation period of antidumping duties (Lee, 2017). For example, based on the antidumping investigations initiated by the USA against China between 1998 and 2006, Lee (2017) found that the greater the market share of Chinese goods in the US market is, the smaller the negative impact of antidumping duties on these products and the larger the exports even after the implementation of the final antidumping measures. We therefore incorporate this variable into the empirical analysis to test its applicability under the current international situation with the rise of trade protectionism.

3.2 US antidumping variables

Our main variables of interest (antidumping duties) come from the Global Antidumping Database (GAD) of the World Bank (Bown, 2016). This database provides detailed information on the use of new contingent antidumping measures by more than 30 countries. The GAD database has detailed information on each antidumping case, such as product information (classified at the US HS 10-digit level), the initiation date and final determination dates and duties. Because the most disaggregated product level that is comparable across countries is at the 6-digit harmonized commodity level, we conduct our analysis at the 6-digit level.

For our analysis, we collect information on all US antidumping cases against China during our sample period (i.e., 2003–2014). There are 242 US antidumping cases against Chinese exporters during that period. Two hundred and five cases out of a total of 242 cases ended with affirmative final International Trade Commission (ITC) determinations (referred to as successful cases). As our analysis examines the effects of antidumping investigations at four different stages (i.e., initiation, final ITC determination and two years after final determination), we focus on the sample of 205 successful cases in the main analysis. Specifically, we create an indicator *initiali* to measure the investigation effect, which takes value one if product i was investigated in year t_j and zero otherwise. According to Staiger and Wolak (1994), even an antidumping investigation could have an adverse impact on the affected product. Therefore, we expect the coefficient of *initiali* to be negative. For the antidumping policies, we interact a variable indicating that the policy was imposed on product i in year t_j with the level of the antidumping duty that is imposed. According to Prusa (2001), antidumping duties decrease the named country's exports to the duty-imposing country. Thus, we expect the sign of $t_j \ln duty_i$ to be negative in the analysis of the destruction effect. Based on the study of Liu and Shi (2018), China is no longer a "new" entrant to the global trading system, and China has established the necessary networks to deflect trade to alternative markets. Therefore, we expect the sign of $t_j \ln duty_i$ to be positive in the analysis of the deflection effect.

3.3 Macroeconomic variables

Several science evidence indicated that macroeconomic situation of the overall economy have long run equilibrium relationships with the initiation and decision making of antidumping investigations, including exchange rate as the international economic factors and real GDP growth rate as the domestic economic factor (Knetter and Prusa, 2003; Mah and Kim, 2006). More specifically, a slump in economic activity in the importing country makes it more likely domestic firms perform poorly which may facilitate the initiation of antidumping investigations (Knetter and Prusa, 2003). We thus expect an increase in the real GDP index of the importing countries to be associated with higher Chinese exports. Also, Knetter and Prusa (2003) indicated that a weak domestic currency will decrease the chance of injury to foreign firms and make them less likely to initiate antidumping investigations. Thus, we expect a negative sign on the coefficient of the real exchange rate.

To obtain the macro-level variables, we use the International Financial Statistics from the International Monetary Fund as our primary source. We collect the real GDP index (the ratio of the real GDP of the current year to the real GDP of the base year (2010)) for China, the US and non-US economies in the sample. We collect the information on real exchange rates from the Bank for International Settlements.

3.4 Industry-level variables

Next, we use three indicators to describe Chinese industries features: industry employment, industry concentration and capital intensity. This addresses concerns related to the effect of omitted variables, such as industry productivity improvements, that would be associated with the imposition of an NTB on a particular industry and subsequent export changes. Nevertheless, how these indicators impact productivity changes are uncertain. Industry employment and industry concentration can reflect the size and agglomeration extent of industry. On the one hand, industries with large size and market share are conductive to format economies of scale to lower cost and attract investment to promote technical progress (Li et al., 2020). On the other hand, for state-owned enterprises that lack effective incentives and supervision mechanisms, free-riding is prone to occur among numerous employees, hindering further innovation and productivity improvement. To survive amid fierce market competition, small-scale enterprises often adopt a series of incentive measures aiming at boost productivity and technical innovation, which are more easier to implement and achieve desirable results, compared with large companies. Capital intensity can reflect the investment status and the asset scale of the industry, which are the basis for the industry’s technological research and further development. Firms with higher capital intensity tend to be more competitive in export markets (Bernard et al., 2007). However, when companies face strong domestic competitive pressure and low international market entry costs, companies with lower capital intensity will also tend to export (Lu, 2010).

Chinese industry data at the 2-digit HS level for the years 2000-2017 comes from the National Bureau of Statistics. We use data on number of employees, number of firms and total fixed assets to construct three productivity measures: the changes in industry employment, industry concentration and capital intensity. In terms of industry classification, this paper adopts the industry classification standard from Sheng (2002), which integrates the Chinese Industrial Standard Classification, the International Trade Standard Classification and HS code to compile the corresponding industry conversion table.

4. Empirical results

4.1 Benchmark results

Our main estimates from equation (5) are reported in Tables 2 and 3. Table 2 presents the empirical results of the trade destruction effect. Our benchmark results is listed in the first column in Table 2. The coefficients on the "trade destruction" variables ($t_j \Delta \ln duty_i$) have the expected negative signs, which indicates that antidumping duties imposed on Chinese products by the US significantly reduce their exports to the US. According to Article 11 of the antidumping agreement (WTO, 2019), dumping duties shall normally terminate no later than five years after first being applied. Therefore, we argue that antidumping duties have a long-term impact on exports of targeted products and use three-year export data on targeted products subject to antidumping measures to verify it. The negative sign of $t_j \Delta \ln duty_i$ (j=1, 2 or 3) indicates that destruction effects are long-lived. The coefficient on the "investigation effect" variable (*initiali*) is statistically and economically significant, indicating that merely launching an antidumping investigation will also benefit the firms bringing the complaint (Prusa, 1992).

In the previous regression, we only include macroeconomic variables without considering controls capturing the market power of the products ($\Delta \ln share_{i,t_j}$). Once we add this variable, the magnitude of the "investigation effect" and "trade destruction" variables decrease, while their significance levels increase. The coefficient on $\Delta \ln share_{i,t_j}$is positive and significant, which indicates that the greater the export penetration of Chinese goods in the US market is, the smaller the negative impact of antidumping duties on those products and the larger the export value would be even after final antidumping actions. Note that an increase in the importing partner's real GDP index significantly increases China's exports to that country. Furthermore, an increase in real exchange rates (defined as dollar/RMB) makes the local currency weaker, and hence, importing from China a less attractive option.

As discussed in Section 1, one of the important variables to include in these regressions is a measure of cost or productivity shocks affecting products. In the absence of product-level information on these variables, we include industry-level controls (such as capital intensity, the numbers of firms and employees) in the regressions. Column 3 of Table 2 reports these results. The signs of coefficients of interest remain unchanged once we include these variables, while their significance is improved. According to the Kennedy formula, the antidumping duty impact on the export of targeted products can be quantified via average antidumping duties and regression coefficient. which is expressed as $(ad_{it}+1)^{\beta}-1$. Thus, the antidumping duties imposed on Chinese exporters led to a 39%, 41% and 51% reduction in its exports to the US in the three years after the final decision. The industry characteristic variables have an important impact on the exports of Chinese products. Specifically, a reduction in the number of firms and an increase in capital intensity are conducive to expanding China's exports to the US, which indicates that leading enterprises with strong export competitiveness and large market share are main exporters to the US. This is reasonable when we consider the strict technical standards in the US.

(Insert Table 2 about here)

The empirical results of the trade deflection effect are presented in Table 3. Interestingly, as shown in column (3) of Table 3, the coefficients on the trade deflection variable ($t_j \Delta \ln duty_i$) are positive and significant after adding industry-level controls, indicating that ignoring industry indicators will affect the accuracy of the estimation results of deflection effect. Using the Kennedy formula, antidumping duties imposed on Chinese exporters led to a 12%, 17% and 24% increase in its exports to non-US countries in the three years following the final decision, indicating that the deflection effect greatly weakened the harm of the destruction effect on the export of products involved. It is worth noting that China’s exports to non-US countries benefited from the increase in the number of firms and the reduction in capital intensity. Considering that, apart from the US, the Association of Southeast Asian Nations (ASEAN) and other developing countries, such as Brazil and India, are increasingly becoming China's important trading partners, which have low market entry costs and technical standards. China's exports to these countries are products with relatively low technical complexity, so small- and middle-sized enterprises with cost advantages are often the mainstay of exporters. Although the “investigation effect” variable (*initiali*) has the correct sign, it is not significant, indicating that the deflection effect usually occurs in the final decision stage. Based on the analysis of destruction and deflection effects, we believe that antidumping duties will have a negative impact on the total export value of Chinese products involved, resulting in a reduction of roughly 25 percent per year.

(Insert Table 3 about here)

4.2 Robustness test

In this section, we use two main methods as a robustness test. First, according to Chandra (2017), we replace the antidumping duties variables with antidumping measures dummy variables to avoid the possibility of noise present in the level of duty rates. Generally, compared to the indicator of whether or not the duty was in force, the duty rates have more measurement errors as the size of the duty rate may vary within the targeted country across firms.

Table 4 reports the results of the robustness test for the destruction effect. The sign of our main variable of interest ($t_j \Delta \ln duty_i$) remains unchanged, indicating that the negative impact of antidumping duties on the exports of targeted products lasts at least three years. Even an antidumping investigation alone hinders the exports of the products involved. When the economic climate of the importing country is good, as captured, for example, by real GDP growth and the appreciation of local currency, the demand for Chinese products will increase. A reduction in disorderly competition is conducive to China's exports to the US.

(Insert Table 4 about here)

The results of the robustness test for the deflection effect are presented in Table 5. Similar to the estimation results in Table 3, there is a lag in the deflection effect, which exists only in the implementation phase of final antidumping duties. Also, macroeconomic variables and industry-level variables have significant impacts on the exports of Chinese products to non-US countries, indicating that our benchmark results are credible.

(Insert Table 5 about here)

Next, we explore the impact of antidumping duties on the quantity of exports. As shown in Table 6, similar to export value, antidumping duties also have a negative impact on the volume of exports. Using the Kennedy formula, the antidumping duties imposed on Chinese exporters led to a 14-percent reduction in exports to the US in the final decision stage. In the antidumping investigation stage, the volume of exports declined significantly. Increased industry concentration and economic growth in the importing country expand the exports of Chinese products.

(Insert Table 6 about here)

Table 7 reports the robustness results for the deflection effect. The "trade deflection" variable ($t_j \Delta \ln duty_i$) has the expected sign. According to the Kennedy formula, the antidumping duties imposed on Chinese exporters led to a 13%, 18% and 24% increase in exports to non-US countries in the three years following the final decision. In other words, the impact of the deflection effect on export volume increases year by year. The signs and significance levels of the remaining variables are the same as those in Table 3, which lends our main results a certain degree of credibility.

Wang, Feng and Wang (2018) simulated the trade impacts generated from anti-dumping and countervailing duties imposed on photovoltaic industry using global simulation model (GSIM), whose results are consistent with our results in Tables 6 and 7. Their results indicated that trade effects could be serious. The anti-dumping and anti-subsidy taxes could act as "containment" which hinders the export of named products to the duty-imposing country and force its export deflect to other markets. In addition, their results also showed that the imposition of anti-dumping and anti-subsidy taxes might do harm not only to the involved country, but also to the filing country itself in view of employment and added value.

(Insert Table 7 about here)

4.3 Heterogeneity in response to antidumping duties

A related question is whether there are any industry-level differences in the effects of antidumping duties. Because base metal, chemical, electromechanical equipment and paper products are four of the most frequently targeted industries, we next explore how exports in these industries are affected.

Table 8 reports the empirical results of the trade destruction effect across industries. The variables we are interested in ($t_j \Delta \ln duty_i$) have expected negative signs in the above-mentioned sectors. antidumping duties have the greatest negative impact on exports in the paper products industry; even in the investigation phase, they are associated with a 40-percent decline in its exports to the US. Regarding the macroeconomic variables, the growth of the real GDP index in importing countries is conducive to the exports of all of the industries considered. For export companies participated in the division of labor in the global value chain, especially those exporting products with relatively high export technical complexity (such as metal products, chemicals and electromechanical equipment), participating in the global value chain will attract foreign companies to invest or enter the domestic market. It is manifested in the increase in industry concentration and capital intensity, which will help generate economies of scale and increase industry production efficiency.

(Insert Table 8 about here)

The empirical results of the trade deflection effect across sectors are reported in Table 9. The variables ($t_j \Delta \ln duty_i$) are positive and significant in the chemical industry and paper products industry, indicating that these two industries have established the necessary trade networks. When facing antidumping duties imposed by the US, they are able to redirect trade to alternative markets. Combined with the results of the destruction effect, it can be seen that the total export of the base metal industry and the electromechanical equipment industry has declined, attributing to the double impact of domestic situation and international situation. Take the base metal industry as an example, although it is the sunset industry with relatively weak competitiveness in developed countries, its role in stabilizing employment and stimulating economic growth cannot be ignored. When the international competitiveness of the base metal industry obviously declines, countries normally takes protective measures, which is also an important reason why China's base metal industry frequently encounters antidumping investigations. Furthermore, under the pressure of overcapacity and environmental degrading, Chinese government take measures to eliminate backward capacity in base metal industry. Notably, increases in capital intensity and total employment are conducive to base metal industry exports to non-American countries, which is mainly related to the development of China's base metal industry. Against the background of overcapacity pressure, environmental pressure and upgrading pressure, the base metal industry has gradually eliminated backward production capacity to avoid disorderly price competition, increased investment input to improve technical content and added value of products, and developed towards centralized- and capital-intensive production to format economies of scale.

(Insert Table 9 about here)

5. Concluding remarks

Antidumping actions against China have risen significantly in recent decades, and a large share of these actions has been initiated by the US. In this paper, we investigate two key questions of interest. First, what is the impact on exports from China when it is targeted with an antidumping duty? We obtain strong evidence of a "destruction effect" of such antidumping activities. We find that the year in which antidumping duties are imposed exhibit a nearly 40-percent reduction in China's exports to duty-imposing countries. We also find evidence of a "deflection effect", which weakens the negative effect of the destruction effect. China's exports to non-US countries increase by 12-percent in the final decision stage.

A second key issue to examine is different industries' responses to antidumping duties. We find that destructive effects are prominent in the base metal, chemical, electromechanical and paper products industries, while the deflection effect is only significantly present in the chemical industry and paper products industry. This indicates that antidumping duties have a greater negative impact on the exports of the base metals industry and electromechanical industry. These results suggest that the impact of antidumping actions could be greater than what a direct effect might suggest.

In view of the negative impact of the trade destruction effect, the targeted enterprise should actively use the WTO dispute settlement mechanism to respond to antidumping lawsuits to protect their interests. In addition, the industry association should assume the responsibility of providing named enterprises with countermeasures and financial support in responding to antidumping investigations. The trade deflection effect can weaken the negative impact of antidumping duties. Therefore, Chinese enterprises should actively implement market diversification strategies to develop multi-market and avoid excessive concentration in traditional markets such as Europe and the United States. The market diversification strategy can not only enhance the ability of enterprises to deal with trade frictions, but also diversify their business risks. For industries where trade frictions are frequent and antidumping measures have a significant negative impact, such as base metals and electromechanical industries, it is necessary to increase foreign direct investment and strengthen cooperation with the host country in technology and management, which can not only effectively circumvent new trade barriers, but also help enhance the international competitiveness of export products.

There are some limitations of our results and approach. First, we have focused on the export response of a single US trading partner after being subject to antidumping investigations. An open research question is what if two or more countries with similar export markets encounters US antidumping actions simultaneously. We speculate that in this case deflection effects will be weaken as these two countries will compete in the process of deflecting trade. Furthermore, we only include three significant industry indicators to investigate the impact of industry features on destruction effect and deflection effect. Though regression results indicates that these three indicator has significant effects, future research still needs to continue to explore the impact of extensive industry characteristics on trade destruction effect and trade deflection effect.

Nevertheless, our results have implications for the empirical literature on deflection effect. Our results show that deflection effect greatly weaken the harm of the destruction effect on the export of products involved, while ignoring industry indicators will affect the accuracy of the estimation results of deflection effect. Future research can focus on the reactions of the third country facing deflected trade.

References

Aggarwal, A. 2010. Trade effects of anti-dumping in India: who benefits?. The International Trade Journal 25(1), 112-158.

Avsar, V., 2017. The anatomy of trade deflection. Global Economy Journal 17 (4), 1-11.

Bao, X., Qiu, L.D., 2011. Is China's antidumping more retaliatory than that of the US? Review of International Economics 19 (2), 374–389.

Bernard, A.B., Jensen, J.B., Redding, S.J., Schott, P.K., 2007. Firms in international trade. Journal of Economic Perspectives 21 (3), 105-130.

Bown, C. P., 2016. Global antidumping database. Available at http://econ.worldbank.org/ttbd/gad/.

Bown, C. P., Crowley, M. A., 2006. Policy externalities: how US antidumping affects Japanese exports to the EU. European Journal of Political Economy 22 (3), 696-714.

Bown, C. P., Crowley, M. A., 2007. Trade deflection and trade depression. Journal of International Economics 72 (1), 176-201.

Bown, C. P., Crowley, M. A., 2010. China's export growth and the China safeguard: threats to the world trading system? Canadian Journal of Economics 43 (4), 1353–1388.

Chandra, P., 2016. Impact of temporary trade barriers: evidence from China. China Economic Review 38, 24-48.

Chandra, P., 2017. Trade destruction and trade diversion: evidence from China. China & World Economy 25 (3), 31-59.

Durling, J. P., Prusa, T. J., 2006. The trade effects associated with an antidumping epidemic: the hot-rolled steel market, 1996-2001. European Journal of Political Economy 22 (3), 675-695.

Feinberg, R. M., 1989. Exchange-rates and unfair trade. Review of Economics and Statistics 71 (4), 704-707.

Felbermayr, G., Sandkamp, A., 2020. The trade effects of anti-dumping duties: firm-level evidence from China. European Economic Review 122: 103367.

Ganguli, B., 2008. The trade effects of Indian antidumping actions. Review of International Economics 16 (5), 930-941.

Knetter, M., Prusa, T., 2003. Macroeconomic factors and antidumping filings: evidence from four countries. Journal of International Economics 61 (1), 1-17.

Lee, M., Park, D., Cui, A., 2013. Invisible trade barriers: trade effects of US antidumping actions against the People's Republic of China. Asian Development Bank Economics Working Paper Series No. 378.

Lee, M., Park, D., Saravia, A., 2017. Trade effects of US antidumping actions against China. Asian Economic Journal 31 (1), 3-16.

Li, Y., Zhang, H., Liu, Y., Huang, Q., 2020. Impact of embedded global value chain on technical complexity of industry export — an empirical study based on China's equipment manufacturing industry panel. Sustainability 12 (7), 2694-2708.

Lu, D., 2010, Exceptional exporter performance? Evidence from Chinese manufacturing firms. University of Chicago Working Paper.

Liu, X., Shi, H., 2019. Anti-dumping duty circumvention through trade rerouting: evidence from Chinese exporters. World Economy 42 (5), 1427-1466.

Lu, Y., Tao, Z., Zhang, Y., 2013. How do exporters respond to antidumping investigations? Journal of International Economics 91 (2), 290-300.

Mah, J.S., Kim, Y.D., 2006. Antidumping duties and macroeconomic variables: the case of Korea. Journal of Policy Modeling 28(2), 157-162.

Ossa, R., 2011. A "new trade" theory of GATT/WTO negotiations. Journal of Political Economy 119 (1), 122-152.

Park, B., 2009. The trade depressing and trade diversion effects of antidumping actions: the case of China. China Economic Review 20(3), 542-548.

Prusa, T. J., 1992. Why are so many antidumping petitions withdrawn? Journal of International Economics 33 (1), 1-20.

Prusa, T. J., 2001. On the spread and impact of anti-dumping. Canadian Journal of Economics-Revue Canadienne D Economique 34 (3), 591-611.

Sabry, F., 2000. An analysis of the decision to file, the dumping estimates, and the outcome of antidumping petitions. The International Trade Journal 14 (2), 109-145.

Sandkamp, A., 2020. The trade effects of antidumping duties: evidence from the 2004 EU enlargement. Journal of International Economics 123: 103307.

Sheng, B., 2002, A political economic analysis of Chinese international trade policy [in Chinese]. Shanghai: Shanghai Sanlian Press.

Staiger, R. W., Wolak, F. A., 1994. Measuring industry specific protection: antidumping in the United States. Brookings Papers on Economic Activity 1 (1994), 51-118.

Wang, H., Wang, J., Feng, Z., 2018. The economic effects of anti-dumping and anti-subsidy policies among China, the US and the EU: the photovoltaic industry. The Singapore Economic Review 63 (03), 513-534.

WTO, 2019. AD initiations: by reporting member. Available at http://www.wto.org/.

WTO, 2019. Technical information on anti-dumping. Available at https://www.wto.org/english/tratop_e/adp_e/adp_info_e.htm.

Table 1 Data Description and Summary Statistics

Variable	Description	Predicted Sign	Mean	Standard Deviation	Observation
Dependent Variable					
$\ln export_{i,t_j}$	Logarithm of China's exports of product *i* in t_j		18.0004	2.5932	1080
Explanatory Variables					
$t_j \ln duty_i$	AD duties against China on product *i* in t_j	(-/+)	0.7127	1.7614	1080
$initial_i$	A dummy variable indicating whether product *i* is subject to AD investigations	(-/+)	0.1429	0.3500	1080
$\ln export_{i,t_j-1}$	Logarithm of China's exports of product *i* in *t-1*	(+)	17.9219	2.5381	1080
$\ln GDP^{im}_{i,t_j}$	Logarithm of the importing country 's real GDP index	(+)	4.5279	0.2574	1080
$\ln GDP^{ex}_{i,t_j}$	Logarithm of the exporting country's real GDP index	(+)	4.5327	0.2625	1080
$\ln RE_{i,t_j}$	Logarithm of the bilateral real exchange rate between the dollar and RMB	(-)	0.04800	0.1586	1080
$\ln NOF_{k,t_j}$	Logarithm of industry *k*'s number of firms	uncertain	9.7119	1.0338	1080
$\ln NOE_{k,t_j}$	Logarithm of industry *k*'s number of	uncertain	15.2373	1.0247	1080

	employees				
$\ln CAPIN_{k,t_j}$	Logarithm of industry k's capital intensity	uncertain	13.8373	3.2510	1080
$\ln Share_{i,t_j}$	Logarithm of product i's market share in the US	(+)	-2.0082	2.0039	1080

Table 2 Trade Destruction Effect of AD Duties

	Dependent Variable: $\Delta \ln export_{it}$ (value)		
Explanatory Variables	Baseline Specification	Add Market Share	Add Industry Controls
	(1)	(2)	(3)
Policy variables			
$t_1 \Delta \ln duty_i$	-0.0794** (-2.76)	-0.0405* (-2.55)	-0.0956** (-2.96)
$t_2 \Delta \ln duty_i$	-0.0659* (-2.05)	-0.0531* (-2.35)	-0.120*** (-3.66)
$t_3 \Delta \ln duty_i$	-0.0695 (-1.84)	-0.0636* (-2.20)	-0.137*** (-4.09)
$initial_i$	-0.523*** (-5.12)	-0.143*** (-3.34)	-0.373* (-2.32)
Aggregate demand and supply shifters			
$\Delta \ln GDP_{i,t_j}$	5.660** (3.12)	7.408*** (12.35)	7.222*** (10.64)
$\Delta \ln GDP_{CHN,t_j}$	-1.335 (-1.89)	-0.688 (-1.60)	0.0487 (0.18)
$\Delta \ln RE_{i,t_j}$	-1.731 (-1.77)	-1.288*** (-6.55)	-0.811*** (-6.59)
Industry cost variables			

$\Delta \ln NOF_{i,tj}$	--	--	-3.41e-6** (-4.77)
$\Delta \ln NOE_{i,tj}$	--	--	-8.31e-10 (-0.17)
$\Delta \ln CAPIN_{i,tj}$	--	--	2.82e-13* (2.46)
Other control variables			
$\Delta \ln export_{i,t_j-1}$	0.276** (3.04)	-0.0322*** (-4.25)	0.00858 (1.93)
$\Delta \ln Share_{i,t_j}$	--	0.925*** (57.72)	0.964*** (75.32)
Constant	-7.061 (-1.23)	10.03*** (-3.53)	-13.54*** (-4.84)
Observations	1035	828	621
AR (2)	0.4654	0.6048	0.8047
Sargan	15.73762	39.76544	82.27843
	(0.1074)	(0.0539)	(0.0617)
IV	19	38	79
Wald-statistic	50.08	1197.21	1764.66
P-statistic	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 3 Trade Deflection Effect of AD Duties

Dependent Variable: $\Delta \ln export_{it}$ (value)			
Explanatory Variables	Baseline Specification (1)	Add Market Share (2)	Add Industry Controls (3)
Policy variables			
$t_1 \Delta \ln duty_i$	0.0157 (1.21)	0.0119 (1.26)	0.0227*** (4.02)
$t_2 \Delta \ln duty_i$	0.0222 (1.24)	0.0179 (1.38)	0.0302*** (4.10)

$t_3 \Delta \ln duty_i$	0.0265 (1.22)	0.0204 (1.25)	0.0418*** (4.57)
$initial_i$	0.0187 (0.48)	0.00809 (0.30)	0.0235 (1.47)
Aggregate demand and supply shifters			
$\Delta \ln GDP_{-CHN,t_j}$	1.959*** (11.21)	1.807*** (11.21)	2.316*** (28.01)
$\Delta \ln GDP_{CHN,t_j}$	-0.0315 (-0.10)	0.412 (1.72)	0.147 (0.98)
$\Delta \ln RE_{i,t_j}$	-0.576 (-1.81)	-1.195*** (-4.99)	-0.458*** (-3.67)
Industry cost variables			
$\Delta \ln NOF_{i,tj}$	--	--	0.257*** (6.64)
$\Delta \ln NOE_{i,tj}$	--	--	-0.0368** (-2.87)
$\Delta \ln CAPIN_{i,tj}$	--	--	-0.0450*** (-4.49)
Other control variables			
$\Delta \ln export_{i,tj-1}$	0.347*** (4.32)	0.00201 (0.04)	0.139*** (6.23)
$\Delta \ln Share_{i,tj}$	--	0.0127 (0.86)	0.0151** (2.85)
Constant	3.615 (1.76)	8.951*** (6.37)	3.706*** (4.87)
Observations	1080	1080	1080
AR (2)	0.1844	0.7833	0.4291
Sargan	21.68494	48.52075	114.0831
	(0.1163)	(0.0508)	(0.0512)
IV	24	44	104
Wald-statistic	638.62	439.95	496.01
P-statistic	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 4 Trade Destruction Effect of AD Duties

(Using AD Measures Dummy Variable)

Dependent Variable: $\Delta \ln \mathbf{export}_{it}$ (value)			
Explanatory Variables	Baseline Specification	Add Market Share	Add Industry Controls
	(1)	(2)	(3)
<u>Policy variables</u>			
$t_1 ad_i$	-0.445** (-2.86)	-0.279** (-3.03)	-0.269*** (-5.80)
$t_2 ad_i$	-0.381* (-2.09)	-0.374** (-2.82)	-0.368*** (-5.52)
$t_3 ad_i$	-0.419* (-2.05)	-0.463** (-2.73)	-0.467*** (-5.43)
$initial_i$	-0.512*** (-4.91)	-0.185*** (-3.57)	-0.167*** (-6.50)
<u>Aggregate demand and supply shifters</u>			
$\Delta \ln GDP_{i,tj}$	5.168** (2.71)	7.593*** (12.37)	6.680*** (16.32)
$\Delta \ln GDP_{CHN,t_j}$	-1.107 (-1.49)	-0.348 (-0.71)	0.325 (1.18)
$\Delta \ln RE_{i,t_j}$	-1.633 (-1.64)	-1.284*** (-5.92)	-0.582*** (-4.99)
<u>Industry cost variables</u>			
$\Delta \ln NOF_{i,tj}$	--	--	-0.257*** (-6.35)
$\Delta \ln NOE_{i,tj}$	--	--	-0.0868*** (-5.02)
$\Delta \ln CAPI_{i,tj}$	--	--	-0.0485*** (-3.56)
<u>Other control variables</u>			
$\Delta \ln export_{i,tj-1}$	0.240* (2.02)	-0.0327*** (-4.06)	-0.00696** (-2.99)
$\Delta \ln Share_{i,tj}$	--	0.936***	0.940***

		(45.56)	(146.50)
Constant	-5.204 (-0.83)	-12.46*** (-3.94)	-7.311*** (-3.99)
Observations	1035	828	828
AR (2)	0.3956	0.8082	0.6642
Sargan	13.38887	33.43341	93.57464
	(0.0992)	(0.0560)	(0.0527)
IV	17	33	87
Wald- statistic	43.24	1270.51	2106.88
P-statistic	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 5 Trade Deflection Effect of AD Duties

(Using AD Measures Dummy Variable)

Dependent Variable: $\Delta \ln \boldsymbol{export_{it}}$ (value)			
Explanatory Variables	Baseline specification	Add market Share	Add industry controls
	(1)	(2)	(3)
<u>Policy variables</u>			
$t_1 ad_i$	0.0745 (1.11)	0.0484 (0.92)	0.0577* (2.01)
$t_2 ad_i$	0.103 (1.13)	0.0777 (1.07)	0.0737 (1.95)
$t_3 ad_i$	0.128 (1.12)	0.103 (1.11)	0.105* (2.25)
$initial_i$	0.0178 (0.43)	-0.00175 (-0.06)	-0.0120 (-0.70)

Aggregate demand and supply shifters			
$\Delta \ln GDP_{i,tj}$	1.932*** (10.97)	1.834*** (10.77)	2.236*** (26.09)
$\Delta \ln GDP_{CHN,t_j}$	-0.00311 (-0.01)	0.442 (1.65)	0.363* (2.29)
$\Delta \ln RE_{i,t_j}$	-0.593 (-1.88)	-1.148*** (-4.48)	-0.504*** (-4.05)
Industry cost variables			
$\Delta \ln NOF_{i,tj}$	--	--	0.236*** (6.01)
$\Delta \ln NOE_{i,tj}$	--	--	-0.0280* (-2.29)
$\Delta \ln CAPI_{i,tj}$	--	--	-0.0327*** (-3.63)
Other control variables			
$\Delta \ln export_{i,tj-1}$	0.338*** (4.13)	-0.00754 (-0.14)	0.145*** (6.15)
$\Delta \ln Share_{i,tj}$	--	0.00744 (0.56)	0.0136** (2.62)
Constant	3.783 (1.87)	8.936*** (6.22)	2.932*** (3.87)
Observations	1080	1080	1080
AR (2)	0.1976	0.7863	0.4383
Sargan	21.95987	41.39318	112.9243
	(0.0560)	(0.0636)	(0.0443)
IV	22	39	102
Wald-statistic	583.68	425.42	582.30
P-statistic	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 6 Trade Destruction Effect of AD Duties

Dependent Variable: $\Delta \ln export_{it}$ (volume)			
Explanatory Variables	Baseline specification	Add market Share	Add industry controls
	(1)	(2)	(3)
Policy variables			
$t_1 \Delta \ln duty_i$	-0.0671* (-2.00)	-0.0350* (-2.25)	-0.0290* (-2.23)
$t_2 \Delta \ln duty_i$	-0.0307 (-0.69)	-0.0466* (-2.03)	-0.0344 (-1.86)
$t_3 \Delta \ln duty_i$	-0.0289 (-0.55)	-0.0511 (-1.69)	-0.0338 (-1.39)
$initial_i$	-0.451*** (-4.89)	-0.140** (-3.24)	-0.0926** (-2.63)
Aggregate demand and supply shifters			
$\Delta \ln GDP_{US,tj}$	2.605 (1.62)	6.441*** (10.39)	5.472*** (9.76)
$\Delta \ln GDP_{CHN,t_j}$	0.123 (0.22)	0.0192 (0.05)	-0.113 (-0.33)
$\Delta \ln RE_{i,t_j}$	1.261 (1.77)	0.0509 (0.24)	0.0925 (0.79)
Industry cost variables			
$\Delta \ln NOF_{i,tj}$	--	--	-0.260*** (-5.51)
$\Delta \ln NOE_{i,tj}$	--	--	-0.0801*** (-3.40)
$\Delta \ln CAPI_{i,tj}$	--	--	-0.00876 (-0.55)
Other control variables			
$\Delta \ln export_{i,t_j-1}$	0.400*** (3.53)	0.0350*** (3.97)	-0.0540 (-1.42)
$\Delta \ln Share_{i,t_j}$	--	1.060*** (58.75)	0.995*** (140.91)
Constant	-2.568 (-0.46)	12.48*** (-3.92)	-5.125 (-1.63)
Observations	840	672	672

AR (2)	0.6790	0.1199	0.0675
Sargan	13.33269	44.0233	83.74924
	(0.2057)	(0.0365)	(0.0811)
IV	19	41	82
Wald-statistic	83.72	828.42	1617.94
P-statistic	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 7 Trade Deflection Effect of AD Duties

Dependent Variable: $\Delta \ln export_{it}$ (volume)			
Explanatory Variables	Baseline Specification	Add Market Share	Add Industry Controls
	(1)	(2)	(3)
Policy variables			
$t_1 \Delta \ln duty_i$	0.0128 (0.98)	0.00726 (0.66)	0.0241*** (4.75)
$t_2 \Delta \ln duty_i$	0.0140 (0.79)	0.00790 (0.54)	0.0318*** (4.42)
$t_3 \Delta \ln duty_i$	0.0131 (0.60)	0.00746 (0.41)	0.0412*** (4.58)
$initial_i$	0.0190 (0.48)	-0.00562 (-0.19)	0.0368* (2.41)
Aggregate demand and supply shifters			
$\Delta \ln GDP_{i,t_j}$	1.328*** (6.69)	1.594*** (8.81)	1.923*** (20.88)
$\Delta \ln GDP_{CHN,t_j}$	0.704* (2.27)	1.051*** (4.00)	0.560*** (3.66)
$\Delta \ln RE_{i,t_j}$	0.647* (2.31)	0.355 (1.69)	0.544*** (5.66)

Industry cost variables			
$\Delta \ln NOF_{i,tj}$	--	--	0.213*** (5.02)
$\Delta \ln NOE_{i,tj}$	--	--	-0.100*** (-4.48)
$\Delta \ln CAPI_{i,tj}$	--	--	-0.0997*** (-5.34)
Other control variables			
$\Delta \ln export_{i,t_j-1}$	0.109 (1.33)	-0.177*** (-4.38)	0.00785 (0.45)
$\Delta \ln Share_{i,t_j}$	--	0.0242** (2.59)	0.0122* (2.02)
Constant	7.031*** (4.26)	9.661*** (7.12)	7.530*** (8.00)
Observations	960	960	960
AR (2)	0.5597	0.9819	0.6384
Sargan	22.04198	40.92791	108.1667
	(0.1067)	(0.1925)	(0.1058)
IV	24	44	104
Wald-statistic	124.50	111.33	195.48
P-statistic	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 8 Trade Destruction Effect of AD Duties

(Differential Effects across Sectors)

Dependent Variable: $\Delta \ln export_{it}$ (value)				
Explanatory Variables	Base Metal	Chemical	Electromechanical Equipment	Paper Products
	(1)	(2)	(3)	(4)
Policy variables				

$t_1 \Delta \ln duty_i$	0.00124 (0.41)	-0.0496** (-3.17)	-0.0146*** (-3.90)	-0.107*** (-19.37)
$t_2 \Delta \ln duty_i$	-0.00812* (-2.11)	-0.0232 (-1.30)	-0.0206*** (-3.80)	-0.114*** (-12.26)
$t_3 \Delta \ln duty_i$	-0.00867 (-1.68)	-0.0390* (-2.19)	-0.0230*** (-3.54)	-0.118*** (-9.06)
$initial_i$	-0.0528*** (-4.12)	-0.165** (-3.24)	-0.0577*** (-5.27)	-0.438*** (-21.24)
Aggregate demand and supply shifters				
$\Delta \ln GDP_{i,t_j}$	7.865*** (32.09)	5.090*** (4.39)	5.907*** (17.64)	8.126*** (17.86)
$\Delta \ln GDP_{CHN,t_j}$	-2.390*** (-12.59)	-2.846*** (-4.41)	-0.423 (-1.80)	-0.462 (-0.76)
$\Delta \ln RE_{i,t_j}$	0.206 (1.14)	-2.089* (-2.30)	-0.725*** (-7.54)	-1.547*** (-6.81)
Industry cost variables				
$\Delta \ln NOF_{i,tj}$	-0.680*** (-9.53)	0.248 (0.95)	-0.477*** (-18.94)	0.833*** (5.20)
$\Delta \ln NOE_{i,tj}$	1.635*** (8.59)	1.129*** (4.30)	0.631*** (10.26)	-1.109*** (-3.94)
$\Delta \ln CAPIN_{i,tj}$	0.832*** (7.57)	1.114*** (3.93)	0.177 (1.14)	0.0337 (0.08)
Other control variables				
$\Delta \ln export_{i,tj-1}$	0.00777*** (3.75)	-0.0554*** (-8.26)	-0.158*** (-25.42)	0.0244*** (3.92)
$\Delta \ln Share_{i,tj}$	0.992*** (226.02)	0.941*** (104.25)	0.438*** (34.02)	0.887*** (68.90)
Constant	-36.45*** (-10.45)	-26.56*** (-4.80)	-10.66*** (-7.14)	-10.66* (-2.06)
Observations	345	145	265	170
AR (2)	0.9968	0.9988	0.9999	0.9740
Sargan	52.94788	17.17999	44.29235	26.63346
	(0.6631)	(1.0000)	(0.9770)	(0.9866)
IV	71	87	78	58
Wald-statistic	7396.34	669.76	686.10	5142.87
P-statistic	0.0000	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. “AR(2)” reports the p-value of the

Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Table 10 Trade Deflection Effect of AD Duties

(Differential Effects across Sectors)

Dependent Variable: $\Delta \ln export_{it}$ (value)				
Explanatory Variables	Base Metal	Chemical	Electromechanical Equipment	Paper Products
	(1)	(2)	(3)	(4)
Policy variables				
$t_1 \Delta \ln duty_i$	-0.0282*** (-8.00)	0.0494*** (4.52)	-0.00419* (-2.13)	0.0833*** (3.85)
$t_2 \Delta \ln duty_i$	-0.0395*** (-10.76)	0.0735*** (4.19)	-0.0105*** (-3.78)	0.123*** (4.32)
$t_3 \Delta \ln duty_i$	-0.0363*** (-8.16)	0.0623** (2.86)	-0.0115*** (-3.97)	0.210*** (6.01)
$initial_i$	-0.0932*** (-10.98)	0.0922** (3.24)	-0.0293*** (-3.70)	0.0710 (0.93)
Aggregate demand and supply shifters				
$\Delta \ln GDP_{i,tj}$	2.953*** (52.84)	0.550 (1.70)	1.412*** (12.06)	4.514*** (5.91)
$\Delta \ln GDP_{CHN,t_j}$	0.453** (3.12)	3.154*** (5.00)	0.832* (2.25)	-6.142** (-3.10)
$\Delta \ln RE_{i,t_j}$	1.489*** (8.54)	-3.880*** (-3.81)	0.0696 (0.46)	1.401** (2.72)
Industry cost variables				
$\Delta \ln NOF_{i,tj}$	-0.224*** (-3.46)	0.471* (2.35)	-0.104 (-1.25)	0.942*** (3.79)
$\Delta \ln NOE_{i,tj}$	0.806*** (5.17)	-2.671*** (-4.20)	0.634*** (4.90)	-0.189 (-0.12)
$\Delta \ln CAPI_{i,tj}$	0.728*** (8.12)	-2.712*** (-4.18)	0.0116 (0.04)	4.438** (3.01)

Other control variables				
$\Delta \ln export_{i,tj-1}$	0.373*** (64.81)	-0.153*** (-5.23)	0.332*** (35.77)	0.203*** (9.78)
$\Delta \ln Share_{i,tj}$	0.00330** (3.24)	0.0322*** (9.94)	-0.0632*** (-3.85)	0.0958*** (7.46)
Constant	-23.79*** (-9.68)	77.71*** (5.17)	-6.780*** (-4.28)	-44.24 (-1.36)
Observations	345	150	265	215
AR (2)	0.9568	0.9983	0.9995	0.9885
Sargan	60.09827	21.49324	41.00445	40.24673
	(0.8604)	(1.0000)	(0.9913)	(0.8363)
IV	86	89	78	63
Wald-statistic	2997.37	87.11	605.35	6838.46
P-statistic	0.0000	0.0000	0.0000	0.0000

Notes: t-statistics are reported in parentheses. "AR(2)" reports the p-value of the Arellano-Bond second-order sequence correlation test. "Sargan" reports the results of the Sargan over-identification test, with p-values in parentheses. ***, ** and * represent significance at the 1-, 5- and 10-percent levels, respectively.

Author Contribution

Lu Cheng: Conceptualization, Methodology, Software, Formal Analysis, Investigation, Data Curation, Writing - Original Draft Preparation. **Zhifu Mi**: Writing - Reviewing and Editing, Supervision, Project Administration. **D'Marris Coffman**: Writing - Reviewing and Editing. **Jing Meng**: Writing - Reviewing and Editing. **Dongfeng Chang**: Resources, Validation, Writing - Reviewing and Editing, Supervision.